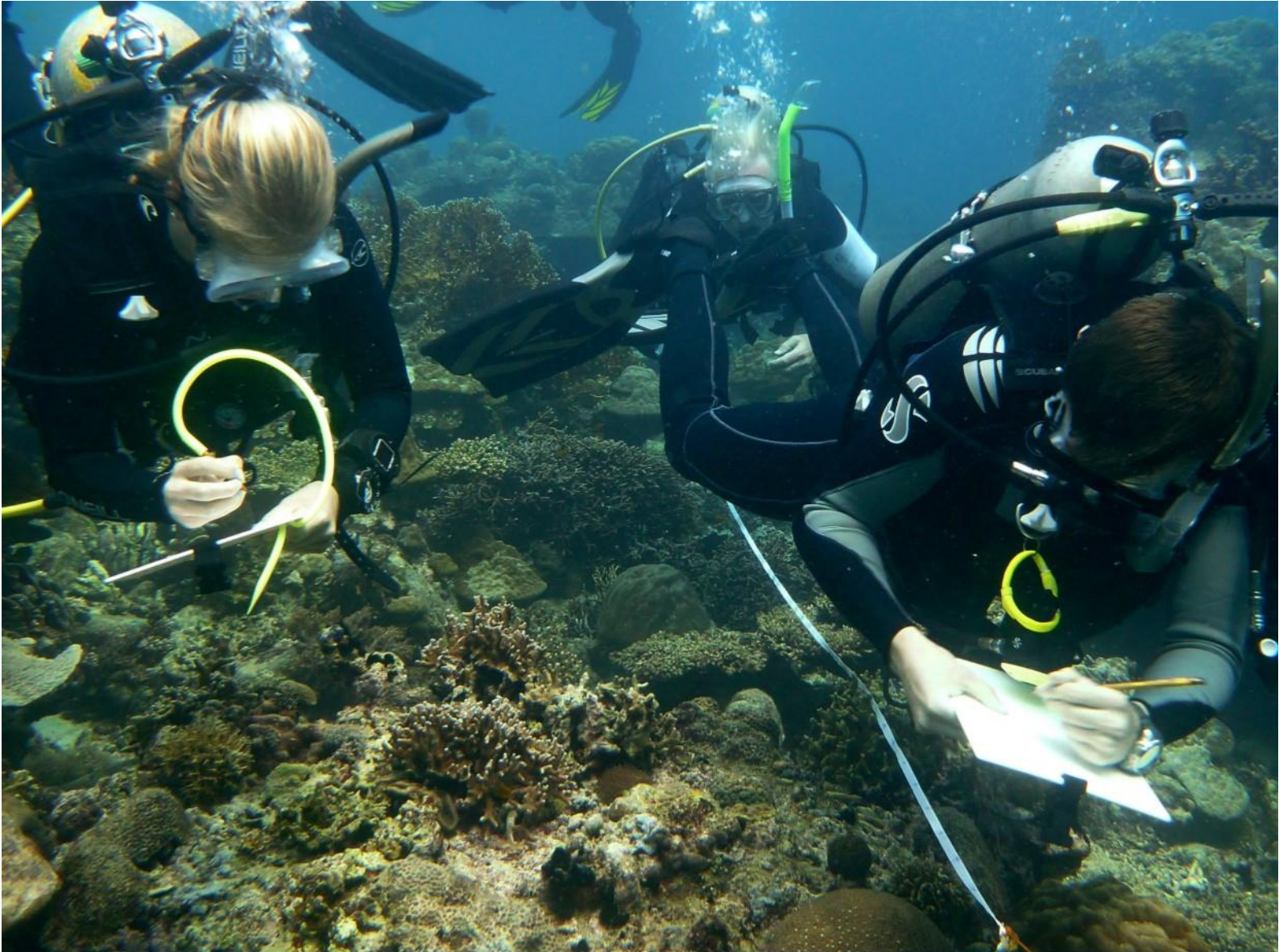




LRCP
Southern Leyte Coral Reef Conservation Project

A Summary of Effort by Coral Cay Conservation in 2015, the Philippines: An Annual Report

Report Date: March 2017

Tom Dallison & Alex Ferguson

In partnership with the Southern Leyte
Provincial Government, Philippines





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The Provincial Government of Southern Leyte

With thanks to:



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Executive Summary

- CCC have been successfully conducting the Southern Leyte Coral Reef Conservation project (LRCP) since 2002, in partnership with the Provincial Government of Southern Leyte (PGSL).
- The project, based in Napantao, San Francisco, practices a three tiered approach to its community-focused conservation: 1) scientific data collection; 2) education and outreach; and 3) capacity building. Outputs from each tier supplement each other and are effectively utilised by PGSL and local government units (LGU) to develop ordinance and make conservation-conscious decisions with regards to Southern Leyte's marine resources.
- The outputs from the LRCP in 2015, as a direct results of active effort by CCC, were categorised as successful. The LRCP saw an increase in the number of marine protected areas (MPA) established with continued effort in the monitoring of historic MPAs. CCC also noted an increase in scholar intake through the highly successful Scholarship Programme whilst continuing to register success within local schools.

Key activities and events in 2015 included:

- The successful implementation of the adapted methodology into its 3rd year that focuses on the establishment, monitoring and sustainable management of small-scale MPAs. The methodology has shown to be positively portrayed throughout Sogod Bay and Southern Leyte by local communities with collected data being encouraging.
- The completion of two, full MPA assessments, three proposed MPA assessments and one crown of thorns seastar (CoTs) rapid visual assessment within the municipalities of San Francisco and Liloan.
- Facilitation in the final stages of the establishment of an MPA in the Barangay Nueva Estrella Norte (NEN), San Francisco, that concluded efforts from 2014.
- Acceptance and provision of training to 20 Filipino scholars, demonstrating a 100% increase from figures in 2014.
- The implementation of modular training opportunities for Southern Leyteños in full-time employment – increasing the scope of CCC's capacity building initiatives.
- The provision of training and capacity building workshops to a large cohort of individuals from Southern Leyte and Sogod Bay.
- Developed and implemented teacher training modules for marine science in collaboration with the Ocean Action Resource Centre (ORC) with the goal of greater consistency in educational resources delivered in schools throughout Southern Leyte.
- Conducted environment-focused lessons in 15 schools within the municipalities of San Francisco, Liloan and Pintuyan.

- Delivered the Seastars Environmental Award Scheme (SEAS) to 5 local schools resulting a total of 10 awards administered, including one gold award, throughout Liloan and San Francisco.
- Conducted a total of 6 community awareness events in barangays as well as two Reef Ranger events.



Credit: Jon Cabilles 2016

Acknowledgements

Coral Cay Conservation would like to extend its heartfelt thanks to the following people and organisations, without whom this project would not have been possible:

- The ex-Provincial Governor for Southern Leyte, Hon. Ricardo Mercado (now the current Congressman) for his valued support and guidance throughout the Napantao sample period
- Provincial Governor for Southern Leyte, Hon. Damian G. Mercado, Vice-Governor Coco Hon. Christopherson M. Yap and the Provincial Board members
- Sir. Nedgar Garves and all the staff at the Provincial Tourism Office
- Ma'am Eva Abad and all the staff at the Provincial Environmental and Natural Resource Management Office (PENRMO)
- Dr Arturo Isip, Department of Education, Southern Leyte Division
- All members of the Sogod Bay Sustainable Marine Management Alliance (SBSMMA)
- Hon. Samson Gumutan Jr., Municipal Mayor of San Francisco
- 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
- Dr Gloria Reyes, Homer de Dios and all staff of Southern Leyte State University
- Our Filipino staff: Tata, Bok Bok, Jesse, Dudong and Ricky whose loyalty, trust, and dedication are highly valued
- All the dedicated international volunteers and staff who gathered the data and made this project possible.

With special thanks to the Waterloo Foundation for their hard support throughout 2014 and 2015 enabling the provision of training courses to local stakeholders and MPA wardens, the delivery of workshops for local stakeholders, community engagement, educational outreach initiatives, teacher training workshops and scientific surveys.

Abbreviations

CCC	-	Coral Cay Conservation
SDP	-	Skills Development Programme
UVC	-	Underwater Visual Census
NTA	-	No-Take Area
NTMP	-	No-Take Marine Park
CT	-	Coral Triangle
MSY	-	Maximum Sustainable Yield
LRFFT	-	Live Reef Food Fish Trade
SEAS	-	Seastar Environmental Awareness Scheme
LRCP	-	Southern Leyte Coral Reef Conservation Project
PGSL	-	Provincial Government of Southern Leyte
MPA	-	Marine Protected Area
NEN	-	Nueva Estrella Norte
CoTs	-	Crown of Thorns Seastar
MAO	-	Municipal Agricultural Office
NGO	-	Non-Government Organisation
NIA	-	Nutrient Indicator Algae
HC	-	Hard Coral
RB	-	Rubble
MR	-	Marine Reserve
MPA MEAT	-	Marine Protected Area Management Effectiveness Assessment Tool
S	-	Species Richness
SBSMMA	-	Sogod Bay Sustainable Marine Management Alliance
TWG	-	Technical Working Group
SLSU	-	Southern Leyte State University
CPUE	-	Catch Per Unit Effort
GIZ	-	Gesellschaft für Internationale Zusammenarbeit
MFARMC	-	Municipal Fisheries and Aquatic Resources Management Council
POSTE	-	Philippine Organisation of Science and Technology Educators
ECO-Club	-	Environmentally Conscious Organisation Club
ECP	-	Expedition Care Programme
BFAR	-	Bureau of Fisheries and Aquatic Resources
PADI	-	Professional Association of Diving Instructors
PNVHS	-	Pintuyan National vocational High School
CNN	-	Cable News Network
EO	-	Educational Officer
CAASAFI	-	Celestino A. Ablas Senior Academy Foundation incorporated
ORC	-	Ocean Action Resource Centre
LNTVHS	-	Liloan National Technical and Vocational High School

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Coral Cay Conservation

Founded in 1986, Coral Cay Conservation (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 bodies and non-governmental organisations within a specific host country, and does not receive monetary payment for the services provided (Fig. 1). CCC is primarily self-financed through an innovative volunteer participatory scheme in which international volunteers are given the opportunity to gain valuable experience by joining a phase of each project, in return for financial contribution towards project costs. Upon arrival, volunteers are entered into a Skills Development Programme (SDP) that trains them in the skills of marine fauna and flora identification, underwater visual census (UVC) methodologies and further

underwater data collection methods. The SDP is under the guidance of highly experienced and 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 collection, assimilation and synthesis as well as conservation and environmental education. Technical skills training and other capacity building programmes are provided for international volunteers and local community stakeholders.

CCC has been successfully operating volunteer based conservation programmes in developing countries for 31 years with several internationally notable accomplishments, including the establishment of MPAs around the world. This includes, but is not limited to 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 areas (NTAs) around Sogod Bay, Southern Leyte, the Philippines.



Figure 1. Schematic diagram demonstrating Coral Cay Conservation's (CCC) implementation strategy within a specified host country of which CCC are based. The sustenance of livelihoods and poverty alleviation are completed through the restoration and protection of valuable socio-economic ecosystems (coral reefs and forests), accompanied by the promotion of sustainable resource extraction and building local capacity.

1. Introduction

1.1 Coral Reefs of the Philippines

The Coral Triangle (CT) holds the world's highest marine diversity, in which over 500 species of coral are found within each ecoregion: areas separated based on the relevant abundance and distribution of their retrospective species (Veron *et al.*, 2010). Located at the heart of the CT is the Philippines (Fig. 2). It is renowned for its highly biodiverse marine ecosystems and encompasses 9% of the global total coral reef area (22,500 km²), placing the country third, behind Australia and Indonesia (Burke *et al.*, 2011). With over 460 species of hard corals, representing around half of the total global reef building coral species (Tun *et*

al., 2004, Nanola *et al.*, 2005), more than 3000 marine fish species of which 1,700 species are reef-associated (Froese and Pauly, 2011) and 42 mangrove species (Spalding, Kainuma and Collins, 2010), the Philippines represents a key global hotspot for marine biodiversity.

Within south-east Asia, approximately 350 million people reside within 50km of the coast and hold a great dependence on the marine and coastal resources through the need to maintain food security and generate income (Cullen, 2007; Clifton and Unsworth, 2010). As a result, coastal and marine resources are becoming

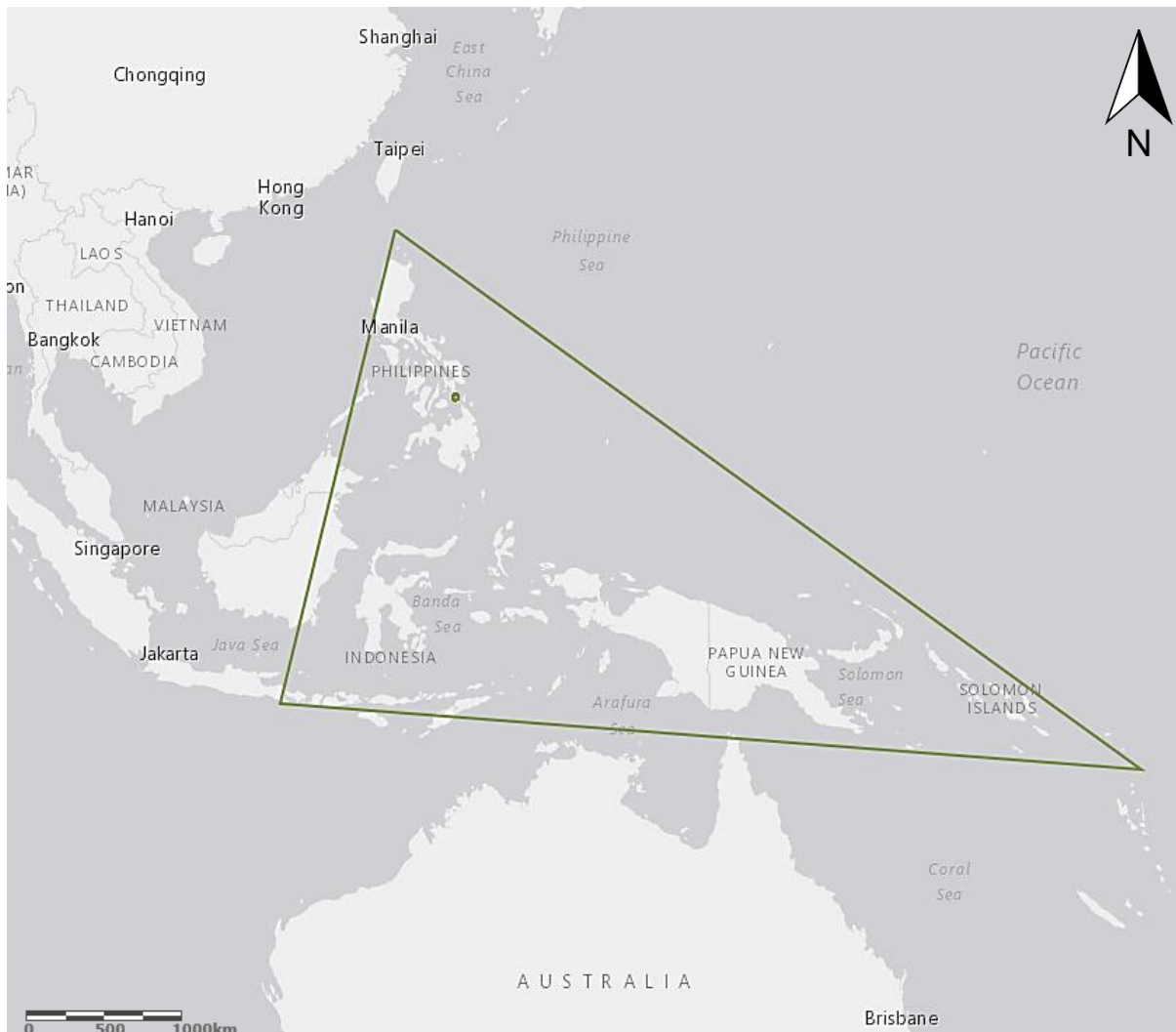


Figure 2. A map of the Coral Triangle (CT) that demonstrates the location of all the respective countries located within the boundaries of the CT. The CT is considered a biodiversity hot-spot that contains over 500 species of hard coral. Located within the CT is the Philippines, an archipelago that consists of over 7,000 islands that encompasses 22,500km² of coral reefs, 9% of the global total. Coral Cay Conservation are based within Southern Leyte that is highlighted with a circular green marker. Map produced using ArcGIS.

increasingly exhausted within the region where overfishing and unsustainable resource exploitation is common (Clifton and Unsworth, 2010). Overfishing from an expanding population and improved fishing technology as well as the deterioration of coastal habitats, are leading to unprecedented levels of collapse beyond recovery (Muallil *et al.*, 2014). The population of the Philippines commonly follows the same trends of increasing human population and marine resource exploitation as other countries within south-east Asia and the CT (Wilkinson, 2008), with 40 million individuals residing within 30km of a coral reef, approximately 45% of the total population in 2011 (Burke *et al.*, 2012). An abundance of livelihoods within coastal communities are supported by coral reefs including fishing, aquaculture (including mariculture) and tourism. Anthropogenic disturbances, whether direct or indirect, ultimately reduce the resilience of coral reef ecosystems. In addition to overfishing, increased sedimentation rates and pollution from land run-off are other examples of impacts that are highly detrimental to coral reef ecosystems. With a reduction in resilience on coral reefs, their ability to cope with perturbations are drastically reduced, subsequently threatening the biological, cultural and social services provided to coastal communities (Brander *et al.*, 2007). By preserving a coral reef's capacity to cope with perturbations, the preservation of its ability to provide the goods and services is achieved. Resilient coral reefs and ecosystems reduce the uncertainty that surrounds resource exploitation and enables coastal communities to utilise resources in a long-term and sustainable manner (Clinton *et al.*, 2012). 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). It is estimated that the Philippines fisheries' yield 30% higher catches than the calculated Maximum Sustainable Yield (MSY) (Green *et al.*, 2003), and are in need

of management, before an imminent collapse (Fig. 3).

Fish and other fisheries constituted 38.7% capita⁻¹ day⁻¹ of animal protein intake for Filipino's, with a 16.1% capita⁻¹ day⁻¹ contribution to overall protein, in 2011 (FAOSTAT, 2011), representing their importance. Reef fish are the main source of protein for the majority (FAOSTAT, 2011), with other fisheries, through the exploitation of giant clams (*Tridacna* sp.) and sea cucumbers (*Holothuridae* sp.), being supported for both commercial and subsistence reasons. The importance of coral reef fisheries is exasperated by reports in 2003, that indicated over 2 million Filipinos directly rely upon fisheries for employment, with 1 million dependents through small-scale subsistence fisheries with coral reefs estimated to yield 5 to 35 tons per km² of fish (Green *et al.*, 2003, Barut *et al.*, 2003). In addition, these systems are commercially and economically important for the export of live fish for the Live Reef Food Fish Trade (LRFFT), where in 2007 it was estimated that the largest export was the coral trout (*Plectropamus leopardus*) equating to USD\$ 140 million, and other species with a total of USD\$30 million in 2007 (Burket *et al.*, 2012). Coastal tourism and diving tourism, in particular, can provide alternative means of income for coastal communities as long as the industry is managed sustainably.

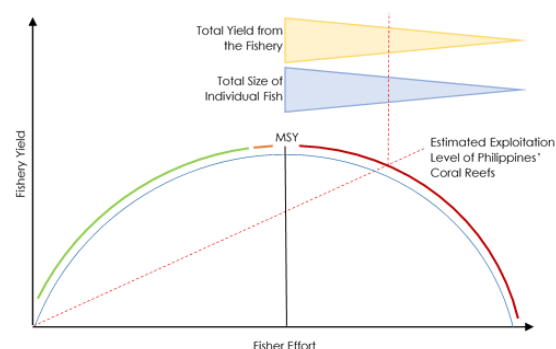


Figure 3. A simplified and adapted maximum sustainable yield (MSY) curve applied to the estimate that, in 2003, the Philippines' coral reef fisheries were fished 30% beyond the MSY (Green *et al.*, 2003) (red dashed line). If the fish stock is fished below the MSY (green), the fish stock will continue to increase. Fishing just before or on the MSY (orange) can be risky, as without continuous monitoring, fishing effort could surpass the MSY and result in the population decreasing. Fishing beyond the MSY (red) can be termed as overfishing. This scenario results in a decrease in fishery yield (yellow triangle) and individual fish size (blue triangle) with an increased effort as fishers try to maintain catch.

1.2 Coral reefs in Southern Leyte

Southern Leyte, one of the six provinces of the Eastern Visayas (Fig. 4) is bounded in the north by the 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 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 good condition, they face a number of anthropological threats. Signs of overfishing are widespread, with commercially important species such as parrotfish (mul mul), groupers (lapu lapu), snappers (maya maya) and sweetlips (lipti) present in low numbers throughout the bay (Longhurst et al, 2013).

1.3 The Southern Leyte Coral Reef Conservation project (LRCP)

In 2002, CCC, 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 (LRCP). Three main objectives were developed:

- I. 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.
- II. To build capacity within government bodies, local organisations and the communities of Southern Leyte to enact sustainable management of marine resources through training schemes.

- III. 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 to establish the appropriate management network needed to conserve and protect coastal systems. During this time, 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 ecological and socio-economic 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 PGSL, to refocus survey work predominately 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 2015. It provides a summary of scientific research, capacity building and education work conducted throughout the year. In general, 2015 has been an extremely successful year for the LRCP, with the successful continuation of adapted methodologies to accurately assess MPA sites and the potential location of new MPAs. Educational and capacity building work has been conducted throughout 2015, with great success. The true impact of the Scholarship Programme throughout the community is to be noted as interest and demand in the programme has continued to increase. In tandem with the educational programmes such as Reef Rangers and the Seastars Environmental Awareness Scheme (SEAS), CCC's influence within the community is growing through outreach and the provision of education. Following the reported closing of CCC operations following Typhoon Yolanda, CCC has bounced back and with continued surveying and educational work, CCC believes it is having a positive influence within the province of Southern Leyte and Sogod Bay.

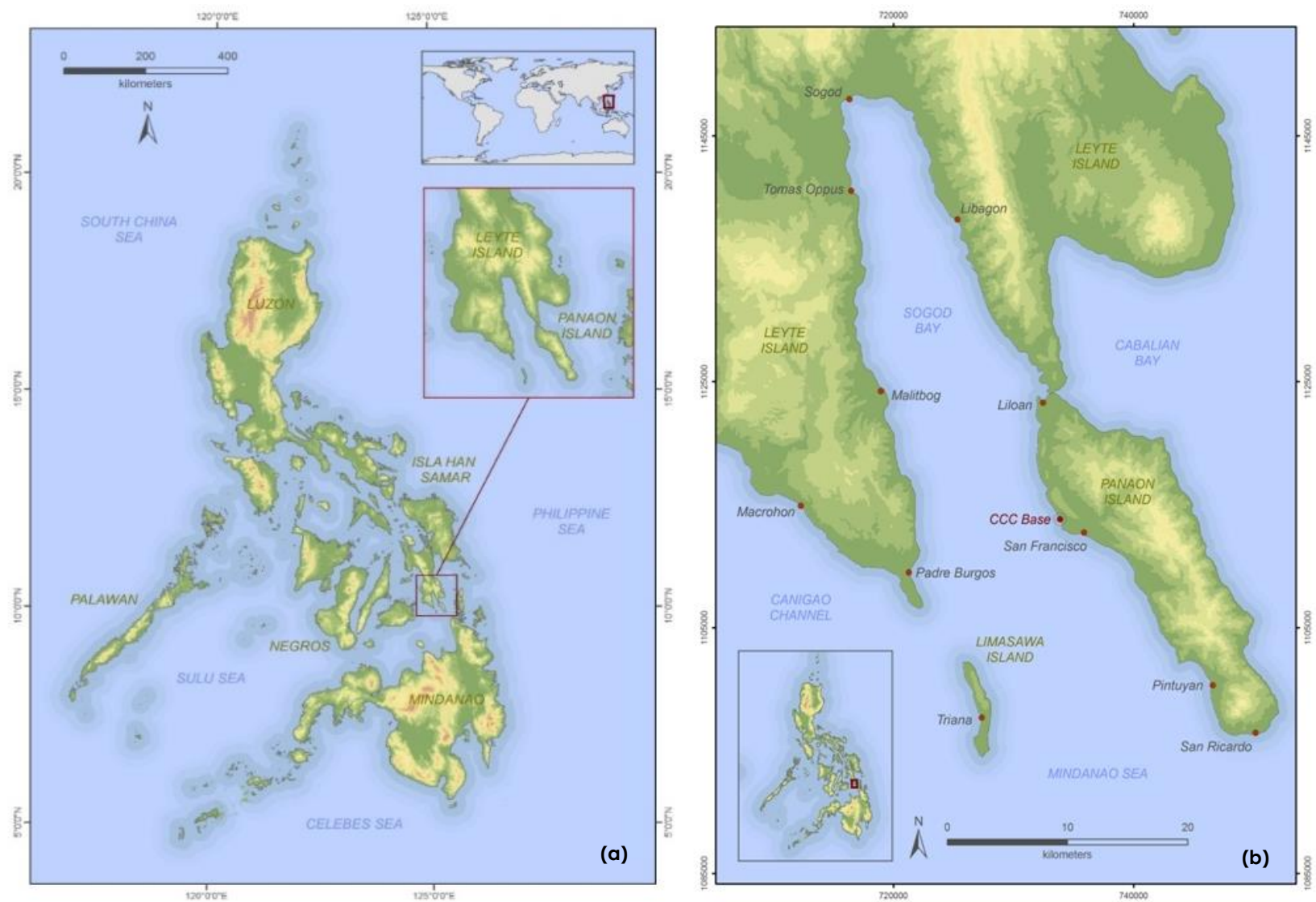


Figure 4. A map of the Philippines (a) and the Southern Leyte Province (b) with Sogod Bay at the centre. The Coral Cay Conservation (CCC) Southern Leyte Coral Reef Conservation Project (LRCP) project site is located in the Municipality of Sand Francisco on the south-eastern side of the bay.

2. Scientific Research

CCC adopted a new survey methodology in 2013 that marked a permanent shift in the structure and purpose of CCC's research programme. With a bountiful amount of MPAs established throughout Southern Leyte, their continued monitoring and assessment is an important tool for their effective management and will allow resource managers to implement changes where necessary to adapt policies, schemes and by-laws. Monitoring and assessment will provide information to detect changes in conditions that may trigger a management response, determine the cause of such changes of concern and to ultimately, evaluate the effectiveness of management actions, a key element that provides continuous feedback (Pomeroy *et al.*, 2004). By providing ecological data, comprehensive MPA surveys enable managers to assess progress towards aims and goals and make informed, ecological management decisions. In combination, CCC will continue to provide scientific data for the establishment of new MPAs.

2.1 MPA Survey Methodology

MPA assessments are conducted using an augmented Reef Check method. The Reef Check methodology is widely recognised and is used to survey coral reefs around the world. It is a mode of UVC that allows for a diverse range of divers to easily and efficiently conduct surveys, with respectable results (Léopold *et al.*, 2009). It was developed in the 1990s with the aim of gathering as much data as possible about the global ecological status of coral reefs (Hodgson, 1999). The globally retrieved data is analysed annually with updates and evaluations on the ecological status being published. Reef Check provides a general picture of the ecological status of a reef and the human impacts affecting it. CCC has enhanced the methodology through additional target species of fish, coral and other invertebrates to better reflect the high biodiversity within Sogod Bay (Appendix A).

Survey transects are conducted at depths of 6m and 12m where topography allows,

both inside and outside the MPA (Fig. 4). 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 100m long and divided into 4 replicates of 20m. Between each replicate there is a 5m gap where no data is recorded. This survey set up allows for robust statistical analysis of the collected data from independent samples.

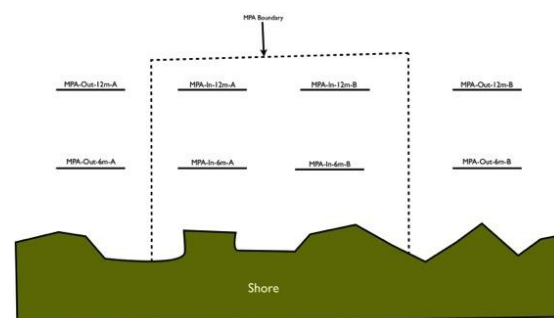


Figure 3. Survey plan for the assessment of Marine Protected Areas (MPAs) utilised by Coral Cay Conservation (CCC). Each transect is 100m long and is sub-divided into four, 25m replicates. A 5m inter-replicate gap is established to which no data are collected equating to four 20m replicates within each 100m transect.

2.1.1 Fishes

Fish diversity and abundance data are collected using UVC methodologies. Selected fish families and species that are recognised as biological indicators on coral reefs for a range of anthropogenic perturbations such as fishing pressure, LRFFT and the ecological status of the reef are recorded. In addition, butterflyfish species are recorded as they provide an accepted method of indicating the status of the coral reef: *The Butterflyfish Indicator Method* (Crosby and Reese, 1996). The size classes of three commercially important fish families are recorded; Grouper (*Lapu Lapu*, Serranidae), Parrotfish (*Mulmul*, Scaridae) and Snapper (*Maya Maya*, Lutjanidae).

Fish data are recorded along a 100m 'belt' transect, where the abundance of fish is recorded within an imaginary 5x5m box along four 20m replicates. Between each 20m replicate, the divers will wait, and not record any fish for a 5m interval, this separates the total 100m transect into four 20m independent replicates (Fig. 5). Each

replicate sums to a total of 500m³ with total transect area surveyed of 2,000m³.

2.1.2 Invertebrates

The location of the transect that is used for the fish UVC is also used to assess the invertebrate abundance and diversity within the area. The invertebrates recorded are target invertebrates that are typically targeted by local stakeholders as food species, collected as curios or important to the ecological balance of the reef. Due to the sessile and/or benthic nature of the targeted invertebrates, i.e. non-locomotive species, divers record their abundance 2.5m either side of the central transect tape (Fig. 6). Special care is taken to assess and explore each geo and biomorphic structure contributing to the rugosity of the transect area for cryptic species and those seeking refuge such as lobsters, *Diadema* sp. and *Holothuridae* sp.. Each replicate equates to 100m², summing to a total area of 400m² surveyed for invertebrate surveys.

2.1.3 Benthic Composition

Benthic diversity is measured by recording biotic and abiotic benthic categories along a point-intercept transect (PIT). Along the transect line, benthic organisms and substrate types are recorded at 50cm intervals (Fig. 7). To reduce bias, a plumb-line is dropped at each designated 50cm point and the substrate that encounters the plumb-line is recorded (Table 1). Every 20m replicate contains 40 benthic points. Further categories are given in Appendix A.

2.1.4 Surveyed Impacts

Within the same area assessed for invertebrates, divers record several impacts on the reef. The total percentage (%) of the coral population effected by bleaching is recorded, 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 nominal 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'.

Table 1. Table consisting of the specific codes used by divers undertaking an MPA survey under the augmented Reef Check methodologies by Coral Cay Conservation (CCC). Each substrate type, whether biotic or abiotic is recorded every 50cm along a 20m replicate that accumulate over a total transect length of 100m. Every 50cm a diver will lower a plumb-line, and record whichever substrate category that plumb-line comes into contact with. *HC (Hard Coral) is further sub-divided into a range of categories based on the lifeform. **OT (Other) is further sub-divided into categories based on their biological identification, these codes are specified.

Biotic Benthic Organisms	Code	Abiotic Substratum	Code
Nutrient Indicator	NIA	Rock	RC
Algae			
Sponge	S	Silt/Mud	SI
Recently Killed Coral	RKC	Rubble	RB
Soft Coral	SC	Sand	SD
Hard Coral*	HC*		
Other**	OT**		
Anemone	O T ANE		
Corallimorph	O T CO		
Halimeda	O T M HA		
Tunicates	O T TU		
Zooanthids	O T ZO		
Gorgonian	O T GO		
Hydroid	O T HY		

2.1.5 Data Analysis

Each 20m belt transect is treated as an independent replicate equating to a total of $n=4$ samples per 100m transect. This produces a minimum of $n=12$ samples inside and $n=12$ samples outside of the MPAs' boundaries. To explore and determine differences in the abundance of fish, invertebrates and the respective

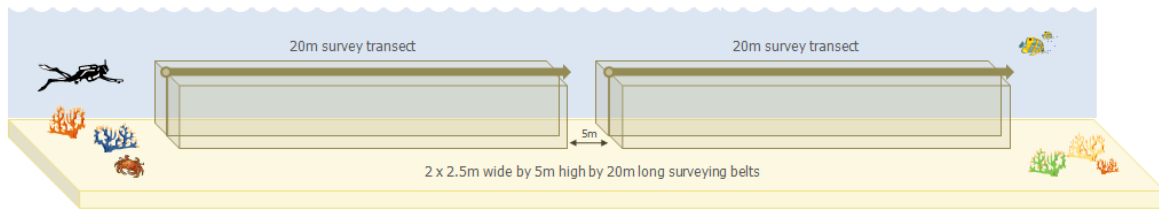


Figure 5. Schematic diagram representing the augmented ReefCheck methodology conducted by Coral Cay Conservation (CCC) surveyors in the assessment of the diversity and abundance of fishes within the Barangay Napantao marine protected area (MPA), Sogod Bay, southern Leyte, the Philippines. Each conducted transect is separated into 4 x 20m replicates segmented by 5m inter-replicate gaps with the abundance of fishes recorded 5m either side of the transect. The presented schematic only represents two of the four 20m replicates.

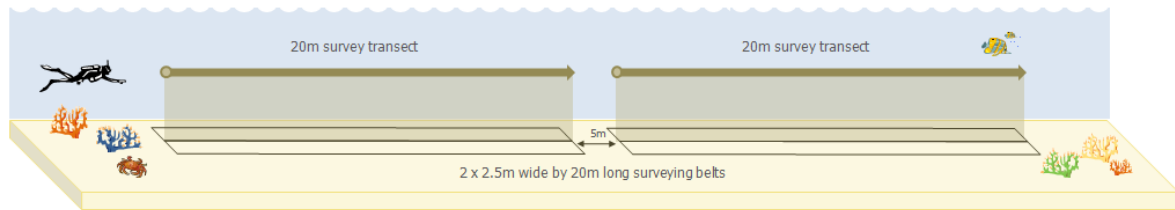


Figure 6. Schematic diagram representing the augmented ReefCheck methodology conducted by Coral Cay Conservation (CCC) surveyors in the assessment of the diversity and abundance of invertebrates within the Barangay Napantao marine protected area (MPA), Sogod Bay, southern Leyte, the Philippines. Each conducted transect is separated into 4 x 20m replicates segmented by 5m inter-replicate gaps with the abundance of invertebrates recorded 2.5m either side of the transect. The presented schematic only represents two of the four 20m replicates.

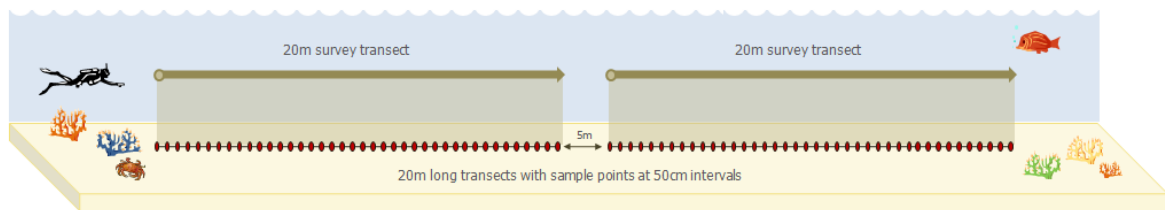


Figure 7. Schematic diagram representing the undertaken point intercept methodology conducted by Coral Cay Conservation (CCC) surveyors in the assessment of benthic composition within the Barangay Napantao marine protected area (MPA), Sogod Bay, southern Leyte, the Philippines. Each conducted transect is separated into 4 x 20m replicates segmented by 5m inter-replicate gaps with the respective benthic substrate recorded at 0.5m intervals. The presented schematic only represents two of the four 20m replicates.

benthic composition between the boundaries of the assessed MPAs, Mann-Whitney U statistical analysis was utilised following tests for normality (Shapiro-Wilks). After this, various diversity indices were developed to enable a more comprehensive analysis of diversity at the sample sites. Based on the nature, and objected outcome of surveying the interior and exterior MPA boundaries, the appropriate diversity index was employed. All statistical analysis was conducted through 'R' (RStudio Team 2016).

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 2015

Between the years 2015 and 2016, CCC conducted a total of two full MPA assessment surveys, one rapid assessment of a proposed site and a further three proposed MPA site assessments. In addition, CCC concluded efforts and assisted the local communities with the establishment of an MPA that had been heavily surveyed throughout 2014; Nueva Estrella Norte (NEN). In 2014, Crown of Thorns seastar (COTs) (*Acanthaster planci*) assessments and removals occurred to assess their true impact on coral reef systems and population levels within proposed areas around Sogod Bay. However, following the successful

assessment and removal of individuals and a re-assessment conducted, again in 2014, it was demonstrated that the previous efforts of CCC had reduced and maintained populations at desired levels. This ultimately resulted in no COTs assessments being conducted in 2015. One of the key aspects of adaptive management is the constant monitoring of sites, and thus re-assessments are scheduled to be conducted in 2016 enabling the monitoring of populations to prevent outbreaks. As COTs take, on average, two years to reach sexual maturity it is likely that the populations will start to increase in 2016. Further information is available in the full reports which can be found on our website: www.coralcay.org or through CCC's Science Department: headofscience@coralcay.org.

2.2.1 Barangay Catig, Municipality of Liloan, Southern Leyte

A rapid assessment of a proposed MPA area in Catig, Liloan at the request of the Municipal Agricultural Office (MAO), in April, 2015, was conducted. At the time, MAO were in the process of securing funding from an international Non-Government Organisation (NGO) (PLAN International) to facilitate the implementation of an MPA within the area and one of the requirements stipulated that a preliminary report was to be produced outlining the areas of suitability that could be designated as an MPA. Therefore, the rapid assessment was conducted. The findings were reported in May 2015, MAO secured the appropriate funding and in July 2015, CCC were requested to complete a full survey on the proposed MPA site of Catig, Liloan to synthesise a detailed ecological report in support of an MPA being established.

From the preliminary assessment, the area proved suitable for an MPA to be established. With regards to the substrate and benthic topography of the area, a range of benthic substrates were recorded. A large continuous hard branching coral meadow was noted that composed of 95% *Porites* sp. (Fig. 8). Coral Bommies were also present and demonstrated a higher diversity of coral species than those within the meadow. In conjunction, the coral bommies were accompanied by a large

meadow of *Sargassum* sp. seagrass. All of which indicate suitable habitat through rugosity and complexity to support a complex community of fish and other organisms. However, in conjunction, fish abundance, diversity and individual size was found to be concerning, with minimal target species recorded (Groupers and Snapper) as well as all parrotfish recorded below 10cm. Another sign, along with substrate damage indicative of Malthusian fishing practices, of overfishing within the area. CCC concluded that from this initial rapid assessment that Catig, Liloan is suitable and in-need of protection. Ideally, an NTA, however, due to the existing dependence on the area by local stakeholders through subsistence fishing practices, the boundaries of the MPA would need to be developed following further discussion and consultation. CCC were requested to undertake a full assessment of the proposed area and the key findings of the surveys were as follows:

- The mean fish abundance ranged from $11.25 \pm 3.77 \text{ } 500\text{m}^3^{-1}$ to $89.57 \pm 17.08 \text{ } 500\text{m}^3^{-1}$, with an overall mean abundance of $48.19 \pm 5.79 \text{ } 500\text{m}^3^{-1}$.
- Approximately 40% of all transects surveyed ($n=8$) demonstrated a significant difference against their possible transect counter-part in the recorded fish abundances through the implementation of Mann-Whitney U statistical analysis.



Figure 8. Hard branching coral meadow found within the Catig, Liloan, marine protected area (MPA) survey site. This meadow conferred a relatively low diversity (α) and was composed of *Porites* sp. (95%).

- On average, the species richness (S) equated to $9.13 \pm 0.57 \text{ } 500\text{m}^3^{-1}$.
 - Results regarding commercially important species concluded initial results obtained from the preliminary rapid assessment, in that the abundance of such commercially important families (*Serranidae*, *Scaridae* and *Lutjanidae*) was low. Mean abundance ranged from $0.25 \pm 0.25 \text{ } 500\text{m}^3^{-1}$ to $18 \pm 5.07 \text{ } 500\text{m}^3^{-1}$. *Scaridae* represented the highest abundance of commercially important families throughout the survey site ($3.88 \pm 1.24 \text{ } 500\text{m}^3^{-1}$). Bumphead parrotfish (*Bolbometopon muricatum*), Humphead wrasse (*Cheilinus undulatus*) and Sweet-lips (*Haemulidae*) were absent from the entire survey site.
 - The size classes of commercially important fish families were concerning. 85.4% were recorded within the size class 0-10cm with 12.4% between 11 and 20cm and the remaining 2.2% between 21 and 30cm in length.
 - Within the survey area, the biomass (g) of commercially important fish families was calculated at $89.56 \pm 24.58\text{g } 500\text{m}^3^{-1}$. A key indicator of overfishing.
 - Regarding the abundance and diversity of target invertebrates, the average abundance throughout the survey site was $80.09 \pm 6.20 \text{ } 100\text{m}^2^{-1}$ with a mean S of $8.22 \pm 0.36 \text{ } 100\text{m}^2^{-1}$.
 - Commercially important invertebrate species including lobster (*Nephropidae*), abalone (*Haliotidae*), triton's trumpet (*Charonia tritonis*), squid (*Teuthida*), greenfish sea cucumber (*Stichopus chloronotus*) and pinkfish sea cucumber (*Holothuria edulis*) were entirely absent from the survey.
 - The benthic substrate was dominated by hard coral (HC) composing 29.06% of the total area surveyed, with rubble (RB) equating to 23.75%. Nutrient indicator algae (NIA) was found to be in abundance (11.41%).
 - The coral reefs of Barangay Catig yielded evidence of moderate levels of anthropogenic impact. Discarded fishing nets were found occasionally throughout the surveying period with medium – high levels of trash were recorded from transects. There were no indicators of coral disease observed during the survey and on average, bleaching was present in less than 1% of hard coral colonies across the site.
- Based on the results of the surveys, CCC made the following recommendations:
- Given the extent of overfishing suggested by the results, an NTA must be established within the proposed MPA boundaries based on areas of ecological importance that would act as a sanctuary for commercially important species.
 - Within the NTA, fishing activities should be forbidden and this NTA area must be strictly enforced. The NTA should be further buffered through a larger Marine Reserve (MR), encompassing the NTA that restricts certain fishing gears (Fig. 9). Only artisanal fishing gear should be permitted (hook and line) within the buffer zones, enabling local stakeholders to sustainably exploit the coral reef, whilst increasing fish stocks.
 - It was recommended that a presentation and general consultation within the local barangay is arranged to demonstrate the ecological status of the current coral reef and the expected response time of proposed results of the stipulated MPA.

- The local stakeholders must be involved in the initial planning phase of the MPA as to increase compliance and ultimately the success of the MPA.
- Continuous monitoring is suggested to assess the diversity and abundance within the MPA. By doing so, it enables local managers to assess and adapt their current policies and by-laws. Local barangay monitoring is to be set up with the facilitation of CCC.
- The MPA boundaries must be enforced to enable fish stocks to recover and for stakeholders to receive the benefits of the proposed MPA site.
- Awareness must be raised on the proposed site and an agreement must be made between all local stakeholders both at the barangay and municipal levels.

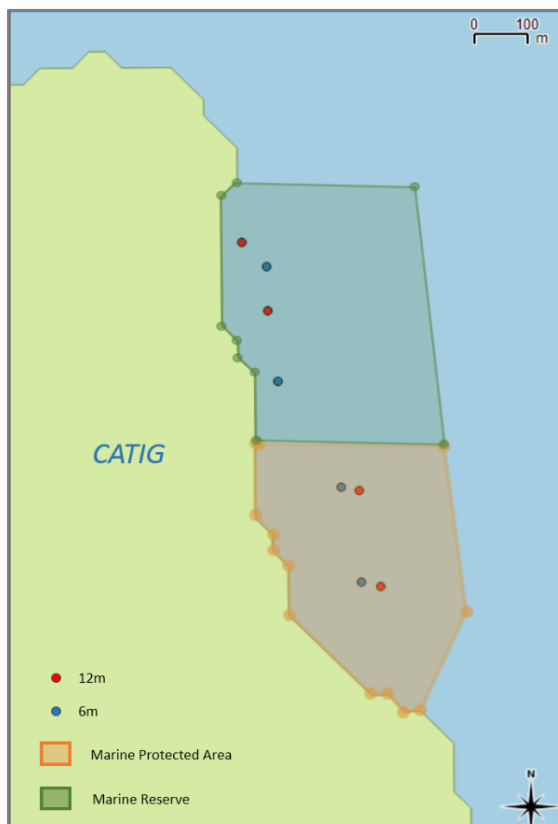


Figure 9. The proposed areas for the designation of a Marine Protected Area (MPA) and Marine Reserve (MR) buffer zone for Catig, Lilaon. The MPA is to be established as a No-Take Area (NTA) where all fishing is prohibited and the buffer MR zone will allow artisanal fishing practices such as hook and line.

2.2.2 Barangay Himayangan, Municipality of Liloan, Southern Leyte

Surveys of Himayangan were requested by the Liloan MAO as they aim to meet the requirements of the 1998 Fisheries Code (Republic Act 8550); stating that 15% of all municipal waters should be protected. CCC surveyed the coral reefs located between 50-150m from the shoreline of the Barangay Himayangan, on the eastern coast of Sogod Bay. Two sites were selected to the north and south of Himayangan beach to determine the best location for an MPA through a comparative study. For the purposes of this section, from this point forth these will be referred to as Himayangan north and Himayangan south. Himayangan north is overlooked by a large, grassy hill while the reefs of Himayangan south lie adjacent to a small area of mangrove forest. Both areas were surveyed in a North to South orientation. Surveying occurred during the months of August and September, 2015. A total of $n=8$ transects were surveyed with each transect composing of 4 replicates.

The aim of this comparative study between Himayangan North and South was to determine an appropriate area to establish an MPA and produce a report that outlined the key results. The key results outlined by the report are as follows:

- Fish abundance was significantly higher in Himayangan North than in Himayangan South, 48.19 ± 9.03 500m^3^{-1} and 18.31 ± 3.99 500m^3^{-1} , respectively. Fish diversity (Fisher's α) did not differ significantly between sites.
- The abundance of commercially important species of Parrotfish, Grouper and Snapper was low across both sites with zero individuals recorded on two out of eight transects. The majority of fish (58.44%) were observed to be less than 10cm in length with no individuals greater than 40cm. The abundance of commercially important fish did not differ significantly between sites.
- There was no significant difference between the calculated mass (g) in

Himayangan North and Himayangan South for both *Serranidae* and *Scaridae*, however, in contrast, a significant difference was calculated between the two sites for *Lutjanidae* with a mean mass (g) of $218.40 \pm 98.46 \text{g } 500\text{m}^3^{-1}$ and $0.22 \pm 0.22 \text{g } 500\text{m}^3^{-1}$, respectively.

- Invertebrate abundance was significantly higher in Himayangan North than in Himayangan South with most invertebrates recorded (82.94%) belonging to the Phylum Echinodermata. Invertebrate diversity (Fisher's α) did not differ significantly between sites.
- There was variation in substrate composition between sites (Fig. 10); rock was the most prevalent substrate in Himayangan North ($36.56 \pm 2.9\%$) while the reefs of Himayangan South were dominated by sand and silt ($38.28 \pm 13.2\%$). Hard coral cover was low in both sites however significantly higher in the Himayangan North in comparison to Himayangan South ($15.94 \pm 2.89\%$ and $4.38 \pm 3.01\%$, respectively).
- Anthropogenic impacts were observed to be present in moderate to high levels. A high abundance of general household and fishing-related trash was observed across both sites. Coral damage was also recorded on several occasions.



Figure 10. Benthic composition at the Himayangan proposed Marine Protected Area (MPA) survey site. The survey site was split into two parts: North and South. The substrate at Himayangan south site is dominated by sand and silt which is disrupted by patches of rock and hard coral.

- The low abundance and complete absence of some commercially important fish and invertebrate species indicates that fishing pressures are too high to sustain healthy populations. Sightings of rare marine organisms across the surveyed area included one hawksbill sea turtle (*Eretmochelys imbricate*) and five blue-spotted ribbontail rays (*Taeniura lymma*).

Based on the results of the comparative report between Himayangan north and Himayangan south, CCC provided the following recommendations:

- Data suggests that Himayangan north was superior in terms of fish, invertebrates and substrate. Protecting this area would allow hard coral cover to increase, enabling fish stocks to recover and potentially generating income through alternative livelihoods in the form of eco-tourism.
- The recommended MPA site would take the characteristics of an NTA site covering a total 4.73ha and would be buffered by a 50m zone termed an MR, which fishing gears and activities are restricted to artisanal hook and line methodologies (Fig. 11).
- Extensive consultations must be developed within the barangay through the development of a committee and complete transparency with the local fishing community to receive compliance of the MPA by-laws.
- The MPA Management Effectiveness Assessment Tool (MPA MEAT) is a national government programme designed to enable MPA manager to assess the effectiveness of their MPA and it should be utilised to increase the success of the designated site.
- The site is in high need of protection but this should only be established

with the support of the local community and with management and monitoring coming from both Barangay and Municipal levels.

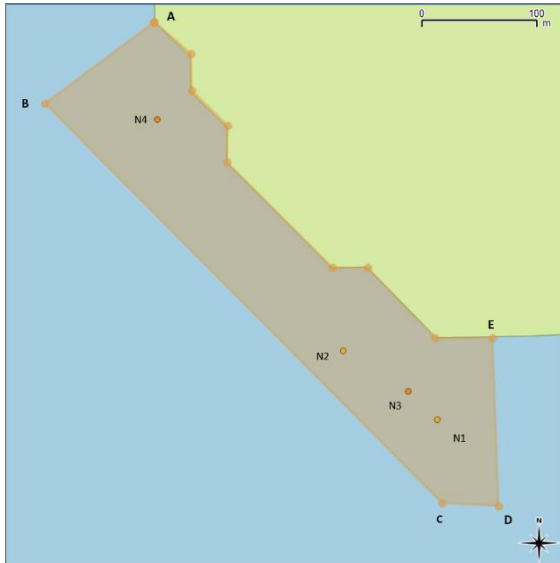


Figure 11. The proposed areas for the designation of a Marine Protected Area (MPA) and Marine Reserve (MR) buffer zone for Himayangan, Liloan. The MPA is to be established as a No-Take Area (NTA) where all fishing is prohibited and the buffer MR zone will allow artisanal fishing practices such as hook and line.

2.2.3 Barangay Gudan, Municipality of Liloan, Southern Leyte

This survey was requested by the Liloan MAO as they aim to meet the requirements of the 1998 Fisheries Code (Republic Act 8550). CCC surveyed the coral reefs located between 50-130m from the shoreline of the Barangay Gudan, on the eastern coastline of Sogod Bay. A second qualitative analysis of the dive site locally known as 'Olly's Wall' was also carried out, as requested by the Liloan MAO. The Barangay of Gudan has a population of approximately 600 people, all of which live within close proximity to the coast. A river mouth of <10m is located approximately 500m away from the proposed site.

CCC's assessment of the proposed MPA site for Gudan was conducted between 15th and 25th May 2015, and the key results are as followed:

- The mean fish abundance across all transects ($n=4$) surveyed was 74.29 ± 14.70 500m^{-3} . Abundance of fish observed at 'Olly's Wall' was low,

however diversity was high with almost all target species recorded.

- Commercially important species of Parrotfish, Groupers and Snappers were recorded in low abundance across the site with no individuals greater than 30cm in length. Grouper were all less than 20cm in length.
- Of the commercially important fish observed in Gudan, all were small. 52.56% fell into the 0-10cm category, 34.62% were between 11-20cm and the remaining 12.82% of commercially important fish were 21-30cm. No recorded individuals reached a length greater than 30cm.
- The biomass of fish within these families was generally low, ranging between 0.01 ± 0.01 kg per 500m^3 and 0.28 ± 0.17 kg per 500m^3 . Other commercially important species such as bumphead parrotfish (*Bombometopon muricatum*) and humphead wrasse (*Cheilinus undulates*) were absent from all surveys.
- Abundance and diversity of invertebrates at 'Olly's Wall' was very high, with almost all target species recorded. At the Gudan site, the average Fisher's a diversity index value was determined at 3.50 ± 0.29 100m^{-2} .

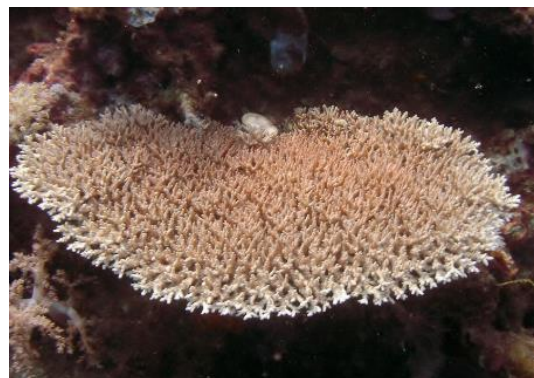
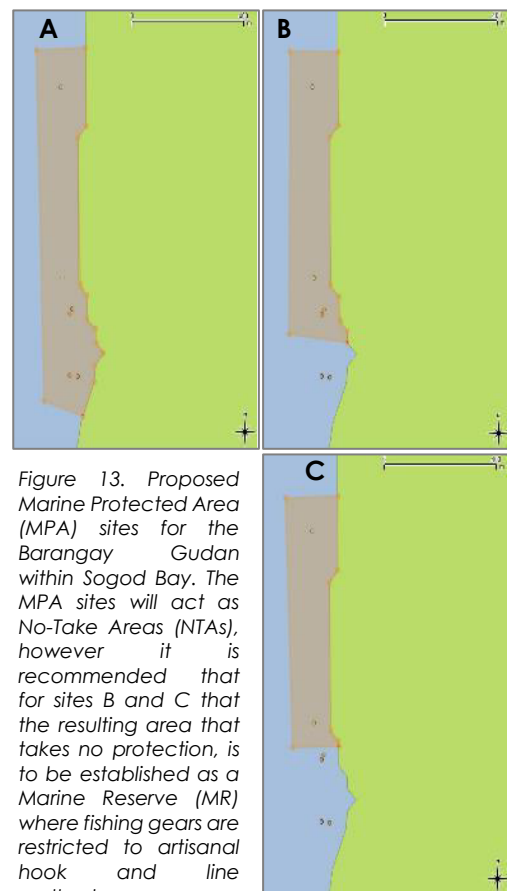


Figure 12. Healthy tabulate *Acropora* sp. colony found whilst surveying the Barangay Gudan proposed marine protected area (MPA) site.

- Rare sightings of fish and invertebrates across the site included a blue-spotted ribbontail ray (*Taeniura lymma*), giant frogfish (*Antennarius sp.*), spotted eagle ray (*Aetobatus narinari*) and flamboyant cuttlefish (*Metasepia pfefferi*).
- Sand (38.59%) was the most commonly recorded substrate during the biophysical survey followed by rock (23.44%) and hard coral (16.27%). 'Olly's Wall' yielded a wide variety of substrates, the most abundantly biotic substrate observed were anemones, followed by soft coral, black (whip) coral and hard coral.
- Anthropogenic impacts were observed to be moderate (2) to high (3). A high abundance of fishing and general trash was recorded both during the biophysical survey and qualitative assessment of 'Olly's Wall'. Coral damage was also observed on occasions with <1% of colonies observed demonstrated signs of bleaching.
- The low abundance and complete absence of some commercially important fish and invertebrate species indicates that fishing pressures are too high to sustain a healthy population. This is a threat both to the reef and the community of the Barangay Gudan.
- Whilst proposed site A will be of maximum value to all stakeholders by increasing fish stocks, commercially important organism population sizes and improve the potential for alternative livelihoods through ecotourism, generating additional income, it was suggested that if sites B or C were established, that the remaining area to be still protected through an MR where fishing activities are restricted to artisanal hook and line methods.
- Extensive consultation will be essential within the local community to ensure compliance with the MPA.
- If individuals from the community are involved in the planning processes they will have a vested interest in the effective running and management of the MPA. If an MPA is declared, an awareness campaign is essential to ensure that

Following the findings of the report, CCC made the following recommendations:

- As a result of the abundance of fish and invertebrates amongst all transects, including the sightings of rare, charismatic fauna, CCC proposed three scenarios, each varied in the size of MPA suggested, ranging from most effective based on their potential functionality with scenario A at 15.6ha, B at 12.3ha and least effective C at 10.5ha (Fig. 13).



everyone is aware of the new MPA, its extent and by-laws.

- It will be important to secure funding from the outset to aid in the establishment of the MPA. Demarcation buoys, and signage are essential tools for raising awareness and promoting enforcement. Securing sustainable financing will help to secure the long-term future and success of the MPA.
- If, after detailed consultation and evaluation, an MPA is designated in Gudan it will be important to ensure that monitoring of the MPA is conducted on a regular basis. Assessing temporal trends in abundance and diversity is crucial in determining how the MPA is achieving its goals.
- Overall the future of a protected area in Barangay Gudan should be reviewed with consultation between all stakeholders involved. The site is in high need of protection but this should only be established with the support of the local community with management and monitoring coming from both Barangay and Municipal levels.

2.2.4 Barangay Punta, Municipality of San Francisco, Southern Leyte

Previously, a marine reserve had been established in Punta in 1997 that was managed through open and closed fishing seasons. However, following a landslide in 2003, resulting in the destruction of the Barangay Punta and the majority of the marine reserve, the bangaray was ultimately abandoned. In 2009 it was decided that a new MPA be established within the boundaries of its historic MR, facilitated by CCC, the Local Government of San Francisco and Barangay Officials.

The current area of the MPA is a total 10.5ha, of which includes a buffering marine reserve, that is supported by the Municipal Ordinance 128, s2009. CCC conducted an assessment on the areas of coral reef inside and outside of the current

MPA boundaries with the subsequent aim of extending the current MPA boundaries in order to protect a greater area and improve functionality. CCC's assessment of the MPA site for Punta was conducted between 10th November and 1st December 2015 and the key results of the report are as follows:

- There was no significant difference in fish abundance or Fisher's (a) diversity index values between the sites inside or outside the MPA. However, transect 1, inside the MPA was found to have significantly higher fish abundance than two other transects inside the MPA boundaries with a mean average of $80.75 \pm 15.12 \text{ } 500\text{m}^3 \text{ }^{-1}$ indicative species' preference to this area. Therefore, highlighting the need for it to remain protected, as this area holds key ecological importance.
- Commercially important species of Parrotfish, Groupers and Snappers were recorded in medium to low abundance across the site with a total of 69 individuals found inside the MPA and 83 outside the MPA with no individuals greater than 30cm in length. The majority were categorised as 0-10cm (45.45%) and 42.21% within the 11-20cm category.
- Invertebrate abundance and Fisher's (a) diversity was not significantly different between the two sites. Inside the MPA the mean S was $31.5 \pm 4.99 \text{ } 100\text{m}^2 \text{ }^{-1}$ in contrast to outside the MPA with a S value of $26 \pm 4.26 \text{ } 100\text{m}^2 \text{ }^{-1}$. With regards to invertebrate abundance, inside the MPA totalled a greater number of invertebrates ($250.25 \pm 83.83 \text{ } 100\text{m}^2 \text{ }^{-1}$) in comparison to outside of the MPA boundaries ($152.25 \pm 40.82 \text{ } 100\text{m}^2 \text{ }^{-1}$).
- Silt (Inside ($32.34 \pm 18.24\%$), outside ($33.13 \pm 13.30\%$)) was the dominant recorded substrate during the biophysical survey followed by hard coral (inside ($26.41 \pm 6.98\%$), outside ($32.81 \pm 3.56\%$)) then rock (inside ($16.25 \pm 4.81\%$), outside (9.84

$\pm 1.85\%$)).

- Anthropogenic impacts observed on the reef were low, however fishing trash was recorded inside and outside of the MPA boundaries. Fish traps were also recorded during the assessment in tandem with white coral band disease.
- No significant difference between inside and outside the MPA of Punta suggested that the MPA failing to protect the area due to multiple factors including the small size of the MPA, illegal activities occurring within the MPA and low levels of enforcement.

Following the findings of the report, CCC made the following recommendations:

- CCC recommends that the current MPA boundaries be extended to include the entire survey area (Fig. 14). This recommendation would have the highest ecological benefit to the area due to the revised boundaries including a larger area of hard coral cover providing a complex habitat.
- Taking the results and the current MPA into consideration, the final designated MPA site for Punta must be decided in consultation with the local Barangay, the local fishers and the Municipal government of San Francisco.
- Support for the establishment of an MPA should be obtained from both Municipal and Provincial government levels. It will be important to secure funding from the outset to aid in the establishment of the MPA. Demarcation buoys, and signage are essential tools for raising awareness and promoting enforcement.
- If an MPA is designated in Punta it will be important to ensure that monitoring of the MPA is conducted on a regular basis. Assessing

temporal trends in abundance and diversity is crucial in determining how successfully the MPA is achieving its goals.

- Overall the future of a protected area in Barangay Punta should be reviewed with consultation between all stakeholders involved. The site is in high need of protection but this should only be established with the support of the local community and with management and monitoring coming from both Barangay and Municipal levels.

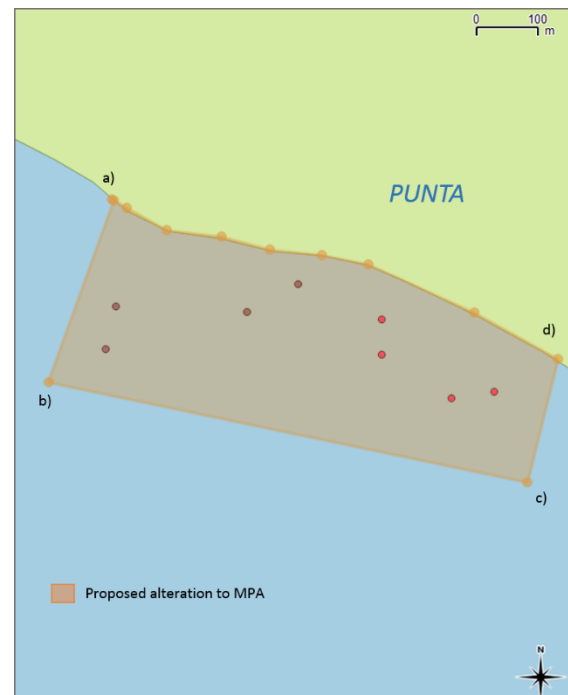


Figure 14. Proposed extension of the current Marine Protected Area (MPA) in Barangay Punta, San Francisco. It is proposed that the area be extended to include a greater area as recent results have suggested that the current MPA has poor functionality.

2.2.5 Bangaray Napantao, Municipality of San Francisco, Southern Leyte

The Napantao MPA was established in 1996 and covers a total of 5ha. Located within the municipality of San Francisco, adjacent to the barangay of Napantao, it estimated that there are 25 direct stakeholders through fishers with approximately 300 indirect stakeholders that utilise the surround waters of the MPA's boundaries (Longhurst *et al.*, 2013). The infrastructure regarding the Napantao MPA is considered good

with a semi-permanent supervised Bantay Dagat hut present in tandem with trained Bantay Dagets, Patrol boat with Bantay Dagat gear as well as user fees being collected. The MPA boundaries are also clearly marked with demarcation buoys. Fishing takes place on a regular basis around the boundaries of the marked MPA, however, it is reported that fishing inside the boundaries is rare.

CCC conducts bi-annual biophysical permanent surveys within the Napantao MPA: three transects inside the MPA boundaries and three outside, constituting to a total of 24 replicates covering a total surveyed area of 12km³ during fish censuses and 2.4km² whilst assessing invertebrates. CCC collect data to enable the continuous ecological monitoring of the site in comparison to the ecological status outside the MPA's boundaries. Through continuous monitoring, resource managers can practice adaptive management, a key process in the success of MPAs as managers can adapt policies and by-laws for the benefit of biota within the MPA as well as the direct and in-direct stakeholders. Full MPA assessments were conducted by CCC in April and October 2015. The key results are as followed:

April 2015:

- With regards to fish abundance inside and outside of the MPA boundaries, mean values of $75 \pm 9.49 \text{ } 500\text{m}^3^{-1}$ and $58.17 \pm 8.84 \text{ } 500\text{m}^3^{-1}$ were determined, respectively. However, in conjunction, there was no significant difference between the two sites.
- The *S* recorded inside ($13.75 \pm 0.66 \text{ } 500\text{m}^3^{-1}$) and outside ($9.33 \pm 0.86 \text{ } 500\text{m}^3^{-1}$) of the MPA boundaries varied significantly following statistical analysis, with the *S* inside the MPA significantly higher than that recorded exterior to the MPA's boundary.
- The abundance and diversity of Butterflyfish has been shown, historically, to act as a good indicator for the ecological status of coral reefs. As a result, the

abundance, *S* and Fisher's *a* Diversity index values were recorded during surveys inside and outside of the MPA boundaries, of which, a significant difference was determined to exist between all three parameters. This indicates that the hard coral colonies present within the MPA are benefiting from the functionality and infrastructure established through the MPA.

- Throughout the assessment, a total biomass (kg) of commercially important species of 66.04kg was recorded. When analysed further, 33.95kg was recorded inside the MPA boundaries with the remaining 26.08kg recorded outside. Of the three commercially important fish families (Serranidae, Scaridae and Lutjanidae), Lutjanidae inside the MPA boundaries were, in general, larger, with a range of size classes, as well as more abundant. Due to this, the difference between the total biomass (kg) of Lutjanidae recorded inside and outside equated to 6.39kg (inside (8.18kg) and outside (1.79kg)). Due to the mobile nature of these commercial species, a significant difference was tested for between each species' mean biomass (kg) 500m^3^{-1} and their location of recording. No significant difference was found.



Figure 15. An example community and coral reef scape typically found within the boundaries of the Napantao Marine Protected Area (MPA). This photo depicts the coral species *Tubastrea micrantha* surrounded by a school of *Chromis* sp. Adjacent two *Zanclus cornutus* are present.

- Initial results of target invertebrate species suggest that abundance had increased, demonstrating a 37.8% increase in comparison to the invertebrate abundance outside the MPA. However, there was no significance difference determined. The same result of no significance applied to their respective *S* and Fisher's (a) diversity values.
- Hard coral percentage (%) cover within the boundaries of Napantao MPA demonstrated a 52.2% increase in comparison to the percentage cover recorded on the coral reefs outside of its boundaries. Conversely, hard coral percentage cover was the greatest inside the boundaries (36.46%), followed by rock (31.25%) and rubble (10%).
- The anthropogenic coral damage impacts were considered medium (2), both inside and outside of the MPA boundaries. The same result was formulated for fish net trash and general trash found along transects. Of the whole survey site, there were minimal signs of coral bleaching and coral disease reported.

October 2015:

- A mean average of 111.67 ± 40.79 500m^3^{-1} fishes composed of 14.08 ± 0.82 500m^3^{-1} species recorded inside the MPA boundary. Contrariwise, outside of the MPA boundaries, a mean average of 12.33 ± 1.14 500m^3^{-1} species, resulting in 82.33 ± 11.14 500m^3^{-1} fishes. No significant difference was identified between the two surveyed areas.
- No significant difference was calculated inside and outside of the MPA boundaries with regards to the abundance, *S*, and the Fisher's (a) diversity index values of Butterflyfish. In comparison, the abundance, *S*,

and Fisher's (a) diversity index values (excluding Fisher's (a) diversity index value inside the MPA boundaries) increased from the surveyed values obtained in April 2015. There are many confounding factors that could influence the Butterflyfish resulting in such results and therefore although butterflyfish species can be used as an indicator species, their use is not conclusive of the ecological status of the reef, and thus, supporting evidence is recorded in order to conclude that the ecological status of the reef has improved.

- Throughout the assessment, a total biomass (kg) of commercially important species of 21.6kg was recorded. When analysed further, 12.3kg was recorded inside the MPA boundaries with the remaining 9.3kg recorded outside. Of the three commercially important fish families (*Serranidae*, *Scaridae* and *Lutjanidae*), *Serranidae* (Grouper) inside the MPA (1.4kg) had the greatest difference inter-boundary with a calculated difference of 1.3kg when compared outside of the MPA boundary (0.1kg). Contrastingly, *Scaridae* (Parrotfish) made the greatest contribution to biomass (kg) calculations both inside and outside the boundaries (8.9kg and 7.7kg, respectively). Due

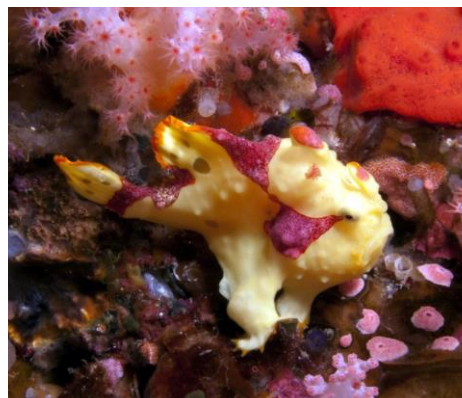


Figure 16. An image of *Antennarius maculatus* (Warty Frogfish) obtained from within the barangay Napantao, San Francisco, marine protected area (MPA), 2013.

to the mobile nature of these commercial species, the variance of biomass (kg) was tested. The mean biomass (kg) 500m^3^{-1} of *Serranidae* differed significantly either side of the MPA boundary.

- The total abundance of invertebrates inside the MPA boundaries was 2.42% lower in comparison to the total abundance outside the boundaries. This trend was prevalent throughout other results such as *S* (-10.32%) and Fisher's (α) diversity index values (-15.45%).
- Hard coral cover at both sites demonstrated a 16.6% increase in comparison to April 2015 data. Rock was the second most dominant at both sites. Worryingly, the percentage composition of coral rubble inside the MPA boundary increased by 20.8% from April to October 2015.
- Notably, the level of anthropogenic impact outside of the MPA boundary was greater than inside the boundary recorded, on

average, at medium (2) with minimal impacts recorded within the boundaries. In addition, the amount of coral bleaching and coral disease were minimal at both sites.

Although this section has briefly compared surveys undertaken in April and October, 2015, CCC is in the process of developing a triennial report that will summate three years' worth of data from the Napantao MPA, of which will compare data and results in a holistic manner, analysing temporal changes in the ecological status of the protected site and make appropriate management recommendations.

2.2.6 Barangay Nueva Estrella Norte (NEN) MPA Establishment, Municipality of San Francisco, Southern Leyte

Upon the request of the Pintuyan MAO, in August and September 2014, CCC undertook assessments of the coral reefs located 75-100m off-shore of the Barangay Nueva Estrella Norte (NEN), Sogod Bay, San Francisco (Fig. 17). The 600 populated Barangay is located approximately 300m away from the MPA site. To request to assess the proposed site was because of the Pintuyan MAO expanding their efforts to meet the requirements of the 1998

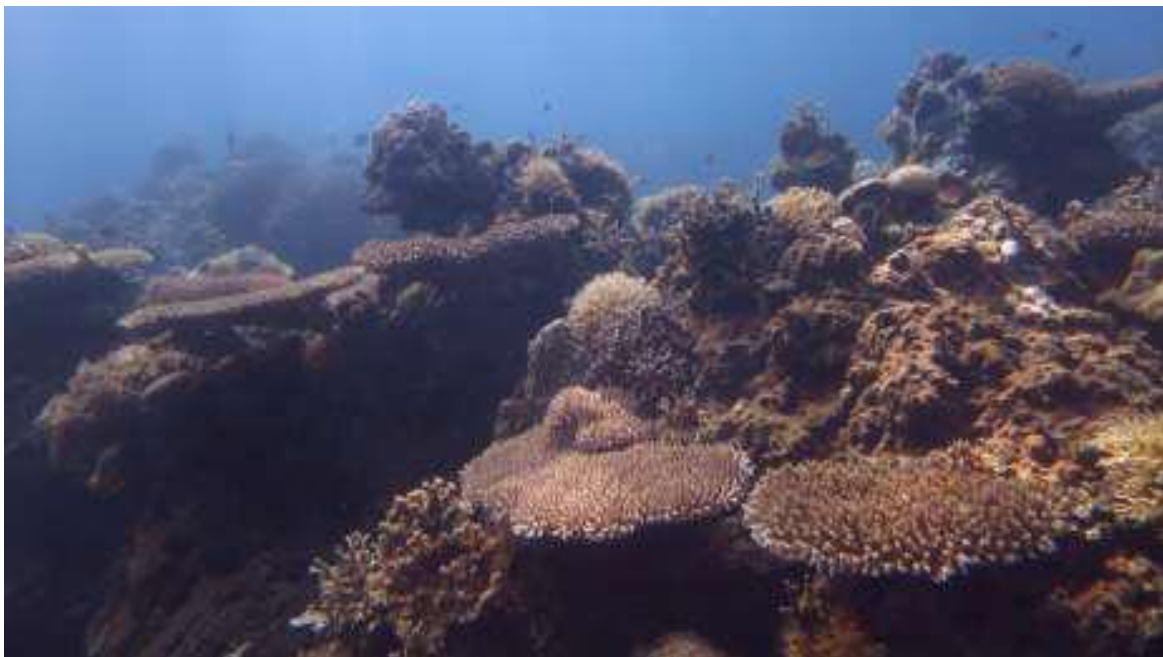


Figure 17. An image taken from within the proposed marine protected area boundaries of Barangay Nueva Estrella Norte, San Francisco. The image depicts healthy tabulate colonies of *Acropora* sp., an essential reef building coral that increases habitat complexity ultimately driving productivity and diversity.

Fisheries Code (Republic Act 8550). Subsequent to recommendations from CCC, following analysis of data obtained from the MPA site, it was decided that an MPA was to be established.

Following from the completion of surveys within the proposed area, a meeting was conducted with the captain of the Barangay NEN and their respective council. Officers from the MAO of Pintuyan, local stakeholders and representatives from other NGOs were also in attendance. There was a subsequent consultation regarding the placement of the MPA. It was agreed that the largest proposed area was to be protected (Fig. 18), equating to a total protected area of >15ha. However, it was agreed that the MPA would practice zonation, enabling stakeholders to undertake activities within certain zones whilst empowering managers to restrict fishing activities and respective gears based on areas of ecological importance.

CCC assisted the community of NEN in the establishment of the MPA through the placement of demarcation buoys clearly

defining its' boundaries. This represented a culmination of hard work from the local community and the MAO of Pintuyan and is testament to the comportment of local stakeholders within the region.

2.3 Technical and Scientific Meetings

Throughout 2015 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 2). 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.



Figure 18. The established marine protected area (MPA) in the Barangay Nueve Estrella Norte equating to >15ha.

Table 2. Technical and scientific meetings attended by CCC throughout 2015. Listed is the date of the meeting, a summary, the attendees and the location.

Month	Activity	Parties Attended	Location
February 2015	<u>SLSU post-MPA meeting –</u> Post Barangay Napantao MPA consultation regarding MPA questionnaires and focus groups that CCC would like to establish. Aiming to assess the Catch Per Unit Effort (CPUE)(kg) and the social perception regarding the Barangay Napantao MPA. <u>Nueva Estrella Norte (NEN) MPA Designation Meeting –</u> Presentation of results from CCC's Barangay NEN proposed MPA site of which four options, along with their respective benefits, were discussed. Option four, the largest area to be protected was decided upon implementing zonation; No-Take Areas (NTAs) and Marine Reserve (MR) buffer zones.	CCC SLSU CCC NEN Barangay Captain NEN Barangay Committee Fisher Folk Peace Corps MAO	Sogod Bay NEN Barangay, San Francisco
March 2015	<u>GIZ Focus Group Meeting –</u> An opportunity to discuss the issues faced by local stakeholders regarding the successful management of MPAs within the region.	CCC PENERMO SLSU Nabantao Barangay Captain MAO (San Francisco, Limasawa, Libagon and others)	SLSU, Bontok
October 2015	<u>Barangay Catig MPA Survey Results Presentation –</u> The presentation of results following surveys in the Barangay Catig, Liloan in order to discuss the implementation of the proposed MPA by CCC. Subsequent to the presentation of results, an MPA was decided upon. <u>MFARMC Meeting –</u> Discuss outstanding issues that centred around the establishment and maintenance of MPAs with concerns over illegal fishing and enforcement.	CCC Catig Barangay Council Local fisher folk and Stakeholders CCC MFARMC	Catig, Liloan Liloan
November 2015	<u>Philippine Organisation of Science and Technology Educators (POSTE) Regional Convention –</u> Presentation given to POSTE participants entitled "Increasing Diversity: Strategies for Teaching Science (Marine Life Conservation)" of which discussions were held regarding the styles of teaching and learning. From this, further discussions and activities were developed regarding the most appropriate ways to educate, influence and raise awareness within the region.	CCC POSTE	SLSU, Sogod

3. Capacity Building

CCC works with local communities to promote conservation education, sustainable resource exploitation and equips them with essential marine conservation and management skills. CCC are committed to assisting local communities by providing a range of scholarships, capacity building and alternative livelihood programmes.

3.1 Scholarship Scheme

CCC's Scholarship Scheme provides opportunities for any Filipino national to join the expedition team in Napantao, San Francisco and receive training, with no expedition fees accrued, with the aim to build the necessary skills and undertake coral reef monitoring within regions of the Philippines outside of CCC's remit. A full four-week training course includes the following:

- PADI dive training to Advanced Open Water
- 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

Scholars are invited from across the Philippines, with priority for placements given to residents of Southern Leyte. In 2015, CCC welcomed 20 scholars (Table 3).

"...Everything that I've learned here is essential to protecting the marine ecosystem. Now that I am a certified Advanced Open Water Diver, I'll be able to realise my dream to become a marine eco-saver and take care of our widely diverse Sogod Bay..." - Jason G Tuang-Tuang

Table 3. Table detailing the participants of the Scholarship Programme conducted by CCC to build capacity throughout the Philippines.

Month	Name	Information
January 2015	Annaviv	-
	Zacate	-
	Tara	-
	Alessandra	
	Abrina	
	Rhea	
February 2015	Lucanio	
	Jose Daniel Santos	-
March 2015	Aprille Grace	-
	Nazaret	
April 2015	Kristine Aura	-
	Daga	-
	Jason Tuang-Tuang	
May 2015	Lovely	-
	Heyres	-
	Kimberely	
	Mamburam	
June 2015	Agatha	-
	Henry	
July 2015	Jen Horn	-
	Maria	-
	Rachelle	-
	Gallmann	
	Marvin	
	Gonzales	
August 2015	Scotty Syling	Ateneo de Manila University
September 2015	Janvie	SLSU
	Lumakang	SLSU and
	Alvin	BFAR
	Valderosa	
October 2015	Dexter	Silliman University
	Fernandez	University of Philippines Los Banos
	Achass Biay	
November 2015	Alexa	University of Philippines Los Banos
	Barcelon	
	Jinefer	SLSU Bontoc Graduate
	Eusebio	

In 2014, CCC developed a modulated scheme considering barriers to participation, through discussions with PGSL and local marine managers. It was highlighted that for participants or potential participants that were involved in full-time employment, a commitment to a

month full-time participation course was unfeasible. The newly developed modulated scheme requires a commitment of 1-2 days per week. In addition, the opportunities to extend their current diving qualification(s) to PADI Dive master, where CCC deem appropriate and are satisfied that, by achieving this qualification, their area of work will be benefitted. At current, local scholars are benefitting from this newly modified scheme with an increase in modulated scholar applications, demonstrating how CCC have adapted to relevant discussions after identifying barriers.

The scholarship programme in 2015 was a great success, with a 100% increase in scholars from 2013. Such an increase is supportive of CCC's actions within the local region. The impact that such an influx of scholars arriving and departing CCC's base in Napantao on the local communities, respective coral reefs and ecosystems has already been brought to light with stories of past scholars currently involved with local NGO's as well as their establishment. As a scholar departs, a quote is often written by the scholar themselves, presenting a personal view on the programme. Aiming to inspire, educate and raise awareness within the younger generation in issues surround their local ecosystems and the dangers that they face, CCC truly believes that these young, prospecting scholars will go on to make a considerable ecological and social change within the local region of Southern Leyte and, hopefully, further.

Below are some quotes left by CCC scholars following their completion of the programme:

"This experience is one of a kind. It's like a fulfilment – a dream come true. I've met wonderful people, learned new things and been given the privilege to learn how to dive which is the one of the best things that has happened in my life. CCC is wonderful! All the fishes, corals and special thanks to the sea cucumbers and sea snakes that still frighten me, always!"

Lovely Joy D. Heyres, May 2015

"One of my goals in joining CCC was to gain a better knowledge and understanding of various marine life. And I'm now even more inspired to learn more and find ways to help preserve the richness of our seas even while we're on land. I'm grateful for meeting everyone here at base, learning & diving together, sharing stories, playing games, and yes, karaoke! I certainly hope to stay in touch with the folks I've met here!"

Jen Horn, July 2015

"My CCC experience, was the funniest and the most amazing kind of learning I had in my life. I now have a different perspective of the ocean; I appreciate it even more than I did before. I have more knowledge on how to protect and help prevent damage to it. The CCC staff are the coolest and friendliest staff I have ever met. I won't forget my co-scholars and volunteers. Thanks CCC for inspiring us, I hope you continue the legacy on spreading knowledge and protecting the ocean, I know I will."

Agatha Henry, June 2015



Figure 19. Two scholarship programme participants, Jen Horn and Agatha Henry, July 2015, ready for one of their dives within Sogod Bay.

A once in a lifetime and a matchless opportunity ensued to me, as I contemplate my moments way back at the site, I ended up longing for the wonderful people I was with, to the reefs I was used to dive in and to the mattress I used to sleep with. I am very grateful to CCC for providing such a delightful experience and giving an irreplaceable pledge to help conserve the fascinating marine life. To future scholars, make your time a significant and expediency stay. Don't dive just to feed your satisfaction with incredible views but develop a sense of environment-importance within yourself."

Marvin Gonzales, July 2015

"Coral Cay Conservation was an amazing opportunity I am grateful to have been given. After every lecture and training, I would see the underwater world in different eyes and appreciate it more. I have made new diverse friends and made beautiful memories. I have been inspired and will do my best to put the things I have learned here to good use. Hopefully we can all influence positive change in this country and around the world."

Mara Gallman, July 2015



Figure 20. Two scholarship programme participants, Marvin Gonzales and Mara Gallman, July 2015, ready for one of their dives within Sogod Bay.

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. This can also include workshops, outreach efforts and educational on-site events. Table 4 lists the training and capacity building activities carried out by CCC in 2015.

Below are some recorded photographs from CCC's training and capacity building activities in 2015:



Table 4. Training and capacity building programmes that Coral Cay Conservation (CCC) conducted throughout 2015 within Southern Leyte, Philippines.

Month	Activity	Parties Attended	Location
March 2015	PNVHS Eco-Committee SON-ok Snorkel Day - An opportunity for a newly formed student Eco-Committee from a high school in Pintuyan to try snorkelling for the first time. This was undertaken in liaison with PeaceCorps and LaMaVe (a practicing whaleshark NGO)(Fig. 21)	CCC PeaceCorps LaMaVe	Son-ok Pintuyan
April 2015	SLSU ECO-Club and CCC MPA Seminar and Workshop - The newly formed Environmentally Conscious Organisation (ECO-Club) by SLSU hosted CCC to enable CCC to educate members of ECO-Club on MPA, their management and current ecological status of global coral reefs.	CCC SLSU ECO-Club	SLSU, Sogod
July 2015	ECP Community Course - Two first aid courses were taught as part of the CCC community interaction work to Barangay Napantao officials.	CCC Barangay Napantao Council	Napantao
September 2015	Bantay Dagat Training for Catig and Napantao Barangays - CCC Napantao opened its base up to local community members of Barangay Catig and Barangay Napantao. The aim of the day was to show community members what CCC do within the area and to further raise awareness on local stressors whilst supplying educational material and activities surrounding MPAs.	CCC Catig Barangay Bantay Dagats Napantao Barangay Bantay Dagats NACOA members	CCC Napantao Base
September 2015	DRT Dive Show - An excellent opportunity for CCC to increase the current levels of eco-tourism within the local region in tandem with giving seminars and establishing discussions on the current conservation efforts within Sogod Bay (Fig. 22).	CCC Department of Tourism	Manila
October 2015	Gudan Community Education Day - An important and valuable process in any MPA establishment process is to provide the local stakeholders with education and awareness of not only the MPA process but the fauna and flora the MPA is aiming to protect with emphasis on the benefits received from the MPA.	CCC Gudan stakeholders	local CCC Napantao Base
November 2015	CNN Visited CCC - International media outlet CNN arrived at CCC as part of a documentary being produced regarding the social and cultural aspects of the region. This was an excellent opportunity for CCC to voice their aims and objectives as well as their success within the local municipalities whilst bringing awareness to the threats faced by local coral reefs and conservation efforts	CCC	CCC Napantao Base

4. Education and Outreach Work

4.1 Teaching in Schools

Coral Cay Conservation's cornerstone belief is that marine conservation goes hand in hand with education and economic development. Therefore, emphasis is placed on alternative livelihoods to reduce the economic dependence of communities on the coastal environment whilst improving their standard of living. In addition, the implementation of educational programmes has provided thousands of people with a better understanding and ability to sustainably manage their coral reefs. As a result, hundreds of local scholars have passed through CCC's doors, some of whom have gone on to take on leading roles within the environmental sectors of their respective governments.

As part of CCC's wider environmental education programme our enthusiastic staff are about all year around providing lessons on environmental issues to local schools, with 2015 being no different. Unfortunately, CCC only had an active educational officer (EO) available on site for 6 out of the annual 12 months. Therefore, as a result, CCC's total school visits were lower than targeted for 2015, however this did not stop CCC staff and volunteers putting in the effort and holding some brilliant intra-school activities. In 2015, our EOs visited a total of 15 schools in San Francisco and the nearby Municipalities of Liloan and Pintuyan (Table 5) 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 their ecology. 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.

Many barriers to the success of MPAs have their roots embedded in cultural, social and

traditional behaviour. Therefore, managers are often confronted with a lack of compliance to modified management policies due to them going against the status quo. In order to alter perceptions, and to increase the success of MPAs, providing education to younger generations is key. Raising awareness of activities and inspiring younger community members, as well as further building capacity within the local community is a strong aim of CCC.

For example, in recent years (2013), CCC has developed the SEAS programme. This programme entails CCC staff members going into schools and supplying educational materials. The programme is a three-tiered set-up (Fig. 21) and aims to develop sustainable partnerships between CCC and local schools by building an environmentally aware culture among the young people of the Barangay. The school must complete specific objectives in order to reach the next level (Bronze, Silver and Gold). The completion of the gold SEAS award depends on the school developing and establishing an Ecological Committee that carries on the CCC ethos of marine conservation. In 2015, CCC facilitated the obtainment of 5 bronze SEAS awards, 4 silver awards and one gold award across 5 schools. CCC saw Caligangan Elementary School achieving the prestigious gold SEAS award for completing all three classes from grades 7 to 10, implementing a coastal clean-up environmental campaign whilst parading the Calignangan beach with various banners and poster they had made; raising awareness in their local community.

Table 5. The range of local schools visited in 2015 within San Francisco and neighbouring municipalities by Coral Cay Conservation's (CCC) education officers (EO). The table displays the month and year of the visit with the municipality the school is in and the respective school's name

Month	Municipality	School Name
January 2015	Pintuyan	Pintuyan National High School
January 2015	Pintuyan	Pintuyan Vocational High School
January 2015	Pintuyan	Pintuyan Central School
January 2015	Pintuyan	Cogon Elementary School
January 2015	San Francisco	Tabugon Elementary School
January 2015	San Francisco	Magapus Elementary School
January 2015	Liloan	Liloan National Technical Vocational High School
January 2015	Liloan	Liloan Central School
January 2015	San Francisco	Napantao Elementary School
January 2015	San Francisco	Bongwasian Elementary School
February 2015	San Francisco	Celestino A. Ablas, Sr. Academy Foundation, Inc (CAASAFI) High School
February 2015	Pintuyan	Pintuyan National Vocational High School
February 2015	Pintuyan	Pintuyan National High School
September 2015	San Francisco	Celestino A. Ablas, Sr. Academy Foundation, Inc (CAASAFI) High School
September 2015	San Francisco	Santa Paz National High School
September 2015	San Francisco	Marayag National High School
September 2015	Liloan	Caligangan Elementary School
September 2015	San Francisco	Napantao Elementary School

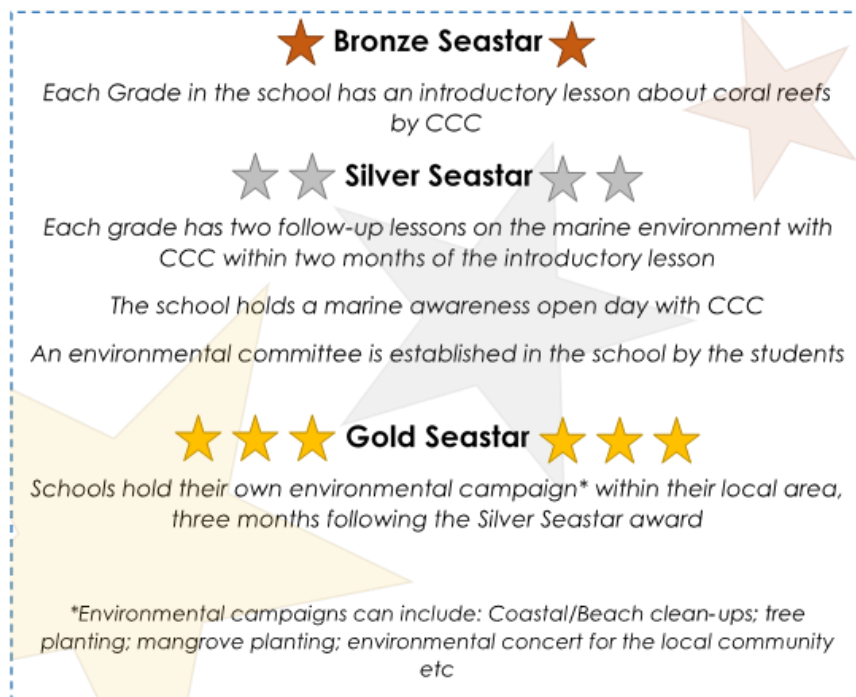


Figure 21. Coral Cay Conservation's Seastar Environmental Awareness Scheme (SEAS) that was established in 2013 and is exhibiting great success through its implementation in both elementary and high schools within the local municipalities of San Francisco, Liloan and Pintuyan, Southern Leyte. In order for each school to progress to the next level and obtain the respective SEAS reward, they must complete certain scientific and community based objectives.

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 demographic

of the local community (Table 6). In 2015, key outreach events were targeted to locations where CCC surveying activities were conducted, specifically: Catig; Himayangan; Gudan; Punta; Napantao; and Nueva Estrella Norte.

Table 6. Other educational and outreach activities conducted by Coral Cay Conservation (CCC) in 2015.

Month	Activity	Parties Attended	Location
February 2015	Reef Rangers with Himayangan High School - CCC welcomed 10 students to Napantao for a fun-filled and educational day with the students given an introduction to CCC, presentations on coral reef biology as well as learning how to identify fish and other fauna. Despite these Reef Rangers living next to the ocean, for some, it was their first opportunity to try out snorkelling. Following further introductions to the CCC volunteers, the Reef Rangers were tasked with developing posters and giving subsequent presentations, discussing the threats to coral reefs and potential management options.	CCC Himayangan High School	CCC Base, Napantao
February 2015	Meeting with Grace Quinton and Ocean Action Resource Centre (ORC)- ORC would like to establish CCC as an official partner, enabling CCC to have more continuity and consistency within their educational programmes. ORC also wishes to benefit from such an affiliation with hopes of increasing volunteer intakes into ORC.	CCC ORC	Silago
March 2015	Reef Rangers with Celestino A. Ablas Senior Academy Foundation Inc. (CAASAFI) - CCC welcomed students to Napantao for a fun filled and educational day with the students given an introduction to CCC, presentations on coral reef biology as well as learning how to identify fish and other fauna. Despite these Reef Rangers living next to the ocean, for some, it was their first opportunity to try out snorkelling. Following further introductions to the Coral Cay volunteers, the Reef Rangers were tasked with developing posters and giving subsequent presentations, discussing the threats to coral reefs and potential management options.	CCC CAASAFI	CCC Base, Napantao
March 2015	Liloan National Technical Vocational High School (LNTVHS) Environmental Day: Raising Earth Warriors - CCC facilitated in the running of the LNTVHS Environmental Day in which CCC saw the newly formed environmental committee conduct their first event in which teams took part in a range of activities and challenges from poster making and quiz bowls to the building of new products from recycled material. The aim of the event was to raise awareness of the current threats to coral reefs within the area and to inspire peers within the school. The day concluded with the presentation of an award from CCC to the school in recognition of their commitment to improving the local environment.	CCC LNTVHS peers and environmental committee	LNTVHS, Liloan

November 2015	Climate Change Workshop – CCC were invited to facilitate a climate change workshop within the local municipality of San Francisco at the Covered Court. There were a range of attendees including the governor of Southern Leyte. CCC conducted various presentations and concluded with activities involving what the Philippines can do about climate change.	CCC Four local schools Governor of Southern Leyte	Covered Court, San Francisco
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Case Study – Climate Change Workshop

A day of activities was conducted with four local schools through Servando Tio Jr. (Sir. Bandy), the SB secretary within the Municipality of San Francisco. The event saw an array of attendees including the governor of Southern Leyte. Coral Cay Conservation were invited by Sir. Bandy to facilitate the event in which three presentations were delivered by CCC's knowledgeable staff (Fig. 22 & 23). The first presentation conducted incorporated a holistic view to climate change, offering the relevant background to the subject, what it was and its causes. This presentation briefly discussed the threats of climate change, in general, as well as current global trends. The second presentation entitled "Climate Change and Coral Reefs" was tailored to apply directly to the local stakeholders and attendees. Oliver McGuinness, Jesse Tinapay and Elena Wagner (Field Base Manager, Community Liaison Officer and Science Office, respectively) covered a range of issues on how climate change impacts coral reefs, historic trends and future predictions. Further raising awareness on the true impacts of increasing ocean temperatures and ocean acidity as well as increased storm surges. The presentations were concluded with a final talk on "What can we, in the Philippines, do about climate change?". This final talk was extremely valuable to stakeholders at all levels, brought about discussion on how the Philippines as whole nation as well as the stakeholders on a community or individual level can help combat the unprecedented climate change that globally, everyone is facing.

Following the presentations, CCC implemented three different activities. The first being a dry run of Coral Watch (an invaluable tool for local stakeholders to accessibly quantify the health of coral through a range of specially produced charts), using the Coral Watch cards and a reef system painting activity. To finalise the activities, a game of musical chairs was also played, in which the chairs represented a habitat, and when removed, symbolised the habitat being destroyed by climate change (Fig. 24).

To complete the day, several short videos were shown on climate change, further raising awareness of the true impacts of climate change and how it will impact very single person.



Figure 22. Students and attendees gathered at the Covered Court, San Francisco, Southern Leyte for the proceedings of the Coral Cay Conservation Climate Change Workshop, March 2015.



Figure 23. Three presentations were delivered incorporating an introduction to climate change, its impact on coral reefs and how the Philippines can combat climate change.



Figure 24. The Climate Change Workshop attendees playing musical chairs in which each chair symbolised a habitat affected by climate change. When one chair was removed, this insinuated a habitat being destroyed or lost through the impact of climate change.

5. Conclusion and the Future

2015 saw the successful delivery of an eclectic range of programmes and workshops throughout Sogod Bay, San Francisco and neighbouring municipalities within Southern Leyte. CCC's ongoing collaboration with the Provincial Government of Southern Leyte and local stakeholders developed to new strengths in 2015 and CCC will continue to work within the area at the comportment of the government and local stakeholders. CCC believe that, each year, their presence within Southern Leyte grows stronger through the development of new relationships and the strengthening of old.

Through the continued surveillance of established MPAs and the assessment of new MPA sites, CCC is continually aiding in the recovery of coral reef ecosystems as well as building capacity and stepping one step closer to the goal of alleviating poverty within the region. From the studies conducted within the region, data suggests that the majority of established MPAs are showing signs of success. Those that are not, CCC's survey methodology is enabling local managers to practice adaptive management, striving for the success of the respective MPA sites. Through the continuation of surveys and establishments within Sogod Bay, CCC are working towards an aim shared with PGSL to establish Sogod Bay as a MR; maintaining and protecting biodiversity whilst promoting the sustainable exploitation of natural marine resources. In 2016 and onwards, CCC aims to continue to support local marine resource management by providing comprehensive ecological MPA assessments at the request of PGSL and local government units. In 2016, targets include:

- Initiate and complete full proposed MPA assessments in a larger geographical area to Barangays that have historically, not been surveyed.
- Continue to conduct surveys on the established Napantao MPA site to build on historic temporal data sets.

- A report will be produced summing all the data from Napantao to assess the true impact the MPA is having on the fauna and flora within the region.
- Conduct at least four other requested MPA assessments as directed by PGSL and local government units.
- Continue to monitor the local population of CoTs on coral reefs and where required, undertake the appropriate action.

The successful integration of survey efforts with capacity building and outreach work in 2015 was demonstrated. In 2016, 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, 2016 will see the continuation 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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Appendices

Table A1. Table listing the target fishes recorded by volunteers throughout the 2015 survey period at various sites throughout Southern Leyte.

Target Fish		
Common Name	Latin Name	Visayan Name
Angelfish	Pomacanthidae	Adlo
Barracuda	Sphyrnidae	
Cardinalfish	Apogonidae	
Damselfish	Pomacentridae	
Anemonefish	<i>Amphiprion</i> sp.	
Sergeant Damselfish	Pomacentridae	
Emperor	Lethrinidae	Katambak
Filefish	Monacanthidae	Ilak
Fusilier	Caesionidae	Dalagang bukid
Goatfish	Mullidae	Timbongan
Groupers	Serranidae	Lapu-lapu
Barramundi Cod	<i>Cromileptes altivelis</i>	
Jack/Trevally	Carangidae	Talakitok
Lionfish	Scorpaenidae	
Lizardfish	Synodontidae	
Moorish Idol	<i>Zanclus cornutus</i>	Sanggowanding
Moral Eel	Muraenidae	
Parrotfish	Scaridae	Mulmul
Bumphead Parrotfish	<i>Bolbometopon muricatum</i>	
Pufferfish	Tetraodontidae	
Rabbitfish	Siganidae	Kitong
Ray	Rajiformes	
Sandperch	Pinguipedidae	
Snapper	Lutjanidae	Maya-maya
Spade/Batfish	Ephippidae	
Spinecheeks	Nemipteridae	Silay
Squirrelfish/Soldierfish	Holocentridae	
Surgeonfish	Acanthuridae	Indangan
Unicornfish	<i>Naso</i> sp.	
Sweetlips	Haemulidae	Lipti
Toby	Tetraodontidae	
Triggerfish	Balistidae	Pakol
Wrasse	Labridae	
Crescent Wrasse	<i>Thalassoma lunare</i>	
Humphead Wrasse	<i>Cheilinus undulatus</i>	
Red Breasted Wrasse	<i>Cheilinus fasciatus</i>	
Butterflyfish*	<i>Chaetodontidae</i>	Alibangbang
Vagabond Butterflyfish	<i>Chaetodon vagabundus</i>	
Klein's Butterflyfish	<i>Chaetodon Kleinii</i>	
Eastern Traingle Butterflyfish	<i>Chaetodon baronessa</i>	
Redfin Butterflyfish	<i>Chaetodon lunulatus</i>	

Long-Nosed Butterflyfish	<i>Forcipiger flavissimus</i>
Humphead Bannerfish	<i>Heniochus varius</i>
Raccoon Butterflyfish	<i>Chaetodon lunula</i>

Table A2. Table listing the target fishes recorded by volunteers throughout the 2015 survey period at various sites throughout Southern Leyte.

Target Invertebrates		
Feather duster worms	Christmas tree worms	Flatworms
Crabs	Nudibranch	Banded coral shrimp
Lobsters	Cowrie	Triton's trumpet
Conch	Drupella	Top shell
Cone shell	Giant clam	Octopus
Other gastropod	Squid	<i>Acanthaster planci</i>
Cuttlefish	<i>Culcita novaeguineae</i>	<i>Protoreaster nodosus</i>
<i>Linkia laevigata</i>	Feather star	Brittle star
<i>Choriaster granulatus</i>	Pencil urchin	Collector urchin
<i>Diadema sp.</i>	Pinkfish	Greenfish
Prickly redfish		
Other sea cucumber		

Table A3. Table listing the target substrates recorded throughout the 2015 survey period at various sites throughout Southern Leyte.

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		