CORAL COVER AND FISH ABUNDANCE IN SICOGON ISLAND, NORTHERN ILOILO, PHILIPPINES

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Abstract: Corals are tiny animals called polyps that live in colonies underwater, either in patches or extensive reefs. The country has an estimated 27,000 km^2 of coral reef with only about 5% of this area still in excellent condition. The coral reefs provide high primary productivity and high fishery yields for food security, coastal protection, tourism, education, research and aesthetic value. Sicogon Island is an island in northern Iloilo Province, which is part of the municipality of Carles and it is approximately 140 kilometers from Iloilo City. It is comprised of three barangays namely Buaya, San Fernando and Alipata with an estimated coral reef area of 9.5 hectares. The existing live hard coral reef cover in Sicogon Island, Carles, Iloilo is in fair to good condition (40.44% - 65.51%). In four sites surveyed, fringing reefs off-shore of Brgy. Alipata and Brgy. San Fernando were in good coral cover condition while the two sites in Brgy. Buaya (Timberland and Purok 2) surveyed were in fair condition. The reef fish's abundance and density in the reefs of four sites were low and fishes belong to Pomacentridae family (damsel fish) dominated the fishes observed in the area. This study will serve as baseline data to be used by the Northern Iloilo Polytechnic State College (NIPSC), Sicogon Development Corporation (SIDECO) as well as for the LGU – Carles in the formulation of comprehensive management plan to sustainably protect and conserve this most precious resource.

Keywords: Sicogon Island, coral reefs, coral cover, fish abundance and density

1. INTRODUCTION

Coral reefs are the flowers of the sea, surrounded by fascinatingly coloured fish with remarkable diversity (Cesar, 2000). Coral reefs and their associated seagrass beds are among the most productive coastal ecosystems (White *et al.*, 2000). They thrive in the shallow waters of over 100 countries in the world's tropical regions (Spalding *et al.*, 2001). They occupy a mere 0.1% of the world's ocean floor, yet these ecosystems host a disproportionate amount of biodiversity, and are heralded among the most diverse and productive habitats on the planet (Hughes *et al.*, 2003).

The Philippines' coastal ecosystems are considered one of the most productive and biologically diverse in the world. With this diversity, coral reefs provide high primary productivity and high fishery yields. According to White *et al.*, (2000) the country has an estimated 27,000 km^2 of coral reef with only about 5 % of this area still in excellent condition. Coral reefs have significant value in terms of fisheries for food security, coastal protection, tourism, education, research and aesthetic value (White, 1987; Gomez *et al.*, 1994; Courtney *et al.*, 1999). However, surveys in the 1980's and 1990's have shown that more than 75 % of the coral reefs in the country had been degraded from human activities (Yap & Gomez 1985; Gomez 1991; Chou *et al.*, 1994; Gomez *et al.*, 1994). The most apparent of these wrong activities are intense fishing pressure and the use of destructive fishing practices (Macmanus *et al.*, 1997; DENR, DA-BFAR & DILG, 2001). As coral

reefs were destroyed, fisheries, tourism, coastal protection and biodiversity values were all lost (Rubec, 1988; Cesar, 1996).

Visayan Sea, one of the major migratory routes of most species in the world is known to be the global center of marine biodiversity. It is considered as one of the country's most productive fishing grounds, with an average annual catch of about 200,000 mt (BFAR, 2002). However, some reports showed that there had been a decline in small scale and commercial fish production in the area due to increased fishing pressure, destruction of habitats and overcapitalization and non-limitation of effort within the area (Hermes *et al.*, 2004).

Within the Visayan Sea is an island of Sicogon Island and part of the municipality of Carles, Iloilo. Sicogon was a popular tourist destination during the 1970s, famous for its crystal clear waters and long stretch of white sand beach lined with coconut trees. It is a home of pristine marine environment. Majority of the residents rely heavily on fishing as their main source of livelihood. Recently, tourism in the island has gradually increased through the efforts of local and provincial governments in promoting the island. Also, the Sicogon Development Corporation (SIDECO) which owns much of the island plans to transform Sicogon into a premier tourist destination starting 2016. Thus, any coastal development in the island would have impact to important ecosystems in the area such as the coral resource as well as the fish abundance. This study, therefore, aims to determine the present status of the coral and fish resources will be used by the Local Government Unit (LGU) in formulating a comprehensive coastal resources and fisheries management plan before the development commences in the island.

2. METHODOLOGY

2.1 Study site and site selection

The coral cover assessment and fish visual census were conducted on April 12-15, 2016 in Sicogon Island. Sicogon Island is approximately 140 kilometers from Iloilo City, comprised of three barangays: Buaya, San Fernando and Alipata. During the site selection, preliminary data gathering was done by interviewing barangay officials and residents who were familiar with coral resources in the area. The information obtained was confirmed using ocular survey and manta tow technique. The survey also considered various disturbances that were apparent in the area either natural or anthropogenic disturbances. There were four coral sites assessed in this study: one in each barangay of San Fernando and Alipata but two sites (Timberland and Purok 2) were identified in Buaya.

2.2 Coral cover assessment

The line intercept transect (LIT) method was used during the coral cover assessment (English *et al.*, 1994). It was used to primarily obtain an estimate cover of a specific sessile benthic life form and/or an object (e.g. coral, sponge, algae, substrate type, etc.), or a group of life forms and/ or objects within a specified area. Life form refers to the morphological form or structure of corals specifically the live hard corals (LHC). The life forms of LHC were categorized based on their morphological forms such as: branching, digitate, corymbose, massive, sub-massive, foliose, columnar, encrusting, tabulate, plate, laminar and leafy fronds. The rest of the life forms were identified for example, as soft corals for soft coral, as algae for algae other than those attached to corals, ephihytic algae or those that are attached to dead corals, biota for sessile and other fauna such as mollusks and invertebrates and abiotic for rock, mud, sand and water.

During the assessment, a transect consisting of a 50 – meter tape with hooks at both ends was used. For each site, a diver using a SCUBA gear laid 3 transects parallel to the shore line or the reef crest. The cover of each coral life form was estimated in centimeter (cm) scale by calculating the fraction of the length of the transect line that was intercepted by the life form and recorded in an underwater writing dive slate. Then, adding all the length values of one type of life form divided by the total length of all surveyed benthic life forms and / or object (e.g. coral, sponge, algae, substrate type, etc.) x 100 gave a percentage (%) cover. Adding all the % cover of LHC life forms would represent the status of coral cover of one study site expressed in % value. The categories of life form and substratum were based on English *et al.* (1994) such as: live hard coral (LHC), live soft coral (LSC), dead coral, dead coral with algae (refers to epiphytic algae attached on corals), algae on substrate other than dead coral with algae, biota (sessile and other fauna), and abiotic (rock/mud/sand/water).

2.3 Fish visual census

Reef fish assemblages were surveyed using a modification of the standard visual census technique described by English *et al.* (1994). A 50 m transect line was laid parallel to the depth contours along the reef slope. When the reef slope was too gradual and not readily recognizable, transect lines were generally laid parallel to the shore. All fish, including juveniles (< 2 cm standard length (SL)) encountered within 5 m of both slope and crest sides of the line were identified, counted and their sizes (SL) were estimated to the nearest centimeter. The surface area covered in each fish census was 50 m x 5 m x 2 sides = 500 m^2.

The location, time and date of each transect laid were georeferenced using a Global Positioning System (GPS). Physico-chemical parameters were also determined which include: temperature, depth, salinity and visibility.

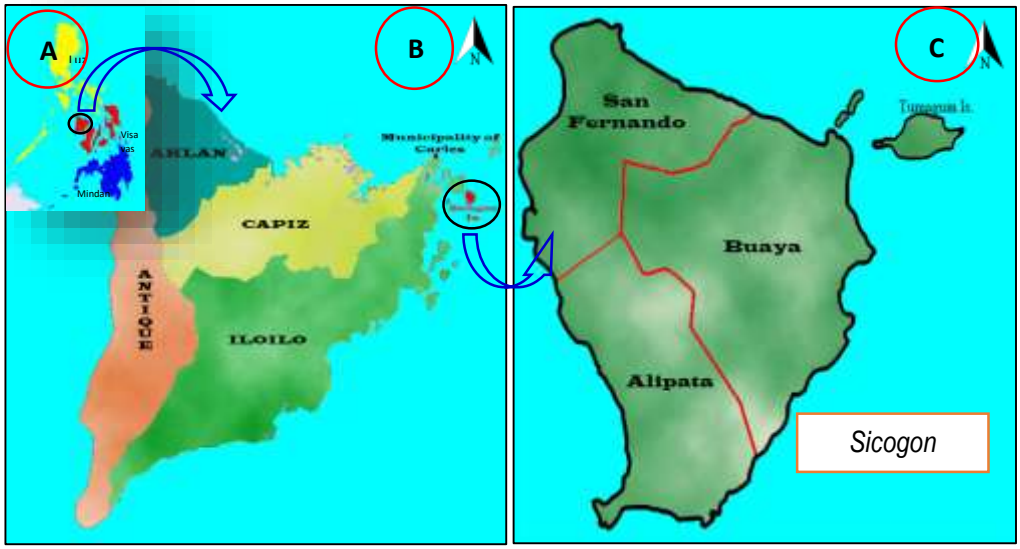

Figure 1. Geographical location of the study site (marked with black circle): (A) Map of the Philippines highlighting the Island of Panay; (B) Map of Iloilo Province depicting the Municipality of Carles & Sicogon island and; (C) Map of Sicogon Island as the study site.

3. RESULTS AND DISCUSSION

3.1 Coral Cover

The coral cover was assessed using the line intercept transect (LIT) method and there were three 50 m transects laid in each assessed site. Coral reefs were then classified as poor (0% – 24.9% cover), fair (25% – 49.9% cover), good (50% – 74.9% cover) and excellent (75% – 100% cover) (Gomez *et al.*, 1994). Physico-chemical parameters obtained during the assessment were within ambient conditions. Weather and sea conditions were also fine condition during the entire duration of the assessment with 2 - 3 oktas cloud cover and calm water movement, respectively.

Among the sites assessed, the fringing reefs off-shore of Brgy. Alipata and Brgy. San Fernando showed good coral cover condition at 65.51% and 55.65%, respectively (Table 1). While both sites in Brgy. Buaya have fair coral cover condition: Timberland (40.44%) and Purok 2 (49.08%). Overall mean live hard coral cover in all 4 sites was 52.67 ±10.59, and is considered good. Since no baseline data is available for live hard coral cover before the typhoon Yolanda (international codename Haiyan), its effect to the coral reef in the area cannot be quantified. Dead coral cover ranged from 0.70% – 5.10%, with overall mean of 3.00% ±2.13. The highest value was recorded in Purok 2 in Brgy. Buaya and lowest in San Fernando (0.70%). While the dead coral with algae (DCA),

primarily those dead corals with epiphytic algae attached on it, on the other hand ranged from 6.15% – 16.20% with overall mean value of 12.76% ± 4.65. The highest DCA cover was recorded in Timberland, Brgy. Buaya. Once the corals died due to some stressors (e.g. dynamite fishing, cyanide fishing, climate change and other anthropogenic disturbances), eventually algae specifically epiphytic algae, would attach and grow on the corals. All algae recorded in the DCA were all epiphytic algae. Based on interviews with the local fisherfolks and actual observation, there were no illegal fishing activities like dynamite/blast fishing and cyanide fishing (major causes of DC and DCA) happening in the survey sites unlike before that the people had engaged into such callous fishing activities in the island when the time that barangay officials in the whole island were not yet active regarding coastal protection and management.

The high percentage of dead coral off-shore of Purok 2 may be the result of anchorage and navigation of some fishing boats as had been observed during the assessment activity. However, in all sites, there were no crown-of-thorns (*Acanthaster planci*) found during the assessment. There were also no signs of crown-of-thorns infestation in the area since grazing pattern on the coral reef was not observed.

Abiotic cover was high in Purok 2 (35.33%). The mean algal cover of all sites was 2.71 ± 4.19% suggesting lower mortality of hard corals in the whole island. The total algae (DCA and other algae) and dead coral cover made up 18.47%, while abiotic contributed 26.70% of the bottom cover in the surveyed sites. The other biota cover (excluded the fishes) was only 0.94% signifying a low abundance of marine living organism which comprised of the kidney scallops, abalone, cowries, sea urchin, giant clam, starfishes and other univalve shellfishes.

In terms of live hard coral life forms, coral submassive (CSM) were the most abundant (37.27%). This was followed by coral foliose (CF) and coral massive (CM), with 26.88% and 18.28% cover, respectively. These three (3) life forms are more resilient to disturbances and strong wave action. Other live hard coral life forms coral branching (CB), tabulate (CT), columnar (CC) and encrusting (CE) made up only 17.57%.

There were no previous studies on coral cover assessment and fish visual assessment that could be used as secondary data for comparison. Furthermore, the extent on the effect of Super Typhoon Yolanda which happened in 2013 in the coral habitats in Sicogon Island could not be measured due to the absence of the said secondary data. Although most of the residents were fishermen, the present study does not quantify the sole and singular effect of fishing on the coral reefs in the area. Tourism activities such as swimming along the coral reefs and souvenir collection (i.e. shells, starfishes), navigation and anchoring in the coral areas were known disturbances. However, the effect of these kinds of disturbances and other stressors would warrant further investigation.

Table1. Summary of bottom cover in reefs for sites in three barangays of Sicogon Island.

Coral Lifeforms	**Brgy. Alipata**	**Brgy. San Fernando**	**Brgy. Buaya_ Purok 2**	**Brgy. Buaya_ Timberland**	**Mean (±SD)**
Live Hard Corals	65.51%	55.65%	49.08%	40.44%	52.67% ±10.59
Live Soft Corals	0.65%	0.96%	0.70%	2.62%	1.23% ±0.93
Dead Corals	1.70%	0.70%	5.10%	4.50%	3.00% ±2.13
Dead Corals With Epiphytic Algae	15.81%	12.86%	6.15%	16.20%	12.76% ±4.65
Other Algae	0.50%	0.00%	1.40%	8.94%	2.71% ±4.19
Abiotic	15.63%	29.63%	35.33%	26.20%	26.70% ±8.28
Other Biota	0.20%	0.20%	2.24%	1.10%	0.94% ±0.97

3.2 Reef fish

The coral reef off-shore of Brgy. Alipata had the highest reef fish abundance recorded while Brgy. Buaya – Timberland had the lowest which could be associated to their dead coral percentage cover results (Table 2). In all four (4) sites, fishes recorded were dominated by 68.10% pomacentrids (damsel fish), 18.84% was apogonids (cardinal fish) and 7.04% was labrids (wrasses), which represent the bulk of herbivorous fishes on typical reefs. This is consistent with rather high algal cover of reefs in all areas. Target species were abundant in Alipata and San Fernando at 27 individuals/500 m^2 and 22 individuals/500 m^2, respectively. However, overall abundance and density in all surveyed sites were low and it implied that the fish biomass (fish population + body weight) in all study sites was also low in which "spill-over effect" in coral reef was quite impossible.

Indicator species (Chaetodontids) were most abundant in San Fernando. The overall low abundance of reef fish is indicative of high fishing pressure on the reefs, although this is likely to be aggravated by other factors such as exposure to rough conditions such as strong waves action and winds during certain months of the year. During interviews with local residents, shellfish gleaning (e.g. abalone, *Haliotis asinina)* activities in the reefs of Buaya were high during extreme low tide. Using the Shannon - Wiener diversity index, it showed that in four (4) reef sites, reef site at Buaya - Purok 2 had a highest diversity value of 1.46, followed by San Fernando with 1.12, Alipata with 1.07 and Buaya – Timberland with 0.24. The mean diversity value for all reef sites in Sicogon Island was 0.97 which means that the reef ecosystems had a very low diversity, in other words, a few number of species present in the island.

Table 2. Summary of reef fish parameters for sites surveyed in Sicogon Island in April, 2016.

Sites	Abundance (individual per 500m^2)			Abundance (individual per hectare)	Density (individual per m^2)	3 most abundant families
	All	Target[1]	Indicator[2]			
Brgy. Alipata	221	27	27	4420	0.442	Pomacentridae: 36.2%, Apogonidae: 13.6%, Labridae: 12.2%
Brgy. San Fernando	159	22	20	3180	0.318	Pomacentridae: 50.0%, Apogonidae: 13.1%, Chaetodontidae: 12.5%
Brgy. Buaya_ Timberland	65	0	1	1300	0.13	Pomacentridae: 76.9%, Apogonidae: 15.4%, Siganidae: 6.2%
Brgy. Buaya_ Purok 2	104	8	10	2080	0.208	Pomacentridae: 48.1%, Apogonidae: 16.3%, Labridae: 9.6%

[1]*target species follow definition in English et al., (1994) and includes Acanthuridae, Haemulidae, Lethrinidae, Lutjanidae, Serranidae (Epinephelinae), and Siganidae*
[2] *includes only Chaetodontidae*

3.3 Physico-chemical parameters

There was a wide range of water salinity difference during the assessment in all sites which ranged from 30 ppt – 38 ppt. Temperatures were relatively the same in all sites from 28.4 ºC - 29.0ºC. The visibility were identical at >3 m visibility. The sediment types in the coral reef areas were sandy. The waters depth in the survey sites ranged from 5 feet up to 21 feet. Dissolved oxygen values were relatively the same in all sites ranging from 5.8 mg/L – 7 mg/L. In general, the physico – chemical values were in optimum level absolutely favorable for the survival of coral polyps and tropical marine organisms dwelling in coral habitat. Physico-chemical parameters obtained during the assessment were within ambient conditions.

4. CONCLUSIONS

The results from this study highlighted the condition of coral reefs and reef fishes in Sicogon Island which essentially need protection and conservation programs from the LGU–Carles. The on-going coastal development (e.g. building and airport constructions) in the island to make it a world class tourist destination in Northern Iloilo should not compromise the ecological benefits and economic value of aquatic ecosystem. The anthropogenic disturbances such as boat anchorage and navigation and fishing in coral reef areas as observed during the assessment might be considered as some of the factors that affect to the fair % cover of the corals which at the same time correlated to the result of low fish abundance.

5. RECOMMENDATIONS

A comprehensive management plan for the whole island can save the present resources and would improve their status, which should be formulated accordingly by the LGU, national government, academe, SIDECO and the communities. Creation of all coral reefs of the island into marine reserves is one better plan to protect the coral resources and increase biodiversity of fishes inhabiting the reefs and also to properly monitor their conditions. Further, information and education campaign (IEC) should be done to educate local residents about the benefits and services that coral reef could provide to their lives once it is protected. Good governance (e.g. planning, mediating differences, regulation of fishing and tourism activities and law enforcement) of the LGU is very important to balance the level of human well-being and ecological well – being in Sicogon Island.

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