

## Symposium Proceedings

### Coral reef assessment in selected marine protected areas in Albay, Philippines

Christian D. Cabiles<sup>1\*</sup>, Antonino B. Mendoza Jr.<sup>1</sup>, Ronnel R. Dioneda Sr.<sup>2</sup>, Victor S. Soliman<sup>3</sup>

<sup>1</sup> Bicol University Tabaco Campus, Tayhi Tabaco City

<sup>2</sup> Bicol University Legazpi City

<sup>3</sup> Bicol University Research and Development Center, Legazpi City

#### Abstract

Five Municipalities in Albay namely Pioduran, Ligao, Oas, Libon in west coast and Rapu-Rapu in east coast were assessed on their coral reef system specifically inside the Marine Protected Areas (MPA) using Reef Check primarily intended to determine their reef health status in terms of types of substrate present, percent cover per substrate, benthic life forms and observation on reef developments and impacts. During the assessment, three coral reef stations per Municipality were established and three replicates per stations were done. Results of the assessment revealed that in terms of life form composition, Municipality of Pioduran, Ligao, Oas and Libon are dominated by Abiotic (non-living) type of substrate with 72%, 68%, 70% and 56% cover respectively, while Rapu-Rapu is mostly dominated by Biotic (living) component with 60% cover. Impacts in the form of trash, coral damage and bleaching are rampant and widely observed in the reef areas of the five Municipalities. When it comes to reef health status, only the reef areas of Rapu-Rapu is in good condition with 56% coral cover, Oas, Ligao and Libon are in fair status (27%, 28% and 35%) while Pioduran is in poor reef health status (21%). Anova result indicate significant differences in terms of % live coral cover per Municipalities ( $P = 1.6 E^{-09}$ ).

Key words: reef check, coral reef, biotic, abiotic, impacts

## INTRODUCTION

Coral reefs are tropical ecosystem, second highest biodiversity on earth (after rain forest). They are the largest and oldest living structure on planet and serve as the habitat for different marine life. Coral reefs are important food sources for hundreds of millions of peoples around the world. They are responsible for the creation of white sand beaches and even islands. They serve as the major tourist destination, creating 100s of millions of dollars annually for coral reefs countries and protect 20% of the world's coast and cities from wave erosion.

Coral reefs are vital ecosystem, providing a source of income, food and coastal protection for millions of people, and recent studies have shown that coral reefs goods and services provide an annual net benefit of US\$30 billion to economies

worldwide (Cesar *et al.* 2003). Coral reefs are composed mainly of reef building corals: colonial animals (polyps) that live symbiotically with the single celled microalgae (zooxanthellae) in their body tissue and secrete a calcium carbonate skeleton. Coral reefs are formed by hundreds of thousands of these polyps and are found in warm, shallow clear, low-nutrient tropical and sub-tropical waters, with optimum temperatures of 25-29°C, although they exist in ranges from 18°C (Florida) to 33°C (Persian Gulf) (Buddemeier and Wilkinson 1994). They are incredibly diverse, covering only 0.2% of the ocean's floor but containing 25% of its species and they are often dubbed the "tropical rain forest of the oceans" (Roberts 2003).

The coral reef area in the Philippines is one of the largest in the world, covering 27,000 km<sup>2</sup>. Unfortunately, these areas have been degraded over the past years. In comparing the status of coral reefs in some areas in the country between

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\* E-mail: cabilesc@ymail.com

1981-1991, Gomez (1991), reports that excellent reef conditions were found in Negros Oriental, Zamboanga del Norte and Aliguay Island in this province.

Unfortunately, coral reefs are also among the most vulnerable ecosystem in the world. Disturbances such as bleaching, fishing, pollution, waste disposal, coastal development, sedimentation, scuba diving, anchor damage, predator outbreaks, invasive species and epidemic diseases have all acted synergistically to degrade coral reef health and resilience. Today, an estimated 20% of coral reefs worldwide have been destroyed, while 24% are in imminent danger and a further 26% are under longer term danger of collapse (Wilkinson 2004).

Because of the continuous effect of natural and man-made activities to coastal habitat (coral reef) including reef fishes which is the root for continuous downtrend of their biodiversity, a rapid assessment is vital to determine the current status and condition of the natural stocks. This is necessary for the development of management approach and formulation of regulatory strategies to protect the resources from extinction.

In coordination with the Department of Environment and Natural Resources, Region V (DENR ROV), this project was conceptualized primarily to assess the coastal habitat (coral reef) of the five Municipalities (Pioduran, Ligao, Oas, Libon and Rapu-rapu) in Albay. Data collected in this assessment will be useful in generating strategies for the protection of this vulnerable habitat and its associated marine resources.

## MATERIALS AND METHODS

Together with the Department of Environment and Natural Resources (DENR RO V), a Sustainable Coral Reef Ecosystem Management Program (SCREMP) was conceptualized primarily intended to assess the three major habitat of the marine coastal environment such as the Mangroves, Seagrass and Corals. SCREMP is a program which is divided into different aspects of focused to be assessed. In this paper, coral reef is the primary focus of the assessment.

### Study sites

Five Municipalities in Albay (Fig. 1) namely Pioduran, Ligao, Oas, Libon (West Coast) and Rapu-Rapu (East Coast) were assessed to generate data specifically on the status of its coral reefs area and fish associated species.

Five Municipalities were the areas of the assessment wherein three stations per Municipality were established. In each station, three replicates using the 100meter transect were conducted. Total of nine replicates per Municipality were established for coral reef assessment.

### Data collection

A 100meter long-line called transect was laid to the reef system and assessment was done using the Line Point Intercept Transect (LPIT). The 100meter transect was divided

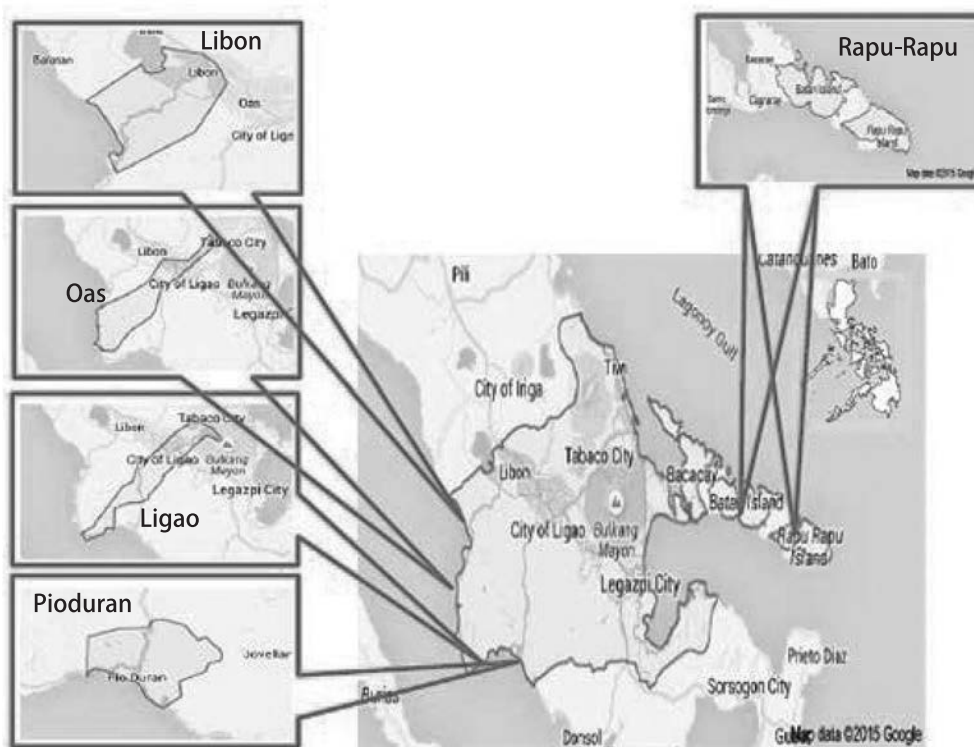
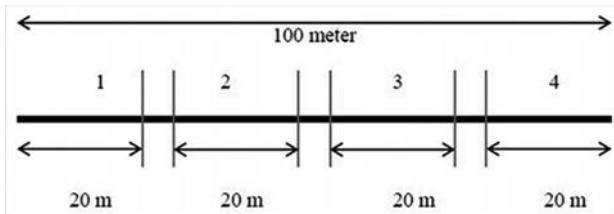


Fig. 1. Map of the study sites.

into four segments which are from 0-19.5, 25-44.5, 50-69.5, 75-94.5 (Fig. 2). Specific type of substrate in specific point (every .5) was recorded during the assessment. Status of the reef system was categorized into poor (0-24.9%), fair (25-49.9%), good (50-74.9%) and excellent (75-100%) condition based on their percent live cover (Gomez 1991).



**Fig. 2.** The 100 meter long-line transect divided into four segments used for coral survey.

## RESULTS

### Substrate type

Types of substrate are one of the bases to assess and determine the status of the coral reef system. In this assessment, ten (10) types of substrate were used to evaluate the condition of the reef system, the ten types of substrate were divided into biotic such as Hard Corals (HC), Nutrient Indicator Algae (NIA), Others (OT), Soft Corals (SC) and Sponge (SP) while under abiotic are the Rubbles (RB), Sand (SD), Recently Killed Corals (RKC), Rock (RC) and Silt (SI) (Table 1).

**Table 1.** Mean Percent Cover of Substrate Types per Municipality.

Substrate Type	Percent (%) Cover of Substrate per Municipality				
	Pioduran	Ligao	Oas	Libon	Rapu-Rapu
<b>Biotic</b>					
HC	18.0	26.0	26.0	36.0	55.0
NIA	3.0	0.0	1.0	3.0	4.0
OT	4.0	4.0	1.0	5.0	0.0
SC	3.0	2.0	1.0	0.0	1.0
SP	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>28.0</b>	<b>32.0</b>	<b>29.0</b>	<b>44.0</b>	<b>60.0</b>
<b>Abiotic</b>					
RB	6.0	2.0	1.0	2.0	1.0
SD	21.0	28.0	29.0	19.0	12.0
RKC	0.0	0.0	0.0	1.0	0.0
RC	39.0	33.0	41.0	34.0	26.0
SI	6.0	5.0	0.0	0.0	1.0
<b>Total</b>	<b>72</b>	<b>68</b>	<b>71</b>	<b>56</b>	<b>40</b>

Results of the assessment conducted at the Marine Protected Areas of the five Municipalities revealed that four (4) of the stations (Pioduran, Ligao, Oas and Libon) were dominated by abiotic (non-living) type of substrate represented by high percent cover of Rocks (RC), while only one of the five Municipalities were dominated by biotic (living) type of substrate represented by high percent cover of Hard Corals (Table 1).

### Benthic life forms

Benthic life forms are the different faunas observed associated to coral reef system. Aside to different types of corals such as hard (branching & massive) and soft corals normally inhabiting the reef system, different types of biotic or living organisms are found existing on the reefs such as macro invertebrates (shells), macro algae (seaweeds), echinoderms (starfish, sea urchin, crown of thorns), sponge and ascidians. These organisms play an ecological important to the reef environment.

### Reef health status

Status of the reef system was categorized into poor (0-24.9%), fair (25-49.9%), good (50-74.9) and excellent condition (75-100) which was based on the percent live cover represented by hard and soft corals.

Results of the assessment revealed that reef system located at the west coast of Albay are in poor (Pioduran) to fair (Ligao, Oas and Libon) reef health condition while reef system located at the east coast was in good (Rapu-Rapu) reef health status (Table 2).

**Table 2.** Status of the Reef System per Municipality.

Municipalities	% Coral Cover (HC + SC )	Status
Pioduran	21	Poor
Ligao	28	fair
Oas	27	fair
Libon	35	fair
Rapu-Rapu	56	good

### Reef development and impacts

Reef impacts observed in the reef system of the five Municipalities includes and dominated by trash in the form of woods, cloth, plastics and other form of garbage discharge from coastal communities. These trashes observed covering the coral colonies which may pose a great threat to corals. Coral damage and bleaching are also observed. Coral damage

is possibly the effect of different human perturbation acting on the reef like destructive fishing, beach seine, trawls, dredging and either anchor given that some reef areas are navigational lane for different boats. Likewise, partial/full coral bleaching are observed on the reef. This may be the effect of changes in sea surface temperature given that some area is shallow. Some coral colonies with trash covering or attached to it are observed suffering from bleaching; this is maybe because the trash traps the light penetration and food directly to coral polyps.

## DISCUSSION

Marine Protected Areas (MPA) is an area where different human activities and perturbation are prohibited. MPA's serve as many biological, ecological and economic benefits. Today, an estimated 20% of coral reefs worldwide have been destroyed, while 24% are in imminent danger and a further 26% are under longer term danger of collapse (Wilkinson 2004). This is due to the different impacts and perturbation acting on this vulnerable habitat. Such findings concur with the results of the survey conducted where three of the Municipalities (Ligao, Oas and Libon) are in fair condition and Pioduran is in poor reef health status. While only Rapu-Rapu has the good reef ecosystem (56%). Reef health status was determined through the total percentage cover of hard corals plus the soft corals per Municipality.

Variability of percent cover in every substrate category per Municipality is noticeable. Analysis of Variance (Anova) test in substrate type per Municipality reveals that there is no significant difference between Municipalities when it comes to substrate present ( $P = 0.5$ ). But when it comes to frequency per substrate type, Anova test reveals that there is highly significant difference between the frequency of substrate per Municipalities ( $P = 1.62353E-09$ ). This is maybe attributed by the status of the reef in each Municipality given that Rapu-Rapu reef area is in good condition while the other Municipalities are in poor (Pioduran) to fair health status (Ligao, Oas and Libon), given these; values of substrate per Municipality may vary according to their reef health status.

For further monitoring purposes; monitoring blocks was deployed in each station per Municipality. Seven (7) monitoring blocks per station was been deployed wherein total of 21 blocks per Municipality was accomplished. This is prior for future monitoring/evaluation of coral community which will have a good comparison of data generated from previous to present condition/status.

## CONCLUSIONS

Abiotic or non-living type of substrate mostly dominates the reef system of the west coast of Albay (Pioduran, Ligao, Oas and Libon) which are in the form of rocks. Rock type of substrate present on these Municipalities is in the form of dead coral colonies and fragments, while Biotic or living type of substrate dominates the reef system of Rapu-Rapu. Biotic factor observed on this reef system are in the form of hard coral (massive and branching) colonies.

## RECOMMENDATIONS

As for the management, protection and conservation of the coral reef habitat, Human impacts and other perturbation such as illegal, destructive fishing and other pollution (trash) should be prohibit acting on the reef system. Coral reef restoration should be conducted on the Municipalities which are found to have a poor to fair reef health status. This mitigating scheme is very important nowadays to rehabilitate degraded corals and restore the diversity of the said habitat.

## ACKNOWLEDGMENTS

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