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Mangroves Community Structure and Growth Parameters in Silo-Siloan Islet, Clarin, Bohol, Philippines

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Abstract
Mangrove play a dynamic role in a marine ecosystem. Mangroves growth and community structure are important to determine the status of a mangrove forest. In this study, the distribution, growth parameters like girth at breast height, height, and crown, relative density, and frequency of mangroves were determined. The study used a line transect with 10x10 meter plots laid depending on the extent of mangrove cover. This was conducted in Silo-siloan islet, Clarin Bohol. The result of the study showed that there were six mangrove species identified namely: Aegiceras floridum, Avicennia marina, Avicennia officinalis, Rhizophora mucronata, Rhizophora stylosa, and Sonneratia alba. In transect 1, highest distribution was observed in Rhizophora mucronata with 63% while in transect 2, Sonneratia alba with 59%. Average size of the mangroves has an average trunk of 32 cm. This can be attributed to the presence of large girths of Rhizophora mucronata and Sonneratia alba trees. The grand mean of these mangroves is 23.024 among the five plots. Result showed that highest relative density and relative frequency were significantly observed in Sonneratia alba and Rhizophora mucronata in all plots. The conservation site considered to have a dense area of this two species.

Keywords: Mangroves Community Structure, Growth Parameters

I. INTRODUCTION

Mangroves are one of the most important marine ecosystems in the world. Mangroves are distributed in a vast array of habitats. They are of different species. In tropical countries like the Philippines alone, there were at least 39 mangrove species (Sinfuego and Bout, 2014). They are the source of various natural products and ecological services (Clough, 2013), and play a big role in climate change mitigation (Donato et al., 2011).

The Clarin group of Islet and Wilderness Area (CGIWA) has a total area of 158 hectares. At present, 90% of the area was covered with mangrove forest and are highly protected under the Presidential proclamation 2151 last December 20, 1981 declaring the area as an initial component of NIPAS system pursuant to RA 7586. Under this act, Silo-Siloan islet has been part of the marine protected area in Bohol. This makes the islet manage to maintain its marine habitats.

Mangroves are primarily distributed in the area along with other marine resources. Earlier studies conducted by the Department of Environment and Natural Resources (DENR) reported five to seven mangroves species in the area. However, their data investigate only the mangroves species in the area. There is no available information on mangrove distribution, community structure, relative density, and frequency.

This study was conducted as part of the extension of our research activities to nearby communities as a core function of the university. This would be part of the marine bank repository that will be established by the R and D department of BISU-Clarin. This serves as a mark of mangrove community structure in a wilderness area of the islets of Bohol. Furthermore, this would be a benchmark of mangrove complexity from the province.

To attain the goal of determining community structure and growth parameters of mangroves in Silo-Siloan islet, the study aimed to know the following: distribution of mangroves, mangroves growth measurement in terms of average girth at breast height, height, and crown cover. Lastly, the study also measures the relative density and frequency of the mangroves species that are important importance value of each species of mangroves found in the area.

II. MATERIAL AND METHODS

Mangrove vegetation assessment followed the standard protocol described by English et al. (1997) with slight modification. In the area, two transects, 50–100 m, depending on the extent of mangrove cover, were laid perpendicular to the shore. A 10 m × 10 m plot was established along the transect line at a certain interval, 10–50 m, depending on the prevailing species zonation pattern. Individual plants found within the plot were identified following the nomenclature of Primavera and Sadaba, 2012, Primavera et al., 2004, DENR 7, 2003, Feller and Sitnik, 1996, and Tomlinson (1986). For each identified species, basic vegetation parameters such as the diameter at breast height (dbh), basal area, and density were measured. Data analyses utilized Microsoft excel. Direct observation on the surrounding environment of each plot was likewise done to record the existing potential threats to mangrove resources in the area.

III. RESULTS AND DISCUSSION

The figure and tables presented here showed the computed values of distribution, community structure based on girth at breast height, cover, and height of mangroves. Moreover, the result also showed the relative frequency and density of each mangrove species found in the islet.

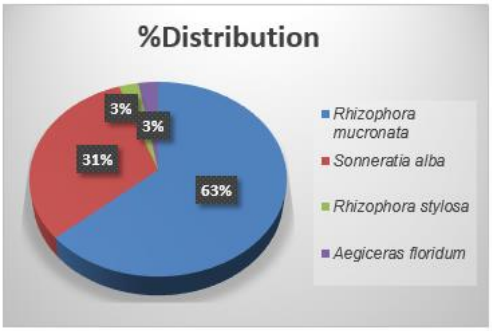

Figure 1. Mangrove Distribution of Silo-Siloan in Transect 1

The Figure (1) one above depicted the mangrove distribution in the first transect laid in the islet. It showed that there were four species identified. Among the four species, high distribution was attributed by *Rhizophora mucronata* with 63%. This type of mangroves occupy a wide range of habitat (Duke et al., 2002). This was followed by *Sonneratia alba* with 31% distribution. They are dominant species which could be the reason for their high distribution in the area (Sreelekshmi et al., 2020). Least distributed in the area are species of *Rhizophora stylosa* and *Aegiceras floridum*. These are species that prefer to thrive in areas near riverbanks which are not present in the site studied, the reason for its low distribution.

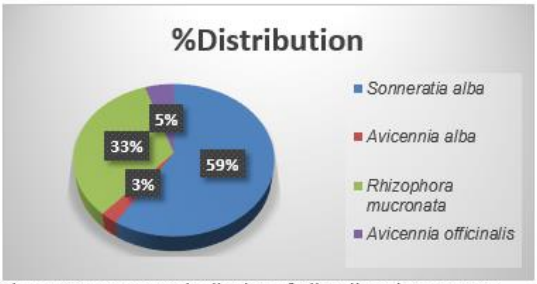

Figure 2. Mangrove Distribution of Silo-Siloan in Transect 2

In transect 2 (Figure 2), it showed that the highest mangrove distribution was observed by *Sonneratia alba* with 59%. This species is of high tolerance to saline environments (Primavera, 2009). This was followed by *Rhizophora mucronata* with 33% distribution. This could possibly be because most of the mangroves along the coastline of Clarin were *Rhizophora* species that greatly influence the species of mangroves in the islet. Then *Avicennia officinalis* 5% and least distribution in *Avicennia marina* with 3%. These are species that are near threatened based on the International Union for Conservation of Nature Red List of Threatened Species (Melana and Gonzales, 2000). Another reason is that they periodically occur in an area.

Table 1. Mangrove Community Structure (Growth Parameters)

Plots	Mean GBH (cm)	Mean Height (m)	Mean Crown Cover (m)
1	32	6.33	**14.87**
2	18.25	4.3	**5.03**
3	24.75	6.35	**9.09**
4	20.37	5.58	**20.28**
5	19.75	4.9	**9.09**
Grand Mean	**23.024**	**5.492**	**11.672**

Table 1 shows the mean average of the different growth parameters of mangroves measured in the five plots. Plot 1 contains species with the highest Girth at Breast Height (GBH) which means that the average size of the mangroves has a trunk of 32 cm. This can be attributed to the presence of large girths of *Rhizophora mucronata* and *Sonneratia alba* trees. The grand mean of is 23.024 among the five plots. This is quite bigger compared to the study of Lunar and Laguardia (2013) in the mangroves found in the area. The height of the mangroves based on the data has an average of 5.492 m which is almost the same in the Cudiamat et al., 2013 in a fringing mangrove in Calatagan, Batangas , Philippines. Plots 1 and 3 contain mangrove species with greater heights compared to the other plots. In terms of crown cover, species in Plot 4 rank the widest with an average mean of 20.28. Since *Rhizophora mucronata* species dominate the plot, it implies that the species are branching, which is a common growth pattern of the species.

Table 2. Relative Density and Relative Frequency of Mangroves Species

Species	Density	RD (%)	F	RF (%)
Sonneratia alba	**0.046**	**45.71**	**73**	**32**
Rhizophora mucronata	**0.026**	**25.87**	**94**	**41**
Avicennia marina	**0.002**	**1.98**	**20**	**8.7**
Rhizophora stylosa	**0.0222**	**22**	**11**	**4.8**
Avicennia officinalis	**0.00222**	**2.22**	**20**	**8.7**
Aegiceras floridum	**0.00222**	**2.22**	**11**	**4.8**

Legend: RD-Relative Density, F-Frequency, RF-Relative Frequency

This table (2) shows the relative density and relative frequency of mangrove species that were observed in the area. Results showed that highest relative density and relative frequency were significantly observed in

Rhizophora mucronata with 94% and *Sonneratia alba* with 73% and in all plots. The conservation site is considered to have a dense area of these two species.This result conforms with the study of Cudiamat e*t al*., 2017 which also showed *S. alba* as dominant species.

IV. CONCLUSION AND RECOMMENDATIONS

The community structure and growth parameters of the mangroves indicate a relatively young forest ecosystem. *Sonneratia alba* has the highest relative density. It covers more than 45% of the mangroves which is attributed to the sandy substrate as its ecological adaptation. In terms of distribution and relative frequency, *Rhizophora mucronata* and *S. alba* are relatively dominant. Indeed, it is concluded that the mangrove growth parameters like distribution, relative frequency, density, and community structure are influenced by substrate type, water quality, and other underlying ecological parameters.

From these findings, it is hereby endorsed that management and conservation of mangroves is an important consideration in monitoring and evaluation of the community structure and growth performance of the mangroves. Close monitoring and assessment of mangrove growth is needed to ensure the effectiveness of the management and conservation implemented. Furthermore, ecological adaptation of mangroves, relative density, frequency and relative dominance must be considered in community-based management programs to determine the appropriate mangroves species for a particular substrate.

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