Species diversity and distribution of mangrove vegetation in Moalboal, Cebu Island, Philippines

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ABSTRACT

This study identifies the diversity and distribution of mangrove species in Moalboal, Cebu, Philippines. Diversity and distribution assessment were conducted through non-experimental descriptive research design. The findings of the study revealed that mangrove vegetation in Moalboal is deteriorating and has continued to degrade over time. Species diversity was also found to be very low, with the Shannon-Weiner Index (H') registering coefficients ranging from 0.8854 to 1.2268 for the various areas in Moalboal. There were only four species belonging to three families of mangroves identified, of which *Sonneratia alba* was determined to be the most dominant. With these results, rehabilitation and protection of mangrove vegetation is recommended to the local management and to ensure the strict implementation, protection and conservation of mangrove management in the studied areas. There is a need to reforest the areas with emphasis on repopulating disappearing species to avoid further degradation. It is further recommended to conduct more research on the implementation of the conservation activities and its effect on the abundance of the mangroves in the area. The study of ecological adaptation of mangroves, relative density, frequency and relative dominance must be undertaken to serve as important bases in community-based management programs.

Keywords: mangroves distribution, mangroves diversity, mangroves in Cebu, mangroves vegetation

I. INTRODUCTION

In the year 1920, the Philippine coastline used to be covered by 400,000-500,000 ha of mangroves. However, due to overexploitation by coastal dwellers and other direct anthropogenic activities, mangrove vegetation areas declined to around 120,000 ha in 1994 (Primavera, 2000). This alarmed various government agencies and other stakeholders of the country. Different mitigation programs were imposed resulting to the increase of mangrove vegetation up to 247, 362 ha (Forest Management Bureau, 2007). This earned the Philippines a place on the list of the most mangrove-rich countries in the world (Long & Giri, 2011) with the country hosting around 50% of the world's approximately 65 species. However, that number has fallen short by almost half of its original area. Possible reasons for this loss may be attributed to localized threats such as climate change, natural calamities, and/or the conversion of these mangrove areas into commercial lots.

Moalboal is a 4th municipal income class municipality in the province of Cebu, Philippines extending as a peninsula on the southwestern tip of Cebu. It is bordered to the west by the Tañon Strait. Negros Island can be seen from the western shoreline. This municipality is between the towns of Alcantara and Badian, located 89 kilometres (55 mi) from Cebu City, about 2.5 hours by bus. It was estimated in the year 2002 that Moalboal used to be covered by 318 ha of mangrove vegetation with 18 mangrove species found

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in the said area (Alburo, Tormis, & Rica, 2002). This figure suggests that Moalboal contributes around 0.12% of coastal area of the total mangrove vegetation in the country. Despite imposing legal sanctions that penalize reclamation of mangrove plantations and the prohibition of the cutting of mangrove trees (as outlined in Section 71 of Republic Act 7161), it was reported by Campo (2014) that a 5,000 sq. meter lot with fully grown mangrove vegetation was nevertheless reclaimed and developed into a commercial establishment. Because of Moalboal's geographic location and white beaches, it is one of the most-visited municipalities by tourists. Although this is a boost for the tourism industry, it is not without adverse effects from an ecological and environmental standpoint. Mangroves have become interspersed with nipa huts and tourist beach resorts in the leeward side of the island, and have been degraded over time (Dahdouh-Guevas & Koedam, 2008).

An update on species diversity and conservation management of mangroves must be conducted, considering that worsening climate change exacerbates damage from calamities and affects coastal regions. It is therefore increasingly important to know the current situation of mangrove vegetation, its diversity, and efforts being put to address whatever threats are experienced at hand in Moalboal. This study aims to revisit the status of the mangrove vegetation in terms of its species diversity to provide a plausible basis for improved conservation programs .

This study aimed to determine the status of the taxonomic diversity and abundance of mangrove species in Poblacion, Moalboal, Cebu, Philippines. It also intended to know the diversity of existing mangrove species in the area. Furthermore, it sought to gather information on the different challenges and programs adopted to address the threats in mangrove vegetation.

II. Methodology

The study utilized a descriptive research design to assess the structure of three areas in Moalboal. Area I is comprised of Brgy. Balbagon, Area II covers Brgy. Poblacion East and Brgy. Tomonoy, while Area III is comprised of Brgy. Saavedra. A 10m x 10m transect plot was established in the three areas. The mangroves inside the plots were identified in situ, classified taxonomically and determined using the field guide manual to Philippine Mangroves by Primavera et al (2004) and counted.

This study used the Shannon-Weiner Index (H') in calculating the proportion of every mangrove specie found in each identified area.

The equation is:

H'=-sum (pi ln pi)

Where: pi=proportion of individuals found in the i species

ln= natural Logarithm

Table 1 below shows the interpretation of species diversity based on a range of H' values.

Table 1
Categories of Species Diversity Index

Relative Values	H' values
Very High	≥ 3.5000
High	3.0000-3.4999
Moderate	2.5000-2.9999
Low	2.0000-2.4999
Very Low	≤1.9999

III. Results and Discussion

Here the researchers present the data gathered and the results of the statistical analyses.

Table 2
Taxonomic Profile and Species Abundance

Family	Genera	Species	f
Sonnneratiaceae	Sonneratia	*Sonneratia alba* (pagatpat)	50
Avicenniaceae	Avicennia	*Avicennia marina* (kalapinay)	20
		Avicennia rumphiana (bungalon, apiapi, miapi)	20
Rhizophoraceae	Rhizophora	*Rhizophora apiculata* (bakhaw lalaki)	38
Total			128

The sample area of the study is composed of 128 mangrove trees. These mangrove trees are classified into three (3) families namely: *Sonneratiacea, Avicenniaceae, and Rhizphoraceae*. There are three (3) genera under this family: *Sonneratia, Avicennia, and Rhizophora* wherein there are four (4) species) as shown in the table.

The figures show the relative densities of all mangrove species in the three areas. Area 1 shows that *S. alba* is the most dense species with 51% in the 10x10 m transect plot. On the other hand, *R. apiculata* is revealed as the next densest species, followed by *A. rumphiana*. The relative densities of Area 11 show that *R. apiculata* has the largest density of all the species in the area that covers more than half of the mangrove area. It covers around 57% of area II. *S. alba* and *A. marina* have the least number of individual species in the area. In area III *R. apiculata* covers almost all the entire area in which its density covers up to 71%. S. marina mangrove species covered around 13% of relative densities which is second to the largest density of mangrove species. A. rumphiana have the least number of species in the area. *S. alba* is very sparse in this area comprising only 7% of the total distribution.

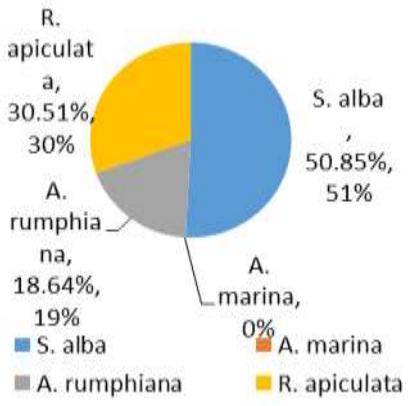

Figure 1. Distribution of Mangrove Species

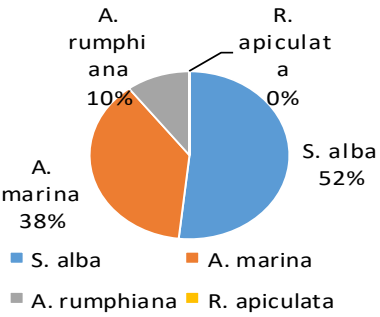

Figure 2. Distribution of Mangrove Species in Area II

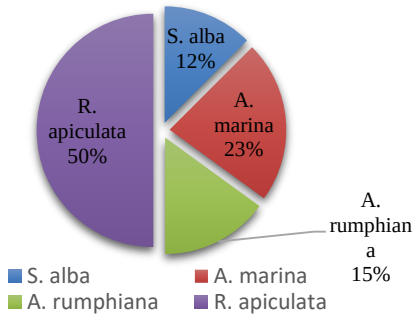

Figure 3. Distribution of Mangrove Species in Area III

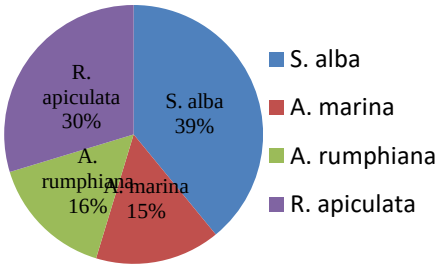

Figure 4. Overall Distribution of Mangrove Species

Table 3
Species Diversity of Mangroves in Moalboal

Area I				
Family	**Genera**	**Species**	**Count**	**%**
Sonnneratiaceae	Sonneratia	*Sonneratia alba* (pagatpat)	30	50.847
Avicenniaceae	Avicennia	*Avicennia marina* (kalapinay)	0	0
		Avicennia rumphiana (bungalon, apiapi, miapi)	11	18.644
Rhizophoraceae	Rhizophora	*Rhizophora apiculata* (bakhaw lalaki)	18	30.508
H index				1.018
Area II				
Family	**Genera**	**Species**	**Count**	**%**
Sonnneratiaceae	Sonneratia	*Sonneratia alba* (pagatpat)	15	32.609
Avicenniaceae	Avicennia	*Avicennia marina* (kalapinay)	11	23.913
		Avicennia rumphiana (bungalon, apiapi, miapi)	3	6.522
Rhizophoraceae	Rhizophora	*Rhizophora apiculata* (bakhaw lalaki)	0	0
H index				0.8854
Area III				
Family	**Genera**	**Species**	**Count**	**%**
Sonnneratiaceae	Sonneratia	*Sonneratia alba* (pagatpat)	5	12.50
Avicenniaceae	Avicennia	*Avicennia marina* (kalapinay)	9	22.50
		Avicennia rumphiana (bungalon, apiapi, miapi)	6	15
Rhizophoraceae	Rhizophora	*Rhizophora apiculata* (bakhaw lalaki)	20	50
H index				1.2268

Table 3 shows the diversity of mangrove species (H') in each area. Area I has four species (4) namely *S. alba, A. marina, A. rumphiana. and R. apiculata*. Total species diversity computed in Area I is 1.018 which is interpreted as very low. In Area II, there are also four (4) counted species. These include *S. alba, A. marina, A. rumphiana*, and *R. apiculata*. Overall computed diversity index is 0.8854 which has a very low relative value. This area shows the very least species diversity among the areas. Area III also has four (4) species found namely *S. alba, A. marina, A. rumphiana,* and *R. apiculata*. Overall computed species diversity is 1.2268. The diversity value of the area is also very low. The result of the data gathered entails that the diversity of mangroves in all the three (3) areas of Moalboal are consistently very low.

IV. Conclusion

Mangroves have offered significant benefits in Cebu's Moalboal area. However, they are facing a tremendous threat evident in their dwindling numbers in terms of diversity and distribution in the identified areas of the said place. *S. alba* has the highest frequency, covering around 39% of the mangroves present in all the areas. *R. apiculata* has a frequency of 30% followed by *R. rumphiana* and *A. marina* which

have the least abundance. Total species diversity in all areas is very low and must be treated as an alarming statistic. This may be utilized as the basis for considerations in future planning to increase the diversity and abundance of the mangrove species in Moalboal. From these findings, it is hereby endorsed that rehabilitation and protection of the mangrove vegetation must be considered in the strategic plans of local management and to ensure the strict implementation, protection and conservation of mangrove management in the studied areas. It is further recommended that more research must be conducted on the implementation of the conservation activities and their effect on the abundance of the mangroves in the area including the study of ecological adaptation of mangroves, relative density, frequency and relative dominance. These studies create a scientific basis for the formulation of community-based ecological management programs. Also, further studies may be conducted to compare the forest structure and diversity of mangroves in their natural or undisturbed habitat.

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