POPULATION DIVERSITY OF MANGROVE SPECIES IN PANGUIL BAY, PHILIPPINES

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Abstract

Mangroves are considered as the most important compositions of the coastal community and among the most productive and biologically complex ecosystems on the planet. Assessment of mangrove species plays a critical role in the conservation and protection of the mangrove forest. This research assesses the diversity of mangrove species in the barangays Maloro, Silangga, and Migcanaway of Tangub City, Philippines. Line intersect transect was used in gathering the frequency count of mangroves present in the identified area. Analysis of data was done using the chi-square test. Results revealed that there were eight species of mangroves present in the three barangays under study which are the Acanthus ebracteatus, Avicennia alba, Avicennia rumphiana, Sonneratia alba, Nypa fruticans, Ceriops decandra, Rhizophora apiculate, and Rhizophora mucronate. Chi-square analysis revealed that the quadrants in each transect have diverse species of mangroves which should be protected and conserved in order to maintain the biodiverse ecosystem of all marine organisms in the coastal areas.

Keywords: *mangrove, diversity, population, assessment, Panguil Bay, line intersect transect*

1.0 Introduction

Mangroves form a unique ecological environment which provide habitat for other species. The muddy or sandy sediments of the mangroves offer homes for different species of epibenthic, infaunal, and meiofaunal invertebrates. The reservoirs within the mangroves support communities of phytoplankton, zooplankton, and fish. Mangroves also play a unique role as hatchery and nursery habitat for juveniles of fish whose adults occupy other habitats like coral reefs and seagrass beds. The particular landscape with aerial roots, trunks, leaves and branches host different kinds of organisms. Furthermore, this habitat is an ideal home for some crab species which live in the roots, on the trunks or even forage in the canopy. A large number of organisms like insects, reptiles, amphibians, birds and mammals thrive in this habitat and contribute to its lifestyle to its unique characteristics (Kathiresan & Bingham 2001).

The Philippines has an estimated 500,000 hectares of mangrove forest in 1918 (Brown & Fischer 1920), and it decreased to 100,000 hectares in 1994–1995 (Primavera 2000). Approximately 60 to 70 of mangrove and associated mangrove species from 26 families are found in the Philippines. An estimated of forty species (from 16) are considered true mangroves (CV-CIRRD 1993; Primavera 2000) which can be defined as those which are restricted to the mangrove community while associated species may also grow in other habitats (Melana & Gonzales 1996). In the Philippines, the majority of the common genera are Rhizophora, Avicennia, Bruguiera and Sonneratia (Calumpong & Menez 1996) and at least 14 species have previously been recorded from Negros Island (Calumpong 1994). Mangroves are dicotyledonous woody shrubs or trees, virtually confined to the tropics. They often form a dense intertidal forest that dominates muddy intertidal shores, frequently consisting of nearly monospecific patches or bands (Hogarth 2015). Guebas et al. (2005) state that mangrove ecosystems are among the most productive and biologically complex ecosystems on the planet. Aside from its ecological function, mangroves representatives such as Rhizophora sp. operate as a physical barrier against tidal and ocean influences using their large aboveground aerial root systems and standing crop. Despite its great importance, mangrove forest faces a serious problem. The primary driving force of mangrove deforestation and mangrove forest loss in Southeast Asia and the Philippines are the rapid expansion of aquaculture development (Dodd & Ong 2008). In the Philippines, 50% of estimated mangrove deforestation can directly account for brackish-water pond development (Primavera 1995). Despite significant conservation and localized replanting efforts, mangrove degradation in the Philippines is still anticipated (Samson & Rollon 2008). This study attempts to test the distribution of mangrove species in the remaining mangrove forest of Tangub City, Philippines.

2.0 Conceptual Framework

The study is anchored on the identification of the population diversity of species in one area. In determining the mangrove diversity, the diversity index is calculated and is compared to other studies with a high level of biodiversity. The chi-square analysis is one statistical technique that can determine the diversity index of the area. The flow of the survey is best shown in Figure 1.

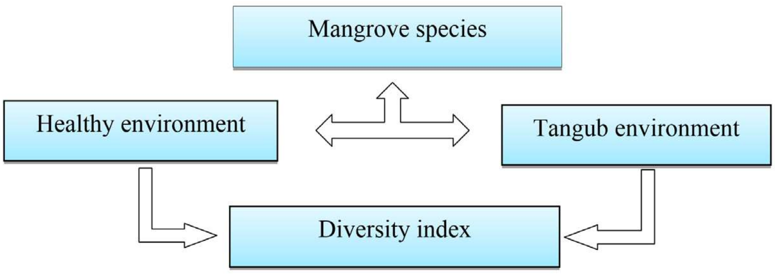

Figure 1. Diagram showing the flow of the study

3.0 Methods and Design

The study employed descriptive survey, stratified random sampling, and line intersect transect. Two-line transect stations are established from the shoreline perpendicular to the mangrove forest. For each station, transect lines measured approximately 100 meters. Within the transect line, 10 x10 m plots for the sampling of mangrove trees were set up with an interval of 10 m in every plot. The mangroves inside each quadrat were identified and counted based on taxonomic classification. The mangrove species were determined using the field guide manual to Philippine Mangroves by Primavera et al. (2004). The level of biodiversity of the parameter is calculated using the Chi-square analysis test.

Study Site

The study was conducted at Tangub City, Misamis Occidental, Philippines. The location map of the survey is shown in Figure 2.

Figure 2. Location map of the two transect lines established in sitio Lucas, Maloro, Tangub City, Misamis Occidental.

Statistical Analysis

Chi-square (X^2) is used in the analysis of the diversity of mangroves in every transect site. The X^2 value is computed using Eq 1 where O is observed value, and *E* is expected value calculated using Eq

$$X^2 = \sum \frac{(O-E)^2}{E} \quad \text{(Eq 1)}$$

$$E = \frac{(row\ total * column\ total)}{grand\ total} \quad \text{(Eq 2)}$$

4.0 Results and Disussion

A total of eight mangrove species were identified and belonged to five (5) different families. Family Rhizophoraceae obtain the highest species composition with three mangrove species these are: Rhizophora mucronata, Rhizophora apiculata, and Ceriops decandra. Regarding the conservation status out of eight species of mangroves, seven (7) species were assessed by the IUCN with the least concern status and only one species near threatened. The list of observed mangrove species is shown in Figure 3.

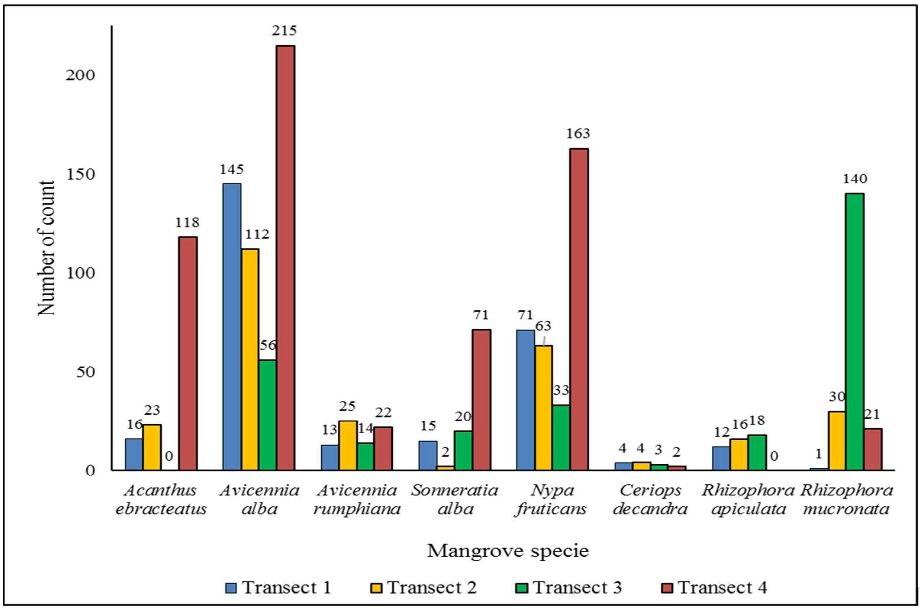

Figure 3. Frequency count of mangrove species found in all transects

The two most observed species of mangrove in all the transects were the Avicennia alba and Nypa fruticans. Least observed were the Ceriops decandra and Rhizophora mucronate.

Table 1. Frequency count and chi-square analysis of mangrove species in transect 1

Species of Mangrove	Quadrant						X^2
	Q_1	Q_2	Q_3	Q_4	Q_5	TOTAL	
Acanthus ebracteatus	11	1	0	4	0	16	15.9164
Avicennia alba	45	21	16	18	45	145	0.40613
Avicennia rumphiana	1	0	4	1	7	13	11.3709
Sonneratia alba	8	0	0	0	7	15	9.64464
Nypa fruticans	21	14	6	12	18	71	3.29458
Ceriops decandra	0	1	2	1	0	4	8.53349
Rhizophora apiculata	0	0	3	3	6	12	10.0406
Rhizophora mucronata	0	1	0	0	0	1	6.28947
TOTAL	86	38	31	39	83	**277**	
Total X^2							65.4962
Tabular X^2 (df =28)							41.337

The data presented in Table 1 were gathered at Lucas, Maloro, Tangub City. The distribution of mangrove species in this area is not uniform. Each quadrat showed the high value of range which varies individually. Reasonably, some quadrats are recorded with a very less number of species due to human malpractices such as aquasilvi as observed. The result showed that the computed value of the chi-square (65.4962) is greater than the tabular chi-square value (41.337) which implied that the mangroves in the area were diversely distributed.

Table 2. Frequency count and chi-square analysis of mangrove species in transect 2

Species of Mangrove	Quadrant						X^2
	Q_1	Q_2	Q_3	Q_4	Q_5	TOTAL	
Acanthus ebracteatus	0	3	0	10	10	23	21.0446
Avicennia alba	15	19	36	40	2	112	25.4299
Avicennia rumphiana	3	7	10	5	0	25	12.2546
Sonneratia alba	1	1	0	0	0	2	3.79012
Nypa fruticans	18	5	3	25	12	63	17.0698
Ceriops decandra	0	2	0	2	0	4	5.20472
Rhizophora apiculata	8	3	2	0	3	16	14.9967
Rhizophora mucronata	3	7	3	0	17	30	43.0116
TOTAL	48	47	54	82	44	**275**	
Total X^2							142.802
Tabular X^2 (df =28)							41.337

Data in Table 2 were gathered still at Lucas, Maloro, Tangub City which was 30 m away from transect 1. Mangrove species in this transect was not evenly distributed per quadrant making the resulting chi-square (142.802) still greater than the tabular chi-square value (41.337) which suggest that the mangroves in the area were diversely distributed.

Table 3. Frequency count and chi-square analysis of mangrove species in transect

Species of Mangrove	Quadrant						X^2
	Q_1	Q_2	Q_3	Q_4	Q_5	TOTAL	
Acanthus ebracteatus	0	0	0	0	0	0	23.7527
Avicennia alba	7	5	4	15	25	56	35.4069
Avicennia rumphiana	2	1	2	2	7	14	6.77548
Sonneratia alba	3	2	6	4	5	20	194.279
Nypa fruticans	2	11	3	2	15	33	21.0733
Ceriops decandra	0	0	2	0	1	3	5.12016
Rhizophora apiculata	1	0	2	3	12	18	11.9638
Rhizophora mucronata	23	35	25	29	28	140	434.19
TOTAL	38	54	44	55	93	**284**	
Total X^2							732.561
Tabular X^2 (df =28)							41.337

Table 3 depicts the data of mangrove species gathered from Silangga, Tangub City. Some species were counted at a very high number while others were recorded in very less number. This distribution of mangrove species varies considerably in size that in turn, not equally distributed. One remarkable feature of this transect is that some quadrants revealed the absence of some species due to a relative mangrove deforestation. The chi-square analysis indicated higher computed value (732.561) than the tabular value (41.337) signifying that this transect densely diverse. The largest, regarding percent cover, was the Rhizophora apiculata, and the lowest was the Acanthus ebracteatus.

Table 4. Frequency count and chi-square analysis of mangrove species in transect 4

Species of Mangrove	Quadrant						X^2
	Q_1	Q_2	Q_3	Q_4	Q_5	TOTAL	
Acanthus ebracteatus	0	0	0	13	105	118	373.444
Avicennia alba	40	45	39	35	56	215	47.1138
Avicennia rumphiana	5	2	3	5	7	22	22.8465
Sonneratia alba	0	1	0	5	65	71	2281.69
Nypa fruticans	3	30	60	70	0	163	174.743
Ceriops decandra	0	0	2	0	0	2	7.42475
Rhizophora apiculata	0	0	0	0	0	0	35.6073
Rhizophora mucronata	3	3	5	0	10	21	33.2745
TOTAL	51	81	109	128	243	**612**	
Total X^2							2976.15
Tabular X^2 (df =28)							41.337

Data in Table 4 were gathered from Migcanaway, Tangub City. The number of species in each quadrant revealed a higher range from one another. The area was dominated by Avicennia alba (215 counts), Nypa fruticans (163 counts), and Acanthus ebracteatus (118 counts). Species uniformity of this transect in terms of distribution was undeniably not equal. Chi-square analysis showed higher observed chi-square value (2976.15) than the tabular chi-square (41.337). The result implied that this transect 4 was diversely occupied by different mangrove species.

5.0 Conclusion

Eight species of mangroves were found in Panguil Bay of Tangub City, Philippines. These are the Acanthus ebracteatus, Avicennia alba, Avicennia rumphiana, Sonneratia alba, Nypa fruticans, Ceriops decandra, Rhizophora apiculate, and Rhizophora mucronate. These species are diversely found in the area which necessitates protection and preservation to maintain a biodiverse community. Coastal clean-up and mangrove reforestations should also be organized to conserve the mangroves present in the area.

References

Brown W. H., Fischer A. F., (1920). Philippine mangrove swamps. In: Minor products of Philippine forests I. Brown W. H. (ed), pp. 9–125, Bureau of Forestry Bull. No. 22,Bureau of Printing, Manila.

Calumpong H. P. (1994). Status of man grove resources in the Philippines. In: Proceedings of the Third ASEAN-Australia Symposium on Living Coastal Resources.

Dodd R. S., Ong J. E. (2008). Future of mangrove ecosystems to 2025. In: Aquatic ecosystems: trends and global prospects. Polunin N. V. (ed), pp. 172-287, Cambridge University Press, New York, NY, USA.

Guebas F. D., et al. (2005). How effective were mangroves as a defense against the recent tsunami? Current Biology 15:443–444.

Hogarth P. J. (2015). The biology of mangroves and seagrasses. 3rd edition, Oxford University Press.

Kathiresan K., Bingham B. L., (2001). Biology of mangroves and mangrove ecosystems. Advances in Marine Biology 40:25-81.

Melana E. E., Gonzales H. I., (1996). Field guide to the identification of some mangrove plant species in the Philippines. Department of Environment and Natural Resources,

.

Primavera J. H. (2000). Development and conservation of Philippine man groves:Institutional issues. Ecological Economics 35:91-106.

Primavera J. H. (1995). Mangroves and brackishwater pond culture in the Philippines. Hydrobiologia 295:303–309.

Primavera J. H. (2004). Handbook of Mangroves in the Philippines-Panay. SEAFDEC Aquaculture Department, lloilo, Philippines, 106 pp.

Samson M. S., Rollon R. N. (2008). Growth performance of planted mangroves in the Philippines: Revisiting forest management strategies. Am bio 37 (4):234-240.

CV-CIRRD (1993). Mangrove production, and management. Central Visayas Technology Guide, Cebu City. The Philippines, Central Visayas Consortium for Integrated Regional Research and Development (CV-CIRRD).