

Assessment of mangrove species diversity in Banaybanay, Davao Oriental, Philippines

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Abstract. Pototan BL, Capin NC, Delima AG, Novero AU. 2021. Assessment of mangrove species diversity in Banaybanay, Davao Oriental, Philippines. *Biodiversitas* 22: 144-153. This study determined mangrove species diversity and community structure in Banaybanay, Davao Oriental, Philippines. Ten 150m long transects plots were laid out perpendicular through the mangrove forests yielding 30 plots and total sampled area of 3,000 m². Individual trees within plots were counted, identified and measured for diameter at breast height (dbh) and tree height. For diversity analysis, Shannon-Weiner Index of Diversity (H'), Pielou's Index of Evenness (J), Simpson's Index of Dominance (C), and Effective Number of Species (ENS) were used. Results showed a total of 33 species belonging to 14 families, 31 of which are true mangroves and two associates. Two threatened species, the endangered *Camptostemon philippinensis* and vulnerable *Avicennia rumphiana*, and three near-threatened species were recorded. Diversity analysis showed a high diversity index ($H'=3.145$; ENS=23) and high species evenness ($J=0.85$) but low dominance ($C=0.05$). *Sonneratia alba* attained the greatest importance value (IV=59.79%) due to high relative density, relative frequency, and relative dominance. Also, Rhizophoraceae is the most represented among 14 families. Hence, Banaybanay being highly diverse with the presence of threatened and near-threatened mangrove species calls for immediate protection and conservation measures because of increasing anthropogenic activities and environmental problems observed in the area.

Keywords: *Camptostemon philippinensis*, Davao Gulf, diversity, importance value, mangrove, *Sonneratia alba*

INTRODUCTION

Mangroves are species of plants that thrive in intertidal areas that vary from trees, vines, ferns to palms (Tomlinson, 1986). Many of the mangrove experts classify these plants into true and associate species. True mangroves, are those species that can only thrive in mangrove habitat while the associate species can exist both on the aquatic and terrestrial, and can also be found in mangrove areas (Food Agriculture Organization 2010; Dieta and Dieta 2015). These mangroves provide tremendous ecological and socio-economic benefits (Bandaranayake 1998; Primavera et al. 2004).

During typhoons, mangrove ecosystem acts as a natural barrier and reduces the risk of coastal flooding and soil erosion (Bagarinao and Primavera 2005). It serves as a nursery to different species of marine life by providing them food and protection against predators. To coastal communities, mangroves are valuable resources for building materials, fodder for livestock, herbal medicine, and source of livelihood (Farley et al. 2010).

Mangrove ecosystem in the Philippines, one of the mega-diverse countries in the world, constantly faces threats due to human activities and other environmental problems (Van Lavieren et al. 2012). At least fifty percent of the world's known species of mangroves are found in the country (Garcia et al. 2014) including threatened species listed as Endangered and Vulnerable (Spalding et al. 1997; Primavera et al. 2014). As estimated by the

Department of Environment and Natural Resources (DENR) in 2003, the country had 7.3 million ha. remaining forest, 3% of which is mangrove (Long and Giri 2011; Bunting et al. 2018; Faustino et al. 2020). In the past decades, mangrove areas in the country continue to decline up to 50% of their original forest cover (Buitre et al. 2019). The decline of mangrove cover is due to the destruction of mangrove habitat for fishponds, cutting of mangrove trees for charcoal, and source of building materials (Primavera 1995). Assessment of mangrove species plays a vital role in ecosystem protection and conservation particularly in Davao Gulf. Davao Gulf is one of the country's marine key biodiversity area (Conservation International Philippines et al. 2009) surrounded by five provinces of Davao region which are Davao Oriental, Davao de Oro, Davao del Norte, Davao del Sur, and Davao Occidental. The gulf is a rich resource for fisheries activities, serves as international port (Alcala et al. 2008), and supports other economic activities. Davao Oriental's coastline is the longest in the country comprising about 3% (Cabrera and Lee 2018). Among the municipalities situated in the southwestern part of Davao Oriental facing Davao Gulf, Banaybanay ranked first in mangrove forest cover with a total of 137 hectares through the use of light detection and ranging (LiDAR) technology (Novero et al. 2019). However, there is limited information on mangrove species thriving in Banaybanay, hence, it is imperative to assess the diversity of its mangrove forest. In particular, this study aims to determine the species composition, diversity, and community structural features

of the mangrove forest in Banaybanay, Davao Oriental in the Philippines.

MATERIALS AND METHODS

Study site

The survey was conducted last October 2019 in the municipality of Banaybanay, Davao Oriental. Banaybanay is a second-class municipality of Davao Oriental, located at 7.1608° N and 126.1601° E of Davao Region. As part of Region XI, the municipality is categorized with Type II and Type IV climate, characterized as having no dry season with very pronounced maximum rainfall from November to January and more or less evenly distributed rainfall throughout the year (Philippine Institute for Development Studies 2005). The municipality has six coastal barangays with mangrove forest features (Forest Management Bureau 2010) that include fringing type in Maputi, riverine type in Kalubihan, Mogbongcogon and Piso, and overwash type in Pintatagan and Puntalinao.

Sampling techniques

Mangrove assessment standard protocol was adapted from English et al. (1994) with modifications following Cañizares and Seronay (2016). A total of ten 150 m long transect lines were established through the mangrove forests perpendicular to shore (Figure 1). Lengths of transects for mangrove surveys depend on the extent of vegetation cover. Some studies implemented shorter transects such as Picardal et al. (2011) with 100 m,

Calicdan et al. (2015) with 110 m, and Dangan-Galon et al. (2016) from 50 to 100 m. This study is limited to rapid diversity assessment and does not include the zonation patterns of the mangrove forests. The locations of transects and sampling plots were marked using Global Positioning System (GPS).

The number of transects per barangay varies on the extent of the vegetation, with three transects for Maputi, two transects each for Kalubihan and Piso and only one transect each for Mogbongcogon, Pintatagan and Puntalinao. The minimum distance between transects was 500 m determined using Google Map. Along each transect line, three 10 m x 10 m quadrats were laid out in 40 m intervals yielding a total of 30 plots. Within the sampled quadrat, every mature tree with diameter of 10 cm and above was listed (Nugroho et al. 2019). The diameter at breast height (DBH) of individual trees was recorded using a tree caliper (Haglof Mantax). Tree height was measured using a range finder (TruPulse 200). The stem diameter and height of fern species and *Nypa* palm were also gathered. However, saplings and seedlings were not included in this rapid mangrove assessment.

Identification of species

The species found in each plot was identified and classified taxonomically using Primavera et al. (2004), Giesen et al. (2006), Primavera and Sadaba (2012), and Pelsner et al. (2011 onwards). The classification of mangroves as true or associate species was based on Giesen et al. (2007) and Primavera (2009).

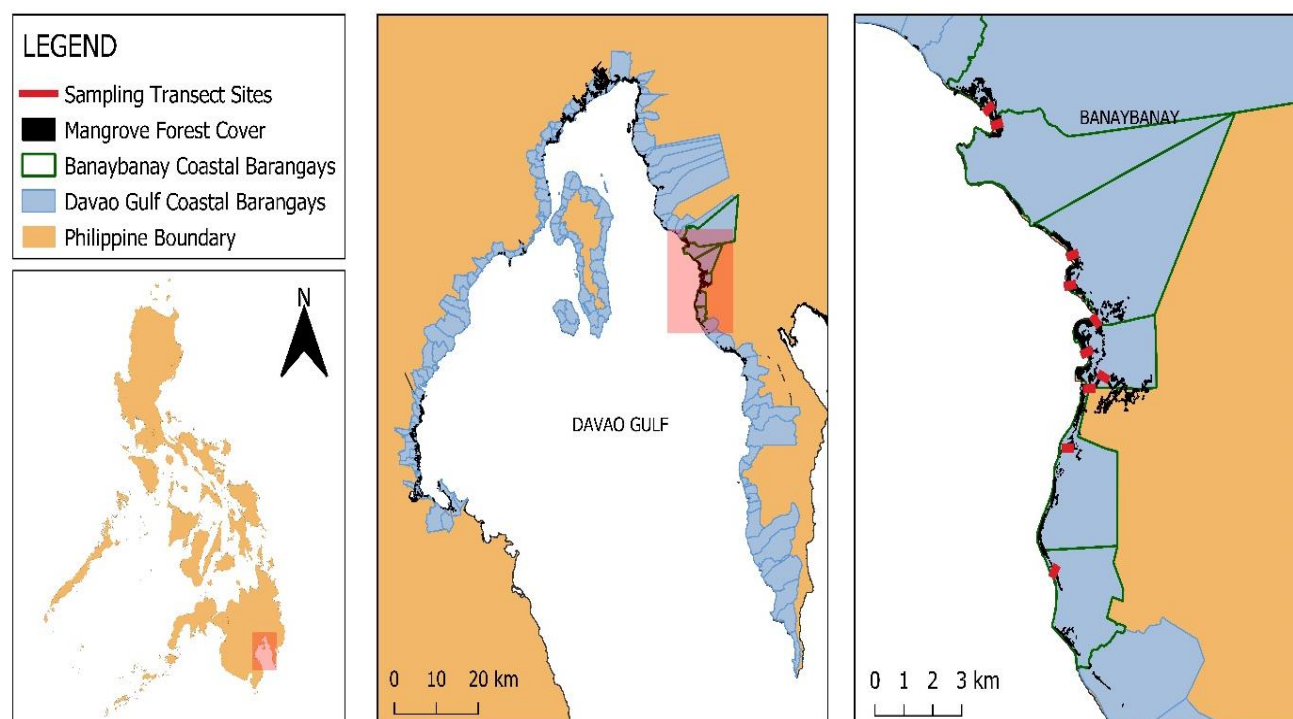


Figure 1. Location of sampling sites in Banaybanay, Davao Oriental, Philippines

Conservation status

Conservation status of each species was based on The IUCN Red List of Threatened Species 2010-2, 2011-1 and 2019-3 (<https://www.iucnredlist.org/>) and Department of Environment and Natural Resources Administrative Order No. 2007-1 (DAO 2007-1) and 2017-11 (DAO 2017-11).

Diversity analysis

Species richness, diversity, evenness dominance using the indices (Baleta and Casalamitao 2016; Baliton et al. 2020) below were obtained. For interpreting H' index, Fernando (1998) classification scheme was used as cited in Baliton et al. 2020. Further, the effective number of species (Cardillo and Novero 2018) for the computed H' index was determined.

$$\text{Shannon - Weiner Index of Diversity } (H') = -\sum_{i=1}^S (p_i \ln p_i)$$

Where:

H' : Shannon-Weiner Diversity Index

p_i : fraction of the entire population made up of species i

S : number of species encountered / species richness

\sum =sum from species 1 to species S

$$\text{Pielou's Index of Evenness } (J) = \frac{H'}{\ln S \text{ (or } H_{\max})}$$

Where:

H' : Shannon's Diversity Index

$\ln S$: natural logarithm of species richness

$$\text{Simpson's Index of Dominance } (C) = \sum_{i=1}^S (p_i^2)$$

Where:

S : number of species encountered / species richness

p_i : fraction of the entire population made up of species i

\sum =sum from species 1 to species S

$$\text{Simpson's Index of Diversity } (D) = 1 - C$$

Where:

C : Simpson's Index of Dominance

$$\text{Effective Number of Species} = \exp(H' \text{ index})$$

Community structure

For community structural features of the mangrove forest, the following formula was computed based on English et al. (1994). Basal area of individual trees, stand basal area, and stems per ha for each species were calculated. The values for basal area were used in computing for relative dominance. These are the essential factors in identifying the relevance and functions of the different species found in the area.

$$\text{Basal area (per tree)} = \frac{\pi \text{ DBH}^2}{4}$$

$$\text{Stand basal area} = \frac{\text{sum basal area per species}}{\text{total area of the plot}}$$

$$\text{Stems per ha} = \frac{\text{no. of stems in all plots per species} \times 10,000}{\text{total area of the plot}}$$

$$\text{Relative density} = \frac{\text{no. of individuals of a species}}{\text{total of no. individuals (all species)}} \times 100$$

$$\text{Relative frequency} = \frac{\text{frequency of a species}}{\sum \text{frequency of all species}} \times 100$$

$$\text{Relative dominance} = \frac{\text{total basal area of species}}{\text{basal area of all species}} \times 100$$

$$\text{Importance value} = \sum \text{Relative density} + \text{Relative frequency} + \text{Relative dominance}$$

RESULTS AND DISCUSSION

Mangrove species composition

A total of 650 individuals representing 33 plant species belonging to 14 families were recorded in Banaybanay (Table 1). Out of the total species composition, 94% ($n=31$) of which are classified as true mangroves while the remaining 6% ($n=2$) were mangrove associates. Most of the species found are trees with 28 species (85%), shrubs (6%) from Acanthaceae, and ferns (6%) from Pteridaceae, and lastly one palm species (3%) from Arecaceae.

For the conservation status of these species, 36% of total species have threatened status with *Avicennia rumphiana* as one vulnerable species and one *Camptostemon philippinensis* as the only endangered recorded. Three (3) species of mangroves were identified as near threatened and these are *Aegiceras floridum*, *Sonneratia ovata*, and *Ceriops decandra*. Moreover, 94% of mangrove species are at lower risk. According to Garcia et al. (2014), no mangrove species was listed in the National Red List crafted by the Philippine Plant Conservation Committee that was issued as a DENR Administrative Order (DAO) 2007-01. Meanwhile, DAO 2017-11 cited two mangrove species, *C. philippinense* as endangered and *Carallia brachiata* (Lour.) Merr. locally known as bakauan-gubat under Rhizophoraceae as Other Threatened Species. The IUCN Red List of Species version 2010-2 was the reference for most species listed in this study (Duke et al. 2010; Ellison et al. 2010) except for *Acanthus ilicifolius* using IUCN 2011-1 (Bignoli 2011) and IUCN 2019-3 for *Terminalia catappa* (Thomson and Evans 2019). Updating of assessments are annotated in the IUCN Red List of Threatened Species, meanwhile, no mangrove species were listed in the latest IUCN Red List 2020-2.

One notable species found is the indigenous and the endangered *C. philippinensis*, locally known as "gapas-gapas" (Figure 2). This species is distributed to Luzon, Palawan, Masbate, Panay, Negros, Bohol, Mindanao and Basilan. It can also be found in Borneo and Celebes (Fernando and Pancho, 1980). Using the IUCN 2010-2, there are only 1,200 mature individuals remaining in the wild in the country. The population of this mangrove species is generally decreasing due to anthropogenic threats mainly due to mangrove forest conversion for aquaculture and cutting (IUCN 2010-2) for wood and charcoal. Locally, there are no published reports on the occurrence of this species in Davao Gulf. According to Primavera JH 2020, pers.com. this could be its first sighting in Davao Gulf. In this study, only four mature individual trees were recorded. On the other hand, *Avicennia rumphiana* which is vulnerable has only 42 individuals in the sampling sites.

There are also less than 20 individuals for the near-threatened species.

Mangrove diversity analysis

The sampled mangrove forests in Banaybanay showed a high species richness of 33 species. In comparison with published surveys on mangroves in neighboring local units around Davao Gulf, Banaybanay is more diverse than Sta. Cruz, Davao del Sur with 17 species (Cardillo and Novero 2018), and Davao del Norte with 11 to 16 different species were obtained in four sites (Pototan et al. 2017).

Using the indices (Table 2), results showed that the sampled mangrove forest showed a high Shannon-Weiner

Index of Diversity ($H' = 3.145$). To achieve such H' index, the effective number of species (ENS) is 23 species and it has a small difference from the maximum diversity ($H_{\max} = 3.496$). This also takes into account the high number of species and large number of individuals recorded. Results also showed high species evenness of 89 % ($J = 0.89$). With higher species richness and species evenness, the diversity is expected to be higher as well. This in turn resulted in low dominance, $C=0.05$ of mangrove forest of the municipality which the value is less than 1. It also shows that the forest is not dominated by single species.

Table 1. Mangrove species identified in Banaybanay, Davao Oriental, Philippines with their conservation status and category

Species	Family	No. of individuals	Conservation status	Life form
True mangroves				
<i>Acanthus ebracteatus</i> Vahl.	Acanthaceae	17	LC ¹	Shrub
<i>Acanthus ilicifolius</i> L.		5	LC ²	Shrub
<i>Nypa fruticans</i> Wurm.	Arecaceae	31	LC ¹	Palm
<i>Avicennia alba</i> Blume	Avicenniaceae	4	LC ¹	Tree
<i>Avicennia marina</i> (Forssk.) Vierh		45	LC ¹	Tree
<i>Avicennia officinalis</i> L.		6	LC ¹	Tree
<i>Avicennia rumphiana</i> Hall. f.		42	VU ¹	Tree
<i>Lumnitzera littorea</i> (Jack) Voigt.	Combretaceae	26	LC ¹	Tree
<i>Lumnitzera racemosa</i> Willd.		35	LC ¹	Tree
<i>Excoecaria agallocha</i> L.	Euphorbiaceae	6	LC ¹	Tree
<i>Sonneratia alba</i> J.E. Smith	Lythraceae	88	LC ¹	Tree
<i>Sonneratia caseolaris</i> (L.) Engl.		10	LC ¹	Tree
<i>Sonneratia ovata</i> Back.		11	NT ¹	Tree
<i>Camptostemon philippinensis</i> (S.Vidal) Becc.	Malvaceae	4	EN ^{1,4}	Tree
<i>Heritiera littoralis</i> Aiton		6	LC ¹	Tree
<i>Xylocarpus granatum</i> Koen.	Meliaceae	15	LC ¹	Tree
<i>Xylocarpus moluccensis</i> (Lam) M. Roem.		13	LC ¹	Tree
<i>Aegiceras corniculatum</i> (L.) Blanco	Myrsinaceae	9	LC ¹	Tree
<i>Aegiceras floridum</i> Roem. & Schult.		18	NT ¹	Tree
<i>Osbornia octodonta</i> F. Muell.	Myrtaceae	12	LC ¹	Tree
<i>Acrostichum aureum</i> L.	Pteridaceae	6	LC ¹	Fern
<i>Acrostichum speciosum</i> Willd.		15	LC ¹	Fern
<i>Bruguiera cylindrica</i> (L.) Blume	Rhizophoraceae	21	LC ¹	Tree
<i>Bruguiera gymnorrhiza</i> (L.) Lam.		8	LC ¹	Tree
<i>Bruguiera sexangula</i> (Lour.) Poir.		13	LC ¹	Tree
<i>Ceriops decandra</i> (Griff.) W.Theob.		7	NT ¹	Tree
<i>Ceriops tagal</i> (Perr.) C.B.Rob.		18	LC ¹	Tree
<i>Rhizophora apiculata</i> Blume		59	LC ¹	Tree
<i>Rhizophora mucronata</i> Lam.		40	LC ¹	Tree
<i>Rhizophora stylosa</i> Griff.		18	LC ¹	Tree
<i>Scyphiphora hydrophyllacea</i> C.F.Gaertn.	Rubiaceae	33	LC ¹	Tree
Mangrove associates				
<i>Dolichandrone spathacea</i> (L.f.) K.Schum.	Bignoniaceae	8	LC ¹	Tree
<i>Terminalia catappa</i> L.	Combretaceae	1	LC ³	Tree
Total		650		

Note: Conservation Status: LC: least concern; NT: near threatened; VU: vulnerable; EN: endangered. ¹: IUCN Red List of Threatened Species 2010-2; ²: IUCN Red List of Threatened Species 2011-2; ³: IUCN Red List of Threatened Species 2019-3; ⁴: DAO No. 2017-11.

Table 2. Diversity analyses for sampled mangrove forests in Banaybanay, Davao Oriental, Philippines

Diversity indices	Value
Species Richness	33
Shannon-Weiner Index of Diversity (H')	3.1453
H _{max}	3.4965
Effective Number of Species (ENS)	23.228
Pielou's Index of Evenness (J)	0.8995
Species Index of Dominance (C)	0.0565
Simpson's Index of Diversity (D)	0.9434

Habitat assessment

Results of this study revealed that the mangrove forests in Banaybanay is comprised of trees with mean DBH ranging between 10.7 and 30.5 cm, mean tree height between 2.88 to 16.5 m, basal area 0.01 to 3.25 m²ha⁻¹, and stem density between 1.2 and 26.4 stems per ha (Figure 3).

Among the mangrove trees, *S. alba* and *S. ovata* showed the greatest mean DBH reaching to 30 cm-wide trunks. *S. alba* comprise the largest basal area of 3.25 m² ha⁻¹ which is about 35% of the total stand basal area with stem density of 26 trees per ha. For tree height, the tallest was *S. ovata* reaching an average height of 16 m and then followed by *S. caseolaris*, *S. alba*, and *B. cylindrica* at around 11 m tall.

On the other hand, more than half (55.23%) of the sampled mangrove stand is dominated by plants with DBH ranging from 11 to 20 cm, while 19.38% are old-growth trees with larger DBH of 21 to 40 cm and 3% of mangroves have very wide DBH > 41 cm. (Figure 4). The classification was based on Lillo et al. (2018) with modifications. These trees with large diameters were found in riverine areas. Most of them thrive along with the Piso and Kalubihan river system. In these barangays, towering and undisturbed trees of mangrove species are present. Transect 7 situated in Barangay Mogbongcogon has larger trees with girth ranging 31 to 40 cm.

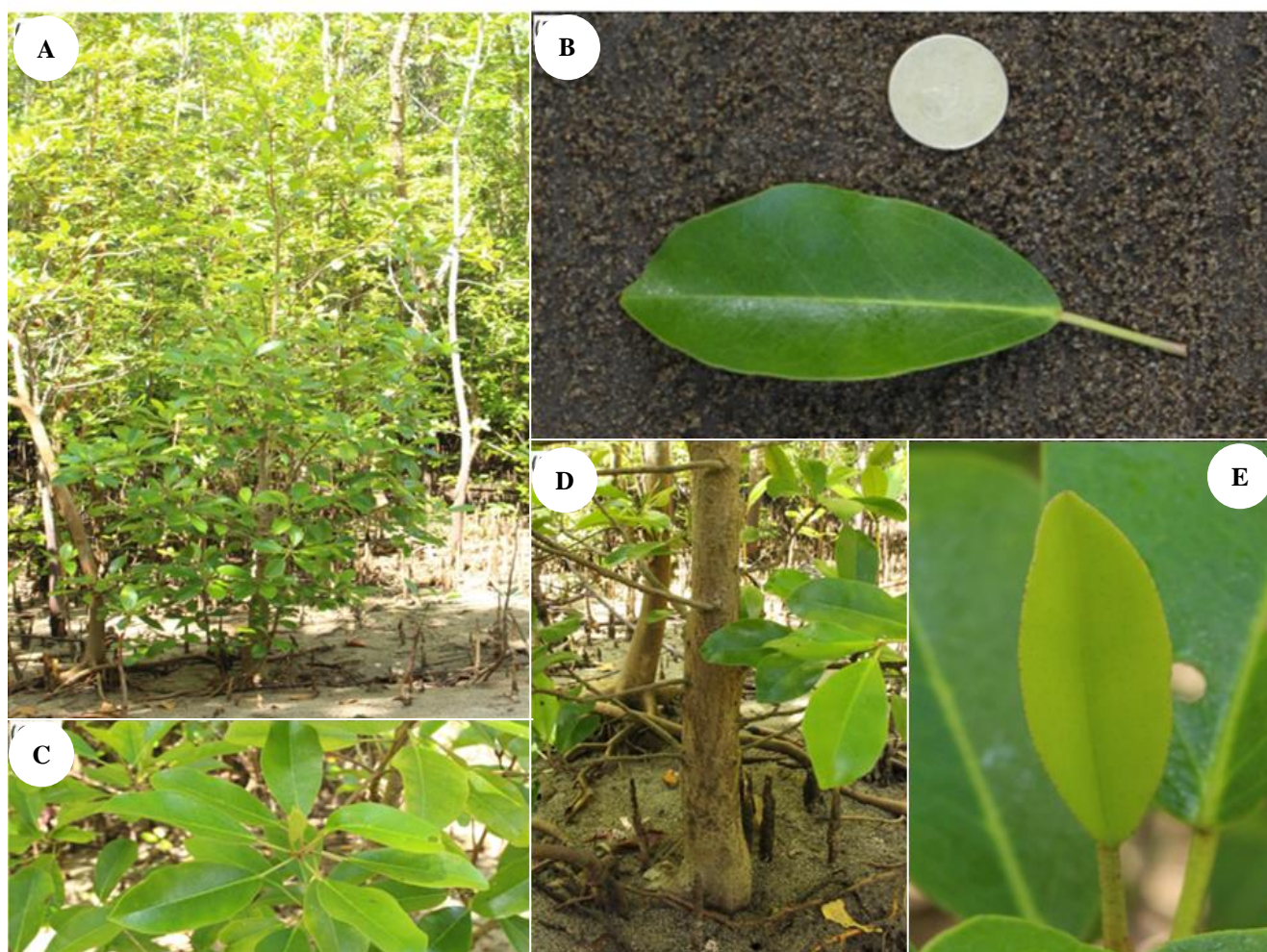


Figure 2. *Camptostemon philippinensis* or 'gapas-gapas' showing: A. Plant habit; B. Leaf morphology; C. Leaf formation and arrangement; D. Stem; and, E. Apical shoot observed in Banaybanay, Davao Oriental, Philippines

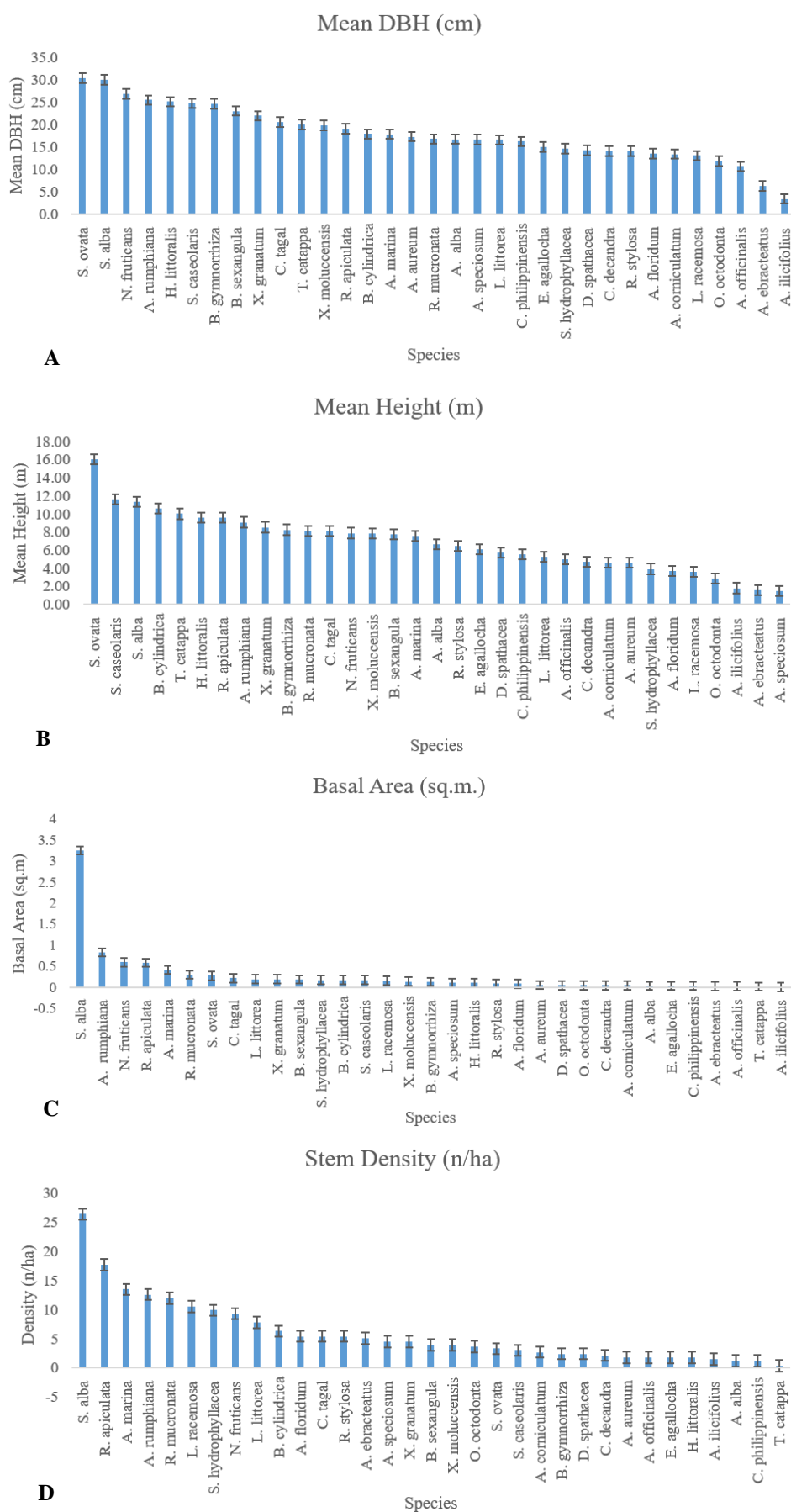


Figure 3. Habitat assessment of sampled mangrove forests in Banaybanay, Davao Oriental, Philippines showing the rankings of species in terms of: A. Mean diameter at breast height (DBH), B. Mean height, C. Basal area, and D. Stem density

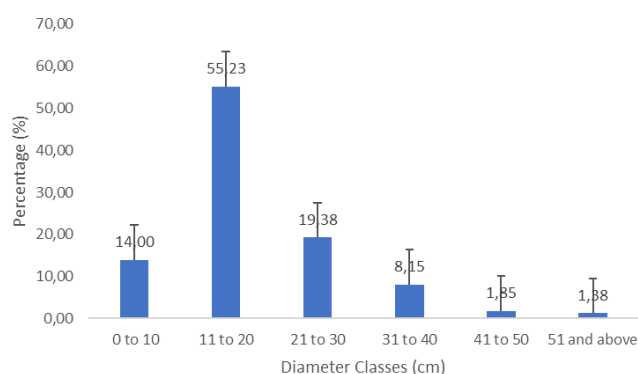


Figure 4. Diameter distribution of mangrove species recorded in Banaybanay, Davao Oriental, Philippines

Mangroves in riverine types are most productive due to freshwater influence (Perera et al. 2013). It was also observed that the locals in the area which are mostly members of the fisherfolks organization were trained by government agencies for mangrove conservation. The area is also situated near the municipal bird sanctuary which means authorities conducts regular monitoring which lessens illegal activities in both habitats. In barangay Maputi with narrow fringing mangrove, houses are directly constructed within the mangrove forest with boats and canoes attached to mangrove trees to protect them during rough weathers. While overwash type of mangrove in barangays Pintatagan and Puntalinao, fishermen hang their fishing nets underneath the trees during high tide.

Vegetation analysis

Table 3 showed the ranks of all the mangrove species of the sampled areas in Banaybanay based on importance value which considers three parameters: relative density, relative frequency, and relative dominance. Among the 33 species, *Sonneratia alba* or 'pagatpat' has the highest importance value 59.8%, relative density 13.5%, seen in most of the sampling transect lines as well as high in dominance 37.5%. These imply that *S. alba* has the largest contribution to mangrove biomass in the municipality. Brown and Kleine (2012) reported that *S. alba* is a rapidly flowering and fruiting species. Much earlier, Tomlinson (1986) reported that this species possesses a physiological mechanism that controls salt, making it a more adaptive species within the mangrove community. In the mangrove forest in Banaybanay, a gigantic *S. alba* tree towers from the ground with 28.2 m height as the tallest tree, showing how acclimated it is in its environment.

Subsequently, *R. apiculata* (IV=24.12%), *A. rumphiana* (IV=22.71%), and *A. marina* (IV=18.02%) are next in rank to *S. alba*. The species of *Rhizophora* found in the

municipality are utilized for tannin extraction locally known as "tungog" production. 'Tungog' is a material extracted from the bark of *Rhizophora* species which provides the coloring agent for the coconut wine locally known as "tuba". Improper debarking of trees can later harm growth and survival of the species leading to loss of individual population (FAO 1994; Bandaranayake 1998).

Sonneratia spp. and *Rhizophora* spp. being popular to locals are spared from cutting by the locals. Also, most of the mangrove tree planting activities conducted in the area use the seedlings of these species giving them financial benefits in the process. Apparently, this promotes the abundance of the species in the area.

Five more species ranked after *A. marina* which belongs to top ten species have importance values that ranged between 10 and 16%. These are *N. fruticans*, *R. mucronata*, *L. racemosa*, *S. hydrophyllacea*, and *L. littorea*. All other species have importance value of less than 10% comprised of other true mangrove trees, ferns, palm, and associate species. Under true mangroves, *C. philippinensis* was ranked as the lowest with mean DBH of 16.25 cm reaching around 6 m tall. With very few individuals, this species occupied only a small basal area of 0.03 and very low stem density of 0.82 per hectare.

In conclusion, rapid mangrove assessment in six barangays of Banaybanay, Davao Oriental northeast of Davao Gulf showed high species diversity. A total of 33 mangrove species representing 14 families with 30 true mangroves and 2 associates were recorded in different forest types: riverine, overwash and fringing. Shannon-Weiner diversity showed a high value ($H=3.145$), with high evenness ($J=0.89$) and low dominance ($C=0.05$). In terms of community structural features, *S. alba* has the greatest importance value around 60 % due to its high relative density, relative frequency, and relative dominance. *S. alba* has also the highest mean dbh and means height suggesting its largest contribution to biomass on the mangrove community. Rhizophoraceae is the most represented with eight different species. Apparently, these species are the most popular to locals and are promoted for mangrove planting subsequently influencing the abundance of the species. Meanwhile, the indigenous and endangered species, *C. philippinensis* was ranked the lowest under true mangroves with very low basal area, stem density, and importance value that calls for immediate protection. Conservation efforts should be exerted for vulnerable *A. rumphiana*, and near-threatened species such as *A. floridum*, *A. rumphiana*, *C. decandra*, and *S. ovata*. Hence, we recommend immediate protection and conservation measures of the mangrove forests in Banaybanay due to increasing anthropogenic activities and environmental problems observed in the area. An Information Education Campaign (IEC) should be considered to raise awareness in the communities residing near their mangrove forest.

Table 3. Community structural analysis of mangrove species found in Banaybanay, Davao Oriental, Philippines

Rank	Species	Relative ensity (%)	Relative frequency (%)	Relative dominance (%)	Importance value (%)
1	<i>Sonneratia alba</i>	13.54	8.70	37.56	59.79
2	<i>Rhizophora apiculata</i>	9.08	8.30	6.74	24.12
3	<i>Avicennia rumphiana</i>	6.46	6.72	9.53	22.71
4	<i>Avicennia marina</i>	6.92	6.32	4.78	18.02
5	<i>Nypa fruticans</i>	4.77	4.74	6.78	16.29
6	<i>Rhizophora mucronata</i>	6.15	6.32	3.38	15.86
7	<i>Lumnitzera racemosa</i>	5.38	5.53	1.75	12.67
8	<i>Scyphiphora hydrophyllacea</i>	5.08	5.14	2.01	12.22
9	<i>Lumnitzera littorea</i>	4.00	3.95	2.23	10.18
10	<i>Ceriops tagal</i>	2.77	3.16	2.48	8.41
11	<i>Xylocarpus granatum</i>	2.31	3.56	2.25	8.12
12	<i>Bruguiera cylindrica</i>	3.23	2.77	2.00	7.99
13	<i>Rhizophora stylosa</i>	2.77	3.56	1.02	7.35
14	<i>Aegiceras floridum</i>	2.77	3.16	0.93	6.86
15	<i>Sonneratia ovata</i>	1.69	1.98	3.16	6.83
16	<i>Acrostichum speciosum</i>	2.31	2.77	1.21	6.29
17	<i>Bruguiera sexangula</i>	2.00	1.98	2.08	6.05
18	<i>Acanthus ebracteatus</i>	2.62	3.16	0.27	6.05
19	<i>Xylocarpus moluccensis</i>	2.00	2.37	1.55	5.92
20	<i>Sonneratia caseolaris</i>	1.54	1.19	1.99	4.72
21	<i>Bruguiera gymnorhiza</i>	1.23	1.19	1.42	3.83
22	<i>Dolichandrone spathacea</i>	1.23	1.98	0.46	3.67
23	<i>Osbornia octodonta</i>	1.85	1.19	0.48	3.51
24	<i>Heritiera littoralis</i>	0.92	1.19	1.19	3.29
25	<i>Ceriops decandra</i>	1.08	1.58	0.41	3.07
26	<i>Aegiceras corniculatum</i>	1.38	1.19	0.47	3.04
27	<i>Acrostichum aureum</i>	0.92	1.19	0.54	2.65
28	<i>Avicennia officinalis</i>	0.92	1.19	0.19	2.30
29	<i>Avicennia alba</i>	0.62	1.19	0.37	2.17
30	<i>Excoecaria agallocha</i>	0.92	0.79	0.37	2.09
31	<i>Acanthus ilicifolius</i>	0.77	1.19	0.02	1.97
32	<i>Camptostemon philippinensis</i>	0.62	0.40	0.29	1.30
33	<i>Terminalia catappa</i>	0.15	0.40	0.11	0.66
	Total	100.00	100.00	100.00	300.0

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