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Notes on mangrove civil reservation area, Sagay Marine Reserve, the Philippines: A baseline mangrove diversity checklist

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ABSTRACT

Sagay Marine Reserve (SMR) being the largest marine reserve in the Philippines is blessed with great biodiversity. However, studies are very limited and there are no published literature in refereed journals for mangroves. This study photo-documented the true mangroves found at the Mangrove Civil Reservation Area (MCRA), a mangrove forest within SMR. A total of 20 species from 12 families were recorded from a series of biodiversity studies, site visits, and species inventory from 2018 to 2021. The list includes *Ceriops zippeliana*, that has long been mistaken as *C. decandra*. NONESCOST MCRA showed the highest mangrove diversity compared to other parts of Negros Occidental. Overall, 7 species were new records while 11 previously reported species were not found in this study. This is the first comprehensive species inventory of mangroves found at the reservation area, providing baseline mangrove diversity data with photos.

Keywords: Mangrove species, Negros Occidental, New record, Philippines, Species inventory

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Introduction

Philippine mangrove diversity is one of the highest in the world with 36 (Primavera and Dianala, 2009) to 42 species (ADB, 2014) found in the country. However, despite many researches in the Philippines, there are limited published studies on mangrove species found in Negros Occidental Province. Fourteen (14) species were reported in Danjugan Island, Southwestern Negros (King et al., 2002), while 10 were found in Binalbagan, Central Negros (Malo and Cari-an, 2012). Apparently, there were no published surveys conducted in Northern Negros, particularly in Sagay Marine Reserve (SMR); even it bears the title of being one of the largest marine reserves in the Philippines (Bocario et al., 2019).

It is within SMR where the Northern Negros State College of Science and Technology (NONESCOST) Mangrove Civil Reservation Area (MCRA) is located. NONECOST MCRA is a 19.84 ha mangrove forest managed by the Northern Negros State College of Science and Technology (former Iloilo State College of Fisheries–Sagay Branch). The stewardship of the area was awarded to the College through a Presidential Proclamation signed by the late President Corazon C. Aquino in March 9, 1987 (Proclamation No. 83 1987). Since then, mangrove conservation and rehabilitation initiatives were implemented.

The reservation has become a research and practicum ground for the faculty and students in Negros Island but no studies has been published in refereed journals on its biodiversity. Thus, references on research undertakings in the area are only grey literatures. This includes the sole reference on mangroves found at NONESCOST MCRA by Bantigue (2010) with 22 recorded species. Although Bantigue (2010) reported a significant number of species, there were no means to verify the identification due to a lack of specimens and photo-documentations. Therefore, to verify and update the species checklist at NONESCOST MCRA, this recent study is presented with photo-documentations.

Material and Methods

This study was conducted at the NONESCOST MCRA (10°56'43" N, 123°25'30" E; 10°56'54" N 123°24'54" E) located in Old Sagay, Sagay City, Province of Negros Occidental. The reservation area is managed by the College of Fisheries and Allied Sciences of NONESCOST, and now part of its newly established Fisheries and Marine Science Research Station (FaMaRS). The species listing was based on a series of biodiversity studies and site visits conducted between 2018 and 2020. To verify those results, a species inventory was conducted in January 2021 where the entire mangrove reservation area was surveyed to cover the whole area and relatively document all mangrove species (Figure 1). The perimeter was further traced along the residential areas to see other mangrove species commonly found in the dikes e.g., *Acanthus* and *Acrostichum*. The data and photos presented were taken between 2018 and 2021. The species were primarily identified using published identification guides to Philippine mangroves by Primavera et al. (2004) and Primavera and Dianala (2009). Morphological observations on mangrove forms (tree, shrub, palm, etc.), root types (prop, buttress, plank, pneumatophores, cones, knee), bark structures, leaf characteristics, and inflorescence were done for each species. Characteristics were further examined during the fruiting seasons for species that require differentiation based on floral and fruit structures.

Results and Discussion

A total of 20 species were photo-documented at the Northern Negros State College of Science and Technology (NONESCOST) Mangrove Civil Reservation Area (MCRA) as shown in Table 1. Eleven previously reported species were not found in the area, while seven species were new records. Each species was photo documented and presented in the figures below (Figures 2A-E) alphabetically.

Sagay Marine Reserve is being one of the largest marine reserves in the country housing a significant number of species such as mangroves, seagrasses, corals, giant clams, etc. (SMR Office 2012 *cf* Bocario et al., 2019). However, these species are poorly documented in scientific literature; similar to with NONESCOST MCRA, a reservation area managed by the academe within SMR-making diversity data difficult to verify. In this study, a total of 20 mangrove species were photo-documented which is lower than previous records of Bantigue (2010). The new list included one species, *C. zippeliana* that has long been mistaken as *C. decandra* (Sheue et al., 2009). The current species observed consistently agreed with the description of Sheue et al., 2009, having shallow calyx tube, short, but erected calyx lobes, and pointed hypocotyl apex, contrary to the blunt apex of *C. decandra*. The occurrence of *C. zippeliana* in the Philippines have been reported especially in the Mindanao region (Sheue et al., 2010; Middeljans, 2014; Mangaoang and Flores, 2019). However, there is a death of reports in their distribution particularly in the Visayas region where this study was conducted. In total, seven species were new records (Table 1), while 11 previously reported were not found in this study suggesting that a total of 29 mangrove species may have resided the reservation area. This record is far higher than species found in Suyac Island, Sagay City (9 species) but are dominated by centuries-old assemblages of *S. alba*, *A. marina*, and *Rhizophora* spp. (Albarico et al.,

2020). In contrast to other studies in Negros Province, King et al. (2002) reported 14 mangrove species in Danjugan Island, while Malo and Carian (2012) reported 10 in Binalbagan. Therefore, northern Negros's area as shown in this study showed the highest mangrove diversity throughout the island-supporting Sagay Marine Reserve's vast marine diversity.

Bantigue (2010) reported a significant number of species over a decade ago for NONESCOST MCRA. However, species reported could not be verified due to a lack of specimens and photo documentation. The latter did not also consider noting key characteristics that is important to verify the species though taxonomy was not the main objective. This can lead to the conclusion that some species either have been lost due to anthropogenic activities or may have been misidentified. Without extensive training/ background in taxonomy, biodiversity reports are easily mislead especially without proper peer review and scrutiny from scientific experts in the field. Ragavan et al. (2014) noted that some mangrove species are difficult to identify like *C. tagal* and *C. zippeliana* due to their almost identical morphology. Hence, whole-year observations are essential to accurately identify some mangroves with distinctions only found in floral and fruit morphology. It is important to note that baseline studies such as that of Bantigue (2010) are essential and should be properly documented with descriptions, vouchered specimens, or photos for appropriate biodiversity assessment and conservation. Thus, this study should be considered as the baseline mangrove diversity data for the Mangrove Reservation Area.

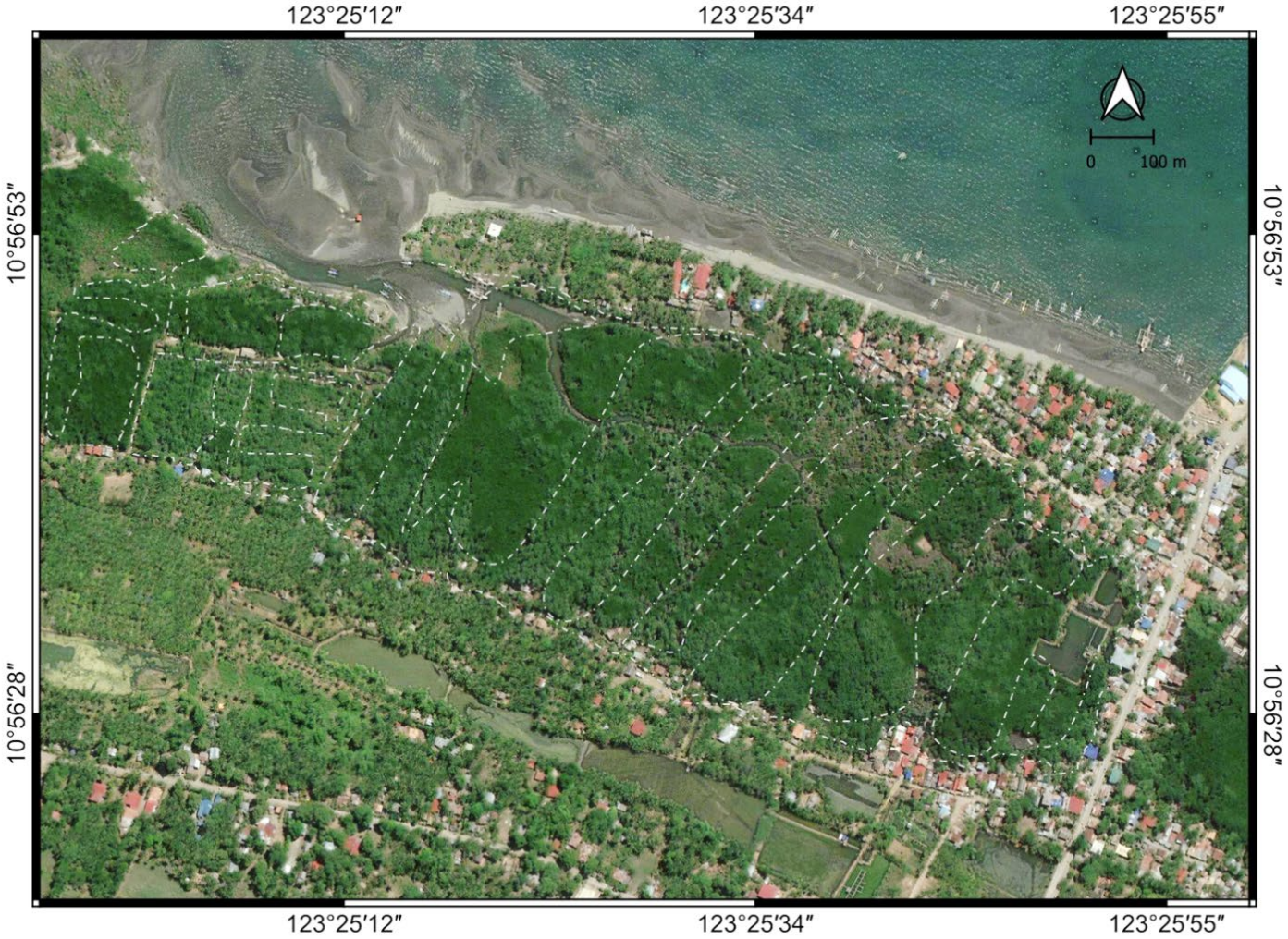

Figure 1. Mangrove Civil Reservation Area, Sagay Marine Reserve. Dashed line represents the rough survey track done during species inventory in January 2021

Table 1. Mangrove species of NONESCOST MCRA, Sagay Marine Reserve. (LC) Least Concern, (NT) Near Threatened, (VU) Vulnerable, (EN) Endangered, (*) not reported by Primavera and Dianala, (+) present, (-) absent

Family	Philippine Mangrove Species (Primavera and Dianala, 2009; Sheue et al., 2009*)	MCRA		IUCN Status	
		Bantigue 2010	This study	Redlist Category	Population Trend
Acanthaceae	*Acanthus ebracteatus*, Vahl 1791	+	-	LC	decreasing
	Acanthus ilicifolius, Linnaeus 1753	+	-	LC	unknown
	Acanthus volubilis, Wallich 1831	+	-	LC	decreasing
	Avicennia alba, Blume 1826	+	-	LC	decreasing
	**Avicennia lanata*, Ridley 1920	+	-	VU	unspecified
	Avicennia marina, (Forsskal) Vierhapper 1907	+	+	LC	decreasing
	Avicennia officinalis, Linnaeus 1753	-	+	LC	decreasing
	Avicennia rumphiana, Hallier fil. 1918	-	+	LC	decreasing
Malvaceae	*Camptostemon philippinensis*, (Vidal) Becc. 1889	-	-	ND	decreasing
Combretaceae	*Lumnitzera littorea*, (Jack) Voigt 1845	-	-	LC	decreasing
	Lumnitzera racemosa, Willdenow1803	+	+	LC	decreasing
Euphorbiaceae	*Excoecaria agallocha*, Linnaeus 1759	+	+	LC	decreasing
Lythraceae	*Pemphis acidula*, Forster & Forster 1775	+	+	LC	decreasing
Malvaceae	*Heritiera littoralis*, Aiton 1789	-	-	LC	decreasing
	Brownlowia tersa, (Linnaeus) Kostermans 1959	-	-	NT	decreasing
Meliaceae	*Xylocarpus granatum*, Köenig 1784	+	+	LC	decreasing
	Xylocarpus moluccensis, (Lamarck) Roemer 1846	+	+	LC	decreasing
Myrtaceae	*Osbornia octodonta*, F. Mueller 1862	-	+	LC	decreasing
Arecaceae	*Nypa fruticans*, Wurmb 1779	+	+	LC	unknown
Primulaceae	*Aegiceras corniculatum*, (Linnaeus) Blanco 1837	-	-	LC	decreasing
	Aegiceras floridum, Roemer & Schultes 1819	-	+	LC	decreasing
Pteridaceae	*Acrostichum aureum*, Linnaeus 1753	-	+	LC	stable
	Acrostichum speciosum, Willdenow 1810	-	+	LC	stable
Rhizophoraceae	*Bruguiera cylindrica*, (Linnaeus) Blume 1828	+	+	LC	decreasing
	Bruguiera gymnorrhiza, (Linnaeus) Lamarck 1798	+	-	LC	decreasing
	Bruguiera parviflora, (Roxburgh) Wight & Arnott ex Griffith 1836	+	-	LC	decreasing
	Bruguiera sexangula, (Lour.) Poiret 1816	+	-	LC	decreasing
	Ceriops decandra, (Griffith) Theob 1883	+	-	NT	decreasing
	**Ceriops zippeliana,* Blume 1849	-	+	LC	decreasing
	Ceriops tagal, (Persoon) Robinson 1908	+	-	LC	decreasing
	Kandelia candel, (Linnaeus) Druce 1913	-	-	LC	decreasing
	Rhizophora apiculata, Blume 1827	+	+	LC	decreasing
	Rhizophora mucronata, Poiret 1804	+	+	LC	decreasing
	Rhizophora stylosa, Griffith 1854	+	+	LC	decreasing
Rubiaceae	*Scyphiphora hydrophyllacea*, Gaertner 1971	+	+	LC	decreasing
Lythraceae	*Sonneratia alba*, Smith 1816	+	+	LC	decreasing
	Sonneratia caseolaris, (Linnaeus) Engler 1897	+	-	LC	decreasing
	Sonneratia ovata, Backer 1920	-	-	NT	decreasing
TOTAL	**36**	22	**20**		

Sagay Marine Reserve is one of the largest marine reserves in the country housing a significant number of species such as mangroves, seagrasses, corals, giant clams, etc. (SMR Office 2012 *cf* Bocario et al., 2019). However, these species are poorly documented in scientific literature; similar with NONESCOST MCRA, a reservation area managed by the academe within SMR-making diversity data difficult to verify. In this study, a total of 20 mangrove species were photo-documented which is lower than previous records of Bantigue (2010). The new list included one species, *C. zippeliana* that has long been mistaken as *C. decandra* (Sheue et al., 2009).

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Figure 2A. Mangroves of NONESCOST MCRA. A) *Acrostichum aureum*, B) *Acrostichum speciosum*, C) *Aegiceras floridum*, D) *Avicennia marina*

Figure 2B. Mangroves of NONESCOST MCRA. E) *Avicennia officinalis,* F) *Avicennia rhumphiana*, G) *Bruguiera cylindrica*, H) *Ceriops zippeliana*

Figure 2C. Mangroves of NONESCOST MCRA. I) *Excoecaria agallocha,* J) *Lumnitzera racemosa*, K) *Nypa fruticans*, L) *Osbornia octodonta*

Figure 2D. Mangroves of NONESCOST MCRA. M) *Pemphis acidula,* N) *Rhizophora apiculata*, O) *Rhizophora mucronata*, P) *Rhizophora stylosa*

Figure 2E. Mangroves of NONESCOST MCRA. Q) *Sciphiphora hydrophyllacea,* R) *Sonneratia alba*, S) *Xylocarpus granatum*, T) *Xylocarpus mollucensis*

However, the absence of *Acanthus* spp. in this study could be attributed by increasing settlements around the mangrove area. *Acanthus* spp. are commonly found in higher elevations such as dikes and in the swash zones. Consequently, increased human settlement around the mangrove forest may have cleared some mangrove shrubs. Having small patches of shrubs makes them difficult to monitor compared to mangrove trees. A small *Acanthus* assemblage (Figure 3) was spotted from a nearby fishpond area approximately 500 m away from the reservation area potentially supporting the results of Bantigue (2010). Newly recorded mangroves such *A. floridum* and *O. octodonta* could be new recruits at NONESCOST MCRA but with some having heights over 3.0 meters suggests older plants. Therefore, these two species while having significant number in the area may either had been misidentified or not included in the previous transect—highlighting the limitation of transect method in mangrove assessment. Unfortunately, the ageing of these two species using height increments was never explored making it difficult to speculate ages without proper tagging.

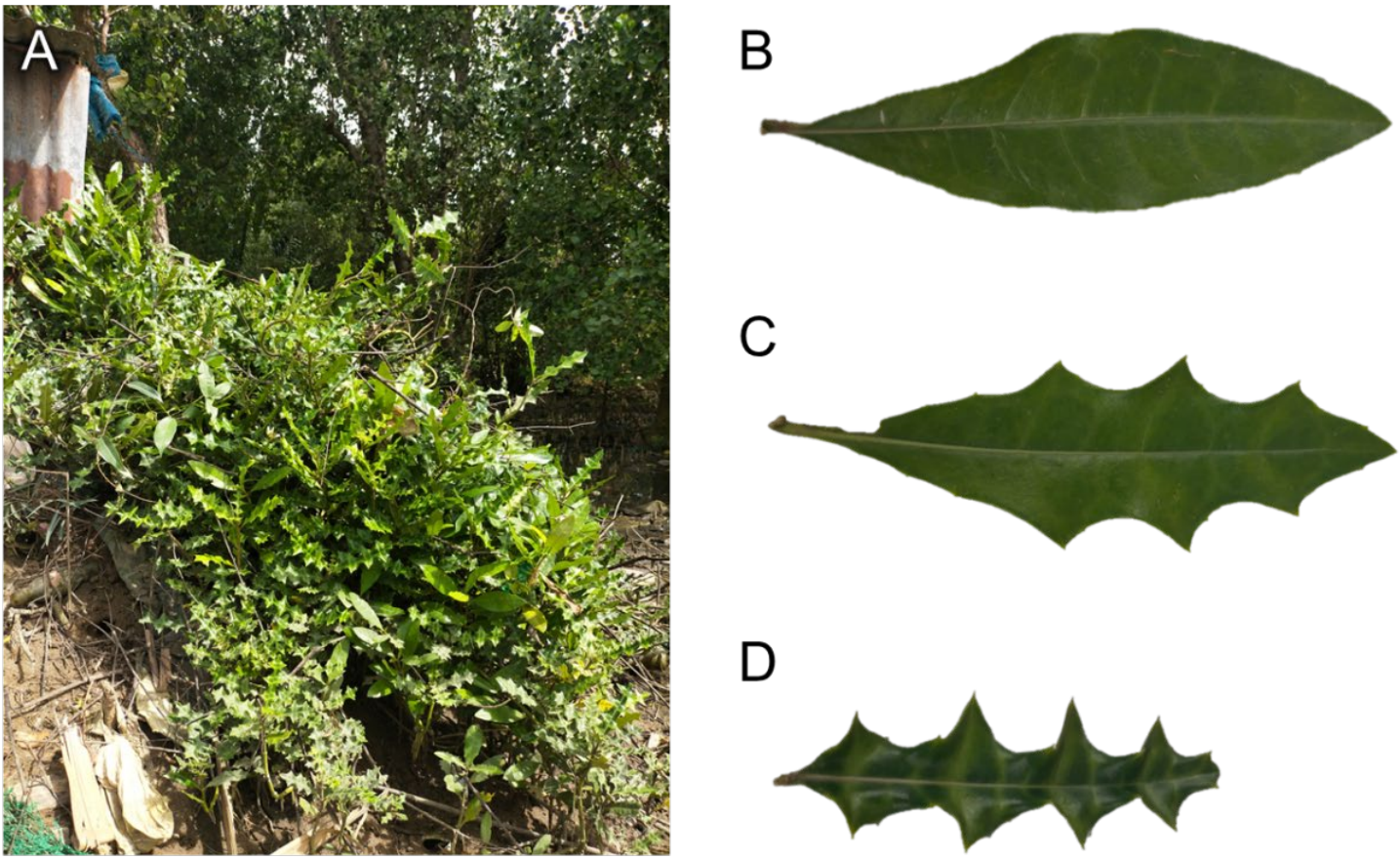

Figure 3. *Acanthus* assemblage in a nearby fishpond (A): B) *Acanthus volubilis* C) *Acanthus ilicifolius*, D) *Acanthus ebracteatus.*

Conclusion

This paper presents an accurate and comprehensive baseline data for mangrove species at Mangrove Civil Reservation Area, Sagay Marine Reserve. This study found seven new mangrove records, with one often mistakenly *C. zippeliana* as *C. decandra*. The series of assessments and a comprehensive species inventory in this study made it possible to hypothetically record all existing mangrove species in the area; and could be used to advance mangrove biodiversity monitoring and management for the reserve, as well as other mangrove forests in Negros Province. Conversely, 11 previously recorded species were not found in the area. The use of the transect method in the previous study have sampled portions of the forest that may lead to species listing discrepancy as far as baseline biodiversity assessment is concerned. This highlights that baseline studies either in large scale or in strict geographical areas should adhere to strict taxonomic accounts with proper documentation, if the vouchered specimen is not possible.

Compliance with Ethical Standard

Conflict of interests: The authors declare that for this article they have no actual, potential, or perceived conflict of interests.

Ethics committee approval: Ethics committee approval is not required for this study.

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Disclosure: -

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