



RESEARCH PAPER

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Avian species in selected mangrove areas in Siocon, Zamboanga del Norte, Mindanao, Philippines

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Abstract

With the rampant habitat destruction of wildlife in the Philippines, the avifauna is the most affected as endemism in the archipelago is so high. Siocon, Zamboanga del Norte potentially harbors several Mindanao threatened endemic species in its Siocon Resource Reserve, a patch of secondary mature lowland forest as well as in mangrove areas. Opportunistic sampling was employed using the point method to primarily document the avifauna, specifically in the mangrove areas of Barangay Manaol and Barangay A.L Micubo. A total of thirty-four (34) birds (avifauna) were identified and classified, where twenty-five of them were common to the two sites. These are *Rhipidura nigritorquis*, *Cinnyris jugularis*, *Lalage nigra*, *Megalurus palustris*, *Passer montanus*, *Gerygone sulphurea*, *Artamus leucorhynchus*, *Pycnonotus goiaver*, *Oriolus chinensis*, *Hirundo tahitica*, *Orthotomus castaneiceps*, *Aplonis panayensis*, *Lonchura atracapilla*, *Coryusv macrohynchos*, *Butorides striata*, *Egretta garzetta*, *Ardeola speciosa*, *Ardea alba*, *Ixobrychus sinensis*, *Pluvialis fulva*, *Himantopus himantopus*, *Sterna hirundo*, *Actilis hypoleucos*, *Anas luzonica*, *Dendrocygna arcuata*, *Geopelia striata*, *Spolopelia chinensis*, *Todiramphus chloris*, *Merops philippinus*, *Pandion haliaetus*, *Haliastur indus*, *Gallinula chloropus*, *Tachybaptus ruficolis*, and *Centropus viridis*. Out of these, three species were endemic to the Philippines (*O. castanneiceps*, *C. viridis*, *A. luzonica*), the latter is also considered a threatened species. This baseline data on avifauna on mangrove forests is necessary for the framework of conservation policy in the area.

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Introduction

The Philippines is one of the countries in the world considered as a biodiversity hotspot (Jumawan *et al.*, 2012) and it is home to many avifauna species, which includes endemic and non-endemic species (Birdlife International, 2020). Specifically, as an archipelagic country, it harbors to more than 600 species of avifauna, where almost 200 of them are endemic (Tanalgo *et al.*, 2015). According to Haribon (2014), 80 species of Philippine birds are now threatened to extinction, 13 are critically endangered, and 54 species are vulnerable. In the Zamboanga Peninsula, there are an estimated 142 species of avifauna in three key conservation sites, namely: the Lituban-Quipit watershed, Lake Maragang-Mt. Timolan and Pasonanca National Park. Around 78 species were found in Zamboanga City, of which 30 are nearly threatened (Paguntalan *et al.*, 2011).

Mangrove ecosystems are one of the most biologically rich, diverse, and productive ecosystems in the world (Mahilac & Madjos, 2020), which provides a home to birds. They serve as some form of nursery for many species of invertebrates as well as birds, making them one of the ecologically essential ecosystems. Despite this crucial role, approximately one-third of the mangrove ecosystems worldwide have been lost over the past 50 years (Alongi, 2002). In the Philippines, a decline of mangroves was reported from half a million hectares in 1918 to only 120,000 hectares in 1994 (Primavera, 2000). This estimate is accordingly accounted for overharvesting for the conversion of mangroves to fishponds during the 1960s and 1970s, fuel or charcoal, agriculture, industry, and human settlements (Dieta & Dieta, 2015).

With this rampant habitat destruction and high endemism of birds, the country now possesses a disproportionately large number of threatened species for its size (Jacosalem *et al.*, 2013). Further, the Philippines ranks second in terms of the number of threatened endemic birds in the world (Mallari *et al.*, 2001). Among the islands where several endemic birds are threatened is Mindanao (Paguntalan *et al.*, 2011). Despite the presence of a restricted-range and

endemic species in the Zamboanga Peninsula (formerly called Western Mindanao), very few studies have been conducted in the area where most of the available information on avifauna is derived from museum records (Dickinson *et al.*, 1991, Lambert 1996, Collar *et al.*, 1999, Kennedy *et al.*, 2000, Brooks 2002) and trip reports of visiting birdwatchers.

Siocon in Zamboanga del Norte, Mindanao potentially harbors several threatened endemic species in its Siocon Resource Reserve, a patch of secondary mature lowland forest as well as in mangrove areas (Paguntalan *et al.*, 2011). Accordingly, there is a need to conduct more field research and surveys in the remaining forest patches of the Zamboanga Peninsula. As surveyed in the municipal office, the avifauna inventory is not yet in place. This study presents a list of bird species and information on the conservation status of the remaining forests and threatened birds in these areas.

Materials and methods

Research Environment

Two selected mangrove areas in Siocon, Zamboanga del Norte, were identified, namely Barangay Manaol (1.01 km. sq. area) and Barangay A. L. Micubo (1.33 km. sq. area). These sites were purposively chosen based on the recommendation by the Municipal Office of the Department of Environment and Natural Resource.

Research design and establishment of sampling stations

A point-count method was applied in this study, wherein 10% of the total land area of each study site was sampled. Random points were selected in each area using a grid map-thirteen random points for Barangay Manaol and seventeen random points for Barangay A. L. Micubo were selected. Each random point has a radius of fifty meters. Observation of avifaunal species in each random point was done for 15 minutes, with the use of binoculars with a long-ranged Nikon DSLR camera (300 mm lens). Birds that were detected during the 15 minutes observatory time yet found outside the 50-meter radius were recorded, but not included in data analysis. Three samplings in the two areas were conducted.

Procurement of permits

Proper communication with the concerned offices was established. This included the LGU of the concerned barangays, as well as the City Environment and Natural Resources offices.

Identification and classification of samples

Each bird documented using photo documentation was identified and classified according to the taxonomic hierarchy from kingdom to species level. Previous studies, the internet, and other books were used as references for identification. The researcher identified bird species that were verified by bird experts from the Zamboanga City Department of Environment and Natural Resources office.

Data analysis

Descriptive statistics were used in describing the bird species directly seen in the sampling area. The t-test analysis was used to determine if there is a significant difference in the distribution of birds in two mangrove areas. Using the following ecological biodiversity indices, comparison of bird species in two mangrove areas were made:

Abundance

Abundance is the number of species in a sample.

$$Abundance = \frac{\text{Number of individuals of a species}}{\text{Total number of individuals of all species}}$$

Density

Density is the number of individuals rooted within the sampling site.

$$Density = \frac{\text{Number of individuals}}{\text{Total number area sampled}}$$

Frequency

Frequency is the number of occurrences in a given time.

$$Frequency = \frac{\text{Number of samples in which species occurs}}{\text{Total number of samples taken}}$$

Margalef's Biodiversity Index

$$D = \frac{\sum n(n - 1)}{N(N - 1)}$$

Where:

D= diversity index

N= total number of organism of all species found

n= number of individual of a particular species

Results and discussion

Thirty-four (34) avifauna species were recorded in the two mangrove areas of Siocon, Zamboanga del Norte. In Barangay Manaol, only 27 species were found, whereas, in Barangay A.L Micubo, 31 species were found. The 34 species were identified and grouped into 11 orders, namely *Passeriformes*, *Charadriiformes*, *Pelecaniformes*, *Accipiformes*, *Podicipediformes*, *Anseriformes*, *Columbiformes*, *Cuculiformes*, *Gruiformes*, *Coraciiformes*, and *Accipitriformes*. This is Table shows the summarized species composition of sites 1 and 2.

Table 1. Species composition of site 1 and site 2.

Bird Species	Order	Brgy. Manaol	Brgy. A.L Micubo
<i>Rhipidura nigritorquis</i>	Passeriformes	O	O
<i>Passer montanus</i>	Passeriformes	O	O
<i>Megalurus palustris</i>	Passeriformes	O	O
<i>Lalage nigra</i>	Passeriformes	O	O
<i>Cinnyris jugularis</i>	Passeriformes	O	O
<i>Lonchura atracapilla</i>	Passeriformes	O	O
<i>Applonis panayanensis</i>	Passeriformes	O	O
<i>Orthotomus castaneiceps*</i>	Passeriformes	O	X
<i>Hirundo tahitica</i>	Passeriformes	O	O
<i>Oriolus chinensis**</i>	Passeriformes	X	O
<i>Pycnonotus goiaver</i>	Passeriformes	O	O
<i>Artamus leucorhynchus</i>	Passeriformes	O	O
<i>Gerygone sulphurea</i>	Passeriformes	O	O
<i>Coryus macrohynchus**</i>	Passeriformes	X	O
<i>Ardea alba</i>	Pelecaniformes	O	O
<i>Ardeola speciosa</i>	Pelecaniformes	O	O
<i>Butorides striata</i>	Pelecaniformes	O	O
<i>Egretta garzetta</i>	Pelecaniformes	O	O
<i>Ixobrychus sinensis</i>	Pelecaniformes	O	O
<i>Pluvialis fulva**</i>	Charadriiformes	X	O
<i>Himantopus himantopus**</i>	Charadriiformes	X	O
<i>Sterna hirundo**</i>	Charadriiformes	X	O
<i>Actilis hypoleucos**</i>	Charadriiformes	X	O
<i>Todiramphus chloris</i>	Coraciiformes	O	O
<i>Merops philippinus</i>	Coraciiformes	O	O
<i>Geopelia striata</i>	Columbiformes	O	O
<i>Spolopelia chinensis</i>	Columbiformes	O	O
<i>Dendrocygna arcuata</i>	Anseriformes	O	O
<i>Anas luzonica</i>	Anseriformes	O	O
<i>Pandion haliaetus**</i>	Accipiformes	X	O
<i>Haliastur indus</i>	Accipitriformes	O	O
<i>Gallinula chloropus*</i>	Gruiformes	O	X
<i>Tachybaptus ruficolis</i>	Podicipediformes	O	O
<i>Centropus viridis</i>	Cuculiformes	O	O

Legend:

O – Present * - Species only found in Brgy. Manaol

X – Absent ** - Species only found in Brgy. A.L Micubo

Egretta garzetta has the highest mean value in terms of abundance and density for both sites in Siocon, Zamboanga Del Norte. However, in terms of

frequency, *Todiramphus chloris* was shown to have the highest mean frequency for Brgy. Manaol, while for Brgy. L.A. Micubo, *Geopelia striata* had the highest mean frequency. Table 3 shows the Margalef's Biodiversity Indices of the two mangrove areas of Siocon, Zamboanga del Norte.

Table 2. Population abundance, density, and frequency means of the different avifauna species found in selected sites of Siocon, Zamboanga del Norte.

Bird Species	Mean Abundance		Mean Density		Mean Frequency	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
<i>Todiramphus chloris</i>	27.33	25	2.71	1.88	0.85*	0.75
<i>Lalagenigra</i>	2.33	11	0.23	0.83	0.10	0.51
<i>Megaluruspalustris</i>	4.33	3	0.43	0.23	0.23	0.08
<i>Meropsphilippinus</i>	7	4.33	0.69	0.33	0.18	0.12
<i>Cinnyrisjugularis</i>	20.33	43.33	2.08	3.26	0.51	0.78
<i>Egrettagarzetta</i>	31.66*	45*	3.13*	3.38*	0.61	0.67
<i>Ardea alba</i>	14.66	7.66	1.45	0.58	0.26	0.24
<i>Spolopeliachinensis</i>	11.33	14	1.12	1.05	0.41	0.51
<i>Geopelia striata</i>	14.33	27.66	1.41	2.08	0.41	0.78*
<i>Rhiphiduranigrotorquis</i>	6	3.33	0.59	0.25	0.26	0.14
<i>Gerygonesulphurea</i>	8.66	27.66	0.86	2.03	0.21	0.47
<i>Butoridesstriata</i>	5.66	7	0.56	0.53	0.23	0.29
<i>Ardeolaspeciosa</i>	4.66	2.66	0.46	0.20	0.26	0.14
<i>Dendrocynnaarcuata</i>	22	19	2.18	1.46	0.33	0.25
<i>Anasluzonica</i>	14.66	8.33	1.45	0.63	0.28	0.18
<i>Hirundotahitica</i>	2.66	19.33	0.26	1.45	0.10	0.49
<i>Tachybaptusruficollis</i>	6	1	0.59	3.38	0.10	0.04
<i>Artamusleucorynchos</i>	7.33	8.66	0.73	0.65	0.18	0.22
<i>Passer montanus</i>	12	10.33	1.19	0.78	0.23	0.14
<i>Lonchuraatricapilla</i>	8.66	16	0.86	1.20	0.18	0.27
<i>Pycnonotusgoiaver</i>	3.33	23	0.33	1.73	0.13	0.53
<i>Haliasturindus</i>	4.33	.33	0.43	0.25	0.13	0.02
<i>Aplonispanayensis</i>	3.33	10	0.33	0.75	0.13	0.18
<i>Actilishypoleucos</i>	0	19.33	0	1.45	0	0.35
<i>Pluvialisfulva</i>	0	3.33	0	0.25	0	0.10
<i>Sterna hirundo</i>	0	5.66	0	0.43	0	0.20
<i>Pandionhaliaetus</i>	0	.33	0	0.25	0	0.02
<i>Himantopuslimantopus</i>	0	13.33	0	1	0	0.14
<i>Corvusmacrorhynchos</i>	0	1.66	0	0.12	0	0.08
<i>Ixobrychussinensis</i>	0.33	0.33	0.03	0.02	0.03	0.02
<i>Centropusviridis</i>	0.66	0.33	0.07	0.02	0.05	0.02
<i>Orthotomuscastaneiceps</i>	2.33	0	0.02	0	0.08	0
<i>Orioluschinensis</i>	0	0.66	0	0.05	0	0.04
<i>Gallinule chloropus</i>	0.33	0	0.03	0	0.03	0

Legend:

* - Avifauna Species with the highest mean values

Table 3. Biodiversity Indices of the two mangrove areas of Siocon, Zamboanga del Norte.

Sites	Biodiversity indices (Margalef)
Site 1 (Brgy. Manaol)	4.722
Site 2 (Brgy. L.A. Micubo)	5.213*

Legend: Highest Value

Brgy. A.L. Micubo had a higher Margalef index with a value of 5.213 as compared to 4.722 of Site 1, Brgy. Manaol. This result implies that the species richness in the area is higher than the other mangrove area (Kanieske *et al.*, 2018). According to Iglesias-Rios and Mazzoni (2014), the Margalef index appears to be a good diversity indicator as well as a valuable parameter

for the temporal data series analysis, from changing environments and for the conservation of natural environments. Although the Margalef index can be used as a diversity index, it can also be used to indicate the speed of ecosystem evolution consistently.

In the paper of Quitain *et al.* (2016) published in JBES, only 8 species were found to be Philippine endemic. But in this study, out of the 34 recorded avifauna, three species were endemic to the Philippines. These are *O. castanneiceps*, *C. viridis*, and *A. luzonica*, where the latter is also considered a threatened species (IUCN, 2020). According to Paguntalan *et al.* (2011), species conservation initiatives are currently focused on the Philippine Eagle, and little attention is being given to the other threatened endemic species. Hunting of wildlife is rampant and local people are unaware of the Philippine Wildlife Act (RA 9147). Doves appear to be the most vulnerable to trade and hunting.

Figs. 1 to 34 show the images of the birds that were directly observed in the two sites.



Fig. 1. *Rhipidura nigritorquis* (Pied fantails).



Fig. 2. *Cinnyris jugularis* (Olive-backed sunbird).

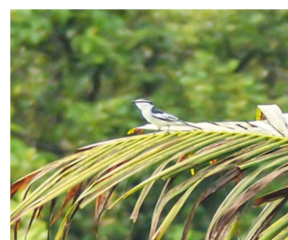


Fig. 3. *Lalage nigra* (Pied trillers).



Fig. 4. *Megalurus palustris* (Striated grassbirds).



Fig. 9. *Oriolus chinensis* (Black-naped oriole).



Fig. 5. *Passer montanus* (Eurasian tree sparrows).



Fig. 10. *Hirundo tahitica* (Pacific swallows).



Fig. 6. *Gerygone sulphurea* (Golden-bellied fly-eater).



Fig. 11. *Orthotomus castaneiceps* (Philippine tailor birds).



Fig. 7. *Artamus leucorhynchus* (White-breasted wood swallow).



Fig. 12. *Aplonispanayensis* (Asian glossy starlings).

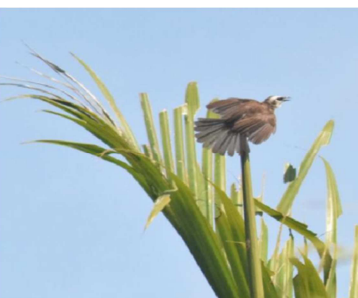


Fig. 8. *Pycnonotus goiaver* (Yellow-vented bulbuls).

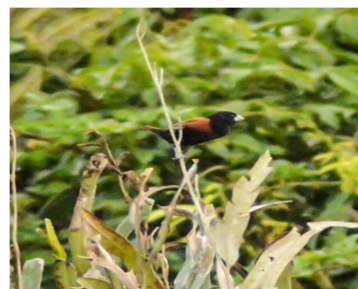


Fig. 13. *Lonchura atracapilla* (Chestnut munia).

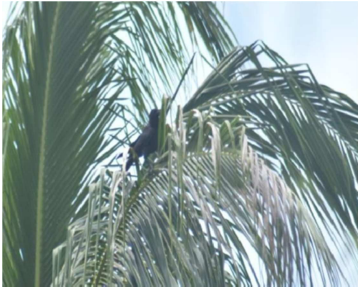


Fig. 14. *Coryusv macrohynchos* (Large billed crows).



Fig. 19. *Ixobrychus sinensis* (Yellow bitterns).



Fig. 15. *Butorides striata* (Striated herons).



Fig. 20. *Pluvialis fulva* (Asian golden plover).



Fig. 16. *Egretta garzetta* (Little egrets).



Fig. 21. *Himantopus himantopus* (Black winged stilt).



Fig. 17. *Ardeola speciosa* (Java pond heron).



Fig. 22. *Sterna hirundo* (Common terns).

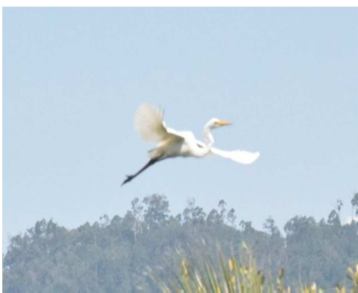


Fig. 18. *Ardea alba* (Great egrets).



Fig. 23. *Actilis hypoleucos* (Common sandpipers).



Fig. 24. *Anas luzonica* (Philippine ducks).



Fig. 29. *Merops philippinus* (Blue-tailed bee eaters).



Fig. 25. *Dendrocygna arcuata* (Wandering whistling ducks).



Fig. 30. *Pandion haliaetus* (Ospreys).



Fig. 26. *Geopelia striata* (Zebra dove).



Fig. 31. *Haliastur indus* (Brahminy kites).



Fig. 27. *Spolopelia chinensis* (Spotted dove).

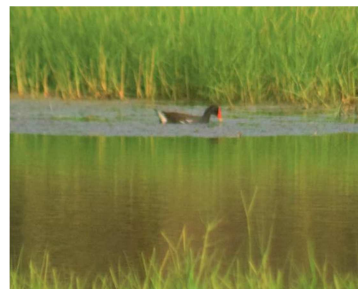


Fig. 32. *Gallinula chloropus* (Common moorhens).

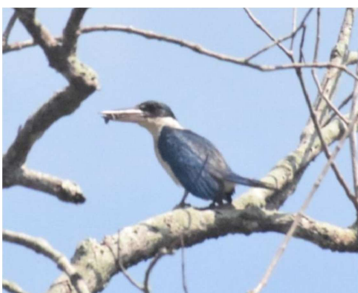


Fig. 28. *Todiramphus chloris* (White-collared kingfishers).



Fig. 33. *Tachybaptus ruficollis* (Little grebes).



Fig. 34. *Centropus viridis* (Philippine coucal).

Conclusion and recommendation

A total of thirty-four (34) avifauna species were identified and classified, where twenty-five (25) of them are common to the two mangrove forests. Out of these, three (3) species were endemic to the Philippines (*O. castanneiceps*, *C. viridis*, *A. luzonica*), where the latter is also considered a threatened species. This baseline data on avifauna in mangrove forests is necessary for the framework of conservation policy in the area.

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