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Diversity and distribution of Avifauna in Mapawa Nature Park, Cugman, Cagayan de Oro City, Misamis Oriental

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Abstract

Bird population is an indicator of the quality of habitat as they respond to threats and varying ecological conditions. Descriptive type of research was used in the study which aimed to assess the species composition, abundance, diversity, endemism, richness, conservation status and distribution of birds in the area. Birds were sampled using point-count method and mist netting methods. Geographic Information System (GIS) was used to determine the distribution of the avifauna species. It was found out that Mapawa Nature Park of Barangay Cugman, Cagayan De Oro City, Misamis Oriental harbors 47 avifauna species which belong to 10 Orders and 24 Families. In which, 16 species are endemic in the Philippines, 27 are resident birds, three are migratory and one is near endemic. Among the avifauna, Philippine Bulbul has the highest relative abundance (28.4%) while Zebra Dove, Mangrove KingFisher, Whiskered Tree Swift, Philippine Hawk Owl, Philippine Dwarf King Fisher, Red Bellied Pita and Blue Tailed Bee-Eater are the least abundant species (0.20%). The area has high diversity index ($H=3.03$) and evenness ($E= 0.49$) which means that it is diverse in terms of avifauna species. For species distribution, an omnivorous bird was the most abundant, Philippine Bulbul due to the availability of food in their habitat. Furthermore, Mapawa Nature Park is a home of abundant, rich and diverse birds in Northern Mindanao. Information and awareness strategies must be implemented inside the area for the protection and conservation of bird species.

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Introduction

The Philippines holds a high biodiversity and endemism in the world but is considered now as highly threatened. Deforestation is one of the major reasons why biodiversity in the country are mostly threatened which resulted to >20% of original forest cover remains (Posa *et al.*, 2008). The country is already considered a top priority in terms of global conservation (Myers *et al.*, 2000).

One of these biodiversity are the bird species which indicates the condition of the environment because they respond quickly to threats and changing environment conditions (Barov, 2011). Bird plays one of the most important ecological services among the vertebrate animals. Bird provides several ecological functions such as pest control, pollination, seed dispersal, fertilization of the soil (Tabur and Ayvaz, 2010) and plant reproduction (Whelan *et al.*, 2015).

However, few studies have been conducted in remote areas thus are unaware of the diversity of birds in their area before they are lost due to different human activities. One of the areas in Mindanao which is understudied is Mapawa Nature Park situated in the hinterlands of Cagayan de Oro City, Misamis Oriental.

Originally, the entire area was under Pasture Lease Agreement (PLA), hence the company's name is E. Pelaez Ranch, Inc. In 1995, the 1,920 hectares of the area was converted into Industrial Forest Management Agreement (IFMA) and 498 hectares was retained under Forest Land Grazing Lease Agreement (FLGLA). Under the IFMA, the company is mandated to reforest or establish 1,200 hectares of forest plantation thus manage the 200 hectares natural forest and protect the entire area from all forms of forest violations and destruction. In 2002, the company decided to establish the Mapawa Nature Park as an ecotourism area.

This study serves as a baseline information on the bird species in the area for conservation and management. The bird species living in this ecotourism site play a significant role as bio-indicator of

the health and sustainability of the area. This study will assess if the bird species are tolerant to human disturbance or sensitive to human activities. This study will also help in the protection of species found to be endemic and threatened in the Philippines.

Indeed, this study aimed to specifically determine the composition, richness, abundance, diversity and evenness of birds. Conservation status and endemism of the species will be determined to know the status of the species in their habitat. A Geographic Information System (GIS) will also be used for monitoring and databasing of information to virtually identify the distribution of species and threats in their habitat (Borana *et al.*, 2013).

Materials and methods

A. Entry Protocol and Sampling Site Description

A Gratuitous Permit (GP) was obtained from the Department of Environment and Natural Resources (DENR) to collect the bird species in Mapawa Nature Park. It is located at 8.4766°N, 124.6352° E in Cugman, Cagayan de Oro City, Misamis Oriental which is one of the eco-tourism spots situated in the hinterlands (Fig. 1).

The park covered 2,500 hectares which consists of forest plantation (1,200 hectares), natural forest (200 hectares) and pasture land (498 hectares). It was claimed as protected, conserved and sustainably managed area by E. Pelaez Ranch Incorporated.

The vegetation of Mapawa Nature Park is composed of indigenous trees such as Pacific Walnut (*Dracontomelon dao*), Narra (*Pterocarpus indicus*), Canary Wood (*Centrolobium microchaete*), Kalumpit (*Terminalia edulis Blanco*), Papaya (*Carica hermaphrodita Blanco*), Native Coffee (*Coffea laurifolia Salisb*), Lauan (*Shorea contorta Vidal*), Halomata Tree (*Cinnamomum camphora*), Black Plum (*Syzygium cumini*), Ilang-Ilang (*Cananga odorata*), Salong (*Agathis dammara*), Tamarind (*Tamarindus indica*), and Mahogany (*Swietenia macrophylla*). Most of the trees in the area are fruit-bearing which is favorable for birds.

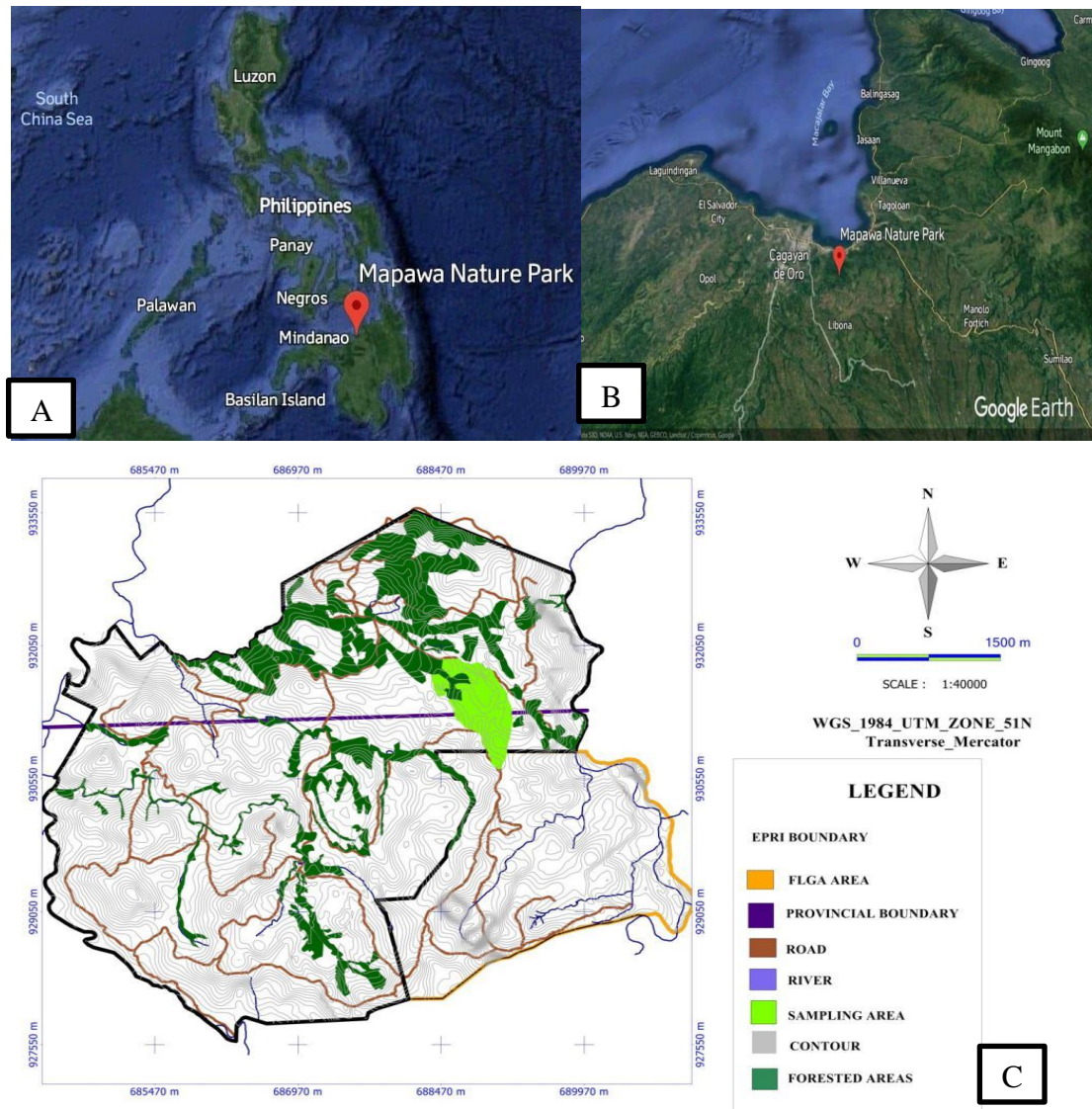


Fig. 1. The map of (A) Philippines (B) Northern Mindanao and (C) sampling areas in Mapawa Nature Park, Cugman, Cagayan De Oro City.

Field Collection of Birds and Data Analysis

B. Ocular inspection and reconnaissance were done to identify the sampling area. One kilometer (1km) transect line was established in the area where the ideal bird flyway was found and divided into 10 sampling points placed every 100 meter. In each sampling point, one (1) mist net was established with different heights to trap the ground and middle storey birds. Ten (10) mist nets were established all along the transect line. The sampling time of the study was from 5:30 - 6:30 in the morning and 3:00-4:00 in the afternoon. Mist-nets were observed in every one hour to identify if there are birds trapped. Species caught in the mist net was marked with a nail polish

indicating it is already recorded. Aside from mist-netting, point-count method was also done by observing each sampling point for five (5) minutes.

This method involved traveling along transect and observing birds at predefined points then record all birds that seen and heard by the help of a local guide (Estades *et al.*, 2006). The captured bird in the mist nets was photographed and then identified based on the anatomical features (bill, feathers, tail, tarsus) using the Guide to the Birds of the Philippines (Kennedy *et al.*, 2000). The sampling of birds was conducted until the plateau is reached which means that all the species in the area are sufficiently sampled (Fig. 2).

The distribution of birds was mapped using the GIS software by obtaining the coordinates.

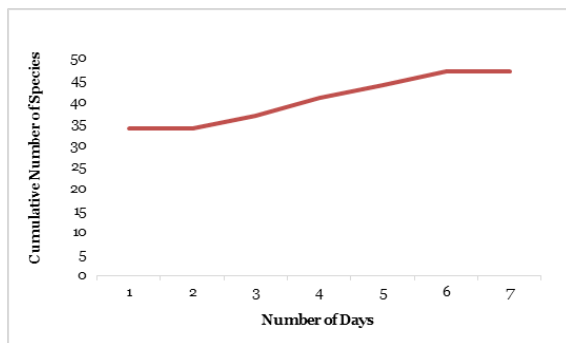


Fig. 2. The species effort curve of birds in Mapawa Nature Park, Cugman, Cagayan de Oro City, Misamis Oriental.

The data of birds were analyzed by determining the species composition, richness, abundance, diversity, abundance, evenness and conservation status and endemism. Species Richness (R) corresponds to the number of species identified in a given area. These indicate on how many avifauna were encountered during the sampling period in a given area. Relative abundance (RA) was used to determine the abundance of avifauna that is found in Mapawa Nature Park where; n_i = number of individuals per species divided by N = total number of individuals of all species encountered [9].

In Shannon-Weiner Index Species Diversity, p is the proportion (n/N) of individuals of one particular avifauna found (n) divided by the total number of individual found (N), \ln is the natural log, Σ is the sum of the calculations, and s is the number of species. This was used to identify the number and abundance of avifauna species especially on its evenness. The GIS was used to determine the distribution of avifauna species using GPSMAP 64s (Garmen) and then connected to the GIS software using Manifold System 8.0.

Results and discussions

A. Species Composition, Classification, Endemism and Conservation Status of Birds

A total of 47 bird species were recorded in Mapawa Nature Park, Cugman, Cagayan de Oro City which belong to 24 Families and 10 Orders (Table 1).

This includes Passeriformes, Columbiformes, Psittaciformes, Coraciiformes, Cuculiformes, Piciformes, Galliformes, Caprimulgiformes, Apodiformes, and Accipitriformes. Passeriformes was the most dominant avifauna species in the area which has 23 species and the least number belongs to Galliformes (1), Caprimulgiformes (1), Apodiformes (1), and Accipitriformes (1).

Among the 47 species, 16 species are endemic in the Philippines, 27 species are resident birds, three (3) are migrant and one (1) is near endemic. The area is a home of many Philippine endemic birds since it is vegetated and far from human disturbance where birds can live and colonize for a longer time. Mindanao has a record of almost 341 species of birds that consist of 147 resident species, 93 migratory, 94 endemic species and 14 migrant and resident species (Relox *et al.*, 2011). In terms of conservation status, 46 species are of least concern while the other one was considered as vulnerable which is the Philippine-dwarf Kingfisher (*C. melanurus*). It was listed as vulnerable on the basis that it was suspected to be undergoing a rapid population decline of 30-90% over 13 years owing to on-going extensive deforestation throughout its range. The species was characterized as generally scarce with an estimated population of 10,000-19,999 mature individuals, although it may be under-recorded owing to its secretive behavior (IUCN, 2018).

Relative Abundance and Diversity of Birds in Mapawa Nature Park

A total number of 507 individuals of birds were found in Mapawa Nature Park. Among the species, Philippine Bulbul (*H. philippinus*) is the most abundant species (28.4%) (Fig. 3). This might be due to the availability of food such as tree-bearing fruits, seed, nectars, small insects, arthropods, and small vertebrates (Kennedy *et al.*, 2000). Food availability has positive impacts on species abundance and distribution (Mengesha and Bekele, 2008). It is also the availability of food which makes birds with a feeding guild of a highly abundant food to dominate the area (Welsh, 1987). The dominance of birds species observed and recorded in the area could be influenced by the presence of the dense vegetation, high encounter rates and far from human disturbance.

Table 1. Composition, taxonomic classification, conservation status and endemism of avifauna in Mapawa, Nature Park, Cugman, Cagayan de Oro City, Misamis Oriental.

Order	Family	Scientific Name	Common Name	Conservation Status	Endemicity	
Passeriformes	Pycnonotidae	<i>Pycnonotus goiaver</i>	Yellow-Vented Bulbul	Least Concern	Resident-Common	
	Nectarinidae	<i>Nectarinia jugularis</i>	Olive-Back Sunbird	Least Concern	Resident-Common	
	Nectarinidae	<i>Anthreptes malacensis</i>	Brown-Throated Sunbird	Least Concern	Resident-Common	
	Monarchidae	<i>Hypothymis azurea</i>	Black-Naped Monarch	Least concern	Resident-Common	
	Rhipiduridae	<i>Rhipidura javanica</i>	Pied Fantail	Least Concern	Resident-Common	
	Pycnonotidae	<i>Hypsipetes philippinus</i>	Philippine Bulbul	Least Concern	Endemic-Common	
	Oriolidae	<i>Oriolus chinensis</i>	Black-Naped Oriole	Least Concern	Resident-Common	
	Zosteropidae	<i>Zosterops everetti</i>	Everetts-White eye	Least Concern	Resident-Common	
	Muscicapidae	<i>Terpsiphone cinnamomea</i>	Rufous Paradise Flycatcher	Least Concern	Near Endemic- Uncommon	
	Muscicapidae	<i>Cyornis rufigastra</i>	Mangrove-Blue Flycatcher	Least Concern	Resident-fairly common	
	Pycnonotidae	<i>Pycnonotus urostictus</i>	Yellow-Wattled Bulbul	Least Concern	Endemic-Fairly Common	
	Laniidae	<i>Lanius cristatus</i>	Brown Shrike	Least Concern	Migrant-Common	
	Dicaeidae	<i>Dicaeum pygmaeum</i>	Pygmy-Flower Pecker	Least Concern	Endemic-Common	
	Timaliidae	<i>Macronous striaticeps</i>	Brown Tit-Babbler	Least Concern	Endemic-Common	
	Pittidae	<i>Pitta sordida</i>	Hooded Pitta	Least Concern	Resident-Common	
	Dicaeidae	<i>Dicaeum australis</i>	Red-Keeled Flower Pecker	Least Concern	Endemic-Common	
	Muscicapidae	<i>Muscicapa griseisticta</i>	Grey-Streaked Flycatcher	Least Concern	Migrant-Common	
	Estrildidae	<i>Lonchora leucogastra</i>	White-Bellied Munia	Least Concern	Resident-Common	
	Phylloscopidae	<i>Phylloscopus olivaceus</i>	Philippine-Leaf Warbler	Least Concern	Endemic-Common	
	Dicaidae	<i>Dicaeum trigonostigma</i>	Orange-Bellied Flower Pecker	Least Concern	Resident-Common	
	Sturnidae	<i>Aplonis panayensis</i>	Asian-Glossy Starling	Least Concern	Resident-Common	
	Muscicapidae	<i>Copsychus saularis</i>	Philippine Magpie – Robin	Least Concern	Resident-Uncommon	
	Columbiformes	Pittidae	<i>Pitta erythrogaster</i>	Red Bellied Pita	Least Concern	Resident Fairly Common
		Columbidae	<i>Treron vernans</i>	Pink-Necked Green Pегion	Least Concern	Resident-Uncommon
			<i>Phapitreron leocotis</i>	White-Eared Brown Dove	Least Concern	Endemic- Common
			<i>Spilopelia chinensis</i>	Spotted Dove	Least Concern	Resident- Common
			<i>Chalcophaps indica</i>	Common Emerald Dove	Least Concern	Resident-Common
		<i>Macropygia phasianella</i>	Philippine Cuckoo Dove	Least Concern	Resident-Common	
		<i>Geopelia striata</i>	Zebra Dove	Least Concern	Resident-Common	
		<i>Ptilinopus leclancheri</i>	Black-Chinned Fruit Dove	Least Concern	Near endemic- uncommon	
		<i>Ptilinopus occipitalis</i>	Yellow-Breasted Fruit Dove	Least Concern	Endemic-Common	
Psittaciformes		Psittacidae	<i>Loriculus philippensis</i>	Colasisi	Least Concern	Endemic-Common
			<i>Bolbopsittacus lumulatus</i>	Guaiabero	Least Concern	Endemic-Common
Coraciiformes	Alcedinidae	<i>Halcyon chloris</i>	White-Collared KingFisher	Least Concern	Resident- Common	
		<i>Ceyx melanurus</i>	Philippine Dwarf KingFisher	Vulnerable	Endemic-Uncommon	
		<i>Halcyon senegaloides</i>	Mangrove Kingfisher	Least Concern	Migrant-uncommon	
Cuculiformes	Meropidae	<i>Merops philippensis</i>	Blue Tailed bee –Eater	Least Concern	Resident Fairly Common	
		<i>Centropus bengalensis</i>	Lesser Coucal	Least Concern	Resident-Common	
		<i>Centropus viridis</i>	Philippine Coucal	Least Concern	Endemic-Common	
		<i>Surniculus lugubris</i>	Philippine Drongo Cuckoo	Least Concern	Resident Fairly Common	
		<i>Centropus melanops</i>	Black-faced Coucal	Least Concern	Endemic-Uncommon	
Piciformes	Megalaimidae	<i>Megalaima haemacephala</i>	Coppersmith Barbet	Least Concern	Resident-Common	
Galliformes	Phasianidae	<i>Gallus gallus</i>	Red- Jungle Fowl	Least Concern	Resident-Common	
Caprimulgiformes	Apodidae	<i>Cypsiurus balasiensis</i>	Asian Palmswift	Least Concern	Resident-Locally- Common	
Apodiformes	Hemiproedae	<i>Hemiprocne comate</i>	Whiskered Tree Swift	Least Concern	Resident Fairly Common	
Accipitriformes	Strigidae	<i>Ninox philippensis</i>	Philippine Hawked Owl	Least Concern	Endemic-Common	
Piciformes	Picidae	<i>Dendrocopos maculatus</i>	Philippine Pygmy Wood Pecker	Least Concern	Endemic-Common	

Meanwhile, Zebra Dove (*G. striata*), Mangrove King Fisher (*H. senegaloides*), Whiskered Tree Swift (*H. comata*), Philippine Hawked Owl (*N. philippensis*), Philippine Dwarf KingFisher (*C. melanurus*), Red Bellied Pita (*P. erythrogaster*) and Blue Tailed bee-eater (*M. philippinsis*) are the least abundant species (0.20%). These least species are insect-eaters. It is known that insects, invertebrates, small mammals, and grains which is the main diet of insectivore birds are more abundant in grassland habitat than in forested area (Shochat *et al.*, 2010). The abundance of bird is mainly affected by the availability of food and cover which is influenced by vegetation composition and structure (Girma *et al.*, 2017).

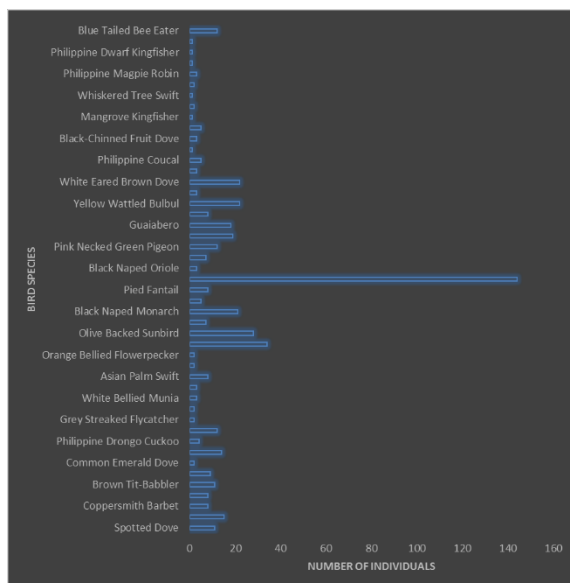


Fig. 3. Relative abundance of the avifauna species in Mapawa Nature Park, Cugman Cagayan de Oro City, Misamis Oriental.

The species diversity index of bird species found in Mapawa Nature Park Cugman Cagayan De Oro City, Misamis Oriental. Among 47 species of birds, the most abundant species observed in all areas is Philippine Bulbul (*H. philippinus*) which is likely associated to their food items such as insect prey (Turner, 1983). Moreover, the results obtained from this study shows that diversity and evenness ($H=3.03$, $E=0.49$) in Mapawa Nature Park is high which means that the values are generally between 1.5 and 3.5 in most ecological studies, and the index is rarely greater than 4 (Kerkhoff, 2019).

In addition, the value between 0 and 1 with 1 being completed evenness of community increases. Furthermore, species diversity may be affected by the structure of habitat, the type of food item and the abundance of the food item (Alviola *et al.*, 2010).

C. GIS Map of Distribution of Birds

Birds have diets that influence the abundance and distribution in a Mapawa Nature Park (Fig. 4). The distribution of birds was classified into four groups depending on their diet as plant and animal-eaters (omnivores), fruit-eaters (frugivores), insect-eaters (insectivores), and nectar-eaters (nectarivore). Most birds are omnivorous which eat both plant-based and animal-based materials being significant parts of their overall diets.

There are 15 species which are omnivorous abundant in the area. Omnivorous bird is consistent with the nature and availability of food and habitat (Lancaster and Rees, 1979).

There are 16 avifauna species are insect eaters in the area. Insects, invertebrates and small mammals which is the main diet of insectivore birds are abundant in grassland than in forested area (Shochat *et al.*, 2010). Food supply for insectivores is shown to vary in fragment size as a result of edge effects because invertebrates like surface dwellers are prone to removal of moisture and may not survive well in the edge habitat which is often warmer and drier than the forest interior (Zanette *et al.*, 2000).

The fruit-eater birds (14) were the third most observed avifauna species and are highly abundant also in the area. It was due to the availability of food since most of the trees found in the area are fruit-bearing trees. Many fruit-eating birds occur more frequently in areas with abundant fruit. Fruit abundance is an important influence for the spatial distribution of birds particularly for those that rely almost entirely on fruit for food. Nectar-eating birds were the least observed avifauna species in the area namely: Colasisi (5), and Brown Throated Sunbirds (Estades *et al.*, 2006).

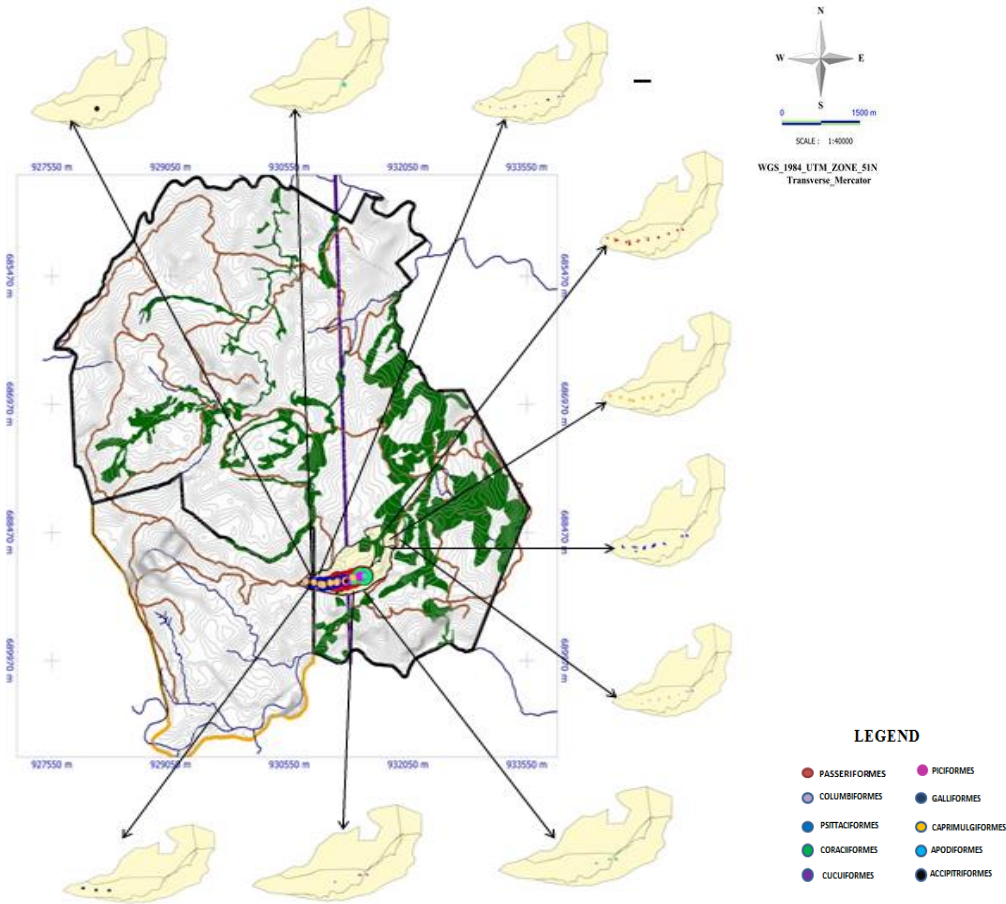


Fig. 4. GIS mapping of avifauna distribution in Mapawa Nature Park, Cugman, Cagayan de Oro City, Misamis Oriental.

At the species level, Philippine Bulbul was the most abundant and dominant because the area is favorable for their diet which is mainly fruit-bearing trees. Philippine bulbul is an omnivorous avifauna species and adaptable to the seasonal availability of fruits (Calimpong and Nuneza, 2015). Hence, the abundance and distribution of avifauna species in Mapawa Nature Park are highly influence by the composition of vegetation and structure of the area which is far from human disturbance and accessible for birds flyway. The distribution and abundance of many bird species are determined by the composition of the vegetation that forms a major element of their habitats (Girma *et al.*, 2017).

Conclusions

As an ecotourism area, Mapawa Nature Park harbors rich, abundant, diverse, endemic and vulnerable species of birds.

Therefore, Mapawa Nature Park is a home of many avian species because of the favorable condition and strict management in the area.

Recommendations

This study would like to recommend to strengthen the rules and regulations to serve as habitat of birds and promote awareness to the visitors about the ecological niche of birds since they do not have infographic information and education campaign on birds.

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