

Species Composition, Abundance and Diversity of Lakeshore Birds in *Lake Mainit, Agusan del Norte, Philippines*

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Abstract— The aim of this study was to assess the avifaunal diversity of lakeshore birds in the three (3) municipalities of Lake Mainit, Agusan del Norte, Philippines namely Jabonga, Kitcharao and Alegria. It was conducted in fourteen (14) transects for a total of sixty-four (64) hours. Birds were recorded and identified using field guides, visual encounter and bio-acoustic cues. A total of one thousand one hundred twenty eight (1128) individual of birds were documented and resolved into twenty-nine (29) species of lakeshore birds belonging to fourteen (14) families. Ardeidae listed the most number of species seen viz., Purple Heron (*Ardea purpurea*), Eastern reef-egret (*Egretta sacra*), Little egret (*Egretta garzetta*), Javan pond-heron (*Ardeola speciosa*), Black-crowned night heron (*Nycticorax nycticorax*), Cattle egret (*Bubulcus ibis*), Yellow bittern (*Ixobrychus sinensis*) and Cinnamon bittern (*Ixobrychus cinnamomeus*). The Common Tern (*Sterna hirundo*), Javan pond-heron (*Ardeola speciosa*), Glossy swiftlet (*Collocalia esculenta*) and Asian glossy starling (*Aplonis panayensis*), were the most abundant species with a relative abundance of 26.4%, 14.9%, 11.4% and 6.0% respectively. The Cinnamon bittern (*Ixobrychus cinnamomeus*) and Common Moorhen (*Gallinula chloropus*) were the least abundant species having 0.08% relative abundance and was encountered once all throughout the survey. Simpson's index was high at Transect VIII (0.462) and low at transect V (0.089). Based on the IUCN Red List of Threatened Species criteria, one species was considered Vulnerable- the Silvery Kingfisher (*Alcedo argentata*). This study recommends additional surveys in the areas not covered by this study and a local campaign for the conservation of these lakeshore birds must be implemented to protect and conserve species considered as "vulnerable".

Keywords—Lakeshore Birds, Species Composition, Abundance, Diversity, Lake Mainit, Agusan del Norte, Philippines

I. INTRODUCTION

Birds are one of the most populous life forms on the planet, and its diversity leads to a richness of life and beauty. Apart from this, birds have always enthralled humans with their stunning plumage, lyrical songs, and artistic behavior [1].

The Philippines, with its 7,100 islands and 186,000 km² of land spread across 800,000 km² of western Pacific Ocean, serves as the southern terminus for the majority of migrants traveling south east through the east Asian flyway. Its beauty stems from the abundance of small islands, reefs, and shoals, as well as the length of the coastline and wetlands. There are 171 (30.8 %) of the 556 species on the Philippine list are migratory [2].

Mindanao is a large island in the Philippine archipelago, located in the country's southernmost region. Due to its tremendous biodiversity in avifauna, it is regarded one of the wealthiest islands. The island is home to about 341 bird species, including 147 resident species, 93 migratory species, 94 indigenous species, and 14 migrant and resident species [3].

Wetlands are described as places that transition between terrestrial and aquatic ecosystems and have a water table at or near the surface or are covered with shallow water. The importance of the world's wetlands is becoming more widely recognized, as they contribute to a healthy environment in a variety of ways[4].

Wetlands are one of the most productive ecosystems on the planet, and they play an important role in regulating hydrological processes within watersheds [5].

Many studies make use of the presence of birds in a given area because birds are important in determining the state of an environment. It acts as an ecological and biological indicator, providing vital information about the ecosystem however, most marsh bird species, which are essential and thought necessary for conservation, have had little research done on their distribution, diversity, and community structure [6].

From large groups soaring overhead to newly hatched chicks drying in the sun, wetland birds give us with some of nature's most beautiful spectacles. These birds are good indicators of water quality and measures of biodiversity, in

addition to their beauty and recreational and economic value [7].

The country features a diverse waterfowl fauna, with 115 species of waterfowl reported, including 20 Ardeidae species, 14 Anatidae species, 17 Rallidae species, and 46 shorebird species. The Philippine Duck *Anas luzonica* and the Brown-banded Rail *Rallus mirificus* are both native to the islands, as are other subspecies. The islands are located on an important migration path for east Asian shorebirds, including *Numenius madagascariensis*, *Calidris acuminata*, and *Calidris acuminata. ruficollis*, as well as the wetlands, are essential wintering grounds for many migratory ducks [8].

People have been observing the seasonal arrivals and departures of birds for ages. Waterbird migration pathways spanning tens of thousands of kilometers can be found across Asia and the western Pacific. As fall approaches, millions of waterbirds in the northern hemisphere fly south on long migrations. Between August and November, they travel through numerous Asian countries, spending the frigid northern winter in warmer climes in the tropical and warm temperate wetlands of eastern and southern Asia [9].

Anthropogenic habitat loss is frequently cited as the primary cause of recent extinctions. The question was raised as to whether habitat degradation is more closely linked to species loss than any other component of human activity, such as agricultural pesticide usage, human population density, mining, quarrying, water pollution, or bird trading [10].

As a result, this research was undertaken to investigate the state of wetland birds in Lake Mainit, Agusan del Norte, as well as to determine their composition, relative abundance, and diversity, as well as to provide baseline information for conservation.

II. RELATED WORK

Numerous studies had been conducted on the effect of anthropogenic pressure in the composition and diversity of lakeshore birds. One study found out that despite the fact that the lake supports a large number of bird populations, anthropogenic activities such as farmland and human settlement expansions near the lakeshore are reducing available habitats for birds by altering vegetation composition and structure, which has an impact on bird abundance and survival. As a result, since lakeshore bird species rely on the lake ecology for survival, anthropogenic pressures such as farming and human development near the lake should be prohibited [11].

A study conducted in Ethiopia revealed that species diversity lowers as a result of different anthropogenic activities such as timber deforestation and fuel harvesting thus the local community should be educated in order to decrease habitat damage caused by numerous human-caused variables [12].

A study in Cagayan Ridge Marine Biodiversity, Philippines on the conservation of seabirds and threatened species reported that introduced predators, shrinking land area, land conversion and agricultural growth, introduced invasive plants were among the avifaunal hazards identified in the area. Beach forest fires, disruption in breeding areas, increased mortality from hooks and fishing lines, firewood harvesting, logging, egg collection or population harvest, and oil spills are all factors that contribute to increased mortality [13].

Based on the reported findings, continuous forest fragmentation increases the number of forest borders, diminishes forest coves, and changes in vegetation composition and structure may have a negative impact on the population of sensitive bird species, implying overlapping territories, increased competition, and nest predation [14].

It was also implied that some species will perish if habitat is changed too quickly for resident species to adjust, but others will welcome the change [15].

A. Research Questions

This study was conducted to determine the composition, relative abundance, and diversity of wetland birds in Lake Mainit, Agusan del Norte, Philippines. It aimed to:

1. Determine the composition, relative abundance and diversity of wetland birds in Lake Mainit, Agusan del Norte, Philippines.
2. Provide baseline information and assessment for conservation of birds documented in the area.

III. METHODOLOGY

A. Description of Study Site

The study was conducted in the three municipalities of Lake Mainit, Agusan del Norte namely Jabonga, Kitcharao and Alegria. It lies within the grid 90° 18' to 9° 23' north latitude and 125° 43' east longitude. Jabonga is a 4th class municipality in the province of Agusan del Norte. Kitcharao is a 3rd class municipality in the province of Agusan del Norte, Philippines. Alegria is a 5th class municipality in the province of Agusan del Norte, Philippines.

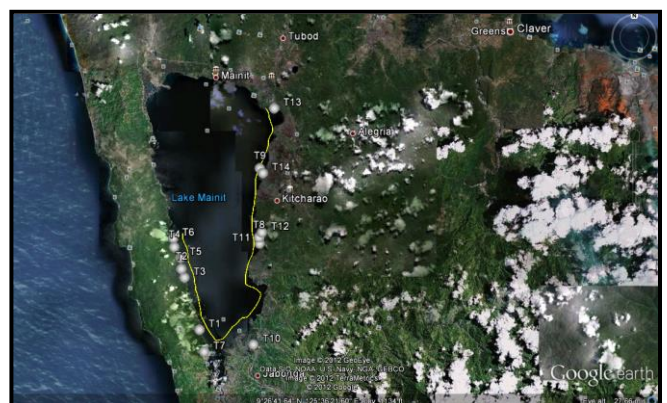


Figure 1. Map of the Study Sites

B. Bird Sampling

A combination of survey techniques was employed in the study to assess the presence of wetland birds and their frequency. These were the imaginary transect counts combined with point counts and complemented with boat survey, actual headcounts, and general observation using field binocular (8x40). Imaginary transect counts was used to record the abundance and diversity of species [16]. The order of sampling was random.

The researcher surveyed the lake by walking along a transect and counted all the birds seen within 50m of the transect. The researcher then selected an area where birds were seen abundant and stayed there for 1 hour. Birds seen in the selected area were recorded every 15-20 minutes so as to prevent repetition of counts. The time and weather condition was also recorded at the start of each sampling. Actual headcounts and observation were done at daylight hours between 6:00 am to 9:00 am; 12:00 to 2:00 pm and 4:00-6:00 pm, counting all the adults and juveniles. Birds were identified through calls and visual encounter. In order to help in species identification, local name, color and markings were recorded on a standard data sheet. Birds were classified and identified using “A Guide to the Birds of the Philippines”[18].

C. Ecological Measurements

The abundance of each bird species per transect was calculated to determine its relative abundance and using the data from each transect area, the Simpson's index of diversity was calculated.

IV. RESULTS AND DISCUSSION

A. Species Composition

TABLE 1 Total Number and Relative Abundance of Species of Birds

Common Name	English Name	Scientific Name	No. of individuals	Relative Abundance
Kanaway	Common Tern	<i>Sterna hirundo</i>	298	26.4180
Wakwak	Javan pond-heron	<i>Ardeola speciosa</i>	168	14.8940
Balinsayaw	Glossy swiftlet	<i>Collocalia esculenta</i>	129	11.4360
Kuling Dagat	Asian glossy starling	<i>Aplonis panayensis</i>	68	6.0284
Tisuk	Tawny grassbird	<i>Megalurus timoriensis</i>	53	4.6986
Tamsi	Olive-backed sunbird	<i>Nectarinia jugularis</i>	53	4.6986
Tabong	Cattle egret	<i>Bubulcus ibis</i>	50	4.4326
Tagak-latian	Eastern reef-egret	<i>Egretta sacra</i>	38	3.3688
Talabong	Little egret	<i>Egretta garzetta</i>	29	2.5709
Bakaw tumana	Yellow bittern	<i>Ixobrychus sinensis</i>	29	2.5709
Balinsasayao	Pacific swallow	<i>Hirundo tahitica</i>	25	2.2163
Tikugas	White-browed crane	<i>Porzana cinerea</i>	24	2.1277
Salaksak	White-throated kingfisher	<i>Halcyon smyrnensis</i>	24	2.1277
Tigso	Striated grassbird	<i>Megalurus palustris</i>	23	2.0390
Maya	Chestnut Munia	<i>Lonchura malacca</i>	22	1.9504
Tikarol	White-collared kingfisher	<i>Halcyon chloris</i>	15	1.3298
Gakit	Tufted Duck	<i>Aythya fuligula</i>	15	1.3298
Dugwak	Purple Heron	<i>Ardea purpurea</i>	12	1.0638
Tikling	Barred Rail	<i>Gallinulus torquatus</i>	11	0.9752
Lapay	Black crowned night heron	<i>Nycticorax nycticorax</i>	8	0.7092
Maria capra	Pied fantail	<i>Rhipidura javanica</i>	8	0.7092
Gitgit	White-breasted wood swallow	<i>Artamus leucorhynchus</i>	6	0.5319
Sayao	Barn swallow	<i>Hirundo rustica</i>	5	0.4433
Salaksak	Pied triller	<i>Lalage nigra</i>	5	0.4433
Kibid	Silvery kingfisher	<i>Alcedo argentata</i>	3	0.2660
Kanaway	Black-headed gull	<i>Larus ridibundus</i>	3	0.2660
Korwakwak	White breasted water hen	<i>Amaurornis phoenicurus</i>	2	0.1773
Yohong Pula	Cinnamon bittern	<i>Ixobrychus cinnamomeus</i>	1	0.0887
Iuman	Common Moorhen	<i>Gallinula chloropus</i>	1	0.0887
TOTAL			1128	100.00

A total of one thousand one hundred twenty eight (1128) individuals of birds were documented and resolved into twenty-nine (29) species of lakeshore birds belonging to fourteen (14) families namely- Alcedinidae, Apodidae, Ardeidae, Artamidae, Anatidae, Campephagidae, Estrididae, Hirundinidae, Laridae, Muscicapidae, Nectariniidae, Rallidae, Sliyviidae, Sternidae and Sturnidae. Ardeidae listed the most number of species seen viz., Purple Heron (*Ardea purpurea*), Eastern reef- egret (*Egretta sacra*), Little egret (*Egretta garzetta*), Javan pond-heron (*Ardeola speciosa*), Black-crowned night heron (*Nycticorax nycticorax*), Cattle egret (*Bubulcus ibis*), Yellow bittern (*Ixobrychus sinensis*), and Cinnamon bittern (*Ixobrychus cinnamomeus*).

The Common Tern (*Sterna hirundo*), Javan-pond heron (*Ardeola speciosa*), Glossy swiftlet (*Collocalia esculenta*) and Asian glossy starling (*Aplonis panayensis*) were the most abundant species with a relative abundance of 26.4%, 14.9%, 11.4% and 6.0% respectively. The Cinnamon bittern (*Ixobrychus cinnamomeus*) and Common Moorhen (*Gallinula chloropus*) were the least abundant species having 0.08% relative abundance and was encountered once all throughout the survey.

B. Relative Density Estimates

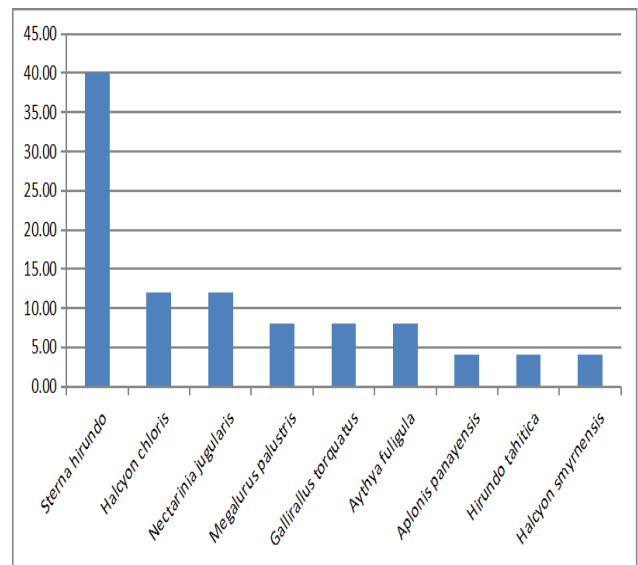


FIGURE 2 Relative Abundance of Bird Species in Transect I

Transect 1 in San Pablo, Jabonga listed twenty-five (25) individuals of birds, documented and resolved into nine (9) species. Among the nine species sighted, Common Tern (*Sterna hirundo*) was the most abundant with a relative abundance of 40.00%. Most of the birds encountered in Transect 1 namely Asian glossy starling (*Aplonis panayensis*), Pacific swallow (*Hirundo tahitica*) and White-throated kingfisher (*Halcyon smyrnensis*) were listed once having a 4.00% relative density.

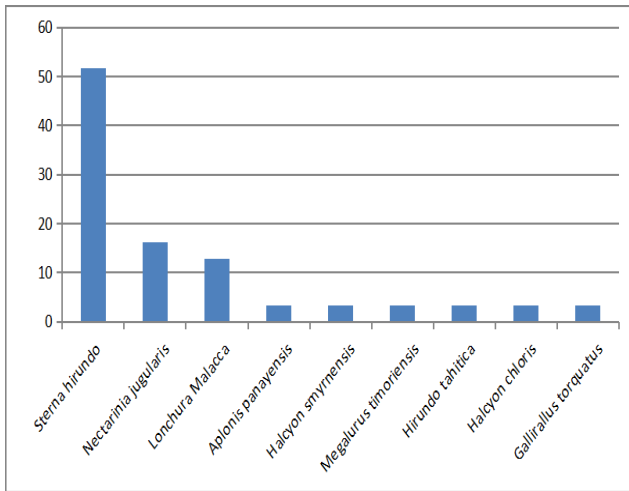


FIGURE 3 Relative Abundance of Bird Species in Transect II

Transect II in Dao, Jabonga recorded thirty-one (31) individual belonging to nine (9) species. The most abundant species documented was Common Tern (*Sterna hirundo*) having a relative abundance of 51.61%. Six (6) of the species considered as the least abundant were Asian glossy starling (*Aplonis panayensis*), White-throated kingfisher (*Halcyon smyrnensis*), Tawny grassbird (*Megalurus timoriensis*), Pacific swallow (*Hirundo tahitica*), White-collared kingfisher (*Halcyon chloris*) and Barred Rail (*Gallirallus torquatus*) with a relative abundance of 3.23%.

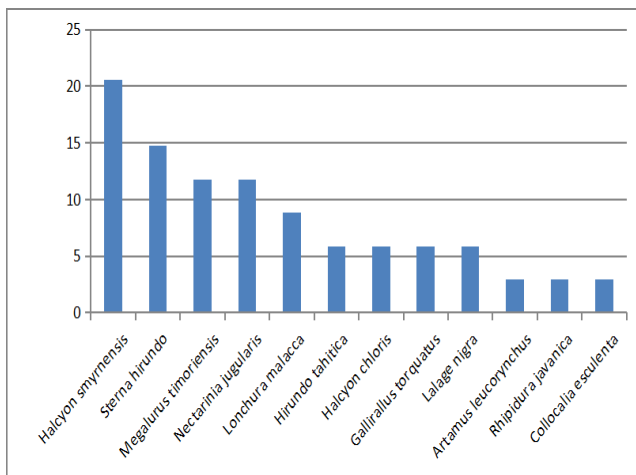


FIGURE 4 Relative Abundance of Bird Species in Transect III

Transect III in Naga, Jabonga documented thirty-four (34) individuals belonging to twelve (12) species. White-throated kingfisher (*Halcyon smyrnensis*) was the most abundant species having a relative density of 20.59% followed by Common Tern (*Sterna hirundo*) with 14.71%. Tawny grassbird (*Megalurus timoriensis*) and Olive-backed sunbird (*Nectarinia jugularis*) had 11.76% relative density. The least abundant species were the White-breasted wood swallow (*Artamus leucorhynchus*), Pied fantail (*Rhipidura javanica*) and Glossy swiftlet (*Collocalia esculenta*) with 2.94% relative abundance.

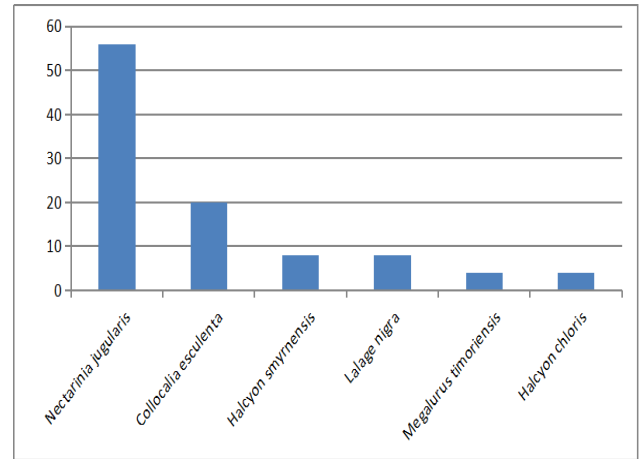


FIGURE 5 Relative Abundance of Bird Species in Transect IV

Transect 4 in Languyon, Jabonga recorded a total of twenty-five (25) individuals belonging to six (6) species. Olive-backed sunbird (*Nectarinia jugularis*) was the most abundant with a relative density of 56% followed by Glossy swiftlets (*Collocalia esculenta*) having 20% relative abundance. The least abundant species were the Striated grassbird (*Megalurus timoriensis*) and White-collared kingfisher (*Halcyon chloris*).

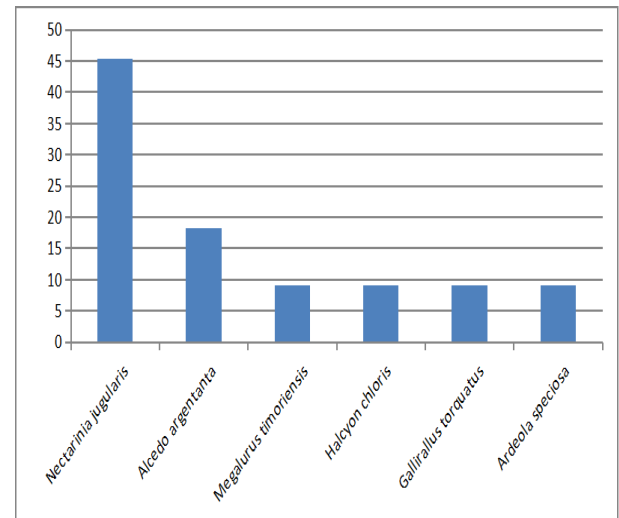


FIGURE 6 Relative Abundance of Bird Species in Transect V

Transect 5 in Magubani, Jabonga recorded eleven (11) individuals resolved into six (6) species viz., Olive-backed sunbird (*Nectarinia jugularis*) with a 45.45% relative abundance, Silvery kingfisher (*Alcedo argentanta*) with 18.18%, Striated grassbird (*Megalurus timoriensis*), White-collared kingfisher (*Halcyon chloris*), Barred Rail (*Gallirallus torquatus*) and Javan-pond heron (*Ardeola speciosa*) had 9.09% relative abundance.

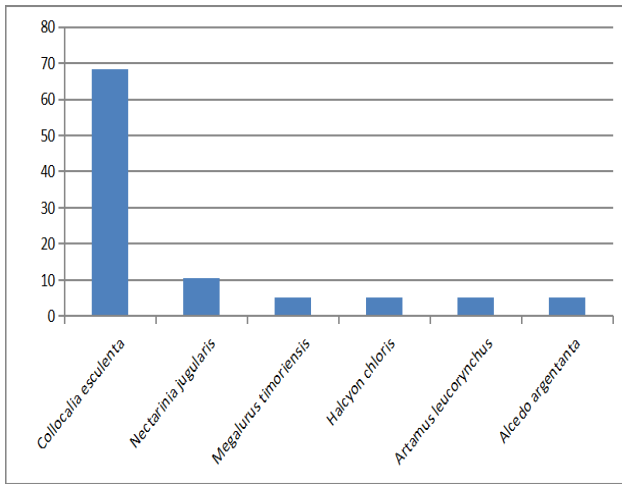


FIGURE 7 Relative Abundance of Bird Species in Transect VI

Transect 6 in Kayatuog, Jabonga accounted nineteen (19) individuals divided into six (6) species. Glossy swiftlets (*Collocalia esculenta*) was the most abundant with 68.42% succeeded by *Nectarinia jugularis* with 10.53%. The rest of the species recorded a relative abundance of 5.26%.

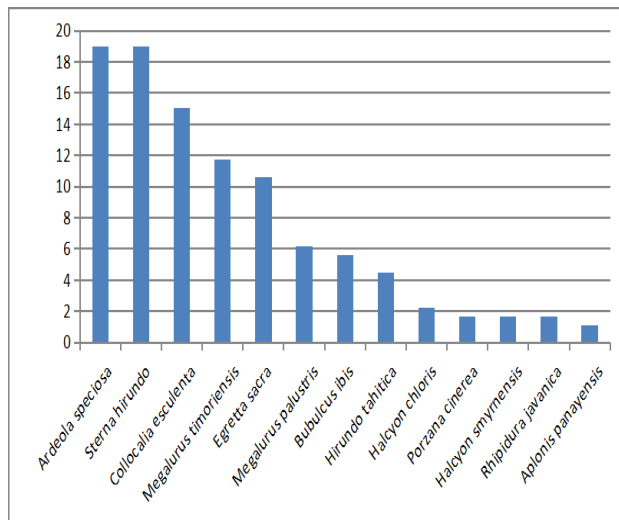


FIGURE 8 Relative Abundance of Bird Species in Transect VII

Transect 7 in Mayugda-Kabuyay, Jabonga noted a one-hundred seventy nine (179) individuals settled into thirteen (13) species. The most abundant was the Javan-pond heron (*Ardeola speciosa*) with 18.99% together with Common Tern (*Sterna hirundo*). *Collocalia esculenta* had 15.08% succeeded by *Megalurus timoriensis* (11.73%), *Egretta sacra* (10.61%), *Megalurus palustris* (6.15%), *Bubulcus ibis* (5.59%), *Hirundo tahitica* (4.47%), *Halcyon chloris* (2.23%). Three species namely *Porzana cinerea*, *Halcyon smyrnensis* and *Phipidura javanica* had (1.68%). The least abundant was *Aplonis panayensis* with 1.12%. Numerous waterbirds were observed in this transect like the *Egretta sacra*, *Sterna hirundo*, *Ardeola speciosa* and *Bubulcus ibis*.

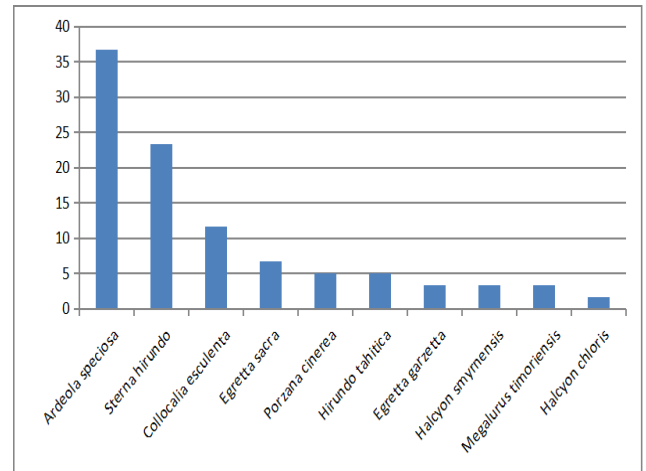


FIGURE 9 Relative Abundance of Bird Species in Transect VIII

Transect 8 in Kalinawan River, Jabonga noted sixty (60) individuals differentiated into ten (10) species. The most abundant was Javan-pond heron (*Ardeola speciosa*) with 36.67% relative abundance. *Sterna hirundo* was also numerous in the area with a 23.33% relative density succeeded by *Collocalia esculenta* (11.67%), *Egretta sacra* (6.67%), *Porzana cinerea* (5.00%) as well as *Hirundo tahitica* (5.00%). *Egretta garzetta*, *Halcyon smyrnensis*, and *Megalurus timoriensis* recorded a 3.33% relative density. The least abundant species was *Halcyon chloris* with 1.67%.

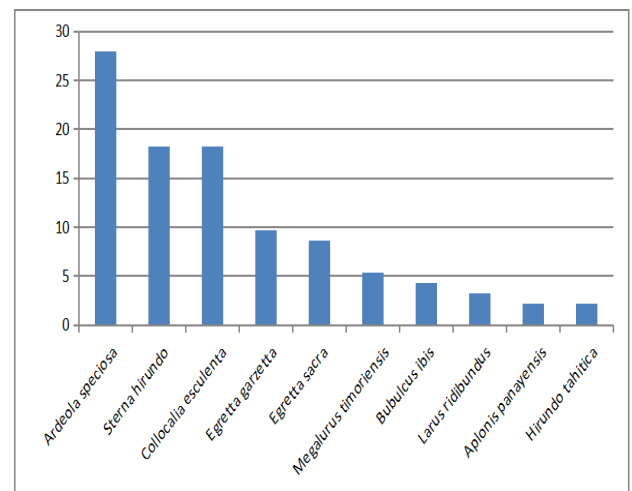


FIGURE 10 Relative Abundance of Bird Species in Transect IX

Transect 9 in Kuyago, Kitcharao documented ninety-three (93) individuals resolved into ten (10) species. *Ardeola speciosa* was the most abundant in the area having a relative density of 27.96% followed by *Sterna hirundo* and *Collocalia esculenta* with 18.28%. Black-headed gull (*Larus ridibundus*) was sighted in the area with 3.23% abundance. The least abundant species was *Aplonis panayensis* and *Hirundo tahitica* both with 2.15% relative density.

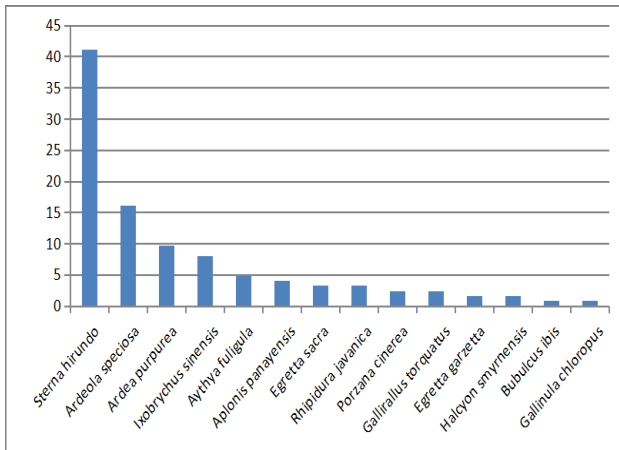


FIGURE 11 Relative Abundance of Bird Species in Transect X

Transect 10 in Tanaway, Kitcharao listed one-hundred-twenty-four (124) individuals belonging to fourteen (14) species. The most abundant was Common Tern (*Sterna hirundo*) having a relative density of 41.13%. Several waterbirds were also seen in the area like the *Ardeola speciosa* (16.13%), *Ardea purpurea* (9.68%), *Ixobrychus sinensis* (8.06%), *Aythya fuligula* (4.84%) and *Aponis panayensis* (4.03%). *Egretta sacra* and *Rhipidura javanica* both had 3.23% relative abundance as well as *Porzana cinerea* and *Gallirallus torquatus* having 2.42% abundance. The least abundant species in the area were *Bubulcus ibis* (0.81%) and Common Moorhen *Gallinula chloropus* (0.81%).

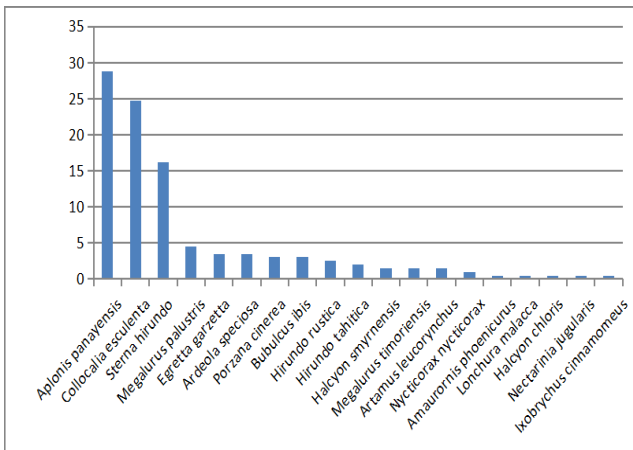


FIGURE 12 Relative Abundance of Bird Species in Transect XI

Transect 11 in Tourism Building, San Roque, Kitcharao documented one-hundred-ninety-eight (198) individuals resolved into nineteen (19) species. The most abundant species was Asian glossy starling (*Aponis panayensis*) with a relative abundance of 28.79% succeeded by Glossy swiftlets (*Collocalia esculenta*) 24.75%. Different species of waterbirds were observed in the area as well namely Common Tern (*Sterna hirundo*) with 16.16% relative density, Little egret (*Egretta garzetta*) together with Javan-pond heron (*Ardeola speciosa*) 3.54%, White-bowed crane (*Porzana cinerea*) and Cattle egret (*Bubulcus ibis*) had a

relative abundance of 3.03%. The least abundant species in the area recorded were White-breasted waterhen (*Amaurornis phoenicurus*), Chestnut munia (*Lonchura malacca*), White-collared kingfisher (*Halcyon chloris*), Olive-backed sunbird (*Nectarinia jugularis*) and Cinnamon bittorn (*Ixobrychus cinnamomeus*) with 0.51% relative abundance.

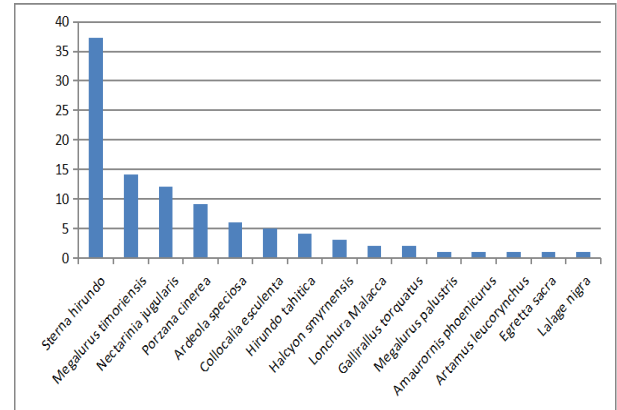


FIGURE 13 Relative Abundance of Bird Species in Transect XII

Transect 12 in Islet Front, San Roque, Kitcharao recorded a total of ninety-nine (99) individuals resolved into fifteen (15) species. The most abundant species observed in the area was Common Tern (*Sterna hirundo*) with 37.37% relative abundance followed by Tawny grassbird (*Megalurus timoriensis*) with 14.14%, Olive-backed sunbird (*Nectarinia jugularis*) with 12.12%, White-browed crane (*Porzana cinerea*) with 9.09%, Javan-pond heron (*Ardeola speciosa*) with 6.06%, Glossy swiftlets (*Collocalia esculenta*) with 5.05%. The least abundant species listed in the area were Striated grassbird (*Megalurus palustris*), White-breasted waterhen (*Amaurornis phoenicurus*), White-breasted wood swallow (*Artamus leucorhynchus*), Eastern-reef egret (*Egretta sacra*) and Pied triller (*Lalage nigra*) with 1.01% relative density.

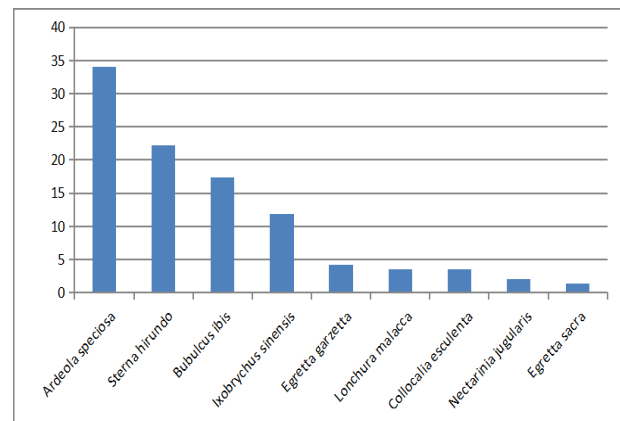


FIGURE 14 Relative Abundance of Bird Species in Transect XIII

Transect 13 in San Pedro, Alegria listed a total of one-hundred- forty-four (144) individuals resolved into nine (9) species. The most abundant species observed was Javan-

pond heron (34.03%) succeeded by Common Tern (*Sterna hirundo*) with 22.22% relative abundance, Cattle egret (*Bubulcus ibis*) 17.36%, Yellow bittern (*Ixobrychus sinensis*) 11.81%, Little egret (*Egretta garzetta*) 4.17%, Chestnut munia (*Lonchura malacca*) and Glossy swiftlets (*Collocalia esculenta*) both had 3.47% and Olive-backed sunbird (*Nectarinia jugularis*) 2.08%. The least abundant species was Eastern-reef egret (*Egretta sacra*) with a relative abundance of 1.39%.

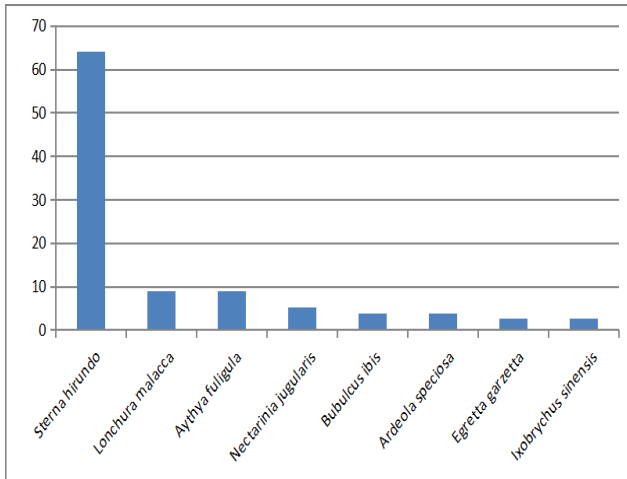


FIGURE 15 Relative Abundance of Bird Species in Transect XIV

Transect 14 in Barangay Alipao, Alegria recorded seventy-eight (78) individuals classified into eight (8) species. The most abundant species was Common Tern (*Sterna hirundo*) with a relative abundance of 64.10%. Chestnut munia (*Lonchura malacca*) and Tufted Duck (*Aythya fuligula*) both had 8.97% relative abundance followed by Olive-backed sunbird (*Nectarinia jugularis*) 5.13%, Cattle egret (*Bubulcus ibis*) 3.85%, Javan-pond heron (*Ardeola speciosa*) 3.85%. The least abundant species recorded were Little egret (*Egretta garzetta*) and Yellow bittern (*Ixobrychus sinensis*) having 2.56% relative abundance.

C. Species Diversity

TABLE 2 Species Diversity of Each Transect Surveyed Computed Using Simpson’s Index

Transect	Simpson’s Index (D)	Simpson’s Index of Diversity (1-D)	Simpson’s Reciprocal Index (1/D)
I	0.175	0.825	5.714
II	0.184	0.816	5.434
III	0.180	0.820	5.555
IV	0.292	0.708	3.424
V	0.089	0.911	11.235
VI	0.343	0.657	2.915
VII	0.200	0.800	5.000
VIII	0.462	0.538	2.164
IX	0.125	0.875	8.000
X	0.202	0.798	4.950
XI	0.160	0.840	6.250
XII	0.213	0.787	4.694
XIII	0.209	0.791	4.784
XIV	0.427	0.573	2.342

The results showed that Transect V has the highest diversity of birds since it has the highest Simpson’s index of diversity of 0.911, lower Simpson’s index value of 0.089 and highest Simpson’s reciprocal index value of 11.235 followed by Transect IX with 0.875 Simpson’s index of diversity value.

Among all transects, Transect VIII has the lowest density of birds with a Simpson’s index value of 0.462, its Simpson’s index of diversity value is 0.538 with a Simpson’s reciprocal index value of 2.164.

D. Conservation Status

Only one (1) bird species categorized by IUCN as “vulnerable” was recorded during the entire survey which is the Silvery kingfisher (*Alcedo argentata*) and identified as endemic to the area [17]. The remaining twenty-eight (28) species of birds were listed by IUCN Threatened Species as “Least Concern” regardless of the population of each bird species.

This study had recorded twenty-nine (29) species of birds as shown in Table 3. Twenty-one (21) of which were resident to the area viz., *Gallirallus torquatus* Barred Rail, *Amaurornis phoenicurus* White-breasted Waterhen, *Porzana cinerea* White-browed crake, *Gallinula chloropus* Common Moorhen, *Collocalia esculenta* Glossy Swiftlet, *Halcyon chloris* White-collared Kingfisher, *Halcyon smyrnensis* White-Throated Kingfisher, *Hirundo tahitica* Pacific Swallow, *Megalurus timoriensis* Tawny Grassbird, *Megalurus palustris* Striated Grassbird, *Artamus leucorhynchus* White-breasted Wood Swallow, *Aplonis payanensis* Asian Glossy Starling, *Ardea purpurea* Purple Heron, *Egretta sacra* Eastern reef-egret, *Ardeola speciosa* Javan pond-heron, *Ixobrychus sinensis* Yellow bittern, *Ixobrychus cinnamomeus* Cinnamon bittern, *Lonchura malacca* Chestnut munia, *Nectarinia jugularis* Olive-backed sunbird, *Rhipidura javanica* Pied Fantail, and *Lalage nigra* Pied Triller.

Only six (6) species of birds were migrant in the area namely *Hirundo rustica* Barn Swallow, *Sterna hirundo* Common Tern, *Egretta garzetta* Little egret, *Nycticorax nycticorax* Black-crowned night heron, *Aythya fuligula* Tufted Duck, and *Larus ridibundus* Black-headed gull. One (1) species of bird was endemic to the area- Silvery kingfisher (*Alcedo argentata*) and one (1) resident/migrant- *Bubulcus ibis* Cattle egret.

TABLE 3 Species Composition and Classification of Wetland Birds Encountered

Family	Species	English Name	Local Name	Conservation Status
Alcedinidae	<i>Halcyon chloris</i>	White-collared kingfisher	Tikarol	Least Concern
Alcedinidae	<i>Halcyon smyrnensis</i>	White-throated kingfisher	Uwak bata	Least Concern
Alcedinidae	<i>Alcedo argentata</i>	Silvery kingfisher	Kibid	Vulnerable
Apodidae	<i>Collocalia esculenta</i>	Glossy swiftlet	Balinsayaw	Least Concern

Ardeidae	<i>Ardea purpurea</i>	Purple Heron	Dugwak	Least Concern
Ardeidae	<i>Egretta sacra</i>	Eastern reef-egret	Tagak-latian	Least Concern
Ardeidae	<i>Egretta garzetta</i>	Little egret	Talabong	Least Concern
Ardeidae	<i>Ardeola speciosa</i>	Javan pond-heron	Wakwak	Least Concern
Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned night heron	Lapay	Least Concern
Ardeidae	<i>Bubulcus ibis</i>	Cattle egret	Tabong	Least Concern
Ardeidae	<i>Ixobrychus sinensis</i>	Yellow bittern	Bakaw-tumana	Least Concern
Ardeidae	<i>Ixobrychus cinnamomeus</i>	Cinnamon bittern	Yohong Pula	Least Concern
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted wood swallow	Gitgit	Least Concern
Anatidae	<i>Aythya fuligula</i>	Tufted Duck	Gakit	Least Concern
Campephagidae	<i>Lalage nigra</i>	Pied Triller	Salaksak	Least Concern
Estrididae	<i>Lonchura malacca</i>	Chestnut munia	Maya	Least Concern
Estrididae	<i>Lonchura leucogastra</i>	White-bellied munia	Mayang-bungol	Least Concern
Hirundinidae	<i>Hirundo tahitica</i>	Pacific swallow	Balinsasayao	Least Concern
Hirundinidae	<i>Hirundo rustica</i>	Barn swallow	Sayao	Least Concern
Muscicapidae	<i>Rhipidura javanica</i>	Pied Fantail	Maria capra	Least Concern
Nectariniidae	<i>Nectarinia jugularis</i>	Olive-backed sunbird	Tamsi	Least Concern
Rallidae	<i>Gallirallus torquatus</i>	Barred Rail	Tikling	Least Concern
Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	Korwakwak	Least Concern
Rallidae	<i>Porzana cinerea</i>	White-browed crane	Tikugas	Least Concern
Rallidae	<i>Gallinula chloropus</i>	Common Moorhen	Ituman	Least Concern
Slyviidae	<i>Megalurus timoriensis</i>	Tawny grassbird	Tisuk	Least Concern
Slyviidae	<i>Megalurus palustris</i>	Striated grassbird	Tigso	Least Concern
Sternidae	<i>Sterna hirundo</i>	Common Tern	Kanaway	Least Concern
Sturnidae	<i>Aplonis panayensis</i>	Asian Glossy Starling	Kuling Dagat	Least Concern

V. CONCLUSION AND FUTURE SCOPE

A total of twenty-nine (29) species were identified belonging to fourteen (14) Families viz., Alcedinidae, Apodidae, Ardeidae, Artamidae, Anatidae, Campephagidae, Estrididae, Hirundinidae, Laridae, Muscicapidae, Nectariniidae, Rallidae, Slyviidae, Sternidae and Sturnidae. One species was listed as "vulnerable", the Silvery kingfisher (*Alcedo argentata*) based on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species and twenty-eight (28) were considered "least concern" regardless of their increasing and decreasing population (see Table 3).

Among the fourteen (14) transects surveyed, Transect 11 (see Figure 12) showed the most number of species recorded all throughout the survey dominated by the species of Asian glossy starling (*Aplonis panayensis*). Transect V (see Figure 6) had the highest Simpson's index of diversity of 0.911 followed by Transect IX (see Figure 10) with 0.875 Simpson's index of diversity. Transect VIII (see Figure 9) showed the lowest Simpson's index of diversity.

Common Tern (*Sterna hirundo*) was the most abundant species in the area with two-hundred ninety-eight (298) individuals recorded succeeded by Javan-pond heron (*Ardeola speciosa*) with one-hundred sixty-eight (168) individuals. The least abundant in the area were Cinnamon bittern (*Ixobrychus cinnamomeus*) and Common Moorhen (*Gallinula chloropus*)(see Table 1).

During the entire survey, twenty-one (21) species of birds were residents, six (6) were migrants, one (1) was endemic and the other one (1) was resident/migrant.

Additional surveys in areas not covered by this study are recommended, as well as a local conservation effort for these lakeshore birds, to safeguard and conserve species classified as "vulnerable."

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