

Diversity and conservation status of avifauna in Mount Lantoy Key Biodiversity Areas (KBA) in Cebu Island, Philippines

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Manuscript received: 24 October 2021. Revision accepted: 15 January 2022

Abstract. Malaki ABB, Alcazar SMT, Lillo EP, Rosales RC, Redoblado BR, Diaz JL. 2022. Diversity and conservation status of avifauna in Mount Lantoy Key Biodiversity Areas (KBA) in Cebu Island, Philippines. *Biodiversitas* 23: 671-678. A study on the bird community in Mount (Mt.) Lantoy Key Biodiversity Areas (KBA) was carried out to determine its diversity and conservation status to conserve, protect, and rehabilitate forest habitat within the KBA. The study was conducted across three sampling sites. By using transect, point count, and mist nets, we found 1,340 individuals belonging to 31 orders, 32 families, and 44 species within the study sites. There were five dominant bird species, i.e., *Hypsipetes philippinus* (J.R.Forster, 1795), *Phapitreron leucotis* (Temminck, 1823), *Psilopogon haemacephalus* (P.L.S.Müller, 1776), *Nectarinia jugularis* (Linnaeus, 1766), and the endangered *Kittacincla cebuensis* (Steere, 1890). We also found rare bird species within the study site, such as *Haliastur indus* (Boddaert, 1783), *Geopelia striata* (Linnaeus, 1766), *Monticola solitarius* (Linnaeus, 1758), *Oriolus chinensis* (Linnaeus, 1766), *Dendrocopos maculatus* (Scopoli, 1786), *Pycnonotus goiavier* (Scopoli, 1786), and *Rallina eurizonoides* (Lafresnaye, 1845). We also found six Philippine endemics, including *K. cebuensis*, *Ninox rumseyi* (Rasmussen et al. 2012), *H. philippinus*, *D. maculatus*, *Loriculus philippensis* (Statius Muller, 1776), and *Caprimulgus manillensis* (Walden, 1875). Based on the IUCN Red List of Threatened Species, two species are Endangered, and 42 species are Least Concern (LC). Using the "Checklist of the Birds of the Philippines," we found two species are Endangered, two species are Near Threatened, and 40 species are LC. The diversity of birds in Mt. Lantoy KBA was moderate. We considered that this KBA is highly exposed to various forest or habitat disturbances such as land-use conversion, charcoal making, firewood gathering, slash-and-burn method of cultivation, and infrastructure development. There is a need to strictly implement the policies governing the utilization of forest resources to augment the diversity of the study site.

Keywords: Cebu Island, conservation status, diversity and composition, Key Biodiversity Area, Mount Lantoy, point count method

INTRODUCTION

With over 20,000 endemic species, the Philippines is considered one of the 17 “megadiversity” countries, of which the country collectively claimed two-thirds of the earth’s biological diversity (Mittermeier et al. 1999). However, as one of 34 global biodiversity hotspots, the high biodiversity and endemism of the Philippines are under an elevated level of threats (Conservation International 2009; Obeña and Buot 2019). Among the significant islands of the Philippines, Cebu is regarded as one of the baldest islands in the Central Visayas (Collar et al. 1999). The Cebu Island has a forest cover of less than 1% of its total land coverage (Mallari et al. 2001). Birdlife International (2012) recorded 604 bird species in the country, and two of these species and 12 subspecies are endemic to the Island, making Cebu one of the nine

Endemic Bird Areas (EBA) in the Philippines (Collar et al. 1999; Mallari et al. 2001). The nearly complete deforestation of Cebu Island has seemingly led to numerous birds and other wildlife (Brooks et al. 1995).

Mount (Mt.) Lantoy Key Biodiversity Areas (KBA) is identified as one of the 117 Important Bird Areas (IBA) in the Philippines by the Haribon Foundation (2014) and Birdlife International (2012). This KBA, located in the southern part of Cebu, particularly in Argao municipality, was ranked 106th of the 206 Conservation Priority Areas (CPA) (Conservation International 2009). Because of the presence of globally threatened species of the country, including the Cebu black-shama *Kittacincla cebuensis* (Steere, 1890), Cebu hawk-owl *Ninox rumseyi* (Rasmussen et al. 2012), Everett's white-eye *Zosterops everetti everetti* (Tweeddale, 1878), and White-vented whistler *Pachycephala homeyeri* (W.Blasius, 1890) (Dutson et al.

1993; Magsalay 1993; Brooks et al. 1995; Conservation International 2009). However, this particular KBA is suffering from the ravage of illegal logging, human encroachment, land conversion for agricultural purposes, and *kaingin* (Paguntalan and Jakosalem 2008; Conservation International 2009). Thus, they potentially affect the sub-populations of the bird species in the area.

For almost a decade, few studies have been done on the threatened and endemic species on the Argao watershed, particularly in Mt. Lantoy Forest KBA. These studies have recorded the following species: *Ninox philippensis spilonota* (Bourne & Worcester, 1894), Cebu black-shama (*K. cebuensis*; Endangered), Streak-breasted bulbul (*Hypsipetes siquijorensis* Steere, 1890; Endangered), Everett's white-eye (*Z. everetti everetti*), Black-chinned fruit dove (*Ptilinopus occipitalis* G.R.Gray, 1844), Variable kingfisher (*Ceyx lepidus* Temminck, 1836), White-throated kingfisher (*Halcyon smyrnensis* Linnaeus, 1758), Lemon-throated leaf warbler (*Phylloscopus cebuensis* Dubois, 1900), and the Philippine pygmy flowerpecker (*Dicaeum pygmaeum* Kittlitz, 1833) (Gonzalez et al. 1998; Paguntalan and Jakosalem 2008; Jakosalem et al. 2012). The discovery of the endangered and endemic bird species within this KBA has put the Island of Cebu into a much higher degree of conservation importance in the Philippine Islands and worldwide.

This study aims to shed light on the current condition of the species richness, diversity, and conservation status of the bird species in Mt. Lantoy KBA. Considering that this area is harboring restricted-range and globally-threatened species (Birdlife Conservation International 2008), and have been exposed to various forest disturbances brought about by indiscriminate cutting of trees, firewood gathering, charcoal making, land-use conversion like "*kaingin making*", road construction, and most importantly gathering of non-timber forest products, e.g., orchids, forest

plants, among others (Malaki et al. 2018; Lillo et al. 2019). However, birds are extensively considered as a bioindicator for the status of the environment, including habitat quality, productivity, and stability, because they are highly responsive to ecosystem changes (Chettri et al. 2001; Veraart et al. 2004; Cresswell et al. 2007; Vallecillo et al. 2016; Hadiprayitno et al. 2019; Husodo et al. 2020). Thus, this information is essential for decision making, particularly in the habitat enhancement, rehabilitation, protection, development, and conservation of the biodiversity resources in Mt. Lantoy KBA in general.

MATERIALS AND METHODS

Study sites, sampling period, and transect locations

This study was conducted from 19 April 2018 to 14 October 2019 in Mt. Lantoy KBA, Cebu, Philippines (Figure 1), part of Nug-as and Mt. Lantoy KBA corridor—comprising the municipalities of Alcoy, Dalaguete, Argao, and Boljoon. It has a total area coverage of 10,457 ha (Conservation International 2009; Haribon Foundation 2014). Mount Lantoy KBA consists of 14 barangays, also considered the local conservation areas (LCA) in the Municipality of Argao, Cebu. A total of seven transects with an average length of 1.63 km were laid out in various sampling locations within Mt. Lantoy KBA, i.e., two in barangay Cansuje, two in barangay Catang, one in Tabayag, and two in barangay Canbantug. Point-count stations were installed on the strategic side of transect, depending on the nature of habitat within the area (Bibby et al. 2000). The stations were established at a regular interval of 200 m apart to avoid double-counting. Transects were established at an elevation ranging from 100 m to 780 m (Table 1).

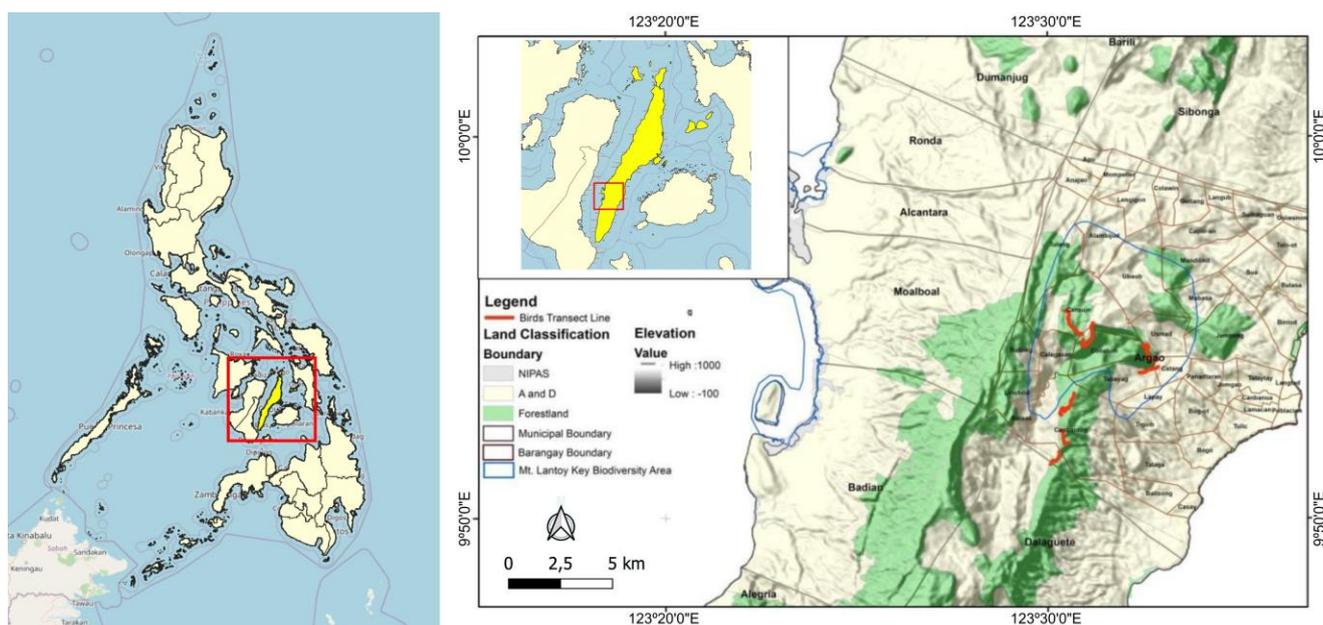


Figure 1. Location of bird transect lines within the three sampling sites in Mount Lantoy Key Biodiversity Areas: Barangays Cansuje, Tabayag, and Canbantug Argao, Cebu, Philippines

Table 1. Showing transect location, transect no., elevation, date of survey, and transect geographic coordinates

Key biodiversity area	Transect location	Transect no.	Transect length (km)	Elevation (m asl)	Date of survey	Geographic coordinates
Mt. Lantoy	Cansuje	1	2.0	530-595	25-28 September 2019	9°54'49.27"N, 123°30'56.36"E
	Cansuje	2	2.0	570-615	27-28 September 2019	9°55'5.88"N, 123°31'9.22" E
	Catang	3	1.5	100-130	2-3 October 2019	9°54'11.23"N, 123°32'54.06"E
	Catang	4	1.2	130-140	4-5 October 2019	9°54'7.38" N, 123°32'48.84"E
	Tabayag	5	1.2	510-780	19-21 April 2018	9°52'39.94"N, 123°30'22.32"E
	Canbantug	6	2.0	530-620	12 October 2019	9°52'19.34"N, 123°30'18.36"E
	Canbantug	7	1.5	540-715	13-14 October 2019	9°51'25.88"N, 123°30'2.88"E

Data collections

The transect and point-count method were carried out daily in the morning starting at 05:30-10:00 am and in the afternoon beginning at 03:30-05.30 pm since birds are more active during this period (Bibby et al. 2000). Data collection was conducted by foot (± 2 km/hour) by recording whether bird species were visible and heard. Mist-nets measuring 6 m \times 4 m (height \times length) were also used in Argao and Alcoy forests to record birds that cannot easily be seen or heard. Nets were opened from 05:30 am-05:30 pm and were checked every hour for netted birds. The survey was undertaken during fair weather or sunny days (Bibby et al. 2000). No survey was conducted during rainy days since bird activities are suppressed (Bibby et al. 2000). Voucher specimens were collected for those species mainly killed during sampling, while the rest were released after proper identification. All captured samples were fixed in 10% buffered formalin and stored in 70% ethanol. All voucher specimens were deposited at the CTU-Argao Campus. Nomenclature and classification of birds were based on Kennedy et al. (2000).

Data analysis

Diversity of avifauna was executed using Shannon-Wiener Diversity Index (H'): $H' = -\ln p_i$, where 'p' is proportional abundance. If $H' < 1.5$, the diversity is classified as low, values of 1.5 to 3.5 are classified as moderate, and values > 3.5 indicate high diversity (Magurran 1988). The distribution of birds in their habitat was determined using Evenness (E) Index: $E = H'/\ln S$, where 'S' is the summation of the number of species in the samples. When 'E' approaches 0 (zero), the bird species is not too diverse, and certain species are dominant. On the contrary, when 'E' comes 1 (one), the number of individuals among species is different, and certain species have no dominance (Ludwig and Reynolds 1988). Importance Value (IV) was calculated by adding the relative density, relative frequency, and relative dominance. The conservation status of each species encountered was evaluated and analyzed using Wild Bird Club of the Philippines - Checklist of Birds of the Philippines 2018 and the "IUCN 2016 Red List for Threatened Species" (Birdlife International 2016). The sampling effort curve was analyzed using EstimateS software (Statistical Estimation of Species Richness and Shared Species from Samples Version 9.1.0 (Colwell 2013). Clustering analysis of the seven transects was implemented using XLSTAT Version 2016.02.28451 in the Microsoft Excel environment and the Bray Curtis dissimilarity matrix through the MVSP software.

RESULTS AND DISCUSSION

Avian diversity and conservation status

We found 1,340 bird individuals belonging to 31 orders, 32 families, and 44 species (Table 2). Among these species of birds, the Philippine bulbul (*Hypsipetes philippinus* (J.R.Forster, 1795) had the highest number of individuals (377), recorded for the entire duration of the survey. The species has an importance value (IV) of 60.01. Hence, it is widely distributed across all the sampling sites. The high distribution of *H. philippinus* could be attributed to its adaptable bird species to a different kind of habitat (Kennedy et al. 2000). Four bird species were also dominant in sampling sites aside from *H. philippinus*, including White-eared brown-dove (*Phapitreron leucotis* Temminck, 1823), Coppersmith barbet (*Psilopogon haemacephalus* P.L.S.Müller, 1776), Cebu black-shama (*K. cebuensis*), and Olive-back sunbird (*Nectarinia jugularis* Linnaeus, 1766). Seven bird species had the lowest number of individuals with only one encountered and an importance value of 0.68. These included Brahminy kite (*Haliastur indus* Boddaert, 1783), Zebra dove (*Geopelia striata* Linnaeus, 1766), Blue-rock thrush (*Monticola solitarius* Linnaeus, 1758), Black-naped oriole (*Oriolus chinensis* Linnaeus, 1766), Philippine pygmy woodpecker (*Dendrocopos maculatus* Scopoli, 1786), Yellow-vented bulbul (*Pycnonotus goiavier* Scopoli, 1786), and Slaty-legged crane (*Rallina eurizonoides* Lafresnaye, 1845). Based on the IUCN Red List of Threatened Species, there are two species of birds with the endangered (EN) category, including the Cebu black-shama (*K. cebuensis*) and the Cebu hawk-owl (*N. rumseyi*) (Birdlife International 2016). Both of them are Philippine endemics, particularly in Cebu Island. On the other hand, 42 bird species are identified to be in the least concern (LC) category.

However, based on the Checklist of the Birds of the Philippines (Wild Bird Club of the Philippines 2018), there are two bird species under the near-threatened or other threatened species (OTS), namely Variable kingfisher (*C. lepidus*), and Glossy swiftlet (*Collocalia esculenta* Linnaeus, 1758). The same bird species under the IUCN threatened category are also classified as endangered based on the Checklist of the Birds of the Philippines (Wild Bird Club of the Philippines 2018). These include *K. cebuensis* and *N. rumseyi*. The rest of the bird species (40) are categorized under the LC status using the later instrument of evaluating the avian conservation status of the Philippines. We also identify at least six out of 44 species considered Philippine endemic, including *K. cebuensis*, *N.*

rumseyi, *H. philippinus*, *D. maculatus*, *Loriculus philippensis* (Statius Muller, 1776), and *Caprimulgus manillensis* (Walden, 1875). These bird species are considered a priority for biodiversity conservation and protection because they are restricted-range species, and notably, some are globally threatened (Conservation International 2009). In addition, this study further confirms that *K. cebuensis* occurs in a variety of habitats, including secondary forests, tree plantations, scrub, and bamboo plantations (Dickinson et al. 1991; Collar et al. 1999; Kennedy et al. 2000; Mallari et al. 2001).

There were four primary land cover types found in the sampling areas, i.e., early secondary growth forest, advanced secondary forest, mixed vegetation, and plantation forest composed of *Swietenia macrophylla* G.King, *Gmelina arborea* Roxb. ex Sm., grassland, and agriculture farms. The dominant tree species recorded in the sampling site were *Rhus taitensis* Guill, *Neonauclea formicaria* (Elmer) Merr., *Ficus benjamina* L., *Canarium euryphyllum* G.Perkins, *Ficus chrysolepis* Miq., *Elaeocarpus cumingii* Turcz., *Microcos stylocarpa* (Warb.) Burr, and *Dysoxylum pauciflorum* Merr. However, the recorded dominant families were Anacardiaceae, Apocynaceae, Burseraceae, Fabaceae, Meliaceae, Moraceae, Myrtaceae, and Rubiaceae.

When we compared the seven transects established among the three sampling sites, namely, barangays Cansuje, Canbantug, and Cansuje, we found that T7 had the highest diversity value (H') of 2.64, followed by T5 (2.62), T6 (2.54), T1 (2.41), T3 (2.37), T2 (2.24), and T4 (2.02) which was considered the lowest diversity value (Table 2). The evenness index values of the seven transects were close to one, which means that the bird species differed from all transects. However, *H. philippinus* (377 individuals) and the endangered *K. cebuensis* (111 individuals) dominated species distribution. However, in the overall analysis, all the seven transects have moderate diversity (Magurran 1988).

Cluster analysis

The cluster analysis of bird species composition by Bray Curtis dissimilarity matrix resulted in four primary groupings (Figure 2). Group 1 was formed primarily by transect 2 and transect 3 (Cansuje and Catang), while group 2 was formed by transect 4 (Catang). Group 3 was a cluster of transects 6 and 7 (Canbantug), and group 4 consisted of transect 1 and transect 5 (Cansuje and Tabayag). It can be deduced from the four group clusters that each group contains more or less similar species composition. However, each grouping differs in species composition from the rest of the three clusters.

Sampling effort curve

We used the species accumulation curve based on Colwell (2013) to determine whether or not our sampling effort is sufficient to account for species richness for the three study sites. We used the Chao 1 (for abundance data) to estimate the number of undetected species in the reference sample and the Chao 1-95% confidence interval

(CI), and it is compared with Chao 1 mean curve (in blue color), respectively. Figure 3 showed that the Chao 1 species accumulation curves have not yet reached the asymptote, which means that there are still species of birds that remain undetected during our sampling. Based on the Chao 1-95% CI upper bound (curve in gray color), as many as 52 bird species can be potentially detected if we intensify our field sampling. On the other hand, the Chao 1 - 95% CI lower bound (curve in orange color) suggests that there would be fewer bird species that can be detected in other sampling situations.

Table 3. Diversity index, number of species, and Evenness Index

Sample transects (T)	Shannon (H')	Evenness (J)	No. of species	Diversity description
T1	2.41	0.72	28	Moderate
T2	2.24	0.81	16	Moderate
T3	2.37	0.84	17	Moderate
T4	2.02	0.81	12	Moderate
T5	2.62	0.81	25	Moderate
T6	2.54	0.90	17	Moderate
T7	2.64	0.87	21	Moderate

Notes: T1: transect 1; T2: transect 2; T3: transect 3; T4: transect 4; T5: transect 5; T6: transect 6; T7: transect 7

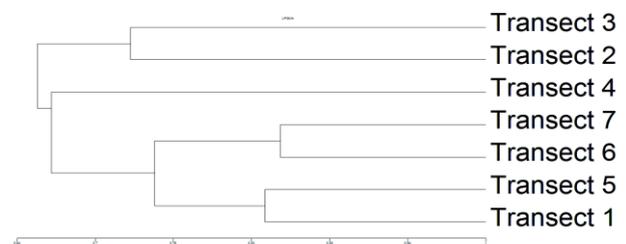


Figure 2. A cluster dendrogram for all the seven transects based on Bray Curtis dissimilarity matrix

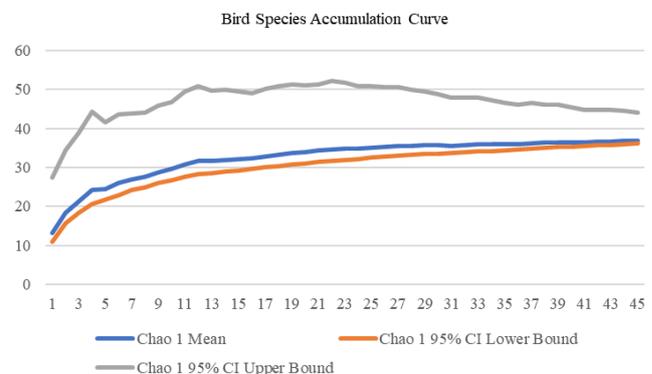


Figure 3. Bird species accumulation curved based on Chao 1 estimator for undetected species during the sampling

Table 2. List of avian species recorded in Mount Lantoy Key Biodiversity Areas, Argao, Cebu, Philippines

Family/scientific name	Common name	No. of individuals	Transects							R.Dn. (%)	R.Frq. (%)	R.Dm. (%)	I.V. (%)	Conservation status	
			1	2	3	4	5	6	7					Wild bird club 2018	IUCN 2016
Accipitridae															
<i>Haliastur indus</i> (Boddaert, 1783)	Brahminy kite	1	+	-	-	-	-	-	-	0.07	0.07	0.53	0.68	LC	LC
Alcedinidae															
<i>Ceyx lepidus</i> (Temminck, 1836)	Variable kingfisher	2	+	-	-	-	-	-	-	0.15	0.15	1.07	1.37	OTS	LC
<i>Todiramphus chloris</i> (Boddaert, 1783)	White-collared kingfisher	11	+	+	+	-	+	-	-	0.82	0.82	3.74	5.39	LC	LC
Apodidae															
<i>Collocalia esculenta</i> (Linnaeus, 1758)	Glossy swiftlet	41	+	+	+	+	+	-	+	3.06	3.06	3.74	9.86	OTS	LC
<i>Collocalia troglodytes</i> (G.R.Gray, 1845)	Pygmy swiftlet	6	+	+	-	-	+	-	-	0.45	0.45	1.60	2.50	LC	LC
Campephagidae															
<i>Lalage nigra</i> (J.R.Forster, 1781)	Pied triller	2	-	-	-	-	+	-	-	0.15	0.15	1.07	1.37	LC	LC
<i>Caprimulgus manillensis</i> (Walden, 1875)	Philippine night jar	2	-	+	-	-	-	-	-	0.15	0.15	3.74	4.04	LC	LC
Columbidae															
<i>Ptilinopus leclancheri</i> (Bonaparte, 1855)	Black-chinned fruit dove	13	+	+	-	-	+	+	+	0.97	0.97	3.74	5.68	LC	LC
<i>Phapitreron leucotis</i> (Temminck, 1823)	White-eared brown-dove	109	+	+	+	+	+	+	+	8.13	8.13	3.74	20.01	LC	LC
<i>Chalcophaps indica</i> (Linnaeus, 1758)	Common emerald dove	3	-	-	+	-	+	-	-	0.22	0.22	1.60	2.05	LC	LC
<i>Treron vernans</i> (Linnaeus, 1771)	Pink-necked green-pigeon	5	+	-	-	-	+	-	-	0.37	0.37	1.60	2.35	LC	LC
<i>Geopelia striata</i> (Linnaeus, 1766)	Zebra dove	1	-	-	-	-	+	-	-	0.07	0.07	0.53	0.68	LC	LC
Cuculidae															
<i>Centropus viridis</i> (Scopoli, 1786)	Philippine coucal	42	+	+	+	+	+	+	+	3.13	3.13	3.74	10.01	LC	LC
Dicaeidae															
<i>Dicaeum australe</i> (Hermann, 1783)	Red-keeled flowerpecker	33	+	+	+	-	+	+	+	2.46	2.46	3.74	8.67	LC	LC
Dicruridae															
<i>Dicrurus baliassius</i> (Linnaeus, 1766)	Balicassiao	10	+	-	-	-	-	+	+	0.75	0.75	2.14	3.63	LC	LC
Estrildidae															
<i>Lonchura malacca</i> (Linnaeus, 1766)	Chestnut munia	2	-	-	-	-	-	-	+	0.15	0.15	0.53	0.83	LC	LC
Laniidae															
<i>Lanius cristatus</i> (Linnaeus, 1758)	Brown shrike	60	+	+	+	-	+	+	+	4.48	4.48	3.74	12.70	LC	LC
Locustellidae															
<i>Cincloramphus timoriensis</i> (Wallace, 1864)	Tawny grassbird	18	+	-	-	-	+	-	+	1.34	1.34	2.67	5.36	LC	LC
Megalaimidae															
<i>Psilopogon haemacephalus</i> (P.L.S.Müller, 1776)	Coppersmith barbet	100	+	+	-	-	+	-	-	7.46	7.46	3.74	18.67	LC	LC
Meropidae															
<i>Merops viridis</i> (Linnaeus, 1758)	Blue-throated bee-eater	5	-	-	-	-	-	+	-	0.37	0.37	0.53	1.28	LC	LC
Monarchidae															
<i>Hypothymis azurea</i> (Boddaert, 1783)	Black-naped monarch	59	+	+	+	+	+	+	+	4.40	4.40	3.74	12.55	LC	LC
Motacillidae															
<i>Motacilla flava</i> (Linnaeus, 1758)	Yellow wagtail	2	-	-	+	-	-	-	-	0.15	0.15	0.53	0.83	LC	LC

Muscicapidae															
<i>Monticola solitarius</i> (Linnaeus, 1758)	Blue-rock thrush	1	+	-	-	-	-	-	-	0.07	0.07	0.53	0.68	LC	LC
<i>Kittacincla cebuensis</i> (Steere, 1890)	Cebu black-shama	111	+	+	+	+	+	+	+	8.28	8.28	3.74	20.31	EN	EN
<i>Cyornis rufigastra</i> (Raffles, 1822)	Mangrove-blue flycatcher	2	+	-	-	-	-	-	-	0.15	0.15	1.07	1.37	LC	LC
<i>Copsychus saularis</i> (Linnaeus, 1758)	Oriental magpie-robin	9	-	-	-	-	+	+	+	0.67	0.67	1.60	2.95	LC	LC
Nectariniidae															
<i>Aethopyga shelleyi</i> (Sharpe, 1876)	Lovely sunbird	17	+	-	+	+	+	+	+	1.27	1.27	1.60	4.14	LC	LC
<i>Aethopyga siparaja</i> (Raffles, 1822)	Crimson sunbird	45	+	-	+	+	+	+	+	3.36	3.36	3.74	10.46	LC	LC
<i>Nectarinia jugularis</i> (Linnaeus, 1766)	Olive-back sunbird	107	+	+	+	+	+	+	+	7.79	7.79	3.74	19.71	LC	LC
Oriolidae															
<i>Oriolus chinensis</i> (Linnaeus, 1766)	Black-naped oriole	1	-	-	+	-	-	-	-	0.07	0.07	0.53	0.68	LC	LC
Pachycephalidae															
<i>Pachycephala homeyeri</i> (W.Blasius, 1890)	White-vented whistler	14	+	-	-	-	+	+	+	1.04	1.04	2.76	4.76	LC	LC
Paridae															
<i>Periparus elegans</i> (Lesson, 1831)	Elegant tit	15	+	-	-	+	+	+	+	1.12	1.12	2.14	4.38	LC	LC
Phasianidae															
<i>Gallus gallus</i> (Linnaeus, 1758)	Red junglefowl	7	+	-	+	-	+	-	-	0.52	0.52	3.74	4.79	LC	LC
Phylloscopidae															
<i>Phylloscopus borealis</i> (J.H.Blasius, 1858)	Arctic warbler	2	-	-	-	-	+	-	+	0.15	0.15	1.07	1.37	LC	LC
Picidae															
<i>Dendrocopos maculatus</i> (Scopoli, 1786)	Philippine pygmy woodpecker	1	+	-	-	-	-	-	-	0.07	0.07	0.53	0.68	LC	LC
Pittidae															
<i>Pitta sordida</i> (Statius Muller, 1776)	Western hooded pitta	18	+	+	-	-	+	+	+	1.34	1.34	1.60	4.29	LC	LC
Psittacidae															
<i>Loriculus philippensis</i> (Statius Muller, 1776)	Philippine hanging-parrot	5	+	+	-	-	-	-	-	0.37	0.37	2.67	3.42	CR	LC
Pycnonotidae															
<i>Hypsipetes philippinus</i> (J.R.Forster, 1795)	Philippine bulbul	377	+	+	+	+	+	+	+	28.13	28.13	3.74	60.01	LC	LC
<i>Pycnonotus goiavier</i> (Scopoli, 1786)	Yellow-vented bulbul	1	+	-	-	-	-	-	-	0.07	0.07	0.53	0.68	LC	LC
Rallidae															
<i>Rallina eurizonoides</i> (Lafresnaye, 1845)	Slaty-legged crane	1	+	-	-	-	+	-	-	0.07	0.07	0.53	0.68	LC	LC
Rhipiduridae															
<i>Rhipidura javanica</i> (Sparman, 1788)	Sunda pied fantail	25	+	+	+	+	+	+	+	1.87	1.87	3.74	7.47	LC	LC
Strigidae															
<i>Ninox rumseyi</i> (Rasmussen et al. 2012)	Cebu hawk-owl	3	+	-	-	-	-	-	-	0.22	0.22	1.07	1.52	EN	EN
Sturnidae															
<i>Aplonis panayensis</i> (Scopoli, 1786)	Asian glossy starling	25	+	-	-	+	+	+	+	1.87	1.87	3.74	7.47	LC	LC
Zosteropidae															
<i>Zosterops everetti everetti</i> (Tweeddale, 1878)	Everett's white-eye	26	+	+	+	+	+	-	+	1.94	1.94	3.74	7.62	LC	LC

Note: (+): present; (-): absent; EN: endangered; LC: Least Concern; OTS: Other Threatened Species

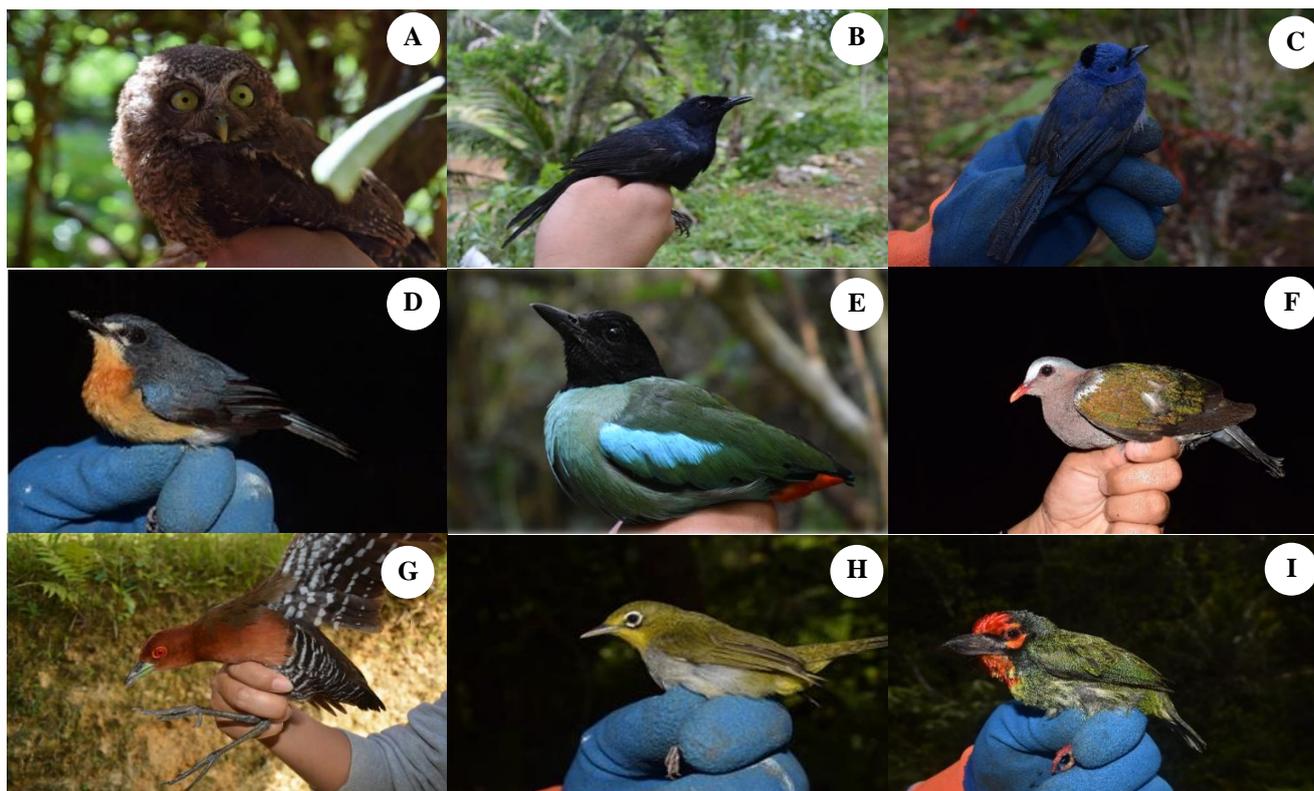


Figure 4. Photos of some avifauna in Mount Lantoy Key Biodiversity Areas, Philippines. A. Cebu hawk-owl (*Ninox rumseyi*); B. Cebu black-shama (*Kittacincla cebuensis*); C. Black-naped monarch (*Hypothymis azurea*); D. Mangrove-blue flycatcher (*Cyornis rufigastra*); E. Western hooded pitta (*Pitta sordida*); F. Common emerald dove (*Chalcophaps indica*); G. Slatty-legged crane (*Rallina eurizonoides*); H. Everett's white-eye (*Zosterops everetti everetti*); I. Coppersmith barbet (*Psilopogon haemacephalus*)

In conclusion, 1,340 bird individuals belonging to 31 orders, 32 families, and 44 species were recorded in Mt. Lantoy KBA. The bird species composition of the KBA has moderate diversity ranging from 2.0 to 3.0 diversity index value. Some are categorized as near-threatened and endangered (IUCN 2016; the Check Lists of the Birds of the Philippines 2018). Strict implementation of policies, rules, and regulations governing the utilization of forest resources and rehabilitation of degraded forest habitat to upgrade the diversity of bird species composition within the study site is required.

ACKNOWLEDGEMENTS

The authors would like to thank the Department of Science and Technology for the funding, the Philippine Council for Agriculture and Aquatic Resources Research and Development for the guidance, the National Research Council of the Philippines for the provision of research and development (R&D) leaders to assist us in establishing a “Niche Center in the Regions for R&D” in Cebu Technological University (CTU), the Department of Environment and Natural Resources for issuing our gratuitous permit (WGP No. 2019-09), and the CTU administration for its all-out support.

REFERENCES

- Bibby C, Jones M, Marsden S. 2000. Expedition Field Techniques: Bird Surveys. Bird Int., Cambridge, UK.
- Birdlife Conservation International 2008. Endemic Bird Areas (EBAs). Bird Conservation International. URL: <http://www.birdlife.org/datazone/eba>.
- Birdlife International. 2012. Birdlife International Country Profile: Philippines 2012. Bird International. <http://www.birdlife.org/datazone/country/Philippines>.
- BirdLife International. 2016. The IUCN Red List of Threatened Species DOI: 10.2305/IUCN.UK.2016-3.RLTS.T22710009A94230408.en.
- Brooks TM, Magsalay P, Dutson G, Allen R. 1995. Forest loss, extinction, and last hope for birds of Cebu. *Oriental Bird Club Bull* 21: 24-27.
- Chettri N, Sharma E, Deb D. 2001. Bird community structure along a trekking corridor of Sikkim Himalaya: A conservation perspective. *Biol Conserv* 102 (1): 1-16. DOI: 10.1016/S0006-3207(01)00092-1.
- Collar NJ, Mallari NAD, Tabaranza Jr BR. 1999. Threatened birds of the Philippines. Bookmark, Makati City, Philippines.
- Colwell RK. 2013. *EstimateS*: Statistical Estimation of Species Richness and Shared Species from Samples. Version 9: Persistent URL <purl.oclc.org/estimates>.
- Conservation International. 2009. Priority sites for conservation in the Philippines: Key Biodiversity Areas. Conservation International. [http://www.conservation.org/global/philippines/publications/pages/Integrated-Marine-Key-Biodiversity-Areas-of-the-Philippines-\(map\).aspx](http://www.conservation.org/global/philippines/publications/pages/Integrated-Marine-Key-Biodiversity-Areas-of-the-Philippines-(map).aspx)
- Cresswell WR, Wilson JM, Vickery J, Jones P, Holt S. 2007. Changes in densities of Sahelian bird species in response to recent habitat degradation. *Ostrich* 78 (2): 247-253. DOI: 10.2989/OSTRICH.2007.78.2.20.100.
- Dickinson EC, Kennedy RS, Parkes KC. 1991. The Birds of the Philippines. British Ornithologists' Union, Tring, U. K.

- Dutson GCL, Magsalay PM, Timmins RJ. 1993. The rediscovery of the Cebu flowerpecker *Dicaeum quadricolor*, with notes on other forest birds on Cebu, Philippines. *Bird Conserv Intl* 3 (3):235-240. DOI: 10.1017/S0959270900000927.
- Gonzalez JCT, Dans ATL, Pedregosa MdG, Chiu SCH. 1998. Cebu Biodiversity Conservation Project: A Report on Island-Wide Forests and Inventory of Selected Sites for Priority Conservation on Cebu. Unpublished Information Submitted to Darwin Initiative and Fauna and Flora International.
- Hadiprayitno G, Al Idrus A, Mertha IG, Ilhamdi ML, Suana IW. 2019. Birds community and it's conservation implications in Gunung Tunak Nature Park, Lombok, Indonesia. *Biodiversitas* 20: 1753-1757. DOI: 10.13057/biodiv/d200636.
- Haribon Foundation. 2014. The State of Philippine Birds. Haribon Foundation for the Conservation of Natural Resources, Inc., Quezon City, Philippines.
- Husodo T, Mochtan KP, Shanida SS, Aminuddin SF, Wulandari I, Putra IS, Megantara EN. 2020. Avian diversity in geothermal power plant areas: Case studies in Kamojang, Darajat, and Gunung Salak, West Java, Indonesia. *Biodiversitas* 21 (3): 1049-1059. DOI:10.13057/biodiv/d210327.
- Jakosalem PGC, Collar NJ, Gill JA. 2012. Habitat selection and conservation status of the endemic *Ninox* hawk-owl on Cebu, Philippines. *Bird Conserv Intl* 23 (3): 360-370. DOI: 10.1017/S0959270912000317.
- Kennedy RS, Gonzales PC, Dickinson EC, Miranda Jr. HC, Fisher TH. 2000. A guide to the birds of the Philippines. Oxford Univ Press, New York.
- Lillo EP, Malaki ABB, Alcazar SMT, Nuevo RU, Rosales RC. 2019. Native trees on Mount Lantoy Key Biodiversity Areas (KBA), Argao, Cebu, Philippines. *Philipp J Sci* 148 (2): 365-377.
- Ludwig JA, Reynolds JF. 1988. *Statistical Ecology: A Primer in Methods and Computing*. John Wiley & Sons, New York.
- Magsalay PM. 1993. Rediscovery of four Cebu endemic birds (Philippines). *Asia Life Sci* 2: 141-148.
- Magurran AE. 1988. *Ecological Diversity and Its Measurement*. Princeton Univ Press, New Jersey. DOI: 10.1007/978-94-015-7358-0.
- Malaki ABB, Cruz RVO, Bantayan NC, Racelis DA, Buot IE, Florece LM. 2018. Factors affecting the spatial distribution of black shama *Copsychus cebuensis* (Steere, 1890) in Argao Watershed Reserve. *Philipp J Sci* 147 (1): 175-189.
- Mallari NAD, Tabaranza Jr BR, Crosby M. 2001. Key Conservation Sites in the Philippines: A Haribon Foundation and BirdLife International Directory of Important Bird Areas. Bookmark Inc., Makati City, Philippines.
- Mittermeier RA, Myers N, Robles-Gil P, Mittermeier CG. 1999. Hotspots. Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. CEMEX/Agrupación Sierra Madre, Mexico City.
- Obeña RDR, Buot JrIE. 2019. Enumeration of *Hoya* species in Mindanao Island, Philippines: Conservation concerns. *Biodiversitas* 20: 1699-1707. DOI: 10.13057/biodiv/d200628.
- Paguntalan LMJ, Jacosalem PG. 2008. Significant records of birds in forests on Cebu Island, Central Philippines. *Forktail* 24 (2008): 48-56.
- Vallecillo S, Maes J, Polce C, Lavallo C. 2016. A habitat quality indicator for common birds in Europe based on species distribution models. *Ecol Indic* 69: 488-499. DOI: 10.1016/j.ecolind.2016.05.008.
- Veraart J, De Groot R, Perelló G, Riddiford N, Roijackers R. 2004. Selection of (bio) indicators to assess effects of freshwater use in wetlands: A case study of s' Albufera de Mallorca, Spain. *Reg Environ Change* 4 (2-3): 107-117. DOI: 10.1007/s10113-004-0070-2.
- Wild Bird Club of the Philippines. 2018. Checklist of the Birds of the Philippines. www.birdwatch.ph.