

Research Article

Records of Philippine Birds in the Critical Watersheds of Surigao del Norte, Northeastern Mindanao, Philippines

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ABSTRACT

The Philippines is recognised as a global biodiversity hotspot with exceptionally high bird endemism. However, many ecologically important regions, including those in Surigao del Norte, remain poorly studied. This study recorded birds in Baoy, Can-agtiw, and Agas-as watersheds with notes on diversity indices and notable and threatened species from August to September 2023. We utilised direct observation along established transect lines and mist-netting methods to record birds in the three watersheds. A total of 63 bird species belonging to 35 families and 14 orders were documented, including 33 Philippine endemics (52.38%). Overall diversity (H') was 3.101, and Baoy watershed recorded the highest number of individuals and richness (647 individuals with 44 spp.). Several locally threatened species were also documented, including two critically endangered species, i.e., Philippine hanging Parrot (*Loriculus philippensis*) and Blue-naped Parrot (*Tanygnathus lucionensis*); the endangered Mindanao Hornbill (*Penelopides affinis*); and five vulnerable species, i.e., Philippine Hawk-eagle (*Nisaetus pinskeri*), Writhed Hornbill (*Rhabdotorrhinus leucocephalus*), Philippine Dwarf Kingfisher (*Ceyx melanurus*), Southern Silvery Kingfisher (*Ceyx argentatus*), and the Mindanao Wattled Broadbill (*Sarcophanops steerii*). Although preliminary, the high number of endemic and threatened birds highlights the conservation value of these watersheds as important critical habitats. These findings emphasise the need for targeted conservation efforts, including immediate protection of these habitats and improving watershed monitoring strategies essential to safeguarding bird populations and ensuring long-term ecological sustainability.

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INTRODUCTION

The Philippines is among the world's most biodiverse nations and a recognised global hotspot, owing to its unique location and high species endemism in Southeast Asia (Mittermeier et al. 1999; Kittelberger et al. 2021). The country holds a record of over 743 species of birds, including 260 endemics. Of these, 182 are listed in the national conservation priority list (Wild Bird Club of the Philippines 2024) and 89 are globally threatened (IUCN 2024). Birds are integral to ecosystems, functioning as both predators and prey as well as contributing to ecological balance. They provide essential services such as pest control, seed dispersal, and ecosystem restoration (Mariyappan et al. 2023), while also serving as indicators of environmental health (Smits & Fernie 2013), particularly in vulnerable watersheds (Pacheco & Sanches Fernandes 2020).

Among the significant islands of the Philippines, Mindanao is regarded as a critical Endemic Bird Area (EBA). However, over the past decades, a significant portion of its tropical forest has experienced extensive deforestation, habitat degradation, and wildlife exploitation (Poffenberger & McGean 1993; Kittelberger et al. 2021). Extensive logging of Mindanao's dipterocarp-rich watersheds from the 1950s to 1970s caused severe upland erosion, lowland siltation, and increased flooding, effects that persist today (Poffenberger & McGean 1993). Adding to the pressure, the island is also widely recognised as a mining hub, where concessions extensively overlap with the critical remaining tropical rainforests (Paz & Mallari 2018). These threats degrade the habitats of many endemic, forest-dependent bird species, particularly those with narrow elevational ranges and larger body sizes, which are more prone to extinction (Kittelberger et al. 2021).

Surigao del Norte in Mindanao hosts three vital watersheds that sustain diverse wildlife and provide essential water resources and ecosystem services for local communities. The three critical watersheds (Baoy, Can-agtiw, and Agas-as) are situated in the Municipalities of Claver, Gigaquit, Malinomo, and Taganaan. These watersheds serve as the primary source of potable water and irrigation in these municipalities. Unlike other well-studied watersheds such as Agusan Marsh (Sucaldito-Salibad & Nuñez 2014), Bega Watershed (Calimpong & Nuñez 2015), and Lake Mainit Watershed (Lador & Seronay 2020), these three critical watersheds in Surigao del Norte remain unexplored in terms of bird studies. This knowledge gap is further underscored by the lack of formal protection and the limited management interventions. Thus, this study was carried out to record birds in these watersheds, with notes on biodiversity indices and highlighting notable and threatened species. Knowing the bird species and understanding bird ecology within watersheds contribute to effective conservation and management strategies. This study provides baseline information on vital bird species and the overall condition of forest ecosystems, which will be necessary in formulating local ordinances and establishing local conservation areas in the watersheds.

MATERIALS AND METHODS

The Study area and the Sampling stations

Surigao del Norte (1,952.62 km²) is located in the northeastern region of Mindanao, positioned between 125° 15' to 126° 15' east longitude and 9° 18' to 10° 30' north latitude. It is bordered to the north and east by the Pacific Ocean, while the south is bordered by the provinces of Agusan del Norte and Surigao del Sur. The study was conducted in three watersheds within Surigao del Norte, namely Baoy, Can-agtiw, and Agas-as (Figure 1 and Table 1). The wildlife Gratuitous Permit (GP) was secured from the Department of Environment and Natural Resources (DENR) (GP number R13-2023-58) prior to the survey.

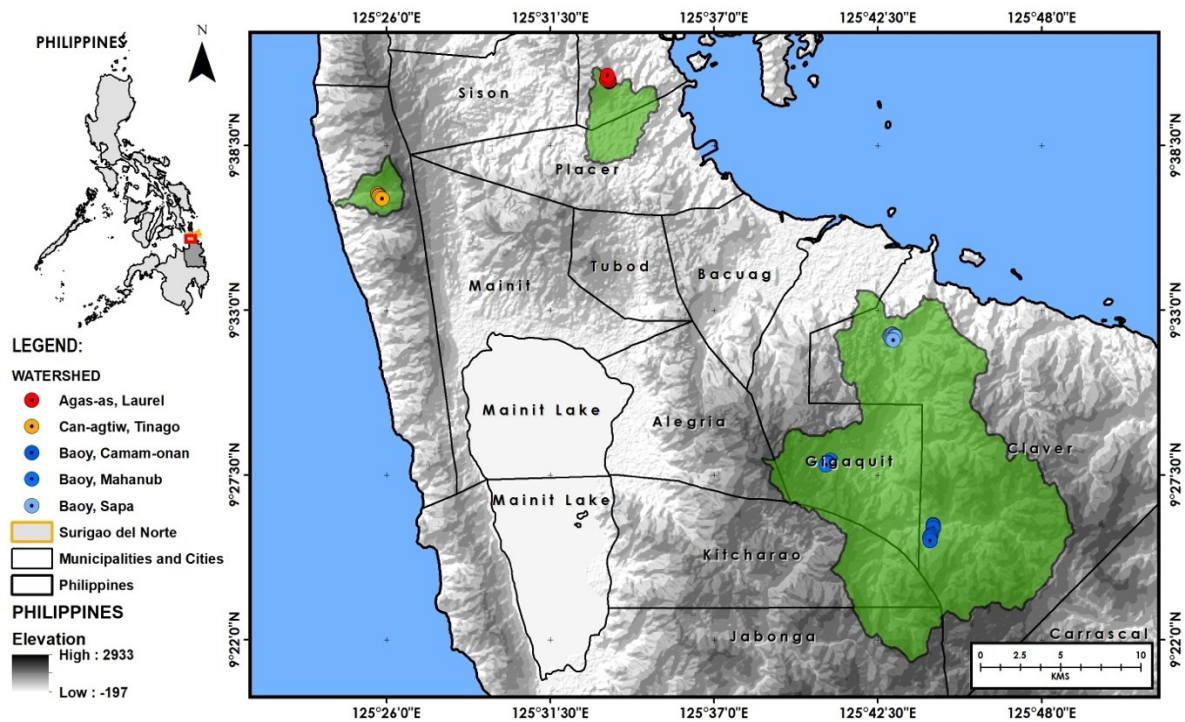


Figure 1. Map of the Surigao del Norte locating the Municipalities of the three watersheds: Claver and Gigaquit (Baoy), Tagana-an (Agas-as), and Malimono (Can-agtiw).

Table 1. Description of the sampling stations in Surigao del Norte, Caraga region, Philippines.

Watershed	Barangay	Municipality	Coordinates	Habitat Type
Baoy Watershed	Site 1: Camam-onan	Gigaquit	N 09°25'50" E 125°44'22"	Old-growth forest
	Site 2: Mahanub	Claver	N 9.465078 E 125.680559	Old-growth with patches of karst forest
	Site 3: Sapa	Claver	N 09°32.123 E 125°42.908	Agro-forest with patches of Karst forests
Can-agtiw Watershed	Tinago	Malimono	N 09°36.864 E 125°25.704	Secondary growth forest with patches of agro-forest
Agas-as Watershed	Laurel	Taganaan	N 09°40.609 E 125°33.478	Agro-forest

Data collection

Fieldwork was carried out from August to September 2023. Direct observations were conducted along established 2-km transects with a width of 100 m on either side (Gibbons & Gregory 2006; Sutherland 2006; Pitogo et al. 2024). At each sampling station, surveyed between 0500 to 0800 h and 1500 to 1740 h, coinciding with peak bird activity. Each site was surveyed twice on consecutive days, starting at the furthest end at dawn to minimize time-of-day bias with two to three observers. All birds seen or heard within a 50 m radius were documented. Binoculars, digital cameras, and telescopes were utilised to locate the birds at far distances within the area. Mist nets with three different mesh sizes were also used to capture birds: 6 x 12 m², 6 x 10 m², and 6 x 6 m² mist nets. The mist nets were strategically established along possible flyways and feeding grounds (fruit-bearing trees). The nets were opened from 0530 to 1730 h (Malaki et al. 2022) and were constantly checked every 30 minutes to 1 hour for possible catch, especially early in the morning and late in the afternoon, to avoid casualties. Species identification was aided by online photographic guides, bird call recordings, and books, including Birds of the Philippines (Allen 2020) and Guide to the Birds of the Philippines (Kennedy et al. 2000).

Data analysis

The Paleontological Statistical Software Package (PAST ver.4.03) was used to analyse species richness (n), number of individuals (N), Shannon-Wiener diversity (H'), evenness (E), and dominance (D). Community structure analysis was derived from mist-net captures. Community similarity was assessed using the Jaccard similarity index in Python 3.13.0, with values ranging from 0 (no similarity) to 1 (complete similarity).

RESULTS AND DISCUSSION

Bird species composition

The survey documented a total of 63 bird species from 14 orders belonging to 35 families (Appendix). The record constitutes 8.48 % of all recognised birds in the Philippines. Of the 63 recorded species, 31 species were captured using mist nets, and 50 species were recorded during the transect survey. The most represented orders are Passeriformes (20 families), and Coraciiformes and Piciformes (2 families). The order Passeriformes is by far the largest order of birds and is found on every continent, with the highest diversity in the tropics (Almeida et al. 2018). The family Columbidae (doves and pigeons) recorded the highest species richness (n = 7 spp.), followed by Alcedinidae (kingfishers, n = 5 spp.) and Nectariniidae (sunbirds and spiderhunters, n = 5 spp.). Columbids are remarkably adaptable, thriving across a wide range of environments. However, they are also among the most threatened bird families globally, with the Philippines recognised as a critical hotspot for Columbid diversity and conservation efforts (Walker 2007).

Among the records, 33 species (52.38 %) were endemic, while 30 species (47.62 %) were resident in the country. More importantly, six species were found to be restricted only to Mindanao (Figure 2). This includes the Writhed Hornbill (*Rhabdotorrhinus leucocephalus*), Philippine dwarf Kingfisher (*Ceyx melanurus*), Southern Silvery Kingfisher (*C. argentatus*), Mindanao Wattle-billed Broadbill (*Sarcophanops steerii*), Mindanao Blue Fantail (*Rhipidura superciliaris*), and White-browed Tailorbird (*Orthotomus nigriceps*), which is only restricted to the Caraga region and some parts of Davao del Sur.

Notable records in the Baoy watershed included a male Philippine Trogon (*Harpactes ardens*) observed in Brgy. Sapa (Figure 2A) and a female captured in Brgy. Camam-onan. This species, endemic to the Philippines and restricted to Basilan, Dinagat, and Mindanao, is currently undergoing a population decline (IUCN 2024). The Writhed Hornbill (*R. leucocephalus*) (Figure 2C), classified as Near Threatened by the IUCN and Vulnerable under the Philippine Red List (PRL), was observed in Sabang, where it was found in captivity at a local residence. Endemic bird species are key determinants of conservation strategies, as their restricted distribution heightens their vulnerability to environmental change (Alvarez-Alvarez et al. 2020), and the extinction of these species may initiate cascading effects that compromise overall biodiversity and ecosystem functioning (Gebremichael et al. 2022).

The results are comparable to the recorded bird species in Mts. Apo, Kitanglad, Hamiguitan, and Malindang (n = 65 spp.) (Nuneza et al. 2015) and in the Karst forest area in Bulacan (n = 63 spp.) (Duco et al. 2021). The species richness recorded across the three critical watersheds is likewise higher than those reported in previous studies, including the avifaunal assessment of eight waterfalls in Agusan del Sur (n = 59 spp.; Nuneza et al. 2018), Mt. Hamiguitan (n = 53 spp.; Ates et al. 2011), Mt. Pantaron in Bukidnon (n = 31 spp.; Salolog et al. 2021), and the mining areas of Agusan del Sur and Claver, Surigao del Norte (n = 47 spp.; Paz & Mallari 2018). These differences in recorded species richness may, in part, be influenced by variations in sampling effort, survey duration, and methodologies employed across studies.



Figure 2. Notable birds restricted to Mindanao recorded in the three watersheds: (A) Male Philippine trogon, (B) Philippine Dwarf Kingfisher, (C) Wreathed Hornbill, (D) White-Browed Tailorbird, (E) Southern Silvery Kingfisher, (F) Mindanao Blue Fantail, and (G) Mindanao Wattled Broadbill.

Conservation status and Local distribution map of notable species

Among the documented species, four species are globally threatened under the IUCN Red List (6.35 %), and eight species are threatened under PRL (12.70 %). Two parrot species, the Philippine Hanging Parrot (*Loriculus philippensis*) and Blue-naped Parrot (*Tanygnathus lucionensis*), are classified as Critically Endangered, whereas the Mindanao Hornbill (*Penelopides affinis*) is listed as Endangered in the PRL (DENR Administrative Order (DAO) 2019-09 2019).

The spatial distribution of multiple threatened bird species across selected watersheds in Surigao del Norte, Philippines, is presented in Figure 3. Notably, the critically endangered, Philippine Hanging Parrot (*L. philippensis*) and the vulnerable Southern Silvery Kingfisher (*C. argentatus*) were recorded in all watersheds. The Baoy watershed recorded the highest number of threatened species ($n = 7$ spp.). Seven species were present in Camam-onan, while three species were present in Sapa, and none were recorded in Mahanub. The high number of threatened species in the Baoy watershed suggests its role as a suitable habitat with abundant resources. This is reinforced by its old-growth forest, interspersed with karst patches and agroforest areas, which provide diverse vegetation and structural complexity that support avian diversity. The Can-agtiw watershed supported five threatened species, whereas the Agas-as watershed recorded the fewest ($n = 3$ spp.). The lower number in Agas-as may be attributed to forest conversion to agriculture and increased anthropogenic disturbance.

The Baoy watershed is the largest surveyed site, which may contribute to the observed bias in the high number of species. However, records showed

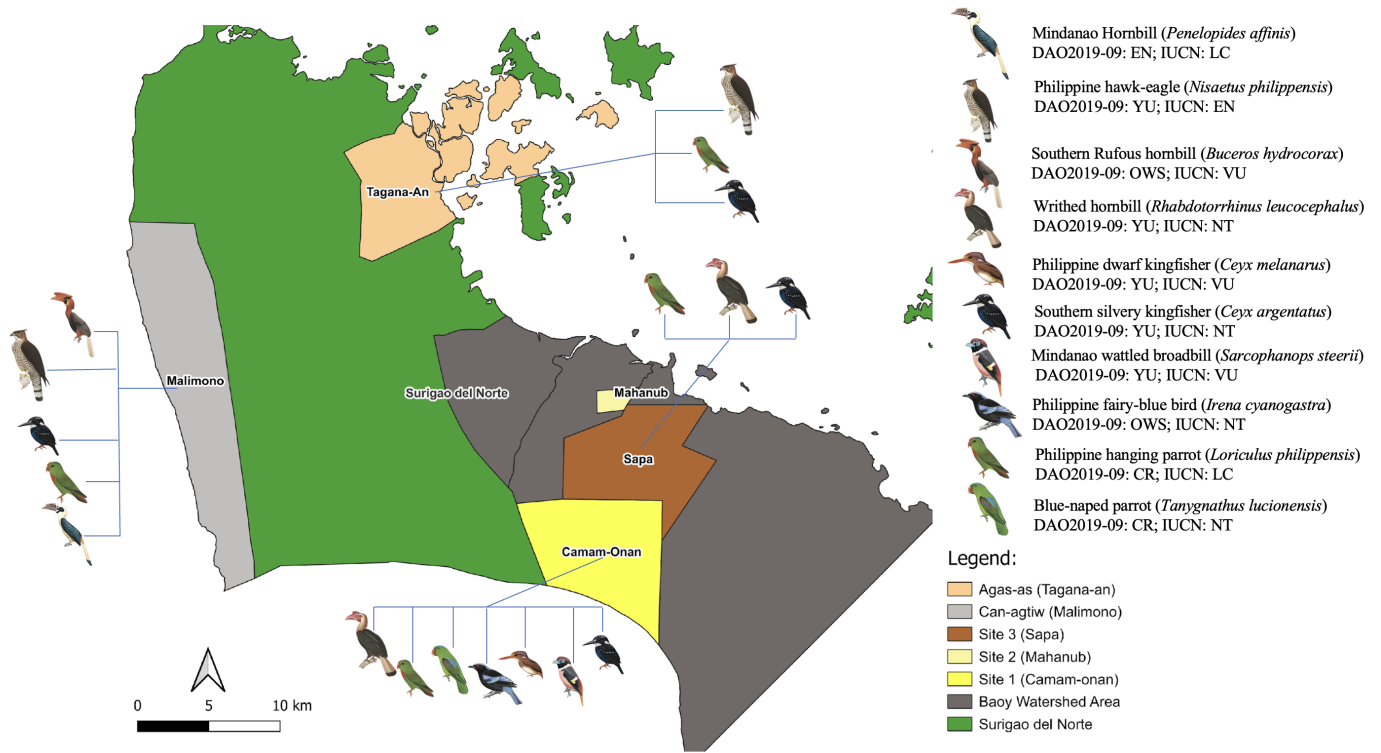


Figure 3. Local distribution map of notable and threatened species across the three watersheds. (PRL DAO2019-09: EN=Endangered, YU=Vulnerable, OWS=Other Wildlife Species, CR=Critically Endangered; IUCN: LC=Least Concern, EN=Endangered, VU=Vulnerable, NT=Near Threatened). Silhouettes from Birds of the World (2025).

several uncommon and threatened bird species, which may support the idea that uncommon birds thrive in undisturbed forests and are intolerant to forest disturbances (Arcilla & Strazds 2023). Although the Agas-as watershed also recorded a significant number of species, majority of the birds were common and abundant in disturbed areas, while some were not endemic to the area. Urban birds often exhibit smaller body size, broader dietary niches, and reduced territoriality, enabling them to exploit fragmented habitats and diverse food sources (Patankar et al. 2021). Furthermore, the higher elevation, particularly in old-growth forest areas, provides secure roosting sites for hornbills. Such environments reduce human disturbance, supporting their survival and shaping distinct evolutionary dynamics (Bastianelli et al. 2017; Laguë 2017).

Most of the species recorded were classified as Least Concern (87.30 %), indicating possible resilience to habitat disturbances and human activities. However, this current record of significantly high richness within these habitats also signifies the adaptive capacity of wildlife to coexist amid anthropogenic influences. Additionally, the cohabitation of globally and locally threatened species within these watersheds presents challenges for conservation efforts, as competition for resources, habitat degradation, and climate change may impact species differently, necessitating targeted management strategies (Tabora et al. 2023). This also underscores the importance of local conservation efforts in protecting watersheds and preserving threatened species, which play a vital role in maintaining biodiversity, ecosystem balance, and the overall health of the watershed.

Community structure and diversity metric

During the survey period, 31 bird species comprising 83 individuals were captured using mist nets. The most abundant in terms of number of individuals was the Yellow-vented Bulbul (*Pycnonotus goiaver*, N = 10), followed by the

Silvery Kingfisher (*C. argentatus*, N = 8), and the Philippine Bulbul (*Hypsipetes philippinus*, N = 7). It was also noted that *C. argentatus* and *P. goiaver* were present in all watersheds. *P. goiaver* is also a common and frequently encountered bird in lowland areas, especially in urban places such as Sapa and Laurel.

The community structure analysis in Table 2 showed that species richness (n) was highest in Site 1 of Baoy watershed (n = 13 spp.), while Agas-as watershed had the highest number of individuals (N = 32). The high species richness could be attributed to higher horizontal heterogeneity of vegetation (Carrasco et al. 2019). However, despite the high richness, most recorded birds were common lowland inhabitants such as *P. goiaver* and *Todiramphus chloris*, which are highly adaptable to anthropogenically altered environments. These species often thrive in urban landscapes, utilising them for foraging, nesting, and reproduction (Tanalgo et al. 2015). Similarly, other urban-adapted birds, including starlings, pigeons, and sparrows, dominate due to their ecological flexibility (Borgmann 2024). While urbanisation typically reduces overall biodiversity, these adaptable species proliferate in remaining niches, with non-native species occasionally establishing dominance, though they form only a minor portion of the avifauna (Thompson et al. 2022).

Species diversity ($H' = 2.48$) was highest at Site 1 in the Baoy watershed, likely due to its protection by local indigenous people and limited anthropogenic disturbance. The presence of old-growth and fruit-bearing trees (e.g., Dao, Fig) further supports high bird diversity, consistent with Batáry et al. (2014) and Joshi et al. (2012), who noted that tree diversity and vegetation complexity promote avian diversity. Similarly, Carrasco et al. (2019) reported a positive correlation between bird and plant species diversity, with denser canopies and varied vegetation supporting more bird species due to greater habitat complexity. Forests exhibiting diverse vegetation density levels, especially areas with native trees, tend to host a greater variety of bird species. Tall native tree species such as Dao (*Dracontomelon dao*), various Lauan (*Shore* spp.), Magkuno (*Xanthostemon verdugonianus*) trees, and several Fig trees (*Ficus* sp.) are present across sampling sites. In contrast, the lowest diversity was recorded at Site 2 ($H' = 0.69$), partly due to heavy rainfall that reduced captures and bird observations during the survey. The overall dominance index was low ($D = 0.06$) and evenness was relatively high ($E = 0.72$), indicating few dominant species consistent with patterns influenced by elevation, habitat type, and disturbance (Alvarez-Alvarez et al. 2020).

The Jaccard similarity index revealed distinct patterns of bird species composition across the five sites (Table 3). The highest similarity (0.475) was observed between the old-growth forest (Baoy S1) and the agro-forest with patches of karst forest (Baoy S3), suggesting that modified landscapes adjacent to or interspersed with karst habitats may still retain a considerable proportion of forest-associated bird species. A moderate level of similarity was also found between Baoy S3 (agro-forest with karst patches) and Can-agtiw watershed (secondary growth forest with agroforest) (0.378), indicating that these structurally heterogeneous habitats support overlapping bird communities. In contrast, Agas-as (an agroforest habitat) exhibited relatively low similarity with old-growth habitats (0.185–0.222), suggesting a substantial turnover in species composition associated with land-use conversion.

Overall, these results indicate that while agroforestry systems and secondary forests retain a subset of forest species, old-growth and karst forest habitats harbour unique bird communities that are not well represented in more disturbed areas. This underscores the importance of conserving both intact and karst-associated forests to maintain avian biodiversity in the landscape.

Table 2. Diversity indices of captured birds in the three watersheds during the survey period.

Indices	Baoy			Can-agtiw	Agas-as	Total
	S1	S2	S3			
Species Richness (n)	13	2	8	10	11	31
Total number of individuals (N)	17	2	13	19	32	83
Species Dominance (D)	0.09	0.50	0.16	0.16	0.15	0.06
Species Diversity (H')	2.48	0.69	1.95	2.09	2.08	3.10
Species Evenness (E)	0.92	1	0.88	0.81	0.73	0.72

Table 3. Jaccard similarity index values showing pairwise similarity of bird communities across different watersheds in Surigao del Norte, Northeastern Mindanao, Philippines

	Baoy S1 (Camam-onan)	Baoy S2 (Camboayon)	Baoy S3 (Sapa)	Can-agtiw	Agas-as
Baoy S1	1.000	0.194	0.475	0.312	0.222
Baoy S2		1.000	0.241	0.176	0.185
Baoy S3			1.000	0.378	0.286
Can-agtiw				1.000	0.318
Agas-as					1.000

CONCLUSIONS

The inventory of watersheds in Surigao del Norte documented 63 species, including 33 Philippine endemics. Notably, eight species were threatened in the Philippine Red List, with *L. philippensis* and *C. argentatus* recorded in all watersheds. Despite their conservation importance, these watersheds are increasingly threatened by poaching, forest clearing for agriculture, expanding human settlement, logging, and the impacts of mining. Although the results are preliminary, the high number of endemic and threatened birds highlights the conservation value of these watersheds. The necessity of including conservation efforts in the watershed management plans is further emphasised by the cohabitation of native and endangered species. Consequently, the designation of this area as a Local Conservation Area is highly recommended to ensure the conservation of its invaluable biodiversity. Considering these findings, the study offers a detailed understanding of bird populations within the three watersheds. This information is vital for shaping targeted conservation and management strategies to preserve the Philippines' significant bird diversity.

AUTHOR CONTRIBUTION

S.C.R. designed the research, collected and analysed the data, and wrote the manuscript; E.G. designed the research, collected and analysed the data, and wrote the manuscript; J.J.A.G. collected and analysed the data; J.R. designed the research, analysed the data, and wrote the manuscript; R.S. designed the research, acquired the funding and supervised the entire process; C.N. designed the research, analysed the data, and wrote the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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APPENDICES

Table S1. Species composition, conservation status, endemism, and occurrence of birds across the surveyed watersheds of Surigao del Norte, Northeastern Mindanao, Philippines.

Taxa	Common Name	Conservation Status				Watersheds			
		DAO 2019-09	IUCN, Population Trend	Endemism	Baoy	S 1	S 2	S 3	Can- agtiw as
Accipitriformes									
Accipitridae									
1.	<i>Haliastur indus</i> (Boddaert, 1783)	Brahminy Kite°	OWS	LC, ↓	Resident	+	-	+	+
2.	<i>Nisaetus pinsheri</i> (Preleuthner and Gamauf, 1998)	Philippine Hawk-eagle°	YU	EN, ↓	Endemic	-	-	-	+
Bucerotiformes									
Bucerotidae									
3.	<i>Penelopides affinis</i> Tweeddale, 1877	Mindanao Hornbill°	EN	LC, ↓	Endemic	-	-	-	+
4.	<i>Buceros mindanensis</i> Tweeddale, 1877	Southern Rufous Hornbill°	OWS	VU, ↓	Endemic	-	-	-	+
5.	<i>Rhabdotorrhinus leucocephalus</i> (Vieillot, 1816)	Wriathed Hornbill°	YU	NT, ↓	Endemic	+	-	+	-
Caprimulgiformes									
Apodidae									
6.	<i>Collocalia troglodytes</i> Gray, 1845	Pygmy swiftlet°	OWS	LC, ↓	Endemic	+	+	+	+
Columbiformes									
Columbidae									
7.	<i>Chalcophaps indica</i> (Linnaeus, 1758)	Asian Emerald Dove°	OWS	LC, ↓	Resident	+	-	-	+
8.	<i>Macropygia tenuirostris</i> Bonaparte, 1854	Philippine Cuckoo dove°	OWS	LC, ↓	Resident	+	-	-	+
9.	<i>Streptopelia tranquebarica</i> (Hermann, 1804)	Red-collared Dove°	OWS	LC, ↓	Resident	-	-	-	+
10.	<i>Spilopelia chinensis</i> (Scopoli, 1786)	Spotted dove°	OWS	LC, ↑	Resident	-	-	-	+
11.	<i>Phapitreron leucotis</i> (Temminck, 1823)	White-eared Brown dove°	OWS	LC, -	Endemic	+	+	+	+
12.	<i>Ramphiculus occipitalis</i> (Gray, 1844)	Yellow-breasted Fruit Dove°	OWS	LC, ↓	Endemic	-	-	-	+
13.	<i>Geopelia striata</i> (Linnaeus, 1766)	Zebra Dove°	OWS	LC, -	Resident	-	-	+	-

Table S1. Contd.

Taxa	Common Name	Conservation Status				Watersheds			
		DAO 2019-09	IUCN, Population Trend	Endemism	Baoy	S1	S2	S3	Can- agtiw as
Coraciiformes									
Alcedinidae									
14.	<i>Halcyon gularis</i> (Kuhl, 1820)	Brown-breasted Kingfisher °	OWS	LC, ?	Endemic	+	+	+	+
15.	<i>Todiramphus chloris</i> (Boddaert, 1783)	Collared Kingfisher °	OWS	LC, ↓	Resident	+	-	+	+
16.	<i>Ceyx melanurus</i> (Kaup, 1848)	Philippine dwarf Kingfisher °	YU	VU, ↓	Endemic	+	-	-	-
17.	<i>Ceyx argentatus</i> Tweeddale, 1877	Southern Silvery Kingfisher °	YU	NT, ↓	Endemic	+	-	-	+
18.	<i>Pelargopsis capensis</i> (Linnaeus, 1766)	Stork-billed Kingfisher °	OWS	LC, ↓	Resident	+	-	+	-
Meropidae									
19.	<i>Merops philippinus</i> Linnaeus, 1766	Blue-tailed Bee-eater °	OWS	LC, -	Resident	-	-	+	+
20.	<i>Merops americanus</i> P.L.S. Müller, 1776	Rufous-crowned Bee-eater °	OWS	LC, -	Endemic	+	+	+	-
Cuculiformes									
Cuculidae									
21.	<i>Cacomantis merulinus</i> (Scopoli, 1786)	Plaintive Cuckoo °	OWS	LC, -	Resident	-	-	+	-
22.	<i>Eudynamis scolopacea</i> (Linnaeus, 1758)	Asian Koel/Western Koel °	OWS	LC, -	Resident	+	-	+	-
23.	<i>Centropus melanops</i> Lesson, 1830	Black-faced Coucal °	OWS	LC, ↓	Endemic	+	-	+	-
24.	<i>Centropus viridis</i> (Scopoli, 1786)	Philippine Coucal °	OWS	LC, -	Endemic	-	-	+	+
Galliformes									
Phasianidae									
25.	<i>Gallus gallus</i> (Linnaeus, 1758)	Red Junglefowl °	OWS	LC, ↓	Resident	-	-	-	+
Gruiformes									
Rallidae									
26.	<i>Hypotaenidia torquata</i> (Linnaeus, 1766)	Barred rail °	OWS	LC, -	Resident	-	-	-	+
Passeriformes									
Artamidae									
27.	<i>Artamus leucorhynchus</i> (Linnaeus, 1771)	White-breasted Woodswallow °	OWS	LC, -	Resident	-	-	+	-
Campephagidae									
28.	<i>Lalage nigra</i> (Forster, 1781)	Pied Triller °	OWS	LC, ↓	Resident	-	-	+	+

Table S1. Contd.

Taxa	Common Name	Conservation Status			Watersheds				
		DAO 2019-09	IUCN, Population Trend	Endemism	Baoy	S 1	S 2	S 3	Can- agtiw as
Cisticolidae									
29.	<i>Orthotomus nigriceps</i> Tweeddale, 1878	OWS	LC, -	Endemic	-	-	-	-	+
Corvidae									
30.	<i>Corvus macrorhynchos</i> Wagler, 1827	OWS	LC, -	Resident	+	+	+	+	+
Dicaeidae									
31.	<i>Dicaeum trigonostigma</i> (Scopoli, 1786)	OWS	LC, -	Resident	-	-	-	-	+
32.	<i>Dicaeum austral</i> (Hermann, 1783)	OWS	LC, -	Endemic	-	-	-	+	+
Estrildidae									
33.	<i>Lonchura leucogastra</i> (Blyth, 1846)	OWS	LC, -	Resident	-	-	-	+	+
Eurylaimidae									
34.	<i>Sarcophanops steerii</i> (Sharpe, 1876)	YU	VU, ↓	Endemic	+	-	-	-	-
Hirundinidae									
35.	<i>Hirundo tahitica</i> Gmelin, 1789	OWS	LC, ?	Resident	+	+	+	+	-
Irenidae									
36.	<i>Irena cyanogastra</i> Vigors, 1831	OWS	NT, ↓	Endemic	+	-	-	-	-
Locustellidae									
37.	<i>Megalurus palustris</i> Horsfield, 1821	OWS	LC, ?	Resident	-	-	-	+	-
38.	<i>Cincloramphus timoriensis</i> (Wallace, 1864)	OWS	LC, -	Resident	-	-	-	+	+
Monarchidae									
39.	<i>Hypothymis azurea</i> (Boddaert, 1783)	OWS	LC, -	Resident	-	-	-	-	+
Nectariniidae									
40.	<i>Aethopyga bella</i> Tweeddale, 1877	OWS	LC, -	Endemic	+	-	-	-	-
41.	<i>Aethopyga pulcherrima</i> Sharpe, 1876	OWS	LC, -	Endemic	+	-	-	-	-
42.	<i>Cinnyris jugularis</i> (Linnaeus, 1766)	OWS	LC, -	Resident	+	-	-	-	+
43.	<i>Arachnothera flammifera</i> Tweeddale, 1878	OWS	LC, -	Endemic	-	-	-	-	+
44.	<i>Leptocoma sperata</i> (Linnaeus, 1766)	OWS	LC, -	Endemic	+	-	-	+	-
Orioliidae									
45.	<i>Oriolus chinensis</i> Linnaeus, 1766	OWS	LC, ↓	Resident	-	-	-	+	+

Table S1. Contd.

Taxa	Common Name	Conservation Status			Watersheds					
		DAO 2019-09	IUCN, Population Trend	Endemism	Baoy			Can- agtiw as		
					S 1	S 2	S 3			
Pachycephalidae										
46.	<i>Pachycephala philippinensis</i> (Walkden, 1872)	Yellow-bellied Whistler °	OWS	LC, ↓	Endemic	-	-	-	-	+
Passeridae										
47.	<i>Passer montanus</i> (Linnaeus, 1758)	Eurasian Tree Sparrow °	OWS	LC, ↓	Resident	-	-	-	-	+
Pittidae										
48.	<i>Erythropitta erythrogaster</i> (Temminck, 1823)	Philippine Pitta °	OWS	LC, ↓	Endemic	+	-	-	-	-
Pycnonotidae										
49.	<i>Hypsipetes philippinus</i> (Forster, 1795)	Philippine Bulbul °	OWS	LC, -	Endemic	-	-	-	-	+
50.	<i>Hypsipetes everetti</i> (Tweeddale, 1877)	Yellowish Bulbul °	OWS	LC, -	Endemic	-	-	+	-	-
51.	<i>Pycnonotus goiavier</i> (Scopoli, 1786)	Yellow-vented Bulbul °	OWS	LC, ↑	Resident	-	+	+	+	+
52.	<i>Poliolophus urostictus</i> (Salvadori, 1870)	Yellow-wattled Bulbul °	OWS	LC, -	Endemic	+	-	-	-	-
Rhipiduridae										
53.	<i>Rhipidura superciliaris</i> (Sharpe, 1877)	Mindanao Blue Fantail °	OWS	LC, -	Endemic	-	-	-	-	+
Sturnidae										
54.	<i>Sarcops calvus</i> (Linnaeus, 1766)	Coledo °	OWS	LC, ?	Endemic	-	-	-	-	+
Timaliidae										
55.	<i>Macronus striaticeps</i> Sharpe, 1877	Brown-tit Babbler °	OWS	LC, ↓	Endemic	-	-	-	-	+
Pelecaniformes										
Ardeidae										
56.	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret °	OWS	LC, ↑	Resident	-	-	+	-	-
Piciformes										
Megalaimidae										
57.	<i>Psilopogon haemacephalus</i> (Müller, 1776)	Coppersmith Barbet °	OWS	LC, ↑	Resident	-	-	+	+	+
Picidae										
58.	<i>Dryocopus javensis</i> Tristram, 1879	White-bellied Woodpecker °	OWS	LC, ↓	Resident	-	-	-	+	-
Psittaciformes										
Psittacidae										
59.	<i>Loriculus philippensis</i> (Müller, 1776)	Philippine Hanging Parrot °	CR	LC, ↓	Endemic	+	-	+	+	+
60.	<i>Tanygnathus lucionensis</i> (Linnaeus, 1766)	Blue-naped Parrot °	CR	NT, ↓	Resident	+	-	+	-	-
61.	<i>Bolbopsittacus lunulatus</i> (Scopoli, 1786)	Guaiabero °	OWS	LC, -	Endemic	+	-	+	+	+

Table S1. Contd.

Taxa	Common Name	Conservation Status			Watersheds										
		DAO 2019-09	IUCN, Population Trend	Endemism	Baoy			Can- agtiw as							
Strigiformes															
Strigidae															
62.	<i>Otus everetti</i> (Tweeddale, 1897)	OWS	LC, ↓	Endemic	-	-	-	+	-	-	-	-	-	-	-
Trogoniformes															
Trogonidae															
63.	<i>Harpactes ardens</i> (Temminck, 1826)	OWS	LC, ↓	Endemic	+	-	-	+	-	-	-	-	-	-	-

Legend: Conservation status: IUCN Red List of Threatened Species: LC-Least Concern, NT-Near Threatened, VU-Vulnerable, CR-Critically Endangered, EN-Endangered; DAO: OWS-Other Wildlife Species, YU-Vulnerable; Population Status: ↓-Decreasing, ↑-Increasing, “-”- Stable, “?”-Unknown, “c”- captured, “o”-observed/ sighted; Occurrence: “+” - Observed, “-” -Not Observed.