



## Avifauna Survey within a University Campus and Adjacent Forest Fragment in Bicol, Eastern Philippines

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### Abstract

With the lack of baseline information on avifauna within Bicol University and the adjacent forest fragment, this research aimed to identify bird species and compare their presence between an urbanized and forest areas. Avian diversity was documented within the Kalikasan Park and Bicol University Main Campus adjacent ecosystems, representing a forest fragment and semi-urbanized ecosystems, respectively. Bird survey was carried out through point count method. Identification was aided by existing taxonomic keys. A total of 44 species were recorded with eleven as Philippine endemics. *Lonchura malacca* (Chestnut Munia) and *Aplonis panayensis* (Asian Glossy Starling) were among the most frequently sighted. Bird species sighted was higher in the forest fragment as compared with the main campus area. The study recommends that Bicol University Main campus be transformed into an avian buffer and safe zone for the protection and conservation of these species and to provide policies to maintain high bird diversity.

**Keywords:** Avian; Birds; Bicol University; Diversity; *Zosterops meyeri*

### Introduction

Avian assemblages in urban areas are a combination of native species that are abundant in the locality, some introduced birds and a variety of other species that may be infrequently sighted in the urban matrix [1].

The alteration pressures on the avian composition is mostly anthropogenic in nature [1]. Humans affect wildlife by modifying the local environment such as conversion of land covers and establishment of structures and buildings [2].

Multiple researches have already documented the avifauna of urbanized areas. A long-standing challenge is that urbanization tends to reduce species richness [3]. Noise pollution in urban settings [4] as well as light pollution [5] and human aggression [6] are among those that shape community assemblage. Human settlements and their design are likewise contributory to avian mobility in urban settings. For instance, window designs have caused unprecedented avian mortality through the years [7-8].

In general, avifauna in the Bicol region remain to be poorly studied. No comprehensive surveys of birds in the region are available in literature. Grant and Whitehead [9] were only among the few who ventured into the bird species of the province of Albay and the adjacent island of Catanduanes, both are part of the Bicol region. This published literature, however, dates back to 1895. Other local sources remain unpublished and are thus unavailable to the public.

Bicol University sits in between a forest fragment, locally known as the Kalikasan Park, and the bustling metropolis of Legazpi City, south of the Luzon Island in the Philippines. By itself, the university campus links the two distinct ecosystems and forms a gradient of natural towards urban ecosystems. Clergaeu and co-workers [10] established that avian communities are less likely affected by the bird diversity of adjacent landscapes but are rather determined by local features. This means that the quality of the area dictates the bird species found in the area. It is on this note that this bird survey was undertaken. With ongoing expansion of university infrastructures, there needs to be a comprehensive data to support future developments and how they may affect

biodiversity. Avian community is known to be an indicator of habitat alterations due to urbanization and development [11-13].

Therefore, the main objective of this research was to identify bird species in the area and provide a baseline information on their diversity and structure. Likewise, this research compared the occurrence of birds between Bicol University Main Campus (a semi-urbanized area) and Kalikasan Park (a forest fragment).

## Materials and methods

### 1) Sampling sites

#### 1.1) Bicol University Main Campus

Four sampling sites in Bicol University Main Campus (Figure 1) were identified: point count A was located near the grounds of College of Science building 1 and College of Nursing characterized by buildings close to fruit bearing trees and ornamental plants lining the pathways. The area includes a major road for vehicles and commuters within the university. Point count B was located at the back of the College of Science building 4. This area is close to the Sagumayon River, less frequented by people and has a number of fruit-bearing trees (*Mangifera indica*, *Cocos nucifera* and *Syzygium* sp.) and other native trees. Building heights within point count A and B are approximately 20 m to 45 m. Point count C was at the back of the Institute of Physical Education, Sports and Recreation (IPESR) building. This area is also traversed by the Sagumayon River but is close to a residential area with mixed vegetation. Point count D was located at the back of the College of Education (BUCE) characterized by grasses and a small rice field. The area is frequented by students and visitors of the university because of the abundance of fruit-bearing trees.



**Figure 1** Map showing the Bicol University Main Campus (blue perimeter) and Kalikasan Park (yellow perimeter). Sampling sites within the main campus are marked from A-D.

### 1.2) Kalikasan Park

The Kalikasan Park is a small forested fragment immediately adjacent to Bicol University Main Campus. Major tree taxa comprising the forest include fruit-bearing trees (*Manigfera indica*, *Carica papaya*, *Sandoricum koetjape*, *Canarium ovatum*, *Cocos nucifera*, *Artocarpus heterophyllus* and *Syzygium* sp.) and evergreens such as *Acacia* sp. and *Pterocarpus indicus*. Species of bamboo are likewise present within the forest. Other common trees include *Gmenila* sp., *Hevea* sp., and *Swietenia* sp. Grasses, vines and shrubs are also found in patches and close to the Sagumayon River, the main source of water.

### 2) Sampling frequency and procedure

The surveys were conducted in the months of January to June 2018. These months were dry or summer season in the Philippines. Three bird surveys were conducted utilizing two methods. The first survey was an initial assessment of the bird species in the area to document their possible occurrence in the university and forested areas. Only the presence and absence of bird species were noted and not included in the final data in this research.

The second survey employed the point count method only within the Bicol University Main

Campus. This is due to the safety restrictions given to researchers by the land administrators of the Kalikasan Park. Occurrence bird species sighted for a period of 20 min as modified from works of Bonthoux and Balent [14] were recorded. Twenty minutes allowed observers to carefully record frequency of sightings and properly tally them under the proper bird identity. The point count method was done for a period of eight consecutive days from 6:00 to 10:00 o'clock in the morning and 3:00 to 5:30 in the afternoon and documented using DSLR camera (Canon 6D and Sigma 150-600 mm) and identified with the aid of field guides [15].

A third survey was done within the Bicol University Main Campus and Kalikasan Park to document the bird species within the two areas. Birds species encountered visually or through bird calls were recorded. Observed birds were identified using guide by Kennedy and co-workers [16]. The conservation status and distribution of the species were assessed using IUCN and Birdlife Database.

### 3) Data analysis

The Simpson's Diversity Index (D) was calculated through the Biodiversity Pro software [17] as shown in Eq. 1.

$$D = (\sum n(n-1)) / N(N-1) \quad (\text{Eq. 1})$$

where D is the Simpson's Diversity Index, n is the number of individuals per species, and N is the total number of individuals of all species sampled.

## Results and discussion

There was a combined total of 44 species of birds documented both in the point count method and bird sighting surveys: 28 in the point count method and an additional 16 species sighted during the final bird survey.

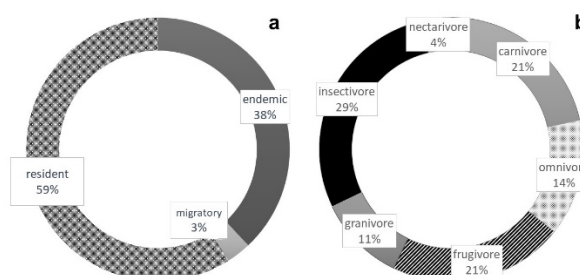
### 1) Point count method within the Bicol University Main Campus

Twenty-eight species of birds belonging to 19 families had been identified during the point count method (Table 1). In point count A, the presence of buildings and increase in urbanity of the area mostly benefited the Eurasian Tree Sparrows (*Passer montanus*) because it served as their nesting site, while the Brown Shrikes (*Lanius cristatus*) used the area as its feeding ground where insects and worms tend to be more abundant in the continuously disturbed grasses. In point counts C and D the abundance of fruit bearing trees and shrubs greatly favored both the Yellow-vented Bulbul (*Pycnonotus goiavier*) and the Asian Glossy Starling (*Aplonis panayensis*). Likewise, the presence of water source in both sampling areas provided source of food for the Little Egret (*Egretta garzetta*) and the Collared Kingfisher (*Todiramphus chloris*). Point count D was dominated by rice fields and grasses which mostly benefited the Chestnut Munia (*Lonchura malacca*) for their diet of grass seeds and grains and shelter and food for the Barred Rail (*Gallirallus torquatus*), White-breasted Waterhen (*Amaurornis phoenicurus*), and the Yellow Bittern (*Ixobrychus sinensis*).

There were 5 Philippine endemics and 5 migratory species recorded within the main

campus. The 5 Philippine endemics are the Lowland White-eye (*Zosterops meyeri*), Philippine Coucal (*Centropus viridis*), Red-keeled Flowerpecker (*Dicaeum australe*), Indigo-banded Kingfisher (*Alcedo cyanopectus*), and the Stripe-headed Rhabdomis (*Rhabdornis mystacalis*) while the 5 migratory species are the Brown Shrike (*Lanius cristatus*), Blue Rock Thrush (*Monticola solitaries*), Common Kingfisher (*Alcedo atthis*), Grey-streaked Flycatcher (*Muscicapa griseisticta*), and the Grey Wagtail (*Motacilla cinerea*).

For all point counts, majority of the occurrences of birds are greater in the morning than in the afternoon. Simpson's index of diversity is fairly uniform for all sampling sites with total diversity index of 0.87, corresponding to a high diversity. Importance Value (IV) showed that Yellow-vented Bulbul (*Pycnonotus goiavier*) had the highest importance value of 43.9. This is followed by the Chestnut Munia (*Lonchura malacca*) with an importance value of 37.66 two species were also the most frequently sighted. Endemism is relatively high with 39% of the species being endemic to the country (Figure 2a). Feeding guilds of the birds sighted were dominated by insectivores (29%). Carnivores (21%) and frugivores (21%) share the same percentage of the total feeding guilds (Figure 2b).



**Figure 2** Pie charts showing (a) endemism status and (b) feeding guilds of bird species observed in Bicol University Main Campus and Kalikasan Park.

Table 1 Bird species recorded within Bicol University Main Campus

Family	Scientific name	Common name	Feeding guild	Sampling area				%RF	IV	
				A	B	C	D			Total
Alcedinidae	<i>Alcedo atthis</i>	Common	Carnivore	-	-	7	-	7	0.24	0.48
		Kingfisher								
Apodidae	<i>Ceyx cyanopectus</i>	Northern Indigo-banded Kingfisher	Carnivore	-	-	4	-	4	0.14	0.28
		Collared Kingfisher	Carnivore	-	20	24	7	51	1.76	3.51
Ardeidae	<i>Todiramphus chloris</i>	Glossy Swiftlet	Insectivore	45	24	41	60	170	5.85	11.70
		Little Egret	Carnivore	32	57	88	68	245	8.43	16.87
Campephagidae	<i>Egretta intermedia</i>	Intermediate Egret	Carnivore	-	-	4	-	4	0.14	0.28
		Yellow Bittern	Carnivore	-	-	-	11	11	0.38	0.76
Columbidae	<i>Ixobrychus sinensis</i>	Pied Triller	Insectivore	2	2	-	-	4	0.14	0.28
		Common Emerald Dove	Frugivore	-	1	1	-	2	0.07	0.14
Cuculidae	<i>Lalage nigra</i>	Zebra Dove	Granivore	16	8	17	37	78	2.69	5.37
		Black-chinned Fruit Dove	Frugivore	1	-	-	-	1	0.03	0.07
Dicaeidae	<i>Chalcophaps indica</i>	Philippine Coucal	Insectivore	-	-	4	2	6	0.21	0.41
		Red-keeled Flowerpecker	Frugivore	4	18	2	4	28	0.96	1.93
Estrilidae	<i>Geopelia striata</i>	Chestnut Munia	Granivore	47	26	65	409	547	18.83	37.66
		Brown Shrike	Insectivore	72	20	43	74	209	7.19	14.39

**Table 1** Bird species recorded within Bicol University Main Campus (continued)

Family	Scientific name	Common name	Feeding guild	Sampling Area				%RF	IV	
				A	B	C	D			Total
Motacillidae	<i>Motacilla cinerea</i>	Grey Wagtail	Insectivore	-	2	5	8	15	0.52	1.03
Muscicapidae	<i>Monticola solitarius</i>	Blue Rock-thrush	Omnivore	2	-	-	-	2	0.07	0.14
	<i>Muscicapa griseiticta</i>	Grey-streaked Flycatcher	Insectivore	-	9	2	-	11	0.38	0.76
Nectariniidae	<i>Cinnyris jugularis</i>	Olive – back Sunbird	Nectarivore	46	29	18	2	95	3.27	6.54
Oriolidae	<i>Oriolus chinensis</i>	Black-naped Oriole	Frugivore	9	4	-	-	13	0.45	0.90
Passeridae	<i>Passer montanus</i>	Eurasian Tree Sparrow	Granivore	65	36	-	29	130	4.48	8.95
Pycnonotidae	<i>Pycnonotus goiavier</i>	Yellow – vented Bulbul	Frugivore	28	155	291	164	638	21.96	43.92
Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	Omnivore	-	-	-	30	30	1.03	2.07
	<i>Gallirallus torquatus</i>	Barred Rail	Omnivore	-	4	6	25	35	1.20	2.41
Rhipiduridae	<i>Rhipidura nigritorquis</i>	Philippine Pied Fantail	Insectivore	6	48	17	2	73	2.51	5.03
Sturnidae	<i>Aplonis panayensis</i>	Asian Glossy Starling	Frugivore	20	126	116	176	438	15.08	30.15
	<i>Rhabdornis mystacalis</i>	Stripe-headed Rhabdornis	Omnivore	-	15	3	-	18	0.62	1.29
Zosteropidae	<i>Zosterops meyeri</i>	Lowland White-eye	Insectivore	-	40	-	-	40	1.38	2.75
Total	Total			395	644	758	1108	2095	100.00	100.00
Simpson's Diversity Index	Simpson's Diversity Index			0.88	0.87	0.8	0.8	0.87		

**Remark:** F = frequency; RF = relative frequency; IV = importance value

## 2) Bird sightings within the Bicol University Main Campus and Kalikasan Park

The lack of parallel sampling using point count method within the Kalikasan Park limited the comparison of bird species with the main campus. Thus, this research only relied with the presence or absence of a bird species within the specified areas (Table 2). Representative species sighted are shown in Figure 3.

Particularly in Kalikasan Park, thirty-two species belonging to 22 families were recorded. These species observations were significantly higher compared to the observations within the main campus of Bicol University with only seventeen (17) species belonging to 16 families. The forested Kalikasan Park evidently provided more refuge and less disturbance to the bird species. There were several observations of the rare and easily disturbed species like the Barrel Rail (*Gallirallus torquatus*) and the Common Emerald Dove (*Chalcophaps indica*) only within the Kalikasan Park.

Eleven Philippine endemics were recorded. These were *Zosterops meyeri*, *Centropus viridis*, *Dicaeum australe*, *Pycnonotus goiavier*, *Phapitreron leucotis*, *Bolbopsittacus lunulatus*, *Loriculus philippensis*, *Picoides maculatus*, *Hypsipetes philippinus*, *Copsychus mindanensis*, and *Orthotomus derbianus*. Only five of these were recorded during the point count method. Twenty or 59% of the species observed were residents and two (2) species (*Lanius cristatus* and *Egretta garzetta*) were migratory. No species are included in the threatened category of the IUCN. Most of the birds observed were categorized as common forest and urban bird

species since the observation areas are slightly disturbed and exposed to human activities.

## 3) Bicol University as a potential avian buffer and safe zone

Urbanization has functionally pushed the boundaries of forests and green spaces, significantly affecting flora and fauna [18-19]. The mere transformation of land areas into urban landscapes and the corresponding pollutions have altered habitats necessary for normal ecosystem functioning [20]. This has repercussions on many facets of biodiversity and the ecosystem services we derive from them. These include biotic homogenization [19], effects on species richness [21] and diversity [22] of plants and animals, and ecosystem services as quantified by soil conservation, food production and carbon sequestration [23]. The trend towards the creation of green spaces as well as the rise of environment-friendly urban zones that somehow mimic natural habitats may buffer these effects.

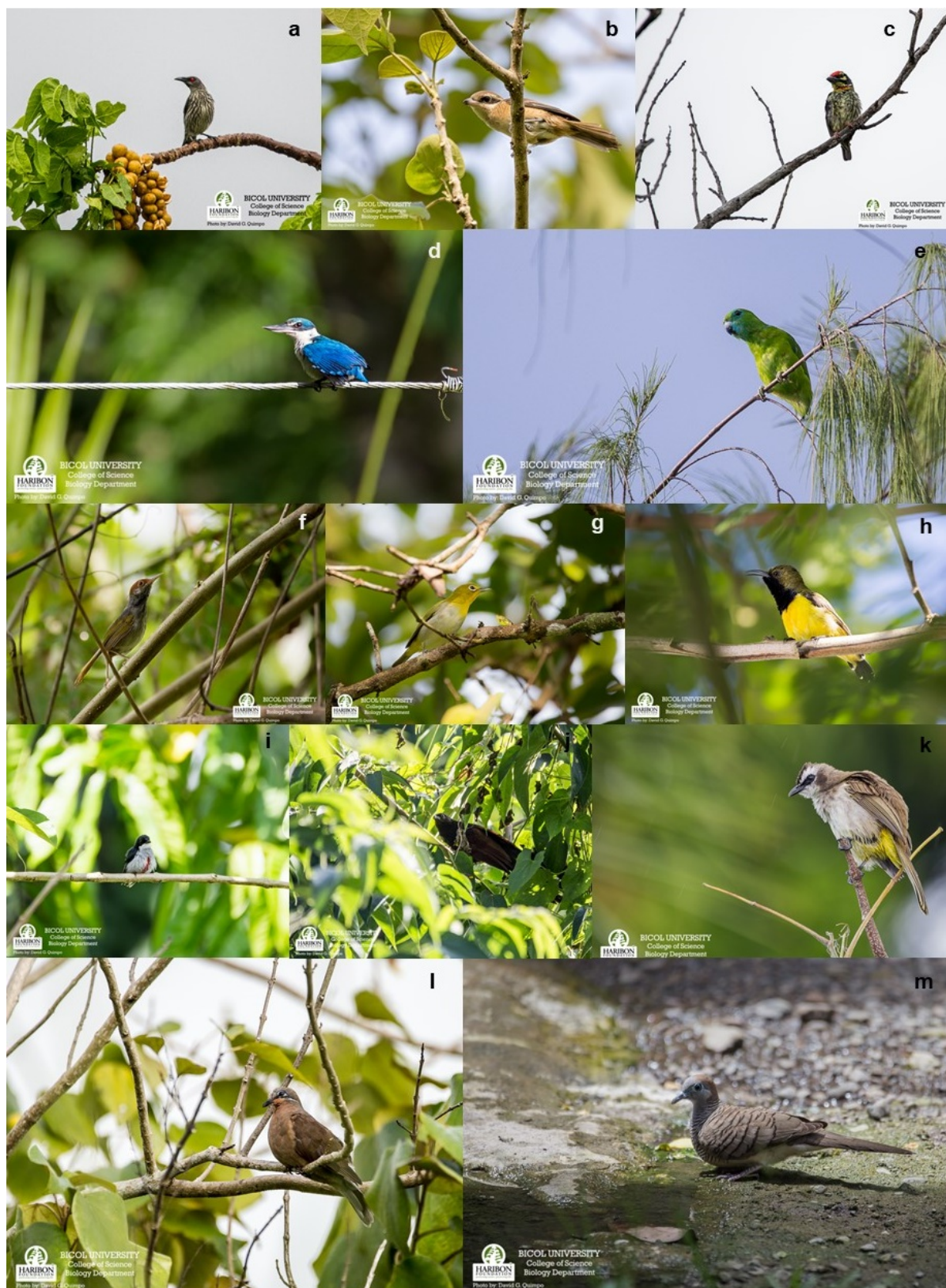
It has already been documented how urbanization can impact bird assemblage [24]. At the University of the Philippines - Diliman campus for example [25], an area very similar to Bicol University in terms of vegetation and infrastructure layout, bird assemblage was found to be non-homogenous with areas allowing some species to exist. While green spaces are known to provide unique species avian assemblage, urbanization may contribute to decreased avian diversity [26]. While anthropogenic disturbances have negative impacts, species of birds respond differently to habitat components [27].

**Table 2** Comparison of avian assemblage between Bicol University Main campus and Kalikasan Park

Scientific name	Common name	Status	University Campus	Kalikasan Park
<i>Aplonis panayensis</i>	Asian Glossy Starling	Resident	P	P
<i>Bolbopsittacus lunulatus</i>	Guaiabero	Endemic	-	P
<i>Bubulcus ibis</i>	Cattle Egret	Resident	-	P
<i>Centropus viridis</i>	Philippine Coucal	Endemic	P	P
<i>Chalcophaps indica</i>	Common Emerald Dove	Resident	-	P
<i>Cinnyris jugularis</i>	Olive-back Sunbird	Resident	P	P
<i>Collocalia esculenta</i>	Glossy Swiftlet	Resident	P	P
<i>Copsychus mindanensis</i>	Philippine Magpie Robin	Endemic	-	P
<i>Dicaeum australe</i>	Red-keeled Flowerpecker	Endemic	P	P
<i>Egretta garzetta</i>	Little Egret	Migratory	P	-
<i>Gallirallus torquatus</i>	Barred Rail	Resident	-	P
<i>Geopelia striata</i>	Zebra Dove	Resident	P	P
<i>Gerygone sulphurea</i>	Golden-bellied Gerygone	Resident	-	P
<i>Hirundo javanica</i>	House Swallow	Resident	-	P
<i>Hypsipetes philippinus</i>	Philippine Bulbul	Endemic	-	P
<i>Lalage nigra</i>	Pied Triller	Resident	P	-
<i>Lanius cristatus</i>	Brown Shrike	Migratory	P	P
<i>Leptocoma sperata</i>	Purple-throated Sunbird	Resident	-	P
<i>Lonchura leucogastra</i>	White-bellied Munia	Resident	-	P
<i>Lonchura malacca</i>	Chestnut Munia	Resident	P	P
<i>Lonchura punctulata</i>	Scaly-breasted Munia	Resident	-	P
<i>Loriculus philippensis</i>	Colasisi	Endemic	-	P
<i>Macropygia tenuirostris</i>	Philippine Cuckoo-dove	Resident	-	P
<i>Oriolus chinensis</i>	Black-naped Oriole	Resident	-	P
<i>Orthotomus derbianus</i>	Grey-backed Tailorbird	Endemic	-	P
<i>Passer montanus</i>	Eurasian Tree Sparrow	Resident	P	P
<i>Phapitreron leucotis</i>	White-eared Brown Dove	Endemic	-	P
<i>Picoides maculatus</i>	Philippine Pygmy Woodpecker	Endemic	-	P
<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	Resident	P	P
<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul	Endemic	P	P
<i>Rhipidura nigritorquis</i>	Philippine Pied Fantail	-	P	P
<i>Streptopelia tranquebarica</i>	Red Turtle Dove	Resident	P	P
<i>Todiramphus chloris</i>	Collared Kingfisher	Resident	P	P
<i>Zosterops meyeri</i>	Lowland White-eye	Endemic	P	P
Total			17	32

**Remark:** P = present





**Figure 3** Representative bird species recorded within Bicol University Main Campus and Kalikasan Park: (a) Asian glossy starling; (b) brown shrike; (c) coppersmith barbet; (d) collared kingfisher); (e) guaiabero; (f) grey-backed tailorbird; (g) lowland white-eye; (h) olive-backed sunbird; (i) red-keeled flowerpecker; (j) Philippine coucal; (k) yellow-vented bulbul; (l) white-eared brown dove; (m) zebra dove.

It remains unclear how much influence urbanization in Legazpi City exerts towards avian diversity as there is no comprehensive baseline surveys to compare with. This research, likewise, is descriptive, and analysis is limited to related literature conducted in an analogous setting. The uniqueness of Bicol University as a potential buffer zone for avian diversity is vested on it being a fusion of a forest and an urbanized location. The university sits in between a forest fragment as its backdrop and a busy modern city at its foreground, creating a link in this ecosystem gradient. This creates a management challenge because avian diversity, as an important parcel of overall biodiversity, depends on the university to limit encroachment of the limited forest space as well as to be, by itself, a safe space for avian species running away from city elements.

Bird innate status of whether they are endemic, metropolitan or migratory among others, have outreaching policy implications. While effects of habitat loss and fragmentation are different in various bird communities [28], avian diversity strongly depends on securing safe habitats. For instance, tree endemism has long been known to be linked with avian diversity. Birds recognize specific tree species. The absence of endemic trees and the proliferation of invasive species alter the avian community of the area. Among the birds sighted in this study, 21.43% are directly dependent on fruit-bearing trees as frugivores, and 28.57% which are insectivores may indirectly be affected by the absence of trees because of the insects which may reside in them. Vis a vis the protection of birds is the protection of their habitat, securing for them a safe space on which to nest, roost and forage with minimal disturbance. This includes a tree management plan, limiting anthropogenic activities in the

area, and actively promoting a balance between development and conservation.

#### **4) Indications of anthropogenic disturbance to avian fauna of Bicol University**

Ongoing construction and development of new buildings and bridges within the observation areas may have affected several species of birds, including flora and fauna, previously recorded in the area. These included the Striped-headed Rhabdornis (*Rhabdornis mystacalis*) and Northern Indigo-banded Kingfisher (*Ceyx cyanopectus*). These bird species are quite rare in other parts of the country but was easily recorded within the campus during a visit by a joint ocular survey by the BU Department of Biology and Haribon Foundation in 2015. This may be indicative of anthropogenic disturbance of the area. Such instance was already documented in the University of the Philippines Diliman campus where ecological replacements of once numerous species were observed in areas with most infrastructure development [29].

#### **Conclusion**

This study provided a baseline information on the bird species within Bicol University main campus and the adjacent Kalikasan Park forest fragment. Forty-four species were recorded with 11 Philippine endemics. Avian diversity was high. Higher number of species were recorded within the Kalikasan Park than in the main campus because of anthropogenic disturbances in the latter. Diet of birds observed in this study is majority composed of insects while still a large portion are carnivores and frugivores. Because of the limited quantitative data within Kalikasan Park, minimal comparison was done. Additional observations within the fragmented forest is therefore recommended and monitoring of the avian fauna alongside the expansion of the university.

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