A Preliminary Assessment on Avian Community in the Urban Forest of Universiti Malaysia Sabah

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ABSTRACT Preliminary assessment was conducted on avian community that presented at the urban forest of Universiti Malaysia Sabah in present study. Four line transects were established at four randomly-selected locations that surrounded the Forestry Complex in UMS. Point-count survey was employed in sampling avian individuals, and then ancillary data was collected through visual assessment, at each sampling post established along respective transects. A total of 201 avian individuals belonged to 46 species and 23 families were sighted and identified in present study, and then 5 threatened species were encountered at arboretum (Transect 1), stairway (Transect 2) and natural-regenerated forest (Transect 4) habitats. Urban forest habitat of UMS was determined with rich resident avian diversity, especially at the stairway habitat. UMS serves as a shelter to wide range of resident avian species, as well as to several migratory and threatened avian species. Due to small sampling area and short sampling time employed in present study, there is a need to conduct similar study on the entire campus of UMS, to provide a holistic understanding on the relationship between avian community and habitat condition at urban forest ecosystem of UMS, as well as for other urban forests in Kota Kinabalu, Sabah.

KEYWORDS: Universiti Malaysia Sabah; Urban Forest; Avian Community; and Habitat Condition
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INTRODUCTION

Universiti Malaysia Sabah (UMS) is regarded as one of the urban forests in the "Rainforest City" of Kota Kinabalu, Sabah. Local environmental quality and human well-being are supported by the green lung of the city that are comprised of UMS and other urban forests in the city, including Kota Kinabalu Wetland Centre (KKWC) (Lee *et al*., 2004; Mojiol, 2018a). KKWC was evaluated and determined with the capability to support both resident and migratory avifauna, with a total of 3526 avian individuals belonged to 83 species were successfully sighted within this urban mangrove ecosystem (Mojiol *et al*., 2008). Nevertheless, similar study was yet been conducted at UMS and other urban forests in Kota Kinabalu, hence there is lacking in relevant information on the given research topic. Past studies highlighted that urban forests provided shelter, food and water to both resident and migratory avifauna (Lee *et al*., 2004), and each avian individual played its part in maintaining local ecosystem in equilibrium (Peh et al., 2005). However, the existing habitat condition of an urban forest determines the presence of a given avian species in that area, as certain habitat requirements must be met for allowing the given species to inhabit and survive at the given habitat (Lerman *et al*. 2014). Therefore, present study was conducted as a preliminary assessment on the avian community that presented at the urban forest habitat of UMS.

METHODOLOGY

Study Site

Universiti Malaysia Sabah is hot and humid throughout the year, with annual rainfall and mean temperature of 2,700 mm and 28.0°C respectively. Forestry Complex of the Faculty of Science and Natural Resource (FSSA) that situated at 6° 2'9.28"N and 116° 7'34.63"E within UMS was selected as sampling area in present study. Four minor urban forest habitats that surrounded Forestry Complex were randomly selected for line transect establishment, such as the arboretum (Transect 1), stairway (Transect 2), roadside (Transect 3), and natural-regenerated forest (Transect 4) habitats. Arboretum

was planted with indigenous dipterocarp, fruit and exotic tree species, while the natural-regenerated forest was dominated by the Petai Belalang (*Leucaena leucocephala*). Various urban tree species were planted systematically (5 m gap between trees) at both sides of the stairway and roadside habitats. Sampling post was established for every 50 m along each transect (16 sampling posts in total), with 3 sampling posts per transect (Transect 1, 2 and 4 with 100 m in length each), except for the 300 m long Transect 3 (7 sampling posts), which was displayed as shown in **Figure 1.**

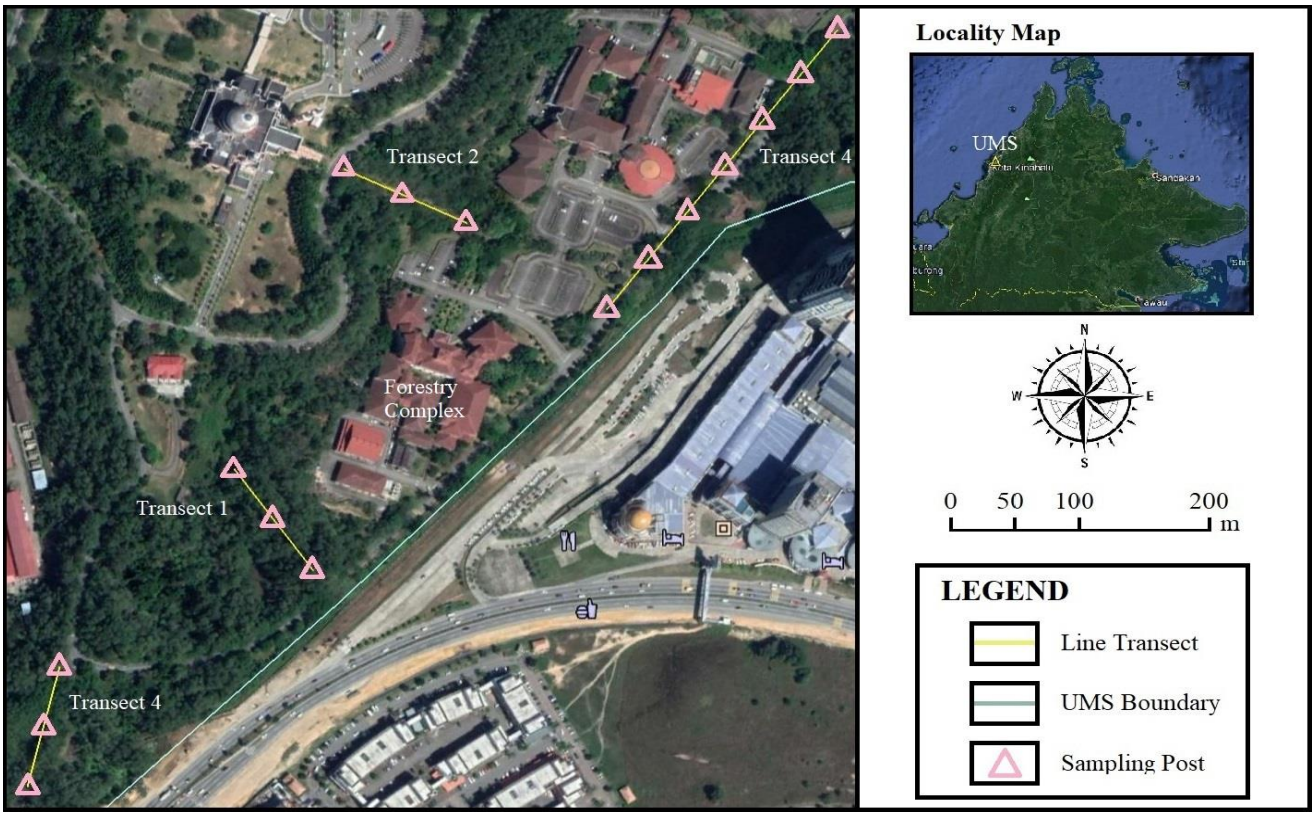

Figure 1. Locations of the Forestry Complex and the four established transects in Universiti Malaysia Sabah, Kota Kinabalu, Sabah.

Point-Count Survey

Point-count survey was conducted at the 16 sampling posts, from 4/03/2019 to 9/03/2019 (6 days) for 3 hours per day (9.00 am to 12.00 pm). A total of 10 minutes were spent at each sampling post for observing avian individuals that located within the range of 10 m radius from the sampling post (center) using a pair of binocular (10 × 50) (Mojiol *et al*., 2008), which was illustrated as shown in below **Figure 2.** Species of sighted avian individuals were identified at field using a pocket guide for Birds of Borneo (Francis, 2007). Besides that, number of individual, IUCN Red List status, encounter rate and relative abundance for each sighted avian species were determined. Shannon's (H') and Simpson's (D) Diversity Indices were estimated, and then Diversity t-test was applied to determine significance differences in species richness and evenness between the four transects in UMS using the statistical software PAST ver. 3.25 (Hammer *et al*., 2001). Additionally, ancillary data was collected as supportive data to present study, through visual assessment at each sampling post and along respective transects (Lerman *et al*., 2014; and Mojiol, 2018b).

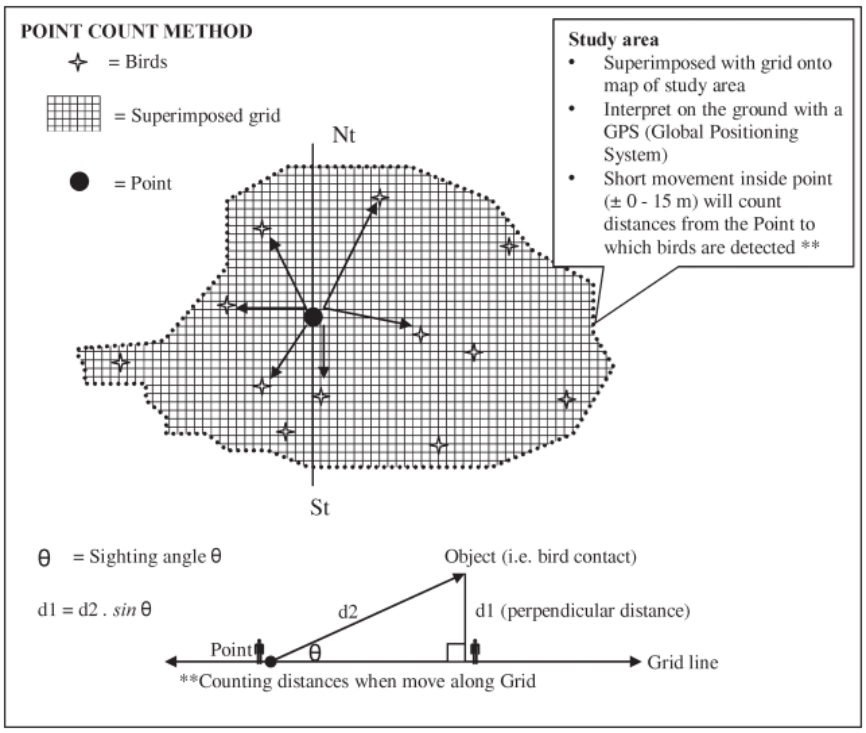

Figure 2. Point-count survey design. (Mojiol et al., 2008).

RESULT

Table 1 displays the recorded urban forest avifauna species during point-count survey in UMS. A total of 201 avian individuals from 46 species and 23 families were sighted throughout the 18 hours and 3.6 km of total sampling hour and distance respectively. About 11 or 6 avian individuals from any of the 46 identified species were expected to be sighted for every 1 hour or 100 m travelled in this urban forest habitat respectively. Siberian Blue Robin (*Larvivora cyane*), Brown Shrike (*Lanius cristatus*), Barn Swallow (*Hirundo rustica*), and Pipit (*Anthus sp.*) were the only four migratory species sighted in UMS (8.7% of 46 species). About 89.1 % of the sighted avian species (41 species) were least concerned (IUCN, 2019), except for near-threatened Nicobar Pigeon (*Caloenas nicobarica*), Streaked Bulbul (*Ixos malaccensis*) and Malaysian Blue Flycatcher (*Cyornis turcocus*), along with the vulnerable Wallace's Hawk Eagle (*Nisaetus nanus*) and Hook-billed bulbul (*Setornis criniger*) that were detected at arboretum (Transect 1), stairway (Transect 2) and natural-regenerated forest (Transect 4) habitats. Furthermore, Yellow-vented Bulbul (*Pycnonotus gioavier*) and Paddyfield Pipit (*Anthus rufulus*) with 3rd highest and the highest relative abundances (19.9 % and 5.97 % respectively) were common at Transect 3, whereas Dusky Munia (*Lonchura fuscans*) with the 2nd highest relative abundance (7.96 %) was commonly encountered at Transect 2.

Table 1. Recorded urban forest avian species during point-count survey in UMS.

Family	Scientific Name	Common Name	n	IUCN
Apodidae	*Aerodramus fuciphagus*	Edible-Nest Swiftlet	3	LC
	Aerodramus maximus	Black Nest Swiftlet	1	LC
	Apus nipalensis	House Swift	1	LC
	Collocalia esculenta	Glossy Swiftlet	2	LC
Columbidae	*Geopelia striata*	Zebra Dove	8	LC
	Columba livia	Rock Dove	1	LC
	Caloenas nicobarica	Nicobar Pigeon	1	NT

Table 1. Recorded urban forest avian species during point-count survey in UMS (Cont.)

Family	Scientific Name	Common Name	n	IUCN
Picidae	*Picoides moluccensis*	Brown-capped Woodpecker	1	LC
Cuculidae	*Zancostomus javanicus*	Red-billed Malkoha	5	LC
Alcedinidae	*Halycon pileata*	Black-capped Kingfisher	2	LC
	Alcedo atthis	Eurasian Kingfisher	1	LC
Accipitridae	*Nisaetus nanus*	Wallace's Hawk Eagle	2	VU
	Haliastur indus	Brahminy Kite	6	LC
	Haliaeetus leucogastor	White-bellied Sea Eagle	3	LC
	Accipiter trivirgatus	Crested Goshawk	3	LC
	Spilornis cheela	Crested Serpent Eagle	2	LC
Nectariniidae	*Aethopyga temminckii*	Temminck's Sunbird	1	LC
	Arachnothere juliae	Whitehead Spiderhunter	1	LC
	Arachnothera longirostra	Little Spiderhunter	11	LC
	Anthreptes malacensis	Brown-Throated Sunbird	1	LC
	Cinnyris jugularis	Olive-backed Sunbird	1	LC
Pycnonotidae	*Ixos malaccensis*	Streaked Bulbul	12	NT
	Pycnonotus goiavier	Yellow-vented Bulbul	12	LC
	Setornis criniger	Hook-billed Bulbul	3	VU
Estrildidae	*Lonchura fuscans*	Dusky Munia	16	LC
	Lonchura atricapilla	Chestnut Munia	1	LC
Vangidae	Hemipus picatus	Bar-winged Flycatcher-shrike	5	LC
Sturnidae	Aplonis payanensis	Asian Glossy Starling	4	LC
Passeridae	*Passer domesticus*	House Sparrow	8	LC
	Passer montanus	Eurasian Tree Sparrow	6	LC
Dicaeidae	*Prionochilus xanthopygius*	Yellow-rumped Flowerpecker	2	LC
	Dicaeum trigonostigma	Orange-bellied Flowepecker	5	LC
Aegithinidae	*Aegithina tiphia*	Common Iora	3	LC
Lannidae	*Lanius cristatus*	Brown Shrike	1	LC
Motacilidae	*Anthus rufulus*	Paddyfield Pipit	40	LC
	Anthus sp.	Pipit	1	LC
	Corvus macrorhynchos	Large-billed Crow	3	LC
Campephagidae	*Coracina fimbriata*	Lesser Cuckooshrike	3	LC
Muscicapidae	*Copsychus saularis*	Oriental Magpie-Robin	4	LC
	Larvivora cyane	Siberian Blue Robin	1	LC
	Cyornis turcocus	Malaysian Blue Flycatcher	1	NT
Hirundinidae	*Hirundo rustica*	Barn Swallow	6	LC
Eurylaimidae	*Cymbirhynchus macrorhynchos*	Black-and-Red Broadbill	1	LC
Cuculidae	*Centropus sinensis*	Greater Coucal	1	LC
Rhipiduridae	*Rhipidura javanica*	Pied Fantail	4	LC
Acanthizidae	*Gerygone sulphurea*	Golden Bellied Gerygone	1	LC

*Note: n = number of individual, IUCN = International Union for Conservation of Nature, LC = Least Concern, NT = Near-threatened, VU = Vulnerable.

The overall species richness and evenness of avian in UMS were 3.242 and 0.06745 respectively. Among the four transects, species richness of avian at Transect 2 (H' = 2.82) was significant higher than those of Transect 1 (H' = 2.303, p<0.05) and Transect 4 (H' = 1.992, p<0.05). Transect 2 was also very significantly higher in species richness and lower in species evenness of avian (D = 0.097) than those of Transect 3 (H' = 1.977, p<0.01; D = 0.2185, p<0.01). There were no significant differences in species richness and evenness of avian between Transect 1, Transect 3 and Transect 4 (p>0.05). Therefore, stairway habitat was inhabited by significantly higher variation of avian species than the other three habitats in UMS, and then. Then, species diversity and evenness of avian were found not significantly different between arboretum, natural-regenerated forest and roadside habitats as well. Table 2 displays the p-values for the significance test of difference in species diversity between the four established transects in UMS.

Table 2. P-values for significant test of difference in species diversity between transects in UMS.

Transect	Transect 1		Transect 2		Transect 3		Transect 4	
	H′	*D*	*H′*	*D*	*H′*	*D*	*H′*	*D*
Transect 1								
Transect 2	***0.0153**	0.05851						
Transect 3	0.09888	0.05521	****0.0**	****0.0075**				
Transect 4	0.1369	0.4359	****0.0**	0.1520	0.9333	0.2335		

*Note: H' = Shannon's Index, D = Simpson's Index, *p<0.05 = significant, **p<0.01 = very significant (Diversity t-test).

DISCUSSION

Present finding serves to provide a better understanding on the relationship between the habitat condition and avian community at the urban forest habitat in UMS. The avian species richness of the study site was situated within the value-range of 1.5 to 3.5, which indicated that UMS, as an urban forest, could house rich avian diversity that was comparable with that of a natural forest (Magurran, 2004). Nevertheless, avian individuals and species encountered at UMS in present study (201 and 36 respectively) are lower than those in KKWC (3526 and 83 respectively) as reported by Mojiol *et al.* (2008), despite that UMS and KKWC are located only about 6.0 km apart from one another. Since that longer sampling hours were spent (a total of 49 sampling hours) and larger sampling area were included in the past study, at the same time mangrove ecosystem was well-acknowledged as an important habitat for avifauna community (Mojiol *et al.*, 2008), which could be the reasons behind the higher avian encounter rate obtained by the past study at KKWC (72 individual per hour) than that of UMS in present study (11 individual per hour).

Moreover, available open space, food source availability, vegetation structure and composition played important roles in the shaping of avian diversity, composition and distribution at the urban forest ecosystem (Mojiol *et al*., 2008; and Lerman *et al*., 2014). In other words, presences of wide open space and high food source availability can be the main factors that lead to the presences of higher avian individual numbers and species diversity presented at the stairway (Transect 2) and roadside (Transect 3), unlike the arboretum (Transect 1) and natural-regenerated forest (Transect 4) habitats with low food source availability and narrow spaces between tree stands. However, the 4 migratory and 5 threatened species that were identified in present study were encountered either in Transect 1, 2 or 4, with Barn Swallow as the sole migratory avian species that could be detected at Transect 3 in present study. Lerman *et al.* (2014) emphasized that different species showed different preferences during habitat selection. Therefore, this finding suggested that urban forest habitats in UMS that are located away from road may serve as important shelters to both the threatened and migratory avian

species, most likely due to the fact that roadside urban forest habitat is disturbed by the daily human activity throughout the day, hence only adapted species will inhabit the given area.

CONCLUSION

The urban forest habitat of UMS houses rich avian diversity, especially at forested areas that are away from road. Not only UMS functions as a permanent habitat to a wide variety of resident avian species, at the same time it also provides shelter to several migratory and threatened avian species. Therefore, there is a need to conserve the urban forest habitat of UMS, so that local avian community will always have their habitats and shelters secured within the campus. However, the sampling area and hour employed in present study are limited, hence further research on the given topic is needed to be conducted in detail for the entire UMS, so that the relationship between habitat condition and avian community at UMS can be evaluated and understood in a more comprehensive manner.

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