Journal of Tropical Biology and Conservation 18: 321–332, 2021 ISSN 1823-3902
E-ISSN 2550-1909

Research Article

A Bird Survey of Sungai Kangkawat Research Station, Imbak Canyon Conservation Area, Sabah.

Nur Nadhirah Izzaty Selamat[1], Mohamad Fizl Sidq Ramji[1*], Hilda Jelembai Neilson Ilan[1], Ng Wen Teng[1], Anna Wong@Wong Yun Moi[2], Annabel Timothy Pianzin[2], Nor Atiqah Norazlimi[3], Nur Syamimi Makbul[4]

[1]Faculty of Resource Science and Technology, Universiti Malaysia Sarawak 94300 Kota Samarahan, Sarawak
[2]Faculty of Tropical Forestry, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah
[3]Department of Technology and Natural Resources, Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub, KM, Jalan Panchor, 84000, Muar, Johor
[4]Malaysian Nature Society Sabah Branch, P.O Box 12377, 88826, Kota Kinabalu

***Corresponding author:** rmfizl@unimas.my

Abstract

A bird survey was conducted at the Sungai Kangkawat Research Station (117°3′34.593″E, 5°4′29.187″N), Imbak Canyon Conservation Area (ICCA), Sabah from 5th until 8th October, 2018. The objective of this survey was to produce a preliminary checklist of bird species in the study area. The primary method used was mist-netting with occasional observation from vocal and visual identification. A total of 30 mist-nets were deployed for 11 hours (0630-1730 hr.) for four consecutive days with a final accumulation of 1840 net/hours. Overall, 59 species comprising 23 families were recorded throughout the survey. Of these, 114 individuals were netted representing 41 species from 13 families. The most abundant species caught was the Little Spiderhunter *Arachnothera longirostra* with 26 individuals. Additionally, 18 species from 10 different families were identified via opportunistic sighting and vocalisation. This includes one Critically Endangered (Helmeted Hornbill, *Buceros vigil*), three Vulnerable (i.e., Rhinoceros Hornbill *Buceros rhinoceros*, Large-billed Blue Flycatcher *Cyornis caerulatus* and Blue-headed Pitta *Pitta baudii* and 20 other Near-threatened species. Four endemic species were recorded namely the Bornean Blue Flycatcher *Cyornis superbus,* White-crowned Shama *Copsychus stricklandi*, Black-headed Pitta *Pitta ussheri* and Blue-headed Pitta *Pitta baudii*. We expect higher diversity of birds in ICCA because the species accumulation curve did not reach an asymptote until the last day of sampling. This suggests additional trapping effort with point counts along predetermined transects should be considered for future surveys.

Keywords: Birds survey, biodiversity, Imbak Canyon, mist-netting, endemic

Received 19 April 2020
Reviewed 05 June 2021
Accepted 05 July 2021
Published 15 October 2021

Introduction

The term biodiversity hotspots specifically refer to; currently 35 identified biological rich areas around the world that have lost at least 70 percent of their original habitat (Mittermeier et al., 2011). A biodiversity hotspot is a biogeographic region, playing a significant role to hold a large amount of biodiversity, as a reservoir, yet being knocked down with massive threats through anthropogenic activities, resulting in catastrophic population lost (Brooks et al., 2002; Mittermeier et al., 2011). Borneo Island is one of the eight hottest global biodiversity hotspots in Southeast Asia, along with Madagascar, Philippines, Brazil's Atlantic Forest, Caribbean, Indo-Burma, Western Ghats and Sri Lanka, and lastly, the Eastern Arc and Costal Forest of Tanzania or also known as Kenya (Dowksza, 2002). Being the third largest island in the world after Greenland and Guinea, with a size of more than half a million square kilometers, covering an area slightly larger area than Texas, Borneo is home to some of the world's most diverse rainforest and Southeast Asia's last intact forest with extraordinary biodiversity; habitat to marvelous creatures like the orangutans, clouded leopard and sun bears. Despite this richness, the forest of Southeast Asia still encounters dramatic changes due to human anthropogenic activities for over the past 40 years (Curran et al., 2004; Sodhi et al., 2004)

Sabah, is a Malaysian state that occupies part of the northern Borneo Island. It is famed with its 4,095 m tall Mount Kinabalu, Malaysia's highest peak, crowned with distinctive granite spires. Sabah is also known for its beaches, rainforest, coral reefs, and abundant wildlife, mostly within protected areas including parks and reserves. In total, there are 93 named protected areas in the State. The number seems many, with approximately 75% of the land area under forest cover but much of these experience high selective logging problems in various regeneration stages (Reynolds et al., 2011). Imbak Canyon Conservation Area (ICCA) was in 2009 gazetted as a protected area in Sabah, a Class I Forest Reserve that functions to safeguard water supplies, soil fertility and environmental quality. It is located 300km from Kota Kinabalu, at central Sabah and has an area of approximately 30,000 hectares of undisturbed forest, with a 25km long valley. ICCA provides numerous biodiversity and serves as an excellent field of study to many researchers around the world, linking two other protected areas, the Maliau Basin and Danum Valley conservation areas. ICCA is also the biggest pure lowland dipterocarp forest remaining in Sabah andserves as the water catchment area for the longest river in Sabah, the Kinabatangan River and its river system. Although these three areas are connected with each other, ICCA is different as it consists of undisturbed pristine lowland rainforest.

Birds are one of the biodiversity components and play an important role in maintaining a balanced ecosystem, providing numerous ecological services. Not only that, birds have been widely used by many researchers as they can act as effective biological indicators since they are able to respond quickly towards any changes that happen in their environment (Sodhi et al., 2005; Yap et al., 2007; Gilbert et al., 2018). According to Phillipps and Phillipps (2014) up until now, the recorded avifauna in Borneo is made up of at least 669 bird species of which 51 are endemic. Back in 2010, an unpublished record of an expedition is ICCA reported a total of 71 bird species including the Scarlet-rumped Trogon *Harpactes duvaucelii* and Oriental Bay Owl *Phodilus badius*. However, the data was considered as incomplete and needed more input, according to one of the participants (Emmor, 2011). This clearly shows that there are still limited bird studies to provide significant information in Sabah particularly in ICCA. Thus, the aim of this survey is to produce a preliminary checklist of the bird species that exist in the ICCA, Sabah.

Material and Methods

Study site

The study area is located at the eastern part of the canyon near Sungai Kangkawat and is named Sungai Kangkawat Research Station (117°3′34.593″E, 5°4′29.187″N). Sampling was conducted over four consecutive days from 5th until 8th October, 2018. Located to the north of Maliau Basin Conservation Area in central Sabah, the canyon encompasses a range of rainforest habitats within a 10 km long valley (250 m asl) where the Sungai Kengkawat Research Station is in the eastern part of the canyon near Kangkawat River (Figure 1).

Being one of the Yayasan Sabah Forest Management Areas in Central Sabah, Malaysia Borneo with an area of 30,000 ha, ICCA is one of the most important protected primary forests in Southeast Asia aside from Maliau Basin and Danum Valley conservation areas with an area of 588 km^2 and 438 km^2 respectively (Reynolds et al., 2011). The vegetation in and around the Sungai Kangkawat Research Station is predominantly characterised by a pristine lowland mixed dipterocarp forest. Other forest types located within walking distance of 2-10 km radius from the Kangkawat River comprise of upland mixed dipterocarp forest, riverine forest, lower montane kerangas forest and limestone forest. A logged over forest is located nearby about 0.5-1 km from the base camp site.

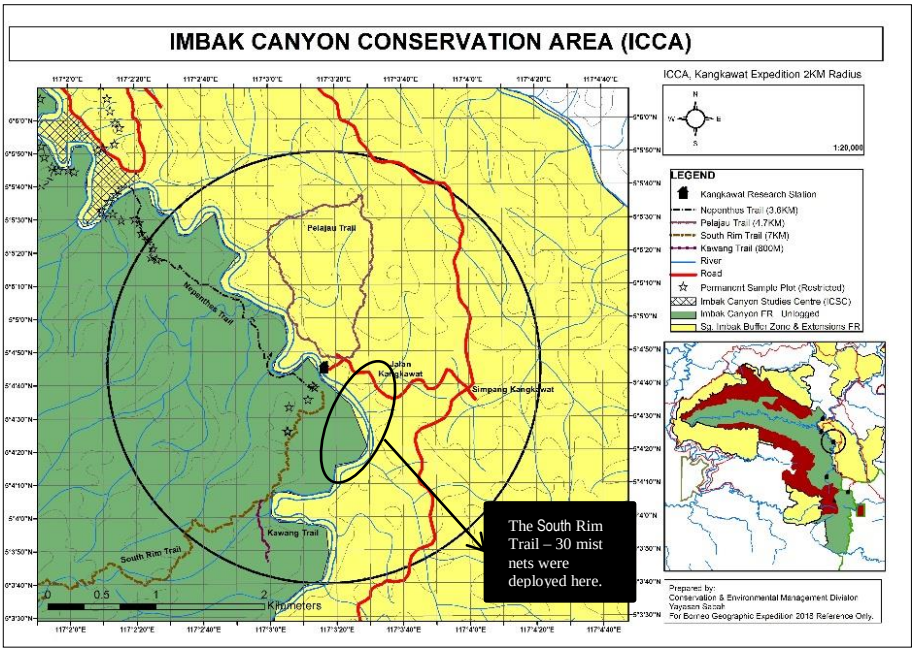


Figure 1 Map of Sungai Kangkawat Research Station. Mist nets were deployed at the South Rim Trail.

Data collection

Throughout the sampling period, a total of 30 understorey mist-nets (15m x 2.5m x 18mm mesh) were set up along the South Rim Trail at 100-150 m intervals and were checked at two hours interval. Twenty nets were left open for 11 hours (0630 - 1730 hr.) and another 10 nets were left open for 24 hours to trap fruit bats. All mist nets were set at least 0.5 m above the ground to reduce the risk of captured birds at the bottom shelf being exposed to ground-dwelling predators like monitor lizards (Arif & Mohd-Azlan, 2014). The total net effort for the mist netting was 1840 net hours.

Birds caught from the nets were immediately transferred into cloth bags prior to the banding and measuring process. Captured birds were measured on site and released immediately to avoid any casualties. Ten morphological characters were recorded, including tarsus (TR), bill length (BL), bill depth (BD), bill width (BW), head bill (HB), wing length (WL), wing span (WS), tail-anus (TA), total length (TL) and weight (W). All bill/feather-based characters were measured using a 30-cm stiff metal ruler and a Mitutoyo® digital caliper (Japan) while weight was measured using PESOLA ® light spring-loaded scales model (Switzerland); 50 g, 100 g and 300 g. In addition, molting (MO) and brood patch

(BP) stages were also noted (if any). The birds were ringed accordingly based on their tarsus size with custom aluminum rings. The reason of putting the ring on is so that any recaptured individuals would not be counted twice. All bill-related measurements were standardized to the nearest 0.01 mm. Birds were identified following Phillipps and Phillipps (2014) and Myers and Allen (2009). Additionally, opportunistic bird survey was also conducted via visual and aural observation.

Results and discussion

A combined total of 59 species from 24 different families were identified over four consecutive sampling days from 5th until 8th of October, 2018 (Table 1). Comparatively, 41 species were netted while and additional number of 18 species were recorded either by visual observation or vocalization. In detail, 113 individuals were netted and ringed to avoid any recaptured individuals being count twice (Arif & Mohd-Azlan, 2014).

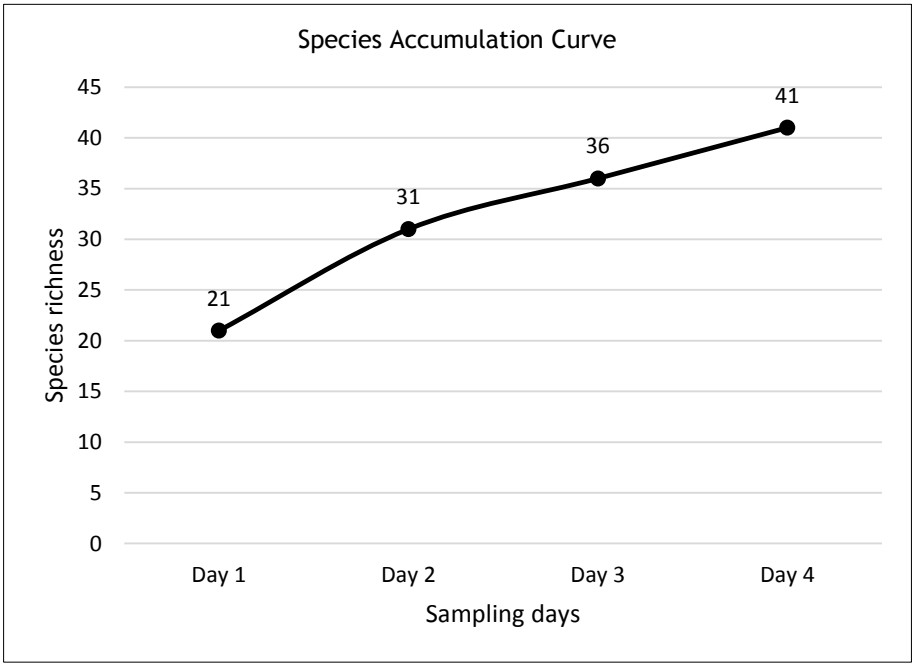


Figure 2. Species accumulation curve with number of species recorded during the sampling period.

Based on the species accumulation curve, a total of 21 species were recorded on the first day of sampling (Figure 2). On the second day, the list rose by 10 species, whilst another ten species were recorded on the final two days of

sampling. Although the species accumulation did not reach the asymptote, the curve nonetheless showed species addition the very final day of the sample period. This suggests that longer sampling period may provide a better insight of the bird diversity in ICCA.

The Little Spiderhunter *Arachnothera longirostra* was recorded as the most abundant species, with 26 individuals caught. This was followed by Grey-chested Jungle Flycatcher *Rhinomyias umbratilis*, Yellow-bellied Bulbul *Criniger phaeocephalus*, Scaly-crowned Babbler *Malacopteron cinereum*, and Rufous-winged Philentoma *Philentoma pyrhopterum*. The largest family was represented by Timaliidae which consists of 11 species such as the Black-capped Babbler *Pellorneum capistrataum*, Browned Fulvetta *Alcippe brunneicauda*, Rufous-crowned Babbler *Malacopteron magnum*, Scaly-crowned Babbler *Malacopteron cinereum*, Short-tailed Babbler *Trichastoma malaccense*, Sooty-capped Babbler *Malacopteron affine*, Striped-wren Babbler *Kenopia striata*, and White-chested Babbler *Trichastoma rostratum*. The second largest family was dominated by the Muscicapidae family with a total of 5 species recorded including the endemic Bornean Blue Flycatcher *Cyornis superbus*.

Taken collectively, the total number of species recorded during this survey was considerably modest given that the sampling period was only limited to four days. Our mist netting effort yielded a high abundance of understorey birds like the Bulbuls (Familiy: Timaliidae). This group of birds are shy ground-dwellers that occupy various forest types with favourable density of trees (Forshaw, 1991; Lindsell, 2001). A Siberian Blue Robin (Turdidae) known as a migratory insectivorous species breeding in Eastern Asia across to Japan, was netted.This species winters in South-east Asia including Peninsular Malaysia, Borneo and Thailand, in order to have a continuous diet of insects (Forshaw, 1991).

Some notable observations include the frequent calls of the Great Argus Pheasant *Argusianus argus* and Helmeted Hornbill *Buceros vigil* which were heard almost every day throughout our observation. Also, the Rhinoceros Hornbill *Buceros rhinoceros* was also sighted regularly throughout the sampling period. This indicates that ICCA serves as a high-quality habitat as these birds are known to be very sensitive towards habitat change. These interesting species were categorized as Critically Endangered (Helmeted Hornbill) and Vulnerable (Rhinoceros Hornbill) and (Great Argus Pheasant) on the IUCN (2021). This could probably be caused by difficulties in searching for suitable habitat as they are being threatened with extensive habitat loss and ongoing hunting pressure.

Table 1. The list of bird species recorded in Sungai Kangkawat Imbak Canyon Conservation Area (ICCA)

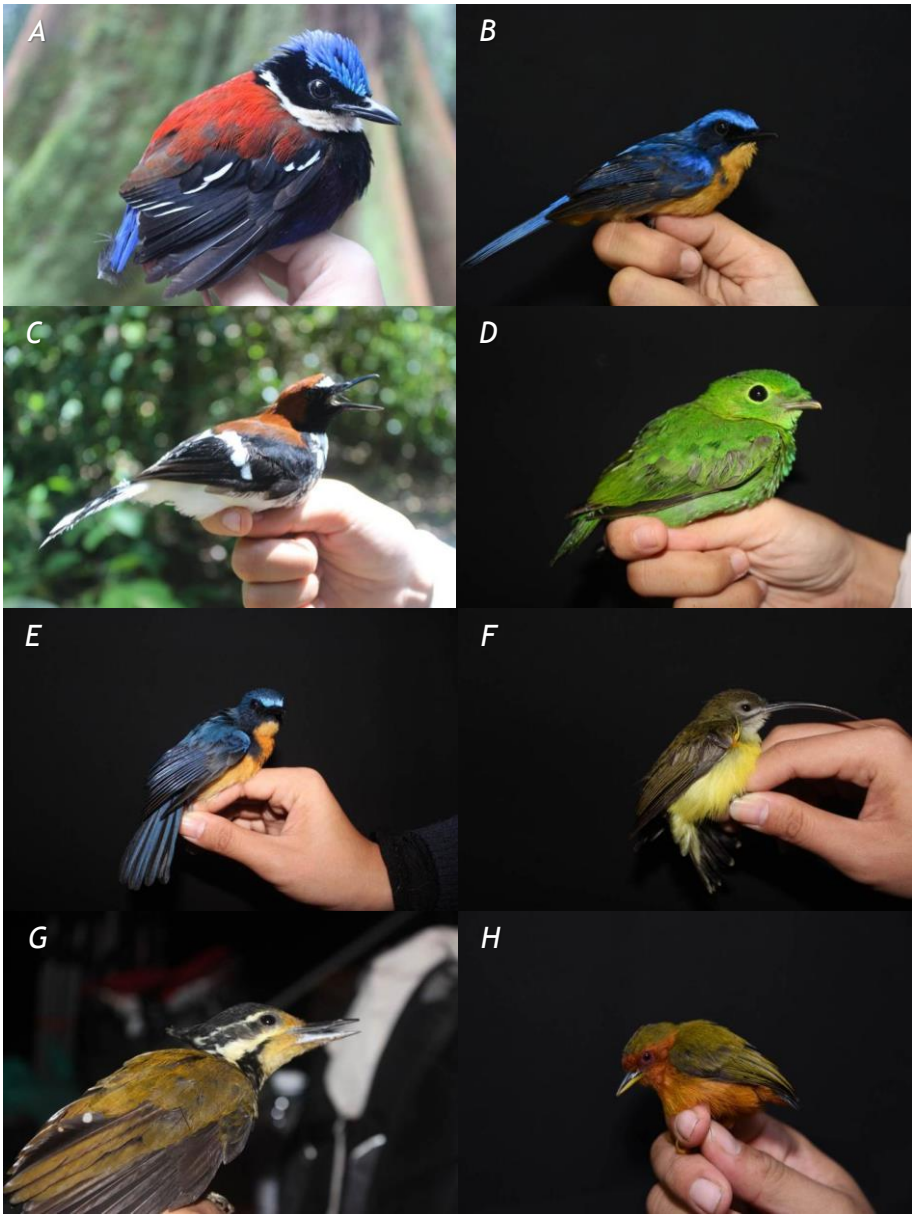
Family	Local Name	Scientific Name	WCE 1997	IUCN	Mn	Obs	Dist
Accipitridae	Crested Serpent Eagle	*Spilornis cheela*	P	LC	-	/	CR
Alcedinidae	Oriental Dwarf Kingfisher	*Ceyx erithaca*	NP	LC	1	-	CR
	Rufous-backed Kingfisher	*Ceyx rufidorsa*	NP	LC	4	-	CR
Bucerotidae	Helmeted Hornbill	*Buceros vigil*	P	CR	-	/	SR
	Rhinoceros Hornbill	*Buceros rhinoceros*	P	VU	-	/	LCR
Cisticolidae	Ashy Tailorbird	*Orthotomus ruficeps*	NP	LC	-	/	CR
Corvidae	Crested Jay	*Platylophus galericulatus*	NP	LC	-	/	CR
Dicaeidae	Yellow-breasted Flowerpecker	*Prionochilus maculatus*	NP	LC	2	-	R
Dicruridae	Greater Racquet-tailed Drongo	*Dicrurus paradiseus*	NP	LC	-	/	CR
Eurylaimidae	Black-and-red Broadbill	*Cymbirhynchus macrorhynchos*	NP	LC	-	/	CR
	Green Broadbill	*Calyptomena viridis*	NP	NT	2	-	CR
Irenidae	Asian Fairy-bluebird	*Irena puella*	NP	LC	-	/	CR
Megalaimidae	Blue-eared Barbet	*Megalaima australis*	NP	LC	-	/	CR
	Red-crowned Barbet	*Megalaima rafflesii*	NP	NT	-	/	CR
	Yellow-crowned Barbet	*Megalaima henricii*	NP	NT	-	/	SMR
Meropidae	Red-bearded Bee-eater	*Nyctyornis amictus*	NP	LC	-	/	CR
Monarchidae	Asian Paradise Flycatcher	*Terpsiphone paradisi*	P	LC	1	/	CR
	Pied Fantail	*Rhipidura javanica*	NP	LC	-	/	LR
	Spotted Fantail	*Rhipidura perlata*	NP	LC	2	-	LR
Muscicapidae	Bornean Blue Flycatcher	*Cyornis superbus*	NP	LC	2	-	E
	Grey-chested Jungle Flycatcher	*Rhinomyias umbratilis*	NP	NT	7	-	R
	Hill Blue Flycatcher	*Cyornis banyumas*	NP	LC	2	-	SR
	Large-billed Blue Flycatcher	*Cyornis caerulatus*	NP	VU	2	-	SR
	Rufous-tailed Jungle Flycatcher	*Rhinomyias ruficauda*	NP	LC	1	-	R
Nectariniidae	Little Spiderhunter	*Arachnothera longirostra*	NP	LC	26	-	CR
	Long-billed Spiderhunter	*Arachnothera robusta*	NP	LC	-	/	SR
	Purple-naped Sunbird	*Hypogramma hypogrammicum*	NP	LC	2	-	CR
Phasianidae	Crested Partridge	*Rollulus rouloul*	P	NT	-	/	CR
	Great Argus Pheasant	*Argusianus argus*	P	VU	-	/	LRF

(Continued on next page)

Table 1. (Continued)

Picidae	Buff-necked Woodpecker	*Meiglyptes tukki*	NP	NT	1	-	CR
	Maroon Woodpecker	*Blythipicus rubiginosus*	NP	LC	1	/	CR
	Olive-backed Woodpecker	*Dinopium rafflesii*	NP	NT	1	-	SR
	Rufous Piculet	*Sasia abnormis*	NP	LC	2	-	CR
Pittidae	Black-crowned Pitta	*Pitta ussheri*	NP	NT	-	/	LE
	Blue-headed Pitta	*Pitta baudii*	P	VU	1	/	LE
	Garnet Pitta	*Erythropitta granatina*	NP	NT	1	-	LR
Pycnonotidae	Grey-cheeked Bulbul	*Alophoixus tephrogenys*	NP	VU	2	-	CR
	Hairy-backed Bulbul	*Tricholestes criniger*	NP	LC	2	-	CR
	Yellow-vented bulbul	*Pycnonotus goiavier*	NP	LC	1	-	CR
	Yellow-bellied Bulbul	*Criniger phaeocephalus*	NP	LC	6	-	LR
Sturnidae	Hill Myna	*Gracula religiosa*	P	LC	-	/	CR
Timaliidae	Black-capped Babbler	*Pellorneum capistrataum*	NP	LC	1	-	CR
	Brown Fulvetta	*Alcippe brunneicauda*	NP	NT	2	-	CR
	Rufous-crowned Babbler	*Malacopteron magnum*	NP	NT	2	-	CR
	Scaly-crowned Babbler	*Malacopteron cinereum*	NP	LC	6	-	CR
	Short-tailed Babbler	*Trichastoma malaccense*	NP	NT	1	-	CR
	Sooty-capped Babbler	*Malacopteron affine*	NP	NT	4	-	CR
	Striped-wren Babbler	*Kenopia striata*	NP	NT	1	-	SR
	White-chested Babbler	*Trichastoma rostratum*	NP	NT	1	-	cr
	Grey-headed Babbler	*Stachyris poliocephala*	NP	LC	1	-	LR
	Chestnut-rumped Babbler	*Stachyris maculata*	NP	NT	3	-	CR
	Chestnut-winged Babbler	*Stachyris erythroptera*	NP	LC	3	/	CR
Trogonidae	Scarlet-rumped Trogon	*Harpactes duvaucelii*	NP	NT	3	-	LLR
Turdidae	Chestnut-naped Forktail	*Enicurus ruficapillus*	NP	NT	1	-	LR
	Siberian Blue Robin	*Luscinia cyane*	NP	LC	2	-	SWV
	White-crowned Forktail	*Enicurus leschenaulti*	NP	LC	1	-	LR
	White-crowned Shama	*Copsychus stricklandi*	NP	LC	3	/	CE
Tytonidae	Oriental Bay Owl	*Phodilus badius*	P	LC	1	-	SR
Vangidae	Rufous-winged Philentoma	*Philentoma pyrhopterum*	NP	LC	5	-	LR

*Note that WCE 1997 = Wildlife Conservation Enactment, P = Protected, NP = Not Protected, IUCN = IUCN Red Data list (2021-1); NE = Not Evaluated, DD = Data Deficient, LC = Least Concern, NT = Near Threatened, V = Vulnerable, EN = Endangered, CR = Critically Endangered, EW = Extinct in the Wild and EX = Extinct. Mn. = Number of individuals mist-netted, Obs = Species recorded by observation, Dist = Distribution, CR = Common Resident, SR = Scarce Resident, LCR = Locally Common Resident, R = Resident, SMR = Sub montane Resident, *E = Endemic, LR = Local Resident, SWV = Scarce Winter Visitor, CE = Common Endemic, LRF = Local Resident Forest, LLR = Lowland Resident*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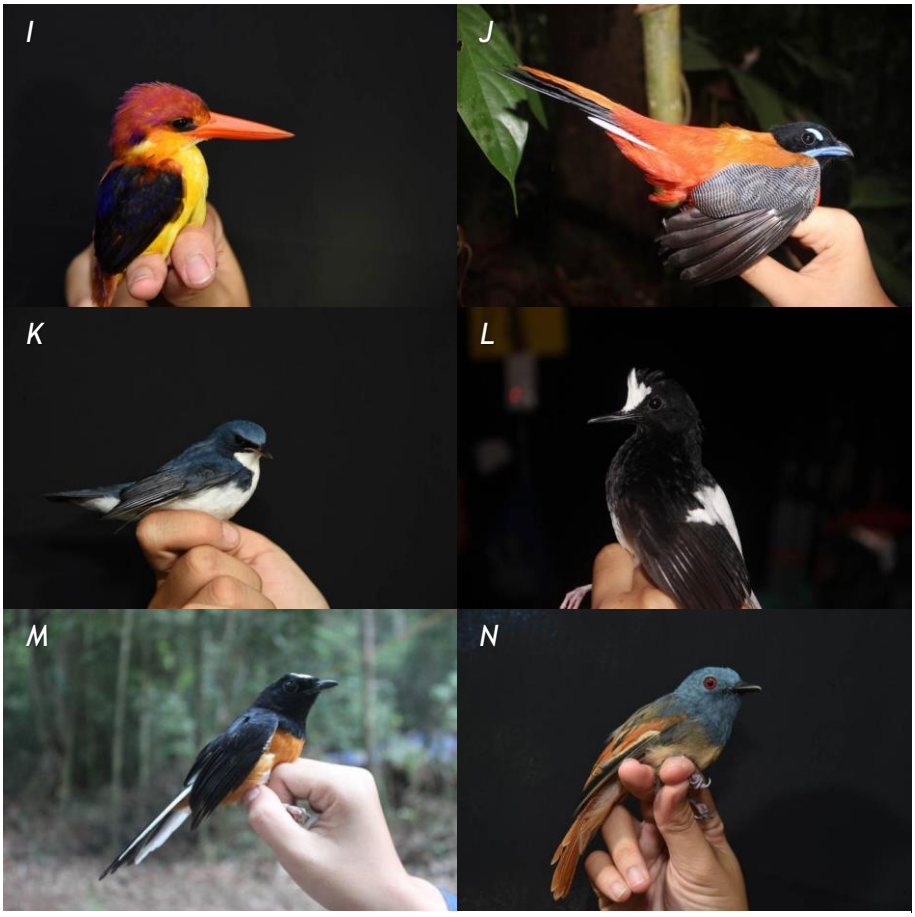

Figure 3. A) Blue-headed Pitta, B) Bornean Blue Flycatcher, C) Chestnut-naped Forktail D) Green Broadbill E) Hill Blue Flycatcher F) Little Spiderhunter G) Olive-backed Woodpecker H) Rufous Piculet I) Rufous-backed Kingfisher J) Scarlet-rumped Trogon K) Siberian Blue Robin L) White-crowned Forktail M) White-crowned Shama N) Rufous-winged Philentoma

Conclusion and Recommendation

The Imbak Canyon Conservation Area is a critical area for bird conservation because the protected areas remain intact as a high-quality habitat. This ensures that ICCA as a whole continues to support a large number of significant endemics and rare species like the Helmeted Hornbill, Garnet Pitta, Blue-headed Pitta, Great Argus and White-rumped Shama. Higher bird richness was expected within ICCA if a longer sampling period is considered. This was supported by the species accumulation curve that depicted an increasing curve until the last day of sampling. Future sampling efforts should include comprehensive bird surveys

with ecological perspectives including temporal and spatial considerations of the bird community in the upper-storey and forest canopy. Furthermore, multiple sampling strategies that incorporate canopy mist-netting method with visual sightings and aural survey recordings should be considered to increase capture rate and sampling efficiency.

Acknowledgment

The authors would like to thank Universiti Malaysia Sabah for the opportunity given to conduct this research under the financial support (Grant No. SDK0043-2018), Sabah Biodiversity Council for the access license Ref. JKM/MBS.1000-2/1JLD.3 (246), Imbak Canyon Management Committee for research permission, and Yayasan Sabah's staffs and rangers for assistance and support in the field; in memory of Suzery Abiri.

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