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**Research Article**

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## **Rapid Assessment of Nocturnal Sciurid and Avifauna Diversity in Kadamaian - Kinabalu Park for Ecotourism Potential**

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### **Abstract**

A rapid assessment of sciurids and avifauna was done from 14<sup>th</sup> October 2020 - 20<sup>th</sup> October 2020 in Kadamaian - Kinabalu Park, Kota Belud, Sabah. Two sets of binoculars (Swarovski 8x30 and Bushnell 10x42) and two sets of Digital SLR cameras affixed with telephoto lens (Canon 7D; Tamron 150-600mm G2 F/4-6.3 and Nikon D500; Nikkor 200-500mm F/5.6) were used to aid in data collections. This assessment managed to record 5 species of Sciurids and 58 species of Avifauna in and around the Kadamaian-Kinabalu Park. Continuous biodiversity surveys are crucial in Kadamaian - Kinabalu, Sabah to maximize the potential ecotourism opportunity.

**Keywords:** canopy mammals, birds, gliding squirrels, ecotourism potential

### **Introduction**

Kadamaian-Kinabalu Park is located in Kota Belud district, west coast of Sabah. It comprises lowland forest and montane forest with pristine rivers, hills and waterfalls. In 2015, Kadamaian Tourism Association (KATA) was established in order to empower Kadamaian as a tourism product. And in early 2019, the Asean Community Based Tourism Standard 2019-2021 award was given to KATA at the Asean Tourism Ministers' Conference in Hanoi, Vietnam (New Straits Times, 2019).

Sciurids are classified under the order Rodentia and Family Sciuridae. Southeast Asia held the greatest diversity of squirrels followed by Africa (Koprowski & Nandini, 2008). Squirrels can be divided into three categories; diurnal tree squirrels, nocturnal gliding squirrels and ground squirrels. Tropical squirrels are seed predators and seed dispersers (Hallwachs 1986; Smythe 1989; Paschoal & Galetti, 1995) as well as agents of pollination. Apart from that, tree squirrels are included in the diet of large avian predators and small carnivores (Datta & Nandini, 2015).

Gliding squirrel is elusive, cryptic and unique animals that are often overlooked by people as they are nocturnal and arboreal. Gliding squirrel's watching is an activity that can be done in wildlife tourism package. There are at least 8 species of gliding squirrels that can be found in Kadamaian - Kinabalu Park area (Phillipps & Phillipps, 2018). Thus, this rapid assessment was conducted to assess ecotourism potential through gliding squirrels' watching activity in the Kadamaian - Kinabalu Park, while avifaunal survey is a secondary objective of this sampling event. The assessment will be followed with a few other visits in order to i) create a checklist on nocturnal non-volant small mammals diversity; and ii) to add them to the growing checklist of avifauna in and around Kadamaian - Kinabalu Park.

## **Methodology**

This rapid assessment was conducted for a total of 7 days; from the 14<sup>th</sup> to 20<sup>th</sup> October, 2019. Sampling was carried out via line transect with a total 1.5 km using direct observation method either through sight and/or vocalisation to record species presence. The trail is accessible and can be access by local communities and tourists. The assessment was focused on nocturnal sciurids, hence surveyors started the assessment before dark at 1600 hours to late night at 0200 hours each day. Two sets of binoculars (Swarovski 8x30 and Bushnell 10x42) and two sets of Digital SLR cameras affixed with telephoto lens (Canon 7D; Tamron 150-600mm G2 F/4-6.3; Nikon D500; Nikkor 200-500mm F/5.6) were used to aid in data collection. Sciurids were identified according to Payne et al. 1985; Carleton and Musser, 2005; Thorington Jr et al., 2012; Phillipps and Phillipps, 2016 while Phillipps and Phillipps, 2016 was used for bird identifications and its corresponding naming system. As for bird vocalisation, unfamiliar bird calls were recorded and compared to online repository (xeno-canto.org) for further identification off-site. As all birds have unique and distinct calls, the surveyor could easily distinguish and differentiate the birds up to species level as well.

## Results and Discussion

### *Sciuridae*

The rapid assessment managed to record a total of 5 species of sciurid from 4 genera which includes two species of gliding squirrels and three species of non-gliding squirrels. Four of these sciurid were listed as Least Concern (LC) while one species was listed as Data Deficient (DD).

Table 1. Taxonomic checklist for sciurids

Taxonomy	Common name	IUCN
<b>Order: Rodentia</b>		
<b>Family: Sciuridae</b>		
<i>Petaurista petaurista</i>	Red giant gliding squirrel	LC
<i>Aeromys tephromelas</i>	Black gliding squirrel	DD
<i>Callosciurus prevostii</i>	Prevost's squirrel	LC
<i>Callosciurus notatus</i>	Plaintain squirrel	LC
<i>Sundasciurus lowii</i>	Low's squirrel	LC

\*Note:

Observation Type;

S: Direct sighting on the individual using naked eyes/binoculars/cameras

V: Observation through vocalisation of the individuals

IUCN Red List Categories:

EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU -

Vulnerable, LR/cd - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt

- Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk, least concern)

As there are about 13 species of gliding squirrels in Borneo and 3 species are endemic to Borneo (Phillips & Phillips, 2016), this rapid assessment shed light on the distribution of these mammals in Borneo. Weather was a strong factor in influencing the sampling results. Weather conditions such as rain affect the rate of capture of non-volant small mammals (Gentry et al., 1966). The survey was done during the rainy season in Kadamaian - Kinabalu Park. Sciurids and avifauna were inactive and have a higher tendency to be in their nests during this weather condition.

### *Species Account of the Sciurids*

#### 1. Red giant gliding squirrel - *Petaurista petaurista* (Pallas, 1766)

Phillips and Phillips (2016) mentioned this species is the most common gliding squirrel that can be found in all types of lowlands to 900m altitude forests in Borneo. Throughout Malaysia, it is also the species that can be found easily in forest. They are easily spotted because of their size and colour. Recent findings on the ecology of this species include limestone habitat usage (Miard et al., 2020). Although this species is still listed as Least Concern (LC) by the IUCN Red List of Threatened Species (Duckworth, 2016), threats such as habitat loss is still

looming throughout their distribution. This species was found in Kipungit trail (No.2).

2. Black gliding squirrel - *Aeromys tephromelas* (Günther, 1873)

Although this species is widespread in Borneo, its occurrence is scarce and little is known about it. This species is smaller in size compared to the red giant gliding squirrel and the colour of its body is full black. It is listed as Data Deficient under the IUCN Red List of Threatened Species (Lee, 2016). This species was found in Nopungguk trail (No.1).

3. Prevost's squirrel - *Callosciurus prevostii* (Desmarest, 1822)

One of the beautiful squirrels in Borneo, this species is diverse in its subspecies throughout Borneo and all have orange or rufous belly. Occasionally found in tall secondary forests and orchards near the forest, this study found five individuals on the same tree foraging with Plainain squirrel. The squirrel was seen on 0536 in the evening. It can be found in tall and secondary forests, orchards that are close to forest. It is diurnal and arboreal, rarely seen on the ground. Its favoured diet is ripe fruit. The IUCN Red List of Threatened Species list them as Least Concern (Cassola, 2016).

4. Plainain squirrel - *Callosciurus notatus* (Boddaert, 1785)

One of the most common squirrels in Peninsular Malaysia and Borneo and is well adapted to habitat changes. This species can be found in cultivated areas, disturbed forests, secondary forests, coastal forests, gardens and plantations. This is also the only squirrel that can easily adapt to oil palm and rubber plantations (Phillipps & Phillipps, 2016). In Borneo, it can only be distinguished from *C. adamsi* by the absence of white spot behind the ear and pale rufous underparts. It was found on 0534 on the neighbouring tree of which Prevost's squirrel was found. It is listed as Least Concern by the IUCN Red List of Threatened Species (Duckworth, 2016).

5. Low's squirrel - *Sundasciurus lowii* (Thomas, 1892)

The most common resident in primary and secondary lowland forests of Borneo, this species is always found foraging from the ground to subcanopy. Its distribution overlaps with Brooke's squirrel in the montane forest. It can be differentiated from Brooke's squirrel by its white belly and shorter, bushy, plain thicker tail. It was found on 0534 on the same tree with *C. Notatus*. The IUCN Red List of Threatened Species list it as Least Concern (Meijaard, 2016).

### ***Avifauna***

A total of 58 species of birds from 28 families were recorded during this assessment in and around Kadamaian-Kinabalu Park. Fifty four species are resident, one migrant and three are endemic to Borneo. Forty seven species are recognised as Least Concern (LC) while nine are listed as Near-Threatened (NT) and two Vulnerable (VU) species by the International Union for Conservation of Nature (IUCN) RedList.

As most birds are more active and forage during the early morning and late evenings, surveyors were only able to sample birds during the evening session, right before nightfall.

### ***Selected Species Accounts for Avifauna***

Most of the birds recorded during this assessment are common resident in Borneo and have Least Concern (LC) status globally. However, 19% of the total birds recorded are of global conservation concern based on the IUCN Red List of Threatened Species. This includes two species of Hornbills (Bucerotidae) i.e the Wreathed Hornbill and Rhinoceros Hornbill which are listed as Vulnerable (VU); and the rest are classified as Near-Threatened (NT) including the Bornean Falconet, Chestnut-collared Kingfisher, Yellow-crowned Barbet, Red-crowned Barbet, Black-and-Yellow Broadbill, Green Broadbill, Streaked Bulbul, Short-tailed Babbler and the Rail-Babbler.

Apart from globally threatened and Near-threatened, those species that were listed above are among the birds that are desirable by bird-watchers and bird photographers (pers.obs.). Bird enthusiasts will travel at great-length to complete their lifer list which will contribute to the ecotourism potential of the study area.

Table 2. Taxonomic checklist for Avifauna

No	Family	Species	Common Name	Obs	Status	IUCN
1	Accipitridae	<i>Spizaetus cirrhatus</i>	Changeable Hawk-Eagle	S	R	LC
2		<i>Spilornis cheela</i>	Crested Serpent Eagle	S	R	LC
3		<i>Accipiter trivirgatus</i>	Crested Goshawk	S	R	LC
4	Falconidae	<i>Microhierax latifrons</i>	Bornean Falconet	S	E	NT
5	Columbidae	<i>Streptopelia chinensis</i>	Spotted Dove	S,V	R	LC
6		<i>Chalcophaps indica</i>	Emerald Dove	S	R	LC
7		<i>Treron vernans</i>	Pink-necked Green Pigeon	S,V	R	LC
8	Psittaculidae	<i>Loriculus galgulus</i>	Blue-crowned Hanging Parrot	S,V	R	LC
9	Cuculidae	<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo	V	R	LC
10		<i>Cacomantis merulinus</i>	Plaintive Cuckoo	V	R	LC
11		<i>Surniculus lugubris</i>	Drongo Cuckoo	V	R	LC
12		<i>Centropus bengalensis</i>	Lesser Coucal	S	R	LC
13		<i>Phaenicophaeus chlorophaeus</i>	Raffles's Malkoha	S	R	LC
14	Strigidae	<i>Ketupa ketupu</i>	Buffy Fish Owl	V	R	LC
15		<i>Ninox scutulata</i>	Brown Hawk-Owl	V	R	LC
16	Caprimulgidae	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar	V	R	LC
17	Apodidae	<i>Hemiprocne longipennis</i>	Grey-rumped Treeswift	S	R	LC
18	Alcedinidae	<i>Actenoides concretus</i>	Chestnut-collared Kingfisher	V	R	NT
19	Bucerotidae	<i>Rhyticeros undulatus</i>	Wreathed Hornbill	S	R	VU
20		<i>Buceros rhinoceros</i>	Rhinoceros Hornbill	S,V	R	VU
21	Ramphastidae	<i>Megalaima henricii</i>	Yellow-crowned Barbet	V	R	NT
22		<i>Megalaima chrysopsis</i>	Golden-faced Barbet	V	E	LC
23		<i>Megalaima rafflesii</i>	Red-crowned Barbet	V	R	NT
24	Picidae	<i>Picus miniaceus</i>	Banded Woodpecker	S	R	LC

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Table 2. (continued)

25	Eurylaimidae	<i>Eurylaimus ochromalus</i>	Black-and-Yellow Broadbill	V	R	NT
26		<i>Eurylaimus javanicus</i>	Banded Broadbill	V	R	LC
27		<i>Cymbirhynchus macrorhynchos</i>	Black-and-Red Broadbill	V	R	LC
28		<i>Calyptomena viridis</i>	Green Broadbill	V	R	NT
29	Campephagidae	<i>Hemipus hirundinaceus</i>	Black-winged Flycatcher-Shrike	S	R	LC
30	Sittidae	<i>Sitta frontalis</i>	Velvet-fronted Nuthatch	S	R	LC
31	Laniidae	<i>Lanius cristatus</i>	Brown Shrike	S	M	LC
32	Irenidae	<i>Irena puella</i>	Asian Fairy Bluebird	S	R	LC
33	Dicruridae	<i>Dicrurus aeneus</i>	Bronzed Drongo	S	R	LC
34	Gisticolidae	<i>Orthotomus sericeus</i>	Rufous-tailed Tailorbird	S,V	R	LC
35	Pycnonotidae	<i>Pycnonotus atriceps</i>	Black-headed Bulbul	S	R	LC
36		<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul	S	R	LC
37		<i>Pycnonotus brunneus</i>	Red-eyed Bulbul	S	R	LC
38		<i>Ixos malaccensis</i>	Streaked Bulbul	S	R	NT
39	Timaliidae	<i>Trichastoma malaccense</i>	Short-tailed Babbler	V	R	NT
40		<i>Trichastoma sepiarium</i>	Horsfield's Babbler	V	R	LC
41		<i>Malacopteron magnirostre</i>	Moustached Babbler	S	R	LC
42		<i>Stachyris erythroptera</i>	Chestnut-winged Babbler	V	R	LC
43		<i>Macronus bornensis</i>	Bold-striped Tit-Babbler	V	R	LC
44	Eupetidae	<i>Eupetes macrocerus</i>	Rail-Babbler	V	R	NT
45	Vireonidae	<i>Erpornis zantholeuca</i>	White-bellied Erpornis	S	R	LC
46	Zosteropidae	<i>Zosterops everetti</i>	Everett's White-Eye	S	R	LC
47	Muscicapidae	<i>Copsychus saularis adamsi</i>	Oriental Magpie Robin	S	R	LC
48		<i>Copsychus stricklandi</i>	White-crowned Shama	S	R	LC

(Continued on next page)

Table 2. (continued)

49	Monarchidae	<i>Terpsiphone paradisi</i>	Asian Paradise-Flycatcher	S, V	R	LC
50		<i>Rhipidura perlata</i>	Spotted Fantail	S	R	LC
51		<i>Hypothymis azurea</i>	Black-naped Monarch	S, V	R	LC
52	Dicaeidae	<i>Dicaeum cruentatum</i>	Scarlet-backed Flowerpecker	S	R	LC
53		<i>Dicaeum trigonostigma</i>	Orange-bellied Flowerpecker	S	R	LC
54		<i>Prionochilus maculatus</i>	Yellow-breasted Flowerpecker	S	R	LC
55	Nectariniidae	<i>Nectarinia jugularis</i>	Olive-backed Sunbird	S	R	LC
56		<i>Arachnothera hypogrammicum</i>	Purple-naped Spiderhunter	S	R	LC
57		<i>Arachnothera longirostra</i>	Little Spiderhunter	S	R	LC
58		<i>Arachnothera everetti</i>	Bornean Spiderhunter	S	E	LC

\*Note:

Observation Type (Obs);

S: Direct sighting on the individual using naked eyes/binoculars/cameras

V: Observation through vocalisation of the individuals which are either identified on site, or recorded and compared to online repository (*Xeno-canto.org*).

Migratory Status (Status):

R- Resident, breed and spend life history within Borneo;

M-Migrant, visits Borneo during cold months in area of origin, or passage migrant in which they spend time in Borneo before departing further south or north;

E-Endemic, can only be found on the island of Borneo or part of it.

IUCN Red List Categories (IUCN):

EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU -

Vulnerable, LR/lc - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt

- Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower

Risk, least concern)



1. Wreathed Hornbill *Rhyticeros undulatus* Shaw, 1811

A local resident species, widespread but scarce and may be locally common in suitable habitats in Borneo. This is one of the larger species of Hornbills found in the region apart from Wrinkled Hornbill (*Aceros corrugatus*), Rhinoceros Hornbill (*Buceros rhinoceros*) and Helmeted Hornbill (*Rhinoplax virgil*) (Phillips & Phillips, 2016). This species of Hornbill is semi-nomadic and has a wide range, foraging in big flocks and roosts communally (Myers, 2009). This is also the only hornbill species found at higher elevations up to 3,300m a.s.l in Mount Kinabalu, with preference at hill forests (Phillips & Phillips, 2016). An arboreal frugivores which feeds primarily on figs and other fruits, as well as invertebrates including snails and other small vertebrates (Smythies et al., 2000). This species is protected in Sabah under the Wildlife Conservation Enactment.

2. Rhinoceros Hornbill- *Buceros rhinoceros* Linnaeus, 1758

Another larger species of resident hornbill, the Rhinoceros Hornbill is locally common throughout forests in Borneo, but are heavily hunted traditionally by the locals (Phillips & Phillips, 2016). This species prefer the lowland areas of the primary forest, but can be found up to 1,750m a.s.l (Myers, 2009). This species are usually found in pairs, or with a juvenile. However they do flock outside of breeding season. They usually forage at the top canopy layer and the emergent, and call with a distinct barking-like sound usually before taking off-flights. Feeds primarily on figs and other fruits but also consume large insects, spiders, lizards and eggs (Myers, 2009). Like the Wreath Hornbill, this species is also protected in Sabah under the Wildlife Conservation Enactment.

3. Borneon Falconet - *Microhierax latifrons* Sharpe, 1879

One of the smallest birds-of-prey in the world, the Borneon Falconet is also endemic to Sabah. This species prefers forest edges and open-areas, and can also be found in primary and secondary lowland forests (Myers, 2009). Phillips and Phillips (2016) claim this species is widespread in Sabah, and is more commonly found in hilly areas. As the name suggests, this bird is a predator and prefers to sally-hunt insects and small vertebrates (Smythies et al., 2000).

4. Chestnut-collared Kingfisher - *Actenoides concretus* (Temminck, 1825)

A species of forest kingfisher that inhabits dense primary lowland forest up to 1650 m a.s.l (Smythies, 1999; Myers, 2009). This species is usually found in the middle to lower storey (Smythies, 1999), by still-perching and usually unobtrusive while hunting for large invertebrates and vertebrates usually from the ground (Myers, 2009). It is the commonest Kingfisher in the hills and submontane areas (Phillips & Phillips, 2016) and is one of the kingfisher species

that can be found far from water-bodies such as streams and rivers (Smythies et al., 2000; Myers, 2009).

5. Yellow-crowned Barbet - *Megalaima henricii* (Temminck, 1831)

This species of Barbet is more commonly found in hills and submontane areas throughout Borneo up to 1,200m a.s.l before being replaced by the Golden-naped Barbet (*Megalaima pulcherrima*) at the ecotone and montane forest (Phillips & Phillips, 2016). They are more often heard rather than seen due to their behaviour of spending time on the crown of trees at the upper storey foraging for food while giving out loud distinct calls.

6. Red-crowned Barbet - *Megalaima rafflesii* (Lesson, 1839)

A locally common resident throughout Borneo especially at disturbed areas and degraded forests (Smythies et al., 2000; Phillips & Phillips, 2016). Similar to most other species of Barbets, they are typically known as arboreal frugivores where diets may include figs, berries and occasionally grubs (Smythies et al., 2000).

7. Black-and-Yellow Broadbill - *Eurylaimus ochromalus* (Raffles, 1822)

One of the most common Broadbill found in the region and exists in most habitats up to 1,200m a.s.l (Myers, 2009; Phillips & Phillips, 2016). This species flocks in groups and feed on smaller prey especially insects from the middle-storey to upper-storey and crowns. Smythies (1999) noted the behaviour of this species occupying a look-out perch before sallying for insects in the foliage. Calls are distinguishable from other birds but may be mistaken to the call of its sister species, the Banded Broadbill (*Eurylaimus javanicus*).

8. Green Broadbill - *Calyptomena viridis* (Raffles, 1822)

A common resident throughout Borneo up to 1,200m a.s.l where it exists in mixed dipterocarp forest and overgrown plantations (Myers, 2009). This species is more common among the other green broadbills that is endemic in Borneo including Hose's Broadbill (*Calyptomena hosii*) and Whitehead's Broadbill (*Calyptomena whiteheadi*) (Phillips & Phillips, 2016). They prefer the lower strata and primarily consume fruits, palms and figs (Smythies et al., 2000).

9. Streaked Bulbul - *Ixos malaccensis* (Blyth, 1845)

An uncommon resident throughout Borneo, this species exists in primary and secondary dipterocarp and lower montane forests up to 1,300m a.s.l (Myers, 2009). It is an arboreal frugivore and insectivore, and flocks at fruiting trees with other species of birds (Phillips & Phillips, 2016).

10. Short-tailed Babbler - *Trichastoma malaccense* (Hartlaub, 1844)

A common resident throughout Borneo that inhabits the primary and secondary lowland dipterocarp, peatswamp, plantations and hill forests up to 1,600m a.s.l (Myers, 2009; Phillips & Phillips, 2016). This species is a terrestrial babbler, where it prefers the understorey and forages invertebrates including insects such as ants, black beetles and grasshoppers among litters at the forest floor- (Smythies et al., 2000).

11. Rail-Babbler - *Eupetes macrocerus* (Temminck, 1831)

This is a rare resident, occurring throughout Borneo at very low density in lowland dipterocarp and hill forests up to 1,100m a.s.l (Myers, 2009). Both Smythies (1999) and Phillips and Phillips (2016) concur this species prefers hilly slopes and submontane habitat of their range. They are mostly confined to the ground level, and prefer to walk rather than fly when disturbed. As a terrestrial bird, this species hunts invertebrates on the forest floor with great speed. This species is also known for its shyness and skittish behaviour and hence is easily overlooked by birders and researchers (Myers, 2009). Calls are almost similar to the Garnett Pitta (which does not occur in Sabah), Blue-banded Pitta and Black-and-crimson Pitta.

As this species was recorded through vocalisation, we used a playback call for the pitta species listed above which has similar call to the Rail-babbler. The calling bird in the thickets only responded to the specific call of the Rail-Babbler while ignoring the other playback calls, which further confirmed its presence in this area. The area where the bird was recorded is also at a slope of more than 50° which is known to be the preferred habitat for a rail-babbler.

## Conclusion

This assessment resulted in a checklist of sciurids and avifauna in Kadamaian - Kinabalu Park which can be further developed into an ecotourism attraction for this area. Continuous studies on the diversity, occurrence and behaviour of these wildlife are needed to capitalise on potentials of ecotourism in Kadamaian - Kinabalu Park.

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