Preliminary Taxonomic Checklist of Mammals in Imbak Canyon Conservation Area

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Abstract

Field survey of mammals was conducted in Imbak Canyon Conservation Area (ICCA), Sabah from 28 November 2010–5 December 2010. Two group of mammals which comprises of large mammals and small mammals (scadents, rodents and bats) were surveyed by trapping and direct observation. A total of 82 cage trap, 5 harp traps, 18 Sherman traps and 15 mist nets were deployed at the study area. A total of 35 species of mammals representing nine orders and 20 families were recorded. Nineteen species of small mammals were captured by using traps (mist nets, harp traps and cage traps) while 10 species of large mammals and six species small mammals were identified through footprints, droppings and calls. One tree was inspected as roosting site for large flying fox *(Pteropus vanpyrus).* The most captured small mammals species was the Fawn Roundleaf Bat *(Hipposideros cervinus)* and Spotted Winged Fruit Bat, *Balionycteris maculata.* This paper presents a preliminary mammalian list for Imbak Canyon Conservation Area, Sabah.

The study of mammals in Sabah can be considered well-conducted base on numerous publication such as by Chasen and Kloss (1931), Davis (1962), Lim and Heyneman (1968), Duff *et al.* (1984), Harding and Gasis (1989), Ghazally *et al.* (1995) and Payne and Francis (1985). The latter study presented the first updated checklist of mammals from Borneo. These researches covered the various aspects of small mammals diversity, abundance and composition in lowland rainforests, primates as well as its adaptation to forest resources harvesting. The impacts from the previous research boost momentum for various researches to further the study on small mammals in Sabah. Shukor (2008) presented species richness of small mammals along the Mt. Kinabalu gradient. Andau *et al.* (2009) documented the species composition and abundance of mammals found in Tabin Wildlife Reserve, Sabah. Later on, finding from scientific expedition such as by Shukor (2006) in Maliau

Basin Conservation Area proved that Sabah is really acknowledged of their small mammals and other aspects of biodiversities. Following the expedition in Maliau Basin Conservation Area, Academy Sciences of Malaysia and Sabah Foundation jointly organized an expedition to ICCA. Therefore, a short survey to document the species composition and abundance of mammals found in ICCA, Sabah has been conducted.

MATERIAL S AND METHOD

Study Area

Imbak Canyon Conservation Area (N 05° 01'. 643' E 117° 02'. 514') is located to the north of Maliau Basin in Lahad Datu, almost right in the centre of Sabah is the Class I (Protection) Forest Reserve. The protected area of almost 30000 ha and 25 km in length encompasses two ridge-top Virgin Jungle Reserves and the Canyon itself, is consists of undisturbed pristine lowland rainforest. It is dominated by dipterocarp trees and has different types of forest; lowland dipterocarp forest and rare lower montane heath forest, a lower altitude version of 'kerangas' of Maliau Basin. The highest peak of this area is up to 1,120 m above sea level (m a.s.l). This area is situated between the other two conservation area, Maliau Basin and Danum Valley *(Figure 1)*.

To date two scientific expeditions has been conducted in this area, which was in 2000 (area at the entrance to the Canyon) and 2004 (in the heart of the Canyon). The early finding found the most rare and endangered species including the borneon pigmy elephant and proboscis monkey.

In this recent study, three study sites were chosen to document the diversity of mammals in ICCA. Slope Trail, Summit Trail and Riverine Trail are mixed dipterocap forest (MDF). The study sites are at about 391 m a.s.l to 459 m a.s.l.

Figure 1. Map showing location of Imbak Canyon Conservation Area (ICCA) 2010.

Trapping

Direct and indirect methods were used to document existence of mammals in the ICCA area. Indirect methods include vocalisation, defecation, feeding signs and foot prints whereas direct methods include cage trap, harp trap, mist-net and Sherman trap.

Three sites within the study area were chosen for bat sampling; the Slope Trail (1 k.m transect), Summit Trail (200 m transect) and Waterfall Trail (200 m transect). Cage trap and Sherman traps were set up along the trail approximately 10 meters apart. Cage trap were set up either on the ground or on tree branch. 82 cage traps were placed at Slope Trail (1 kilometers, k.m transect) ranging from 391 m a.s.l to 459 m a.s.l. Cage traps were baited with bananas and salted fish while the Sherman trap baited with salted fish and peanut butter mix and were check twice daily, in the morning and evening (Lim, 1973) *(Figure 2)*. Bats were captured using mist nets measuring 12 m × 2 m with mesh size of 36 mm. Depending on the suitability of the bat fly-ways, nets were placed randomly; 10 were in the Slope Trail, three in the Summit Trail and two were in Waterfall Trail. Nets in all the study sites were left opened from dusk to dawn and checked every one hour or two hours between 1830 hrs to 2030 hrs. Two harp traps were placed at Slope Trail while one was in the Summit Trail. Bats captured were placed in cloth bags before being measured and processed. Observation of large mammlas was conducted from during the period of mist net checking.

Figure 2. Traps used to capture small mammal in the Imbak Canyon Conservation Area.

Sample Collection and Processing

Identification of mammals was done following Payne and Francis (1985). Data recorded include species, sex, morphological measurements, time of capture, locality, habitat and altitude. The abbreviations used were: W = weight (g), TL = total length (mm), HB = head to body length (mm), T = tail length (mm), HF = hind foot length (mm) and FA = forearm length (mm).

Selected or targeted specimens were euthanized using chloroform and preserved as wet specimen in 75% ethanol. Sample including blood spot/ blood strip were air dried and kept in a Ziploc while the muscle and liver tissue were preserved in 75% ethanol for DNA analysis. All representatives of preserved specimens were deposited into the reference collection facilities at UNIMAS and several at Universiti Malaysia Sabah (UMS).

RESULTS AND DISCUSSION

A total of 35 species of mammals representing nine orders and 20 families were recorded. Nineteen species of small mammals were captured *(Table 1)* by using traps (mist nets, harp traps and cage traps) while 10 species of large mammals and six species small mammals were identified *(Table 2)* through footprints, droppings and calls. One tree was spotted as roosting site for Large Flying Fox (*Pteropus vanpyrus*). The most captured small mammals species was the Fawn Roundleaf Bat (*Hipposideros cervinus*) and Spotted Winged Fruit Bat, *Balionycteris maculata (Figure 3)*.

SPECIES ACCOUNT

Insectivora

Two species from this order were recorded. Moonrat, *Echinosorex gymnurus* was observed and savi's pigmy shrew, *Suncus estruscus* was captured by pitfall trap (set by insect group) at Riverine Trail.

Scandentia

Three species of treeshrews: the Mountain Treeshrew *(Tupaia montana)* and the Striped Treeshrew *(T. dorsalis)* were captured by cage trap while the Slender Treeshrew *(T. gracilis)* were observed at Slope Trail.

Chiroptera

Ten species of bats were recorded in this study. Only one species, the Large Flying Fox, *Pteropus vampyrus* was observed roosting at tree nearby Kuli Base Camp every evening (1730 hours onwards). The remaining nine species were captured at different study sites. Two species of fruit bats, the Shortnosed Fruit Bat *(Cynopterus brachyotis)* and Spotted Wing Fruit Bat, *Balionycteris maculata* were captured at Slope Trail and Riverine Trail.

TABLE 2. LIST OF MAMMALS SPECIES RECORDED BY OBSERVATION IN IMBAK CANYON CONSERVATION AREA

Order	Family	Species	Common Name	Trail	Method
Insectivora	Erinaceidae	*Echinosorex gymnurus*	Moonrat	Riverine	Sighted
Scandentia	Tupaiidae	*T. gracilis*	Slender Treeshrew	Riverine	Sighted
		Exilisciurus exilis	Plain Pygmy Squirrel	Riverine	Sighted
Chiroptera	Pteropodidae	*Pteropus vampyrus*	Large Flying Fox	Riverine	Sighted
Primates	Hylobatidae	*Hylobates muelleri*	Borneon Gibbon	Riverine	Sighted
	Pongidae	*Pongo pygmaeus*	Orangutan	Riverine	Nests sighted
	Cercopithecidae	*Presbytis rubicunda*	Maroon Langur	Riverine	Sighted
Pholidota	Manidae	*Manis javanica*	Pangolin	Riverine	Sighted
Rodentia	Sciuridae	*Ratufa affinis*	Giant Squirrel	Slope	Sighted
	Hystricidae	*Hystrix brachyura*	Common Porcupine	Slope	Sighted, spike found in Slope Trail
Carnivora	Viverridae	*Prionodon linsang*	Banded Linsang	Slope	Sighted
Proboscidea	Elephantidae	*Elephas maximus borneensis*	Borneo Elephant	Riverine	Track, dung
Artiodactyla	Suidae	*Sus barbatus*	Bearded Pig	Slope	Wallow, track
	Tragulidae	*Tragulus javanicus*	Pelanduk	Slope	Sighted
		T. napu	Napuh	Riverine	Sighted
	Cervidae	*Muntiacus muntjak*	Red Muntjac	Riverine	Sighted

Bat, *Hipposideros cervinus* was abundantly captured in Summit Trail. The remaining was recorded in all study sites. Hollow-Faced Bat, *Nycteris javanica* was captured by harp-trap at Slope Trail. Dusky Roundleaf Bat, *H. ater*; Diadem Roundleaf Bat, *H. diadema* and Dayak Roundleaf Bat, *H. dyacorum* were only captured in Summit Trail.

Primates

Three species of primate were spotted in our survey. All were spotted nearby Riverine Trail. They were Borneon Gibbon, *Hylobates muelleri*; Orangutan, *Pongo pygmaeus*; and Maroon Langur,

Figure 3. Species of bats captured in the Imbak Canyon Conservation Area.

Presbytis rubicund. None individual of Orangutan were spotted in this survey as only the abandoned nests were detected.

Pholidota

The Pangolin *(Manis javanica)* was found clinging at tree-branch in the Riverine Trail.

Carnivora

The Banded Linsang, *Prionodon linsang* was spotted at a close range in the Slope Trail around 2000–2100 hours. No captured were made but only photographs were taken as records.

Artiodactyla

Foot prints and mud wallows of Bearded Pig, Sus barbatus were observed at Slope Trail. An individual of the Lesser Mouse-deer *(Tragulus javanicus)*; Napuh, *T. napu* and Red Muntjac, *Muntiacus muntjak* was spotted moving on the forest in Slope Trail. Lesser Mouse-deer was spotted several times during daytime in Slope Trail.

Rodentia

Nine species of rodents were recorded in this study. Captured rodents gave a total of six species: Brown Spiny Rat, *Maxomys rajah*; Dark Tailed Rat, *Niviventer cremoriventer*; Low's Squirrel, *Sundasciurus lowii*; Muller's Rat, *Sundamys muelleri* and Large-Pencil Tailed Tree Mouse *Chiropodomys major.* Banana was favored by all rodents and scadents as all were captured by using banana none were captured by using salted fish as bait. Giant Squirrel, *Ratufa affinis* was observed in the Slope Trail while Plain Pygmy Squirrel, *Excilisciurus exilis*; and Common Porcupine, *Hystrix brachyuran* were observed in the Riverine Trail.

Proboscidea

Footprint and feces of *Elephas maximus borneensis* were spotted nearby Riverine Trail.

GENERAL DIVERSITY AND DISTRIBUTION

Data indicated that diversity of mammals is relatively high and more works needed to be done to capture and recorded the true mammal diversity of Imbak Canyon Conservation Area. The relatively high number of mammal diversity was because more mammal species are found at the lowland forests compared to highland forests (Shukor, 2008). However, further study should be conducted in the future especially in the higher elevation as study by Shukor (2008) found that diversity of small mammal is reported high at higher elevation. Mammal diversity from this study is higher than study done by Shukor *et al*. (2010) in Maliau Basin where only five large mammal species and 11 small mammals species (three species of rodents and eight species of bats) as shown in *Table 3* and *Table 4.* The differences might be because of altitude as our study in ICCA is less than 700 m a.s.l while study done by Shukor *et. al* (2006) was at 900–1000 m a.s.l.

TABLE 3. LIST OF MAMMAL SPECIES RECORDED IN ICCA (2010) AND HEATH FOREST OF MALIAU BASIN, SABAH (1988, 1996 AND 2006) BY TRAPPING METHOD

Order	Family	Species	Common Name	ICCA	Maliau Basin
Insectivora	Sorocidae	*Suncus estruscus*	Savi's Pigmy Shrew	√	
Scandentia	Tupaiidae	*Tupaia montana*	Mountain Treeshrew	√	√ √
		T. tana	Large Treeshrew		√ √
		T. dorsalis	Striped Treeshrew	√	
Rodentia	Muridae	*Maxomys rajah*	Brown Spiny Rat	√	
		M. whiteheadi	Whitehead's Rat		√ √ √
		Leopoldamys sabanus	Long Tailed Giant Rat	√	√
		Niviventer cremoriventer	Dark Tailed Rat	√	
		N. rapit	Long-Tailed Mountain Rat		√
		Chiropodomys major	Large-Pencil Tailed Tree Mouse	√	
		Sundasciurus lowii	Low's Squirrel	√	
		Sundamys muelleri	Muller's Rat		
Chiroptera	Nycteridae	*Nycteris javanica*	Hollow-Faced Bat	√	
	Hipposideridae	*Hipposideros cervinus*	Fawn Roundleaf Bat	√	√
		H. diadema	Diadem Roundleaf Bat	√	√
		H. dyacorum	Dayak Roundleaf Bat	√	
		H. bicolor	Bicolored Roundleaf Bat		√
	Rhinolophilidae	*Rhinolophus trifoliatus*	Trefoil Horshoe Bat	√	
		R. sedulus	Lesser Wolly Horshoe	√	√
		R. borneensis	Bat		√
		R. accuminatus	Borneon Horshoe Bat	√	
		R.creaghi	Accuminate Horshoe Bat		√
			Creagh's Horshoe Bat		
	Pteropodidae	*Cypnopterus brachyotis*	Greater Short-Nose Fruit Bat	√	
		Aethalops alecto	Grey Fruit Bat		√
		Balionycteris maculata	Spotted Wing Fruit Bat	√	
	Vespertilionidae	*Kerivoula papillosa*	Papillose Wooly Bat	√	
		K. intermedia	Small wolly Bat		√

(1988); (1996); √ (2006)

TABLE 4: LIST OF MAMMAL SPECIES RECORDED IN ICCA (2010) AND HEATH FOREST OF MALIAU BASIN, SABAH (1988, 1996 AND 2006) BY DIRECT OBSERVATION METHOD

Order	Family	Species	Common Name	ICCA	Maliau Basin
Insectivora	Erinaceidae	*Echinosorex gymnurus*	Moonrat	√	
Scandentia	Tupaiidae	*T. gracilis*	Slender Treeshrew	√	
		Exilisciurus exilis	Plain Pygmy Squirrel	√	
Chiroptera	Pteropodidae	*Pteropus vampyrus*	Large Flying Fox	√	
Primates	Hylobatidae	*Hylobates muelleri*	Borneon Gibbon	√	√√
	Pongidae	*Pongo pygmaeus*	Orangutan	√	√
	Cercopithecidae	*Presbytis rubicunda*	Maroon Langur	√	√
Pholidota	Manidae	*Manis javanica*	Pangolin	√	
Rodentia	Sciuridae	*Ratufa affinis*	Giant Squirrel	√	
	Hystricidae	*Hystrix brachyura*	Common Porcupine	√	
Carnivora	Viverridae	*Prionodon linsang*	Banded Linsang	√	
	Ursidae	*Helarctos malayanus*	Sun Bear		√√
Proboscidea	Elephantidae	*Elephas maximus borneensis*	Borneo Elephant	√	√√
Artiodactyla	Suidae	*Sus barbatus*	Bearded Pig	√	√√
	Tragulidae	*Tragulus javanicus*	Mouse Deer	√	√√
		T. napu	Napuh	√	
	Cervidae	*Muntiacus muntjak*	Red Muntjac	√	√
		Cervus unicolour	Sambar Deer		√√
	Bovidae	*Bos javanicus*	Tembadau		√
Perissodactyla	Rhinocerotidae	*Dicerorhinus sumatrensis*	Sumatran Rhinoceros		√

√ **(1988);** √ **(1996);** √ **(2006)**

Both methods, indirect and direct method gave good results and next research in the future should include both. Most of the large mammals were spotted in the Riverine Trail as this trail is less visited by researches during the study and thus minimise the disturbance. Slope Trail is much higher in small mammals diversity compared to others trail where it captured 14 species compared to eight species in both Summit Trail and Riverine Trail.

CONCLUSIONS

The survey found that Imbak Canyon Conservation area harbors a relatively high mammalian species. Indirect method and mist-netting and cage trapping was efficient in spotted and capturing insect bats and rodents respectively in this survey. However, further study is needed to record the actual diversity of the mammalian species in ICCA.

ACKNOWLEDGEMENTS

We would like to thank Sabah Foundation and Academy Sciences of Malaysia for their invitation and permission to carry out the survey as well as providing accommodations during expedition and Sabah Wildlife Department for permission to collect voucher specimens. We also would like to thank Sabah Wildlife Department, Sabah Foundation and PERHILITAN for their field assistance. Finally we would like to thank Universiti Malaysia Sarawak for financial support (vote no. E14006/S07/06/ZRC/03/2007 awarded to Prof. Mohd Tajuddin Abdullah and SRC/07/2011(01) Prof. Mohd Tajuddin Abdullah and Prof. Fatimah Abang) and lastly everyone who involve directly and indirectly to make this expedition possible and successful.

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IMBAK CANYON CONSERVATION AREA, SABAH

Geology, Biodiversity and Socio-economic Environment

Editors : A. Latiff and Waidi Sinun

ACADEMY OF SCIENCES MALAYSIA
902-4, Jalan Tun Ismail 50480 Kuala Lumpur
Tel: 603-2694 9898 Fax: 603-2694 5858
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ISBN 978-983-9445-77-0