JOURNAL OF TROPICAL BIOLOGY AND CONSERVATION 10: 1-9, 2013

Report

Notes on the mammal fauna in and around the Gunung Kuli Research Station, in Imbak Canyon Conservation Area, Sabah, Malaysia

Ong Kay York, Julia George Kunai, Daniel Pamin, Hisashi Matsubayashi, Henry Bernard* and Abdul Hamid Ahmad

*Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah Malaysia. *email: hbtiandun@gmail.com*

ABSTRACT. Primary forest sites for biodiversity conservation in Sabah are declining. Therefore, biodiversity surveys in areas where primary forests still exist are of paramount importance. Information derived from such studies are crucial in order to develop sound biodiversity conservation management plans. A brief camera trapping study of six days and nights in a localised area at the southern slopes of the Imbak Canyon Conservation Area in Sabah, supported by direct and indirect observations, revealed a rich mammal community in the surveyed areas. A total of 23 species of small to large-sized mammals from 6 orders and 13 families were recorded. Compared to an earlier study in the same area, the mammal species recorded in the present study included 14 species that are new records for Imbak Canyon. Clearly, Imbak Canyon is an important area for mammal conservation.

Keywords: Mammal species, Imbak Canyon, Camera trapping.

INTRODUCTION

Imbak Canyon Conservation Area (ICCA) is part of the more than 10,000 km^2 Yayasan Sabah Forest Management Area (YSFMA) located in the south central part of Sabah. Covering a land area of approximately 300 km^2, which includes areas of primary forests and disturbed habitats, the ICCA has since 2009 been a Class I (Protection) Forest Reserve. Logging is totally prohibited in this area. The ICCA encompasses two ridge-top Virgin Jungle Reserves together with the canyon in between. The canyon of the ICCA is 750 m deep and about 3 km wide. The base of the canyon lies at approximately 250 m a.s.l. Whereas its rim perches at more than 1,000 m a.s.l. Together with the Maliau Basin Conservation Area (588 km^2) and Danum Valley Conservation Area (438 km^2), the ICCA contributes a significant coverage of the protected area network in the central part of Sabah and forms an integral component of the proposed Sabah Biodiversity Corridor and the Heart of Borneo project in which biodiversity resources are regarded to be one of the richest in Sabah (Latif & Sinun, 2012).

Three exploratory expeditions have been carried out in different parts of the ICCA in the past 10 years. The first expedition, organised by the Sabah Forestry Department in 2004 was at the eastern part of the canyon. The second expedition held in 2009 and organised by Yayasan Sabah, focused on the central part of the canyon. The third and most recent expedition was held from 26th November to 5th December 2010. Organised by the Academy of Sciences Malaysia and Yayasan Sabah, the focus was the Gunung Kuli research station in the south of Imbak Canyon (Latif & Sinun, 2012).

A scientific programme was carried out by the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah, in and around the Gunung Kuli research station

Received 4 October 2012. Revision accepted 16 November 2012

from 13th to 20th June 2011. As part of the scientific programme, a mammal survey was carried out. The aim of the survey was to update the checklist of mammals at the ICCA. The last mammal survey in 2010 recorded a total of 35 species of mammals. These include the bat fauna, accounting for 50% of the total number of mammal species recorded (Bunya *et al.*, 2012).

MATERIALS AND METHODS

Two methods were employed in the present mammal survey i.e. camera trapping and general wildlife recce survey. Both methods were employed simultaneously from 14th to 19th June 2011. Camera trapping was conducted along the Ridge trail (10 km) and Summit trail (4 km). The general wildlife recce survey included direct and indirect observations, where the identity of the animals seen, their tracks or other signs of animals found along the trails, were recorded. The general wildlife recce survey was conducted along the Waterfall trail (3 km), Riverine trail (3 km) and Slope trail (4 km) twice a day between 8:30hrs and 12:00hrs and 15:00hrs to 18:00hrs. The Riverine trail was not surveyed throughout its entire length due to a collapsed bridge which was impassable during the survey period. All trails were located between 300 m -1,900 m abobe sea level (a.s.l). The vegetation around Mount Kuli research station comprises primary lowland and upper mixed dipterocarp forest (300-900 m a.s.l.), lower montane forest (900-1,200 m a.s.l.) and rocky ultrabasic lower montane forest (1,200-1,400 m a.s.l.) with the highest point being the peak of Mount Kuli at 1,900m.

A total of 24 camera trap stations were established during the survey (Table 1) - nine along Summit trail (Digital Cuddeback Capture cameras, Non Typical inc. U.S.A.) and 15 (i.e. eight Digital Cuddeback Capture cameras and seven Marif analogue cameras, Yamaguchi, Japan)

Table 1. Location coordinates of the camera-trap stations in and around the Mount Kuli research station in the southern part of Imbak Canyon Conservation Area in central Sabah, Malaysia.

	GPS location coordinates			
Trap station	Latitude North	Latitude East	Elevation (m)	Trail
R01	5° 01' 34.8"	117° 02' 35.5"	314	Ridge
R02	5° 01' 35.4"	117° 02' 30.4"	324	Ridge
R03	5° 01' 34.4"	117° 02' 25.5"	352	Ridge
R04	5° 01' 34.5"	117° 02' 21"	385	Ridge
R05	5° 01' 34.1"	117° 02' 16.8"	453	Ridge
R06	5° 01' 34"	117° 02' 13.6"	460	Ridge
R07	5° 01' 32.3"	117° 02' 9.8"	503	Ridge
R08	5° 01' 31.8"	117° 02' 5.2"	545	Ridge
R09	5° 01' 33.1"	117° 02' 2.4"	532	Ridge
R10	5° 01' 33.3"	117° 01' 58.5"	572	Ridge
R11	5° 01' 31"	117° 01' 54.9"	592	Ridge
R12	5° 01' 29.3"	117° 01' 51"	619	Ridge
R13	5° 01' 27.9"	117° 01' 46.5"	625	Ridge
R14	5° 01' 25.4"	117° 01' 42.5"	626	Ridge
R15	5° 01' 23.6"	117° 01' 38.8"	645	Ridge
S16	5° 04' 6"	117° 03' 7.3"	673	Summit
S17	5° 02' 46.32"	117° 03' 10.5"	769	Summit
S18	5° 00' 13.1"	117° 03' 14.6"	903	Summit
S19	5° 00' 8.4"	117° 03' 18.8"	974	Summit
S20	5° 00' 2.7"	117° 03' 23.8"	994	Summit
S21	4° 59' 56.9"	117° 03' 27.3"	1183	Summit
S22	4° 58' 35.4"	117° 03' 25.2"	1258	Summit
S23	4° 59' 44.4"	117° 03' 26"	1260	Summit
S24	4° 59' 38.8"	117° 03' 22.9"	1274	Summit

along Ridge trail. A single camera was set up at each camera station mounted on the tree trunks close to the ground at approximately 30cm. The distance between camera stations along the Summit trail ranged from 250 to 400 m, whereas camera stations along the Ridge trail were placed at regular intervals of 150 m along the trail. No lures or baits were used for cameras along Summit trail. Cameras along Ridge trail were baited with a local variety banana suspended about 1 m above ground level in front of the camera detection zone. Further information on camera-trapping along the Ridge trail is given by Matsubayashi et al. (2011). All cameras were set to take one photograph at every trigger and the time delay between triggers was 60 seconds. The identity of animals from the pictures captured by camera-traps, and from animal foot prints, claw marks on tree trunks and other signs of animal presence from the general wildlife recce survey were determined based on descriptions given by Payne *et al.* (1985). Only identifications of species with high certainty are reported in this paper.

RESULTS AND DISCUSSION

Sampling effort

For the camera trapping method, a total of 45 camera-trap nights and 75 camera-trap nights were successfully conducted at the Summit and Ridge trail, respectively. The recce survey was conducted for five days. Overall, 23 species of small to large-sized mammals from six orders and 13 families were recorded (Table 2; Figure 1), including 14 species that were not previously recorded by Bunya *et al.* (2012). With the addition of the new records of mammals detected from the present study, the mammal species count for the ICCA is now 49 species. Details of individual species for all mammal species recorded from the present study are grouped by family and discussed in the following sections.

Mammal Species Account

Scandentia

Only two species of tree shrew were recorded in the present study i.e. large tree shrew (*T. tana*) and common tree shrew (*T. longepis*). Both species were detected by camera trapping. *Tupaia longepis* was photographed from the Ridge trail area, while *T. tana* was photographed from both the Summit and Ridge trails. Known to forage on the forest floor and in the forest canopy at low heights, both species are usually easily trappable by live trapping. On the contrary, both species were not recorded previously by Bunya *et al.* (2012). Although the *Tupaia* spp. may have a range outside natural forest habitats, such as in gardens and at the edge of plantations bordering forests, they are associated with primary or old growth forests. Habitats in which the *Tupaia* spp. was recorded in this study are typical ones for the species. *Tupaia tana* and *T. longepis* are listed as of "Least Concern" under the IUCN Red list (2011), but the general population trends for both species is thought to be decreasing due to habitat loss (Han, 2008; Han & Stuebing, 2008).

Dermoptera

A single flying lemur (*Cynocephalus variegatus*) was sighted along the Waterfall trail at 16:18 hours on 19th June 2011. This species is a new record for the Gunung Kuli research station and was sighted resting on the trunk of a large tree (>120 cm d.b.h), approximately 10 m above the ground before taking off by gliding to the next nearest tree approximately 30 m away when approached by observers. *Cynocephalus variegatus* is known to be found throughout the lowlands forest up to 900 m a.s.l. in Borneo (Payne et al., 1985). Although widely distributed, the species is infrequently detected because of its secretive behaviour in addition to being highly cryptic. The species is in listed under the "Least Concern" category of the IUCN Red list (2011).

Table 2. Summary of mammal species recorded in and around Mount Kuli Research Station, Imbak Canyon Conservation Area from 14th - 19th June 2011.

Order	Family	Common name	Scientific name	Trail	Detection method
Scandentia	Tupaiidea	Large tree shrew	*Tupaia tana*	Ridge, Summit	Camera trap
		Common tree shrew	*Tupaia longepis*	Ridge	Camera trap
Rodentia	Sciuridae	Jentink's squirrel	*Sundasciurus jentinki*	Ridge	Camera trap
		Low's squirrel	*Sundasciurus lowii*	Ridge	Camera trap
	Muridae	Red spiny rat	*Maxomys surifer*	Ridge	Camera trap
		Long-tailed giant rat	*Leopoldamys sabanus*	Summit	Camera trap
	Hystricidae	Common porcupine	*Hystrix brachyurus*	Ridge	Camera trap
		Long-tailed porcupine	*Trichys fasciculata*	Ridge	Camera trap
Dermoptera	Cynocephalidae	Colugo	*Cynocephalus variegatus*	Waterfall	Sighted
Carnivora	Ursidae	Sun bear	*Helarctos malayanus*	Waterfall	Claw marks on tree trunk
	Viveridae	Malay civet	*Viverra tangalunga*	Ridge	Camera trap
		Masked palm civet	*Paguma larvata*	Ridge	Camera trap
		Hose's civet	*Hemigalus hosei*	Ridge	Camera trap
		Banded civet	*Hemigalus derbyanus*	Ridge	Camera trap
		Short-tailed mongoose	*Herpestes brachyurus*	Ridge	Camera trap
	Felidae	Leopard cat	*Prionailurus bengalensis*	Ridge	Camera trap
Artiodactyla	Suidae	Bearded pig	*Sus barbatus*	Riverine	Sighted, hoof tracks
	Tragulidae	Chevrotain	*Tragulus* spp.	Ridge	Camera trap
	Cervidae	Red muntjac	*Muntiacus muntjak*	Riverine, Slope	Camera trap, hoof tracks
		Yellow muntjac	*Muntiacus atherodes*	Ridge	Camera trap
Primates	Cercopithecidae	Long-tailed macaque	*Macaca fascicularis*	Summit	Camera trap
		Pig-tailed macaque	*Macaca nemestrina*	Ridge, Summit	Camera trap
	Hylobatidae	Bornean gibbon	*Hylobates muelleri*	Slope, Riverine	Sighted, vocalization

1 

2 

3 

4 

5 

6 

7 

8 


9


10


11


12


13


14

Figure 1. Mammals species detected by camera-trapping method in and around Mount Kuli research station in Imbak Canyon Conservation Area, central Sabah, Malaysia. **1.** Common tree shrew *Tupaia longipes* **2.** Large tree shrew *Tupaia tana* **3.** Long tailed giant rat *Leopoldamys sabanus* **4.** Red spiny rat *Maxomys surifer* **5.** Jentink's squirrel *Sundasciurus jentinki* **6.** Low's squirrel *Sundasciurus lowi* **7.** Long-tailed porcupine *Trichys fasciculata* **8.** Leopard cat *Prionailurus bengalensis* **9.** Malay civet *Viverra tangalunga* **10.** Masked palm civet *Paguma larvata* **11.** Yellow muntjac *Muntiacus atherodes* **12.** Red muntjac *Muntiacus muntjac* **13.** Long-tailed macaque *Macaca fascicularis* **14.** Pig-tailed macaque *Macaca nemestrina*.

Primates

Three primate species were recorded. The Bornean gibbon (*Hylobates muelleri*) was identified through its typical loud, bubbling calls, which were heard from around the Riverine trail and Slope trail areas between 07:00 hours and 08:00 hours daily throughout the survey period. *Macaca fascicularis* and *M. nemestrina* were not directly observed and instead their presence was detected from camera traps located at the Ridge trail and Summit trail. These two macaque species are known to be distributed throughout lowland forests in Borneo and are capable of living on mountains up to 1,300 m a.s.l. (Payne *et al.*, 1985). Although described to be common species, both *M. fascicularis* and *M. nemisterina* were not detected by Bunya *et al.* (2011). Hence, these macaques are new records for the Mount Kuli area. *Macaca nemisterina* is listed as a "Vulnerable" species, whereas *M. fascicularis* is listed as "Least Concern" under the IUCN Red list (Richardson *et al.*, 2008). Even so, it is believed that the global population trend of *M. fascicularis* is declining due to habitat loss.

Rodentia

The rodents in the present study were represented by six species, namely Low's squirrel (*Sundasciurus lowii*), Jentink's squirrel (*Sundasciurus jentinki*), Red spiny rat (*Maxomys surifer*), Long-tailed giant rat (*Leopoldamys sabanus*), Malayan porcupine or better known as the common porcupine (*Hystrix brachyrus*) and Long-tailed porcupine (*Trichys fasciculata*). All species were photographed along the Ridge trail except for *L. sabanus*, which was photographed at the Summit trail. *Sundasciurus jentinki* is confined to Borneo in mountains above 900 m a.s.l (Payne *et al.*, 1985). However, in this study *S. jentinki* was photographed at an altitude below 650 m a.s.l. indicating that the distribution of this species based on elevation is greater than previously thought. This species is a new record for Mount Kuli. The other five rodent species generally occupy lowland forests. While photo-captured rodent species in this study are listed as of "Least Concern" on the IUCN Red list, only three of the species have a stable population trend (Aplin & Lunde, 2008; Lunde *et al.* 2008; Duckworth *et al.* 2008). The population trend for *S. jentinki* is currently unknown (Duckworth & Meijaard, 2008), while both populations of *M. surifer* and *H. brachyura* are known to be decreasing (Aplin *et al.*, 2008; Lunde *et al.*, 2008). The main factor causing the declining of the population of *H. brachyura* is habitat loss, but it is not known what factors are contributing to the decline of the population of *M. surifer* (Aplin *et al.*, 2008; Lunde *et al.*, 2008).

Carnivora

Only one species of carnivore, the Banded linsang (*Prionodon linsang*) was previously recorded by Bunya *et al.* (2011). In the present survey, the Sun bear (*Helarctos malayanus*) and five viverids were recorded. The presence of *H. malayanus* was based on claw marks left on a tree trunk located along the Waterfall trail. The claw marks unmistakably belonged to Sun bears as the marks were very conspicuous. Claw marks on the trees by other carnivores are usually very faint. This is the only bear species found in Borneo and is listed as "Vulnerable" under the IUCN Red list (Fredriksson *et al*., 2008). All the five viverid species in this study were detected via camera-trap. They were the Malay civet (*Viverra tangalunga*), Masked palm civet (*Paguma larvata*), Hose's civet (*Hemigalus hosei*), Banded civet (*Hemigalus derbyanus*) and Short-tailed mongoose (*Herpestes brachyurus*) (see, Matsubayashi *et al.*, 2011 for details). The *H. hosei* is only very rarely detected. The detection of this species in Mount Kuli is the sixth only confirmed observation for this species in Sabah. A Leopard cat (*Prionailurus bengalensis*) was photographed on the Ridge trail. This is the first wild cat species to be recorded from the ICCA area. A total of five species of wild cats are found on Borneo island. The Leopard cat is known to have a vast distribution across Borneo (Payne *et al.*, 1985) and is regarded as of "Least Concern" by the IUCN.

Artiodactyla

A single direct sighting of the Bornean bearded pig (*Sus barbatus*) was made at the Riverine trail. Numerous other signs of bearded pigs were detected including hoof prints, active mud wallows and mud rubbing marks on tree trunks near rivers, along animal and human-made trails near slopes and ridge-tops indicating that the animal is widely distributed in the study area. Two barking deer species i.e., the Southern red muntjac (*Muntiacus muntjac*) and Bornean yellow muntjac (*Muntiacus atherodes*) were photographed by camera traps on the Ridge trail and Summit trail. *Muntiacus atherodes* is a Bornean endemic species. Only cameras from the Ridge trail recorded both species, whereas cameras on the Summit trail only detected the presence of *M. muntjac*. Bunya *et al.* (2012) recorded only one barking deer species, *M. atherodes*. The *M. muntjac* is thought to predominate over *M. atherodes* in low hill ranges and the forest coast line (Payne *et al.*, 1985). *Muntiacus atherodes* is more dominant in extensive hill and mountain ranges (Payne *et al.*, 1985). A Mouse deer (*Tragulus* sp.) was also captured via camera trapping, but the species could not be determined with certainty as two different species of mouse deer (*T. napuh* and *T. kanchil*) are known to exist in Sabah and it is not easy to tell them apart based on photographs captured. All Artiodctyla species recorded in this study except *S. barbatus* are categorised as of "Least Concern." The *S. barbatus* is categorised as "Vulnerable" under the IUCN Red list (Kawanishi *et al.*, 2008)

CONCLUSION

A total of 23 species of small to large sized mammals from 13 families in five orders were recorded in the present study. Of this number, 14 species are new records for the ICCA area. Despite the brief duration of the present survey that employed the camera trapping method, in addition to the commonly used methods of direct and indirect observations for detecting the presence of wildlife species, the present study has yielded good results. A larger number of mammals would have been detected if a greater camera trapping effort was carried out. It is suggested that in future, camera trapping over a longer survey period and covering a larger area of the ICCA should be conducted, particularly in areas that have not been surveyed. The applications of other methods, such as mist-netting and live trappings, will yield a more complete picture of the true mammal species richness and diversity of the ICCA. Nonetheless, results of the present survey clearly revealed that the ICCA is an important area for mammal conservation.

ACKNOWLEDGEMENTS

We thank the staff and students of the Institute for Tropical Biology and Conservation, Universiti Malaysia Sabah for assisting us with fieldwork. We especially would like to thank the rangers of Yayasan Sabah based at Gunung Kuli Research Station for their excellent field support during the survey. Funding for the Imbak scientific programme was provided by Universiti Malaysia Sabah through the Institute for Tropical Biology and Conservation.

REFERENCES

Aplin, K. & D. Lunde. 2008. *Trichys fasciculata*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Aplin, K., D. Lunde & G. Musser. 2008. *Maxomys surifer*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Bunya, K., W. Marni, H.I. Hussin, T.P. Malim, K.N. Kamaruddin, M.N.M. Saad, F. Abang & M.T. Abdullah. 2012. Preliminary taxonomic checklist of mammals in Imbak Canyon Conservation Area.

Duckworth, J.W. & E. Meijaard. 2008. *Sundasciurus jentinki*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Duckworth, J.W., E. Meijaard & K.H. Han. 2008. *Sundasciurus lowii*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Francis, C.M. 2008. *A Field Guide to the Mammals of South-East Asia.* New Holland, United Kingdom

Fredriksson, G., R. Steinmetz, S. Wong & D.L. Garshelis. 2008. *Helarctos malayanus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 15 November 2011.

Han, K.H. & R. Stuebing. 2008. *Tupaia tana*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Han, K.H. 2008. Tupaia glis. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 15 November 2011.

Kawanishi, K., M. Gumal & W. Oliver. 2008. *Sus barbatus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 15 November 2011.

Lunde, D., K. Aplin & S. Molur. 2008. *Hystrix brachyura*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Lunde, D., K. Aplin, L. Rueda & S. Molur. 2008. *Leopoldamys sabanus*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 21 November 2011.

Matsubayashi, H., H. Bernard & A.H. Ahmad. 2011. *Small Carnivores of the Imbak Canyon, Sabah, Malaysia, Borneo, Including a New Locality for the Hose's Civet* Diplogale hosei. Small Carnivore Conservation, Volume 45: 18-22.

Payne, J. & C.M. Francis. 1985. A *Field Guide to the Mammals of Borneo*. The Sabah Society with World Wildlife Fund, Kota Kinabalu, Sabah, Malaysia.

Richardson, M., R.A. Mittermeier, A.B. Rylands & B. Konstant. 2008. *Macaca nemestrina*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <www.iucnredlist.org>. Downloaded on 15 November 2011.