
Short Notes

Amphibians and Reptiles of Imbak Canyon Study Centre and Batu Timbang Camp

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Abstract

Amphibians and reptiles of Imbak Canyon Study Centre and Batu Timbang Camp have never been studied and this expedition was organised to produce an inventory of the species. The herpetofaunal animals were searched actively using the visual encounter survey method. A total of 84 specimens of amphibians and reptiles were obtained, comprising 75 amphibians and nine reptiles. The total number of species obtained during the expedition was 33 (26 amphibian species and 7 reptilian species). Twenty species were obtained from Batu Timbang Camp (BTC) and 21 species were recorded from Imbak Canyon Study Centre (ICSC). The updated compiled list of species of herpetofauna at ICCA is now 73 species (37 amphibian species and 36 reptilian species).

Keywords: herpetofauna, frogs, lizards, geckoes, snakes, biodiversity, vertebrate

Introduction

Herpetofauna has the highest diversity in tropical forests around the world and is a key component in the vertebrate fauna of the forest. For example, amphibians play a vital role in the food web as a major predator insectivore (Rebouças & Solé 2015). The study of ecology and zoology helped detect anthropogenic impacts on forest ecosystems. These studies contain information about the natural life history and habitat requirements of important taxa.

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For example, the study of the ecology of the species could identify changes in diet, seed dispersal, distribution patterns and behaviours, as a result of logging and how these changes affect animal populations and forest ecology (Meijaard et al. 2005). In the meantime, herpetofauna has been proven to be a suitable model for the study of human impact on the environment in complex biological systems (Ernst & Rodel 2005). These animals are very sensitive to environmental changes and require special habitat and microhabitat to survive, especially during breeding. Understanding patterns of biodiversity are vital to conservation management, and any decision on planning and development of an area, should be based on accumulated knowledge of the species groups that only come with more available data. Species lists are usually the basic data of biological inventory and are often employed when there are limited conservation resources (Mace 2004). However, species lists still represent information that can be used to assist management authority of the area, until more ecological studies can be associated with the lists. The objectives of this study were to identify as many species of amphibians and reptiles as possible at the Imbak Canyon Study Centre (ICSC) and at Batu Timbang camp.

Methodology

The interior of Imbak Canyon Conservation Area (ICCA) (approximately 30,000 ha) is covered with a continuous rainforest. The periphery of the area is inhabited by local communities. The main relief is a succession of hills and streams between 250 and 333 m, with the highest peak at 1120 m a.s.l. Temperatures in the lowland vary between 25°C to 35°C. The wet season is between November and April and the dry season is from May to October.

The study sites comprise the ICSC which includes forest trails after crossing the Ara hanging bridge and Kapur hanging bridge and roads towards the Imbak falls; and Batu Timbang camp about 27 km from the ICSC.

Sample collection

Reconnaissance surveys were conducted during the day to look for suitable sampling sites. Visual encounter surveys were conducted at night with the aid of headlights by a team of 3-4 observers, walking at a steady pace along a designated stream or trail for a prescribed time within the first two hours after nightfall from 2000h to 2200h. Frogs were observed with the naked eye with the aid of headlights in appropriate microhabitats, such as along the banks of streams and trails. All frog sightings and/or all calls heard at a distance of approximately 10 m on either side of the 1.5 km long centre-line were searched

and animals sighted were captured by hand. All samples collected were placed into individual plastic bags and labelled accordingly.

At most, two voucher specimens were euthanized with Tricaine (Ethyl 3-aminobenzoate methanesulfonate salt), fixed in 10% formalin and transferred to 70% alcohol for storage. Before fixation, measurements of the specimens were taken with a Mitutoyo digimatic caliper to the nearest 0.1 mm. Parameters measured were snout-vent length (SVL), measured from the tip of the snout to the tip of the vent and tibia length (TL). Colour photographs were taken and liver tissue was extracted and stored in 95% ethanol prior to fixation and preservation. Taxonomic nomenclature follows Frost et al. (2011). All specimens are deposited at the Imbak Canyon Study Centre.

Results and Discussion

A total of 84 specimens of amphibians and reptiles was obtained, comprising 75 amphibians and nine reptiles (Figure 1). The amphibians are represented by six families (Figure 2), Bufonidae (10 specimens), Dicroglossidae (18), Megophryidae (7), Microhylidae (3), Ranidae (19) and Rhacophoridae (18). The reptiles are represented by four families (Figure 3), Colubridae (one specimen), Gekkonidae (five specimens), Agamidae (one specimen), and Scincidae (two specimens).

The total number of species obtained during the expedition is 33 (26 amphibian species and 7 reptilian species) (Table 1). The updated compiled list of species of herpetofauna at ICCA is now 73 species (37 amphibian species and 36 reptilian species) (Yayasan Sabah 2014). Twenty species were obtained from Batu Timbang Camp (BTC) and 21 species were recorded from Imbak Canyon Study Centre (ICSC).

Based on the species list from Table 1, following the conservation status of the IUCN Red List of Threatened species, only one species is endangered, which is the Spiny Turtle; two species are Vulnerable (Malayan Flat-shelled Turtle and the King Cobra); and eight species are Near Threatened (Spiny Slender Toad, Long-fingered Slender Toad, Brown Slender Toad, Greater Swamp Frog, Lesser Swamp Frog, Dring's Slender Litter Frog, Green-spotted Rock Frog, Cinnamon Frog). There are 22 species that are not yet evaluated by the IUCN Red List and this is a major concern for the conservation status of these species.

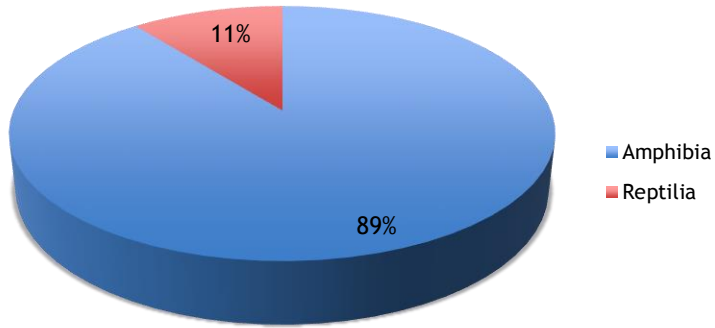


Figure 1. Relative abundance of amphibians and reptiles.

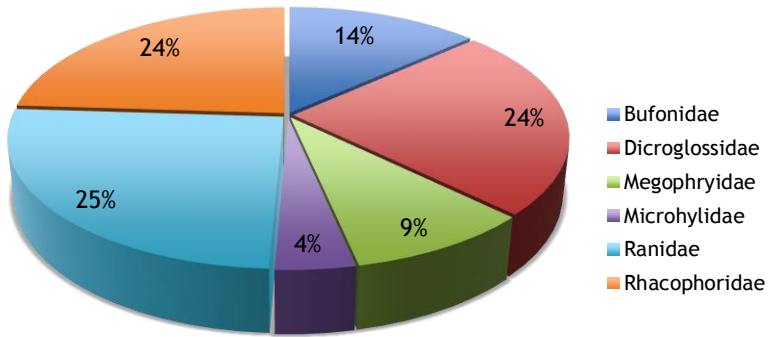


Figure 2. Amphibian relative abundance according to families.

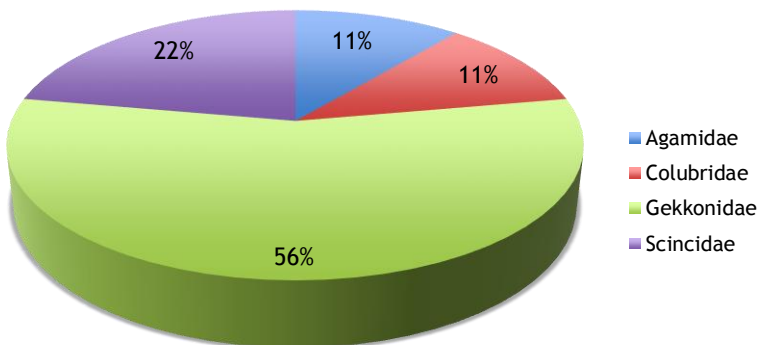


Figure 3. Reptilian relative abundance according to families.

Table 1. The updated compiled list of amphibian and reptile species at Imbak Canyon Conservation Area [ICSC=Imbak Canyon Study Centre, BTC=Batu Timbang Camp, YS=Yayasan Sabah (2014)].

No.	Class/Family/Species	Common Name	# Individ.	ICSC	BTC	YS	Status
Amphibia (75)							
Bufonidae (10)							
1	<i>Ingerophrynus divergens</i>	Forest Toad	2		x	x	LC
2	<i>Rentapia hosii</i>	Hose's Tree Toad	2		x	x	LC
3	<i>Phrynoidis juxtasper</i>	Giant River Toad	3	x	x	x	LC
4	<i>Ansonia spinulifer</i>	Spiny Slender Toad	3	x		x	NT
5	<i>Ansonia longidigita</i>	Long-fingered Slender Toad				x	NT
6	<i>Ansonia leptopus</i>	Brown Slender Toad				x	NT
Dicroglossidae (18)							
<i>Fejervarya</i>							
7	<i>limnocharis</i>	Grass Frog	1	x			LC
8	<i>Limnonectes ingeri</i>	Greater Swamp Frog	3		x		NT
9	<i>Limnonectes kuhlii</i>	Kuhl's Creek Frogs	8	x	x	x	LC
<i>Limnonectes</i>							
10	<i>leporinus</i>	Giant River Frog	5	x	x	x	LC
11	<i>Limnonectes paramacrodon</i>	Lesser Swamp Frog	1	x			NT
12	<i>Ingerana baluensis</i>	Dwarf Mountain Frog				x	LC
13	<i>Limnonectes finchii</i>	Rough Guardian Frog				x	NE
14	<i>Limnonectes palavanensis</i>	Smooth Guardian Frog				x	NE
Megophryidae (7)							
<i>Leptotalax</i>							
15	<i>fritinniensis</i>	Twittering Slender Litter Frog	5		x		NE
<i>Leptobranchella</i>							
16	<i>mjobergi</i>	Mjoberg's Dwarf Litter Frog	2		x	x	LC
17	<i>Megophrys nasuta</i>	Bornean Horned Frog			x	x	LC
18	<i>Leptotalax dringi</i>	Dring's Slender Litter Frog				x	NT
Microhylidae (3)							
19	<i>Chaperina fusca</i>	Brown Thorny Frog	1		x	x	LC
20	<i>Metaphrynella sundana</i>	Tree Hole Narrow-mouthed Frog	2		x		LC
21	<i>Kalophrynus pleurostigma</i>	Rufous-sided Sticky Frog				x	LC
Ranidae							
22	<i>Chalcorana raniceps</i>	White-lipped Frog	4	x	x	x	LC
23	<i>Meristogenys orphnocnemis</i>	Northern Torrent Frog	6		x	x	LC
24	<i>Odorrana hosii</i>	Poisonous Rock Frog				x	LC
25	<i>Pulchrana picturata</i>	Spotted Stream Frog	1	x	x		LC
26	<i>Pulchrana signata</i>	Striped Stream Frog	3	x		x	LC

27	<i>Staurois guttatus</i>	Black-spotted Rock Skipper	2	x	x	NE
28	<i>Staurois latopal-matus</i>	Rock Skipper	3	x	x	LC
29	<i>Staurois tuberilinguis</i>	Green-spotted Rock Frog			x	NT
Rhacophoridae (18)						
30	<i>Kurixalus appendiculatus</i>	Frilled Tree Frog	1	x	x	LC
31	<i>Nyctixalus pictus</i>	Cinnamon Frog	1	x	x	NT
32	<i>Polypedates colletti</i>	Collett's Tree Frog	7	x	x	LC
33	<i>Polypedates leucomystax</i>	Four-lined Tree Frog	1	x		LC
34	<i>Polypedates macrotis</i>	Dark-eared Tree Frog	3	x		LC
35	<i>Polypedates otilophus</i>	File-eared Tree Frog		x	x	LC
36	<i>Rhacophorus nigropalmatus</i>	Wallace's Flying Frog	2		x	LC
37	<i>Rhacophorus pardalis</i>	Harlequin Flying Frog	3	x	x	LC
Reptilia (9)						
Lacertilia						
Agamidae (1)						
38	<i>Aphaniotis ornata</i>	Ornate Earless Agama	1	x		NE
39	<i>Draco melanopogon</i>	Black-bearded Gliding Lizard			x	NE
40	<i>Draco sumatranus</i>	Common Gliding Lizard			x	NE
41	<i>Gonocephalus bornensis</i>	Borneo Forest Dragon			x	NE
42	<i>Gonocephalus grandis</i>	Great Anglehead Lizard			x	LC
43	<i>Gonocephalus mjobergi</i>	Mjoberg's Anglehead Lizard			x	NE
44	<i>Phoxophrys cephalum</i>	Mocquard's Eyebrow Lizard			x	NE
Gekkonidae (1)						
45	<i>Aeluroscalabotes felinus</i>	Cat Gecko	1		x	NE
46	<i>Cyrtodactylus cf. yoshii</i>	Yoshi's Bow-fingered Gecko	1	x	x	NE
47	<i>Cyrtodactylus ingeri</i>	Sabah Bow-fingered Gecko			x	NE
48	<i>Cyrtodactylus malayanus</i>	Borneo Bow-fingered Gecko			x	NE
49	<i>Cyrtodactylus pubisulcus</i>	Inger's Bow-fingered Gecko	1		x	NE
50	<i>Gekko mutilata</i>	Common Four-clawed Gecko	2	x		NE
51	<i>Gekko smithii</i>	Large Forest Gecko			x	LC
Geoemydidae						

52	<i>Heosemys spinosa</i>	Spiny Turtle			x	EN
	<i>Notochelys</i>	Malayan Flat-shelled				
53	<i>platynota</i>	Turtle			x	VU
	Scincidae (2)					
	<i>Tropidophorus</i>	Brook's Keeled				
54	<i>brookei</i>	Skink	2	x	x	NE
55	<i>Eutropis rudis</i>	Rough Skink			x	NE
	Varanidae					
56	<i>Varanus salvator</i>	Water Monitor			x	LC
	Serpentine					
	Calamariidae					
	<i>Calamaria suluensis</i>	Yellow-bellied Reed				
57		Snake			x	LC
	Colubridae (1)					
58	<i>Ahaetulla prasina</i>	Oriental Whipsnake			x	LC
59	<i>Asthenodipsas laevis</i>	Smooth Slug Snake	1	x		LC
		White-spotted Cat				
60	<i>Boiga drapiezii</i>	Snake			x	LC
		Black-headed Cat				
61	<i>Boiga nigriceps</i>	Snake			x	LC
	<i>Gonyosoma</i>	Red-tailed Green				
62	<i>oxycephalum</i>	Ratsnake			x	LC
63	<i>Lycodon effraenis</i>	Brown Wolf Snake			x	LC
		Malayan Banded				
64	<i>Lycodon subcinctus</i>	Wolf Snake			x	LC
65	<i>Xenochrophis</i>	Triangle Keelback			x	NE
	<i>trianguligerus</i>					
	Elapidae					
66	<i>Calliophis bivirgata</i>	Blue Coral Snake			x	NE
		Equatorial Spitting				
67	<i>Naja sumatrana</i>	Cobra			x	LC
68	<i>Ophiophagus hannah</i>	King Cobra			x	VU
	Natricidae					
	<i>Rhabdophis</i>					
69	<i>conspicillatus</i>	Red-belled Keelback			x	LC
	Viperidae					
	<i>Trimeresurus</i>					
70	<i>borneensis</i>	Bornean pit viper			x	NE
71	<i>Tropidolaemus</i>	Wagler's Keeled			x	LC
	<i>wagleri</i>	Green Pit Viper				
	Pythonidae					
	<i>Malayopython</i>					
72	<i>reticulatus</i>	Reticulated Python			x	NE
	<i>Python</i>	Bornean Short-tailed				
73	<i>breitensteini</i>	Python			x	LC
Grand Total			84			

IUCN Red List of Threatened Species: NE=Not Evaluated, DD=Data Deficient, LC=Least Concern, NT=Near Threatened, VU=Vulnerable, EN=Endangered, CR=Critically Endangered, EW=Extinct in the Wild, EX=Extinct.

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References

- Doan TM. 2003. Which methods are most effective for surveying rain forest herpetofauna? *Journal of Herpetology* **37(1)**: 72-81.
- Ernst R, Rodel M-O. 2005. Anthropogenically induced changes of predictability in tropical anuran assemblages. *Ecology* **86**: 3111-3118.
- Frost DR. 2009. Amphibian Species of the World: an Online Referece. Version 5.3 (12 February 2009). American Museum of Natural History, New York, USA. Available from <http://research.amnh.org/herpetology/amphibia/index.php>.
- Hout MC, Papesh MH, Goldinger SD. 2013. Multidimensional scaling. *Wiley Interdisciplinary Reviews: Cognitive Science* **4(1)**: 93-103.
- Hughes JB, Hellmann JJ, Ricketts TH, Bohannan BJ. 2001. Counting the uncountable: statistical approaches to estimating microbial diversity. *Applied and Environmental Microbiology* **67(10)**: 4399-4406.
- James FC, Rathbun S. 1981. Rarefaction, relative abundance, and diversity of avian communities. *The Auk* **98(4)**: 785-800.
- Kirol CP, Beck JL, Dinkins JB, Conover MR. 2012. Microhabitat selection for nesting and brood-rearing by the Greater Sage-Grouse in xeric big sagebrush. *The Condor* **114(1)**: 75-89.
- Kobler A, Maes G, Humblet Y, Volckaert F, Eens M. 2011. Temperament traits and microhabitat use in Bullhead, *Cottus perifretum*: fish associated with complex habitats are less aggressive. *Behaviour* **148(5)**: 603-625.
- Kruskal JB. 1964. Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. *Psychometrika* **29(1)**: 1-27.
- Mace GM. 2004. The role of taxonomy in species conservation. *Philosophical Transactions of the Royal Society B: Biological Sciences* **359**: 711-719.
- Meijaard E, Sheil D, Nasi R, Augeri D, Rosenbaum B, Iskandar D, Setyawati T, Lammertink M, Rachmatika I, Wong A, Soehartono T, Stanley S, O'Brien T. 2005. *Life after Logging: Reconciling Wildlife Conservation and Production Forestry in Indonesia Borneo*. CIFOR, Jakarta, Indonesia.

- Patthey P, Signorell N, Rotelli L, Arlettaz R. 2012.** Vegetation structural and compositional heterogeneity as a key feature in Alpine Black Grouse microhabitat selection: conservation management implications. *European Journal of Wildlife Research* **58(1)**: 59-70.
- Pradhan BK, Badola HK. 2012.** Effects of microhabitat, light and temperature on seed germination of a critically endangered himalayan medicinal herb, *Swertia chirayita*: conservation implications. *Plant Biosystems* **146(2)**: 345-351.
- Rebouças R, Solé M. 2015.** Diet of *Adenomera thomei* (Almeida and Angulo, 2006) (Anura: Leptodactylidae) from a Rubber Tree Plantation in Southern Bahia, Brazil. *Studies on Neotropical Fauna and Environment* **50(2)**: 73-79.
- Ugland KI, Gray JS, Ellingsen KE. 2003.** The species-accumulation curve and estimation of species richness. *Journal of Animal Ecology* **72(5)**: 888-897.
- Yayasan Sabah. 2014.** Imbak Canyon Conservation Area: Strategic Management Plan 2014-2023. Kota Kinabalu, Sabah: Yayasan Sabah.