

# Crocker Range National Park, Sabah, as a refuge for Borneo's montane herpetofauna

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**Abstract.** — Crocker Range National Park in Sabah (East Malaysia), northern Borneo, is an exceptional area for herpetological diversity. Inventories of the Park are incomplete, but show high diversity, as well as regional endemism shared with the adjacent and more well-known Gunung Kinabalu National Park. The montane ecosystem of the Range offers refuge for a number of rare herpetofaunal taxa, including *Stoliczka borneensis*, *Rhabdophis murudensis*, *Oligodon everetti*, *Philautus bunitus*, *Ansonia anotis*, *Sphenomorphus aesculeticola*, and undescribed species of squamates of the genera *Sphenomorphus* and *Gongylosoma*. The 59 species of amphibians and 45 species of reptiles now recorded from the Range represent 39 and 16.2 per cent of the total Bornean amphibian and reptile fauna, respectively. The high levels of deforestation of the surrounding regions of Borneo, particularly lowland rainforests, heighten the importance of protection of primary forests of northern Borneo's Crocker Range.

**Key words.** *Crocker Range National Park, Sabah, Malaysia, herpetofauna, conservation*

Citation: Das, Indraneil. 2006. Crocker Range National Park, Sabah, as a refuge for Borneo's montane herpetofauna. *Amphib. Reptile Conserv.* 4(1):3-11(e15).

## Introduction

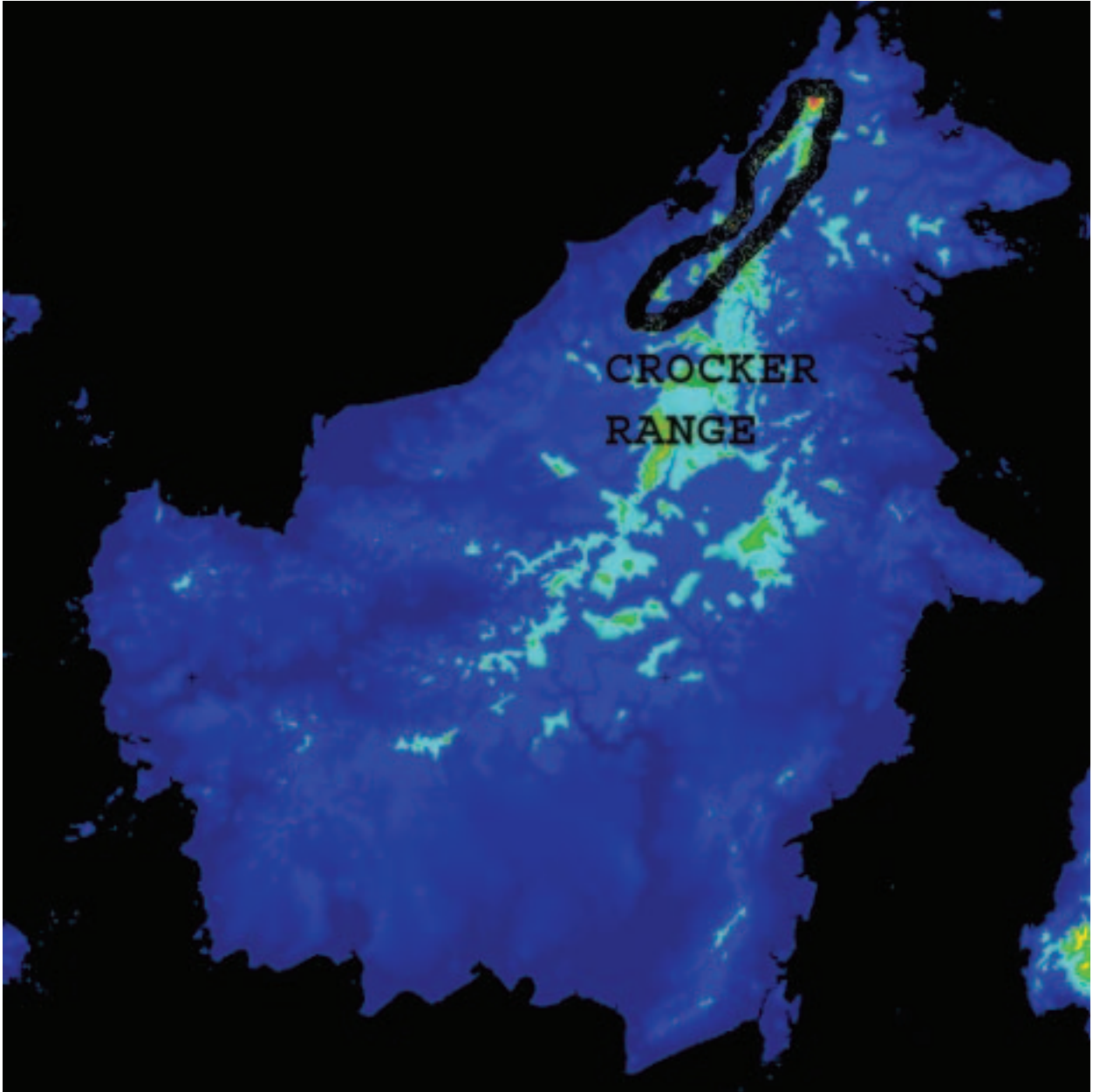
Borneo, one of four major islands of the great Indo-Malayan Archipelago (along with Sumatra, Java and Sulawesi), is situated on the eastern edge of the Sunda Shelf between coordinates 04° S to 07° N and from 109–119° E. It is the second largest tropical island in the world (after New Guinea), covering a land area of approximately 743,380 sq km. During the Pleistocene glaciation, sea levels fell between 120–200 m below current levels, uniting the islands of the Sundas (Morley and Flenley 1987). Palynological evidence reveals that during the last glacial maxima, upland plant species moved down, in response to temperature changes (Flenley 1997; Newsome and Flenley 1988).

Vegetational zonation for Borneo is arguably best known from Gunung Kinabalu (Kitayama 1991), the northern edge of Crocker Range, which has a largely intact vegetation. At about 1,200 m is the upper boundary of lowland rainforest, where the majority of emergent trees, comprises primarily the dipterocarps, disappear from the canopy (Beaman and Beaman 1998). The lower montane forest is five-layered, lacking emergents. The upper limit of the lower montane forest is 2,000–2,350 m, that of the upper montane forest, between 2,800–3,000 m. The upper montane forest has a dense herbaceous layer. The upper limit of the lower subalpine coniferous forests is 3,400 m, which is

sparse in undergrowth and lower in height. Unfortunately, not much is known of the ecological distribution of the montane fauna within these altitudinal ranges and even less so of their conservation status. Montane regions, particularly ranges at 1,200 m above sea level, because of their Paleohistory, have been centers for speciation and endemism. Because of the inaccessible nature of montane regions in terms of logistics, these have also remained one of the least known, and most generalizations stem from studies conducted in Gunung Kinabalu, the highest mountain in Borneo (see MacKinnon et al. 1996).

Adjacent to the Gunung Kinabalu National Park is the Crocker Range National Park, although the Kinabalu region is geologically and floristically part of the same range. Situated in northwestern Sabah, this is the largest protected area in East Malaysia, covering an area of 1,399 sq km. The Park is named for William Maunder Crocker (?–1899), a British administrator with the Rajah Brooke's Sarawak Civil Service, who introduced British administrative practice in what was then British North Borneo (now the Malaysian State of Sabah). The altitudinal variation of this Park is remarkable, in rising from near sea level to 1,670 m and extending from the base of Gunung Alab to the town of Tenom. The higher slopes are dominated by moss forests and by a profusion of rhododendrons and orchids. A general description of the site is in Briggs (1997:68). Preliminary studies on the herpetofauna of the Crocker Range National

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**Figure 1.** Map of Borneo, showing the location of Crocker Range National Park, Sabah. Map generated with the MICRODEM mapping program written by Peter Guth of the U.S. Naval Academy, using the GTOPO30 data set and edited by the author using Photoshop version 6.0.  
DOI: 10.1514/journal.arc.0040015g001

Park, at low elevations (290–410 m) have been conducted by Tan (1992), resulting in the discovery of new species by Inger (1989) and in general ecological studies of amphibians by Inger and Stuebing (1992). As predicted by Inger (1966) and Inger and Stuebing (1989), the fauna of both Sabah and of Borneo had continued to grow through new collections and better laboratory and field techniques. An assessment of the herpetological biodiversity of Crocker Range, Sabah, was conducted 2000–2001, in order to gather baseline data on species occurrence and habitat use. The present manuscript, written in 2001, was delayed in press, and two subsequent field collections from the Crocker Range have now been published—Ramlah et al. (2001) and

Hee et al. (2004) both reported anuran amphibians collected from the Range. Their lists have been included in the present inventory.

### Methodology

Field work was conducted between the years 1999–2001, during both the dry and wet months. Collecting techniques included netting for aquatic amphibians (adults as well as the larval stages), and “cruising” collection, including walking along forest trails or streams at all times of the day, and particularly after dusk, following evening showers. Potential microhabitats (e.g., under fallen trunks and branches and but-

**Table 1.** Checklist of the herpetofauna of Crocker Range (the National Park and associated lowlands).**Amphibians****Bufonidae**

- Ansonia anotis* Inger, Tan & Yambun, 2001  
*Ansonia hanitschi* Inger, 1960  
*Ansonia leptopus* (Günther, 1872)  
*Ansonia longidigita* Inger, 1960  
*Ansonia spinulifer* (Mocquard, 1890)  
*Bufo asper* Gravenhorst, 1829  
*Bufo juxtasper* Inger, 1964  
*Leptophryne borbonica* (Kuhl & van Hasselt, 1827)  
*Pedostibes maculatus* (Mocquard, 1890)  
*Pedostibes rugosus* Inger, 1958

**Megophryidae**

- Leptobranchella baluensis* Smith, 1931  
*Leptobranchella parva* Dring, 1983  
*Leptobranchium montanum* Fischer, 1885  
*Leptolalax* cf. *gracilis* (Günther, 1872)  
*Leptolalax* cf. *pictus* Malkmus, 1992  
*Megophrys nasuta* (Schlegel, 1858)  
*Megophrys* cf. *kobayashii* Malkmus & Matsui, 1997

**Microhylidae**

- Chaperina fusca* Mocquard, 1892  
*Kalophrynus heterochirus* (Boulenger, 1900)  
*Kalophrynus pleurostigma* Tschudi, 1838  
*Kalophrynus subterrestris* Inger, 1966  
*Kaloula pulchra* Gray, 1831  
*Metaphrynella sundana* (Peters, 1867)  
*Microhyla borneensis* Parker, 1926

**Ranidae**

- Fejervarya limnocharis* (Wiegmann, 1835)  
*Huia cavitympanum* (Boulenger, 1893)  
*Ingerana baluensis* (Boulenger, 1896)  
*Limnonectes finchi* (Inger, 1966)  
*Limnonectes ingeri* (Kiew, 1978)  
*Limnonectes kuhlii* (Tschudi, 1838)  
*Limnonectes leporinus* (Andersson, 1923)  
*Limnonectes palavanensis* (Boulenger, 1894)  
*Meristogenys kinabaluensis* (Inger, 1966)  
*Meristogenys orphnocnemis* (Matsui, 1986)  
*Meristogenys poecilus* (Inger & Gritis, 1983)  
*Meristogenys whiteheadi* (Boulenger, 1887)  
*Occidozyga baluensis* (Boulenger, 1896)  
*Rana erythraea* (Schlegel, 1837)  
*Rana hosii* Boulenger, 1891  
*Rana luctuosa* (Peters, 1871)  
*Rana raniceps* (Peters, 1871)  
*Rana signata* (Günther, 1872)  
*Staurois latopalmatus* (Boulenger, 1887)  
*Staurois natator* (Günther, 1858)  
*Staurois tuberilinguis* Boulenger, 1918

**Rhacophoridae**

- Nyctixalus pictus* (Peters, 1871)  
*Philautus aurantium* Inger, 1989  
*Philautus bunitus* Inger, Stuebing & Tan, 1995  
*Philautus hosii* (Boulenger, 1895)  
*Philautus mjobergi* Smith, 1925

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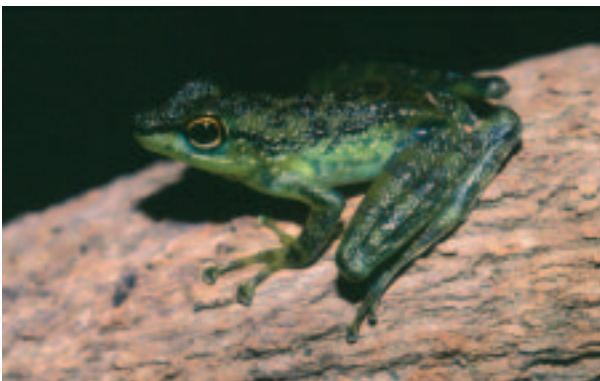
**Plate 1.** A view of forests of the Crocker Range National Park at 16th Mile, on the Papar-Keningau Pass.  
DOI: 10.1514/journal.arc.0040015g002



**Plate 2.** *Megophrys nasuta*.  
DOI: 10.1514/journal.arc.0040015g003



**Plate 3.** *Nyctixalus pictus*.  
DOI: 10.1514/journal.arc.0040015g004



**Plate 4.** *Staurois natator*.  
DOI: 10.1514/journal.arc.0040015g005



**Plate 5.** *Limnonectes palavanensis*.  
DOI: 10.1514/journal.arc.0040015g006

Table 1. Continued.

**Amphibians**

*Philautus petersi* (Boulenger, 1900)  
*Polypedates leucomystax* (Gravenhorst, 1829)  
*Polypedates macrotis* (Boulenger, 1891)  
*Polypedates ottilophus* (Boulenger, 1893)  
*Rhacophorus angulirostris* Ahl, 1927  
*Rhacophorus baluensis* Inger, 1954  
*Rhacophorus everetti* Boulenger, 1894  
*Rhacophorus gauni* (Inger, 1966)  
*Rhacophorus pardalis* Günther, 1858

**Reptiles****Agamidae**

*Bronchocela cristatella* (Kuhl, 1820)  
*Draco haematopogon* Boie in: Gray, 1831  
*Phoxophrys borneensis* Inger, 1960  
*Phoxophrys cephalum* (Mocquard, 1890)

**Eublepharidae**

*Aelurosscalabotes felinus* (Günther, 1864)

**Gekkonidae**

*Cosymbotus platyurus* (Schneider, 1792)  
*Cyrtodactylus baluensis* (Mocquard, 1890)  
*Cyrtodactylus matsuii* Hikida, 1990

**Scincidae**

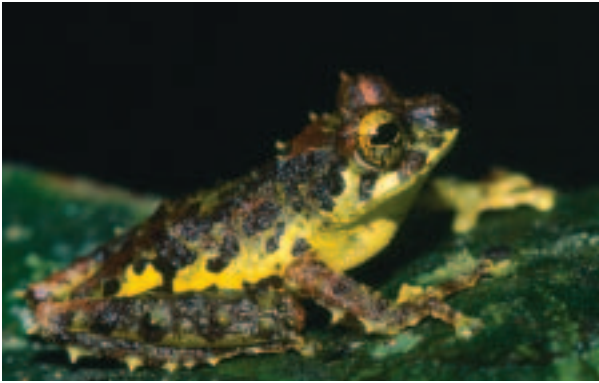
*Apterygodon vittatus* Edeling, 1864  
*Mabuya* sp.  
*Sphenomorphus* sp.  
*Tropidophorus mocquardii* Boulenger, 1894

**Colubridae**

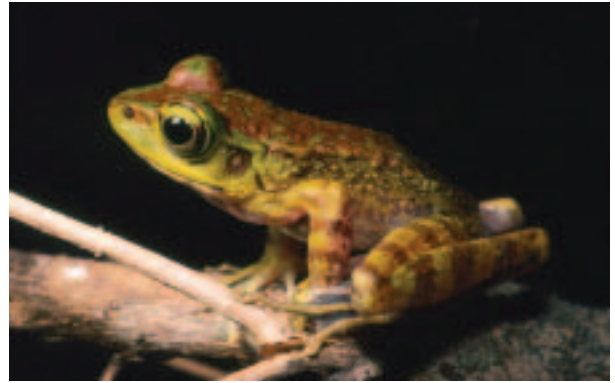
*Ahaetulla prasina* (Boie, 1827)  
*Asthenodipsas laevis* (Boie, 1827)  
*Asthenodipsas malaccanus* Peters, 1864  
*Amphiesma flavifrons* (Boulenger, 1887)  
*Amphiesma saravacense* (Günther, 1872)  
*Calamaria leucogaster* Bleeker, 1860  
*Calamaria suluensis* Taylor, 1922  
*Coelognathus flavolineatus* (Schlegel, 1827)  
*Gongylosoma baliodeirum* (Boie, 1827)  
*Gongylosoma longicauda* (Peters, 1871)  
*Gongylosoma* sp.  
*Gonyophis margaritatus* (Peters, 1871)  
*Hydrablades periops* (Günther, 1872)  
*Lepturophis albofuscus* (Duméril, Bibron & Duméril, 1854)  
*Lycodon effraenis* Cantor, 1827  
*Lycodon subcinctus* Boie, 1827  
*Oligodon everetti* Boulenger, 1893  
*Pareas nuchalis* (Boulenger, 1900)  
*Psammodynastes pulverulentus* (H. Boie in F. Boie, 1827)  
*Pseudorabdion albonuchalis* (Günther, 1896)  
*Ptyas fusca* (Günther, 1858)  
*Rhabdophis chrysargos* (Schlegel, 1827)  
*Rhabdophis conspicillatus* (Günther, 1872)  
*Rhabdophis murudensis* (Smith, 1925)  
*Sibynophis geminatus* (Boie, 1826)  
*Sibynophis melanocephalus* (Gray, 1825)

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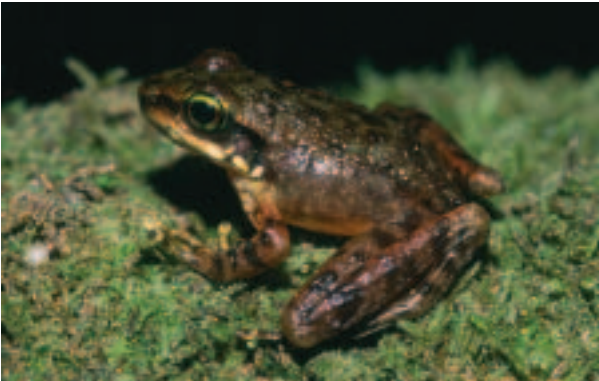




**Plate 6.** *Rhacophorus everetti*.  
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**Plate 7.** *Meristogenys kinabaluensis*.  
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**Plate 8.** *Meristogenys whiteheadi*.  
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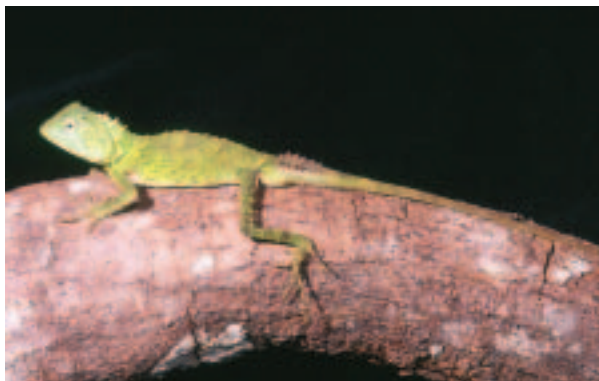
**Plate 9.** *Rana hosii*.  
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**Plate 10.** *Leptophryne borbonica*.  
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**Plate 11.** *Phoxophrys borneensis*.  
DOI: 10.1514/journal.arc.0040015g012



**Plate 12.** *Phoxophrys cephalum*.  
DOI: 10.1514/journal.arc.0040015g013



**Plate 13.** *Aeluroscalabotes felinus*.  
DOI: 10.1514/journal.arc.0040015g014

Table 1. Continued.

<b>Colubridae</b>
<i>Stoliczka borneensis</i> Boulenger, 1899
<b>Crotalidae</b>
<i>Pariasis sumatranus</i> (Raffles, 1822)
<i>Popeia sabahi</i> (Regenass & Kramer, 1981)
<i>Trimeresurus borneensis</i> (Peters, 1872)
<i>Tropidolaemus wagleri</i> Wagler, 1830
<b>Elapidae</b>
<i>Calliophis intestinalis</i> (Laurenti, 1768)
<i>Ophiophagus hannah</i> (Cantor, 1836)

DOI: 10.1514/journal.arc.0040015t001

Table 2. Geographical statistics for Borneo. \*Total land area figures for Indonesia and Malaysia represent only the sum of the Bornean components (Brunei Darussalam, Malaysia, and Indonesia). Data from Smythies and Davison (1999:6).

	Land Area (km <sup>2</sup> )	Human Population (1990)	Population Density (km <sup>2</sup> )	Forested Area (km <sup>2</sup> ) in 1990	Percent Forest Cover
*Brunei Darussalam	5,760	300,000	52.1	4,360	75.7
*Malaysia	198,160	3,527,200	17.8	134,214	67.7
Sabah	73,710	1,808,800	24.5	44,367	60.2
Sarawak	124,450	1,718,400	13.8	89,847	72.2
*Indonesia	539,460	9,096,000	16.9	396,100	73.4
West Kalimantan	146,760	3,228,000	22.0	87,000	59.3
Central Kalimantan	152,600	1,396,000	9.1	111,100	72.8
South Kalimantan	37,660	2,597,000	69.0	8,000	21.2
East Kalimantan	202,440	1,875,000	9.3	180,000	88.9
<b>Total</b>	<b>743,380</b>	<b>12,923,200</b>	<b>17.4</b>	<b>534,674</b>	<b>71.9</b>

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tresses of tree trunks) were searched. Data on specimens taken from systematic institutions have also been collated. These include the Natural History Museum, London; Field Museum of Natural History, Chicago; Zoological Museum, Gunung Kinabalu National Park Headquarters; "Borneensis Collection" of Universiti Malaysia Sabah, Kota Kinabalu; and the Sabah State Museum, Kota Kinabalu.

Data recorded for each capture include species, sex, stage of growth, and reproductive condition. Voucher specimens were retained to verify identification and eventual deposition in appropriate systematic institutions. Dietary and microhabitat data was recorded in standard pro forma. All species and colour morphs were photographed in life using color slide transparency film, for use in talks, field manuals, and for production of publicity material.

## Results and discussions

The known amphibian fauna includes the families Bufonidae (ten species), Megophryidae (seven species), Microhylidae (seven species), Ranidae (21 species), and Rhacophoridae (14 species). The reptile fauna recorded thus far includes Agamidae (four species), Eublepharidae (one species), Gekkonidae (three species), Scincidae (four species), Colubridae (27 species), Crotalidae (four species), and Elapidae (two species). Table 1 lists the herpetofauna of the Crocker Range as known at present.

As may be expected, a large number of species are exclusively montane in distribution. These include *Ansonia anotis*, *A. hanitschi*, *A. longidigita*, *Leptobranchella baluensis*, *L. parva*, *Leptobranchium montanum*, *Leptolalax* cf. *pictus*, *Kalophrynus subterrestris*, *Huia cavitympanum*, *Ingerana baluensis*, *Meristogenys kinabaluensis*, *M. orphnocnemis*, *M. poecilus*, *M. whiteheadi*, *Rana signata*, *Philautus bunitus*, *P. petersi*, *Rhacophorus angulirostris*, *R. baluensis*, *R. everetti*, and *R. gauri*, among amphibians. A few widespread species occur in the lowlands of the Range, including the human-commensal, *Kaloula pulchra*. The number and proportion of reptiles that are essentially montane at this site seemed slightly lower: *Draco haematopogon*, *Phoxophrys borneensis*, *P. cephalum*, *Cyrtodactylus baluensis*, *C. matsuii*, *Sphenomorphus* sp., *Tropidophorus mocquardii*, *Amphiesma saravacense*, *Stoliczka borneensis*, and *Popeia sabahi*. On the other hand, there were relatively more lowland species, including human commensals among the reptiles, and these include: *Bronchocela cristatella*, *Aeluroscalabotes felinus*, *Cosymbotus platyurus*, *Apterygodon vittatus*, *Mabuya* sp., *Ahaetulla prasina*, and *Coelognathus flavolineatus*.

Of the ecological types (habitat + use of diel time) represented among the amphibian fauna, 36 are exclusively riparian and/or utilize riparian habitats for breeding and 23 are non-riparian. All are active at night, and some (including *Staurois latopalmaris* and *Ansonia longidigita*) also found abroad during the day. Among the reptiles, only four species can be





Plate 14. *Amphiesma saravacense*.

DOI: 10.1514/journal.arc.0040015g016



Plate 15. *Sphenomorphus* sp.  
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Plate 16. *Stoliczka borneensis*.  
DOI: 10.1514/journal.arc.0040015g017



Plate 17. Logging in the lowlands of the Crocker Range.  
DOI: 10.1514/journal.arc.0040015g018

classified as riparian, the rest non-riparian. The reptile fauna of the Range could also be divided into a diurnal community (19 species) and a nocturnal one (25 species); the activity patterns

of a few (e.g., the sit-and-wait viperid snakes, as well as their non-venomous colubrid mimic, the so-called Mock Viper, *Psammodynastes pulverulentus*) are difficult to classify into



either of these two categories. Divided into categories based on microhabitat use, 17 were exclusively arboreal, 24 primarily terrestrial, one primarily fossorial, and three aquatic.

A number of rare taxa are known from the Range. These include the third specimen known of the montane colubrid snake, *Stoliczka borneensis*, hitherto known only from Gunung Kinabalu and Trus Madi (and most recently, from Sarawak's Gunung Murud); *Oligodon everetti*, also known solely from the Gunung Kinabalu massif; and *Rhabdophis murudensis*, known from Gunung Murud, to the south of Crocker Range. Additional specimens of a Crocker Range frog endemic, *Philautus bunitus*, were collected. New species collected from the range include a semi-fossorial skink of the genus *Sphenomorphus* and the colubrid snake of the genus *Gongylosoma*. Another species of snake collected, *Popeia sabahi*, was until recently referred to the mainland Asian population of *Trimeresurus popeiorum*. The 59 species of amphibians and 45 species of reptiles recorded to date from the Range represent 39 and 16.2 percent of the total Bornean amphibian and reptile fauna, respectively.

The high levels of deforestation of countries within Borneo (excluding Brunei Darussalam; see Das 1994) are a cause for concern (Primack and Hall 1992; Table 2). Most of the productive forests of East Malaysia, for instance, have either been already logged or placed under logging concessions (MacKinnon et al., 1996:398).

The uncertain future of tropical rainforests of Borneo in the long term places great importance of protection of montane forests of northern Borneo, such as the Crocker Range of Sabah, for the survival of biodiversity.

**Acknowledgments.**—I thank Sabah Parks, and its Scientific Officer, Jamili Nais for permission and facilities to work in the Crocker Range National Park. Collections from the Park were made under permit number TS/PTD/5/5Jld. 14(76). Field work was supported by a research grant (UNIMAS 192/99 [4]) administered by Universiti Malaysia Sarawak. I thank Prof. Ghazally Ismail, former Deputy Vice Chancellor, UNIMAS, and Datuk Lamri Ali, Director of Sabah Parks for invitation to participate in the Crocker Range Scientific Expedition (1999); Fatimah Abang and Andrew Alek Tuen, successive Directors at the Institute of Biodiversity and Environmental Conservation (UNIMAS), for support and facilities, and colleagues, past and current, at IBEC (Stuart James Davies, and Nicolas Pilcher) for support. For field companionship, I thank Christopher Cowell Austin, Heok Hui Tan, and Kelvin Kok Peng Lim.

For permission and facilities to examine specimens under their care, I thank the staff of the Field Museum of Natural History, Chicago (Robert Frederick Inger, Alan Resetar, and Cassandra Redhed); Sabah Parks Zoological Museum, Gunung Kinabalu National Park Headquarters (Jamili Nais and Maklarin Lakim); Sabah State Museum, Kota Kinabalu (Anna Wong), and the Borneensis Collection of Universiti Malaysia Sabah, Kota Kinabalu (Maryati Mohammed, Ahmed Sudin, and Lucy Kimsui). Gary Geller, Jet Propulsion Laboratory, National Aeronautics and Space Administration, helped generate the base map of Borneo.

Finally, I'd like to thank Aaron Bauer and Lee Grismer for comments on the manuscript.

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*Manuscript received: 18 February 2002; Accepted: 21 July 2004; Published: 26 December 2006*