

## AN ACCOUNT OF ANURAN AT CROCKER RANGE NATIONAL PARK, SABAH

Ramlah Zainudin, Lizanah Wasly and Haidar Ali<sup>1</sup>

### ABSTRACT

*The survey was conducted at three localities at Crocker Range National Park, Sabah. A total of 110 individuals and 18 species belonging to the family of Ranidae, Bufonidae, Microhylidae, Megophryidae and Rhacophoridae were identified. The family of Ranidae (44%) dominated the area with Rana kuhli being the most abundant (65 individuals). There was no significant difference in terms of species occurrence for both sites A and B ( $H=47.50$ , Mann-Whitney). Although more individuals were captured at Site A with a total of 73 individuals, Site B appeared to be more diverse in terms of species captured ( $H=0.829$ ).*

### INTRODUCTION

The anuran, consisting of frogs and toads, has been extensively studied in Sabah by a number of different investigators in the past (Inger and Stuebing 1997; Inger 1966; Inger and Stuebing 1989; Inger and Stuebing 1992; Inger et al. 1995; Inger et al. 1996; Wong 1994). As a consequence, the number of frog species known to occur in Borneo has dramatically increased from a mere 92 species not more than four decades ago (Inger 1966) to at least 140 species known presently (Inger and Stuebing 1997). The number continued to increase as new frog species were discovered every year from their varied habitats. Further, as new scientific tools for taxonomic classification emerged, the complexity of species status in some of the known frogs had been resolved and new species were identified. To obtain an overall picture of diversity and distributions of anurans in Borneo, it became pertinent to collect more specimens from previously unexplored habitats with the intention to inventorise and document their conservation status.

A scientific expedition to the Crocker Range National Park (CRNP), located south of Kota Kinabalu, Sabah, was organized by the Universiti Malaysia Sarawak and the Sabah Parks in October 1999 for a total period of two weeks. The park consisted mostly of dipterocarp forest with a small percentage of montane forest. The CRNP was known to harbour a wide variety of wildlife such as the vulnerable primates, orangutans, gibbons, tarsiers, longtailed and pigtailed macaques. Other wildlife included the porcupines, bears, civet cats, marbled cats and wild pigs that roamed freely within the Park boundaries. Unfortunately, information on the anuran species of the CRNP was rather scanty to date. The only data available on the anurans of the Crocker Range came from a study carried out in Sinsuran which reported a total of 40 species collected in 1998 (Inger and Stuebing 1992). Our study aimed to do an inventory of species occurrence at Crocker Range and also to obtain tissue samples for phylogenetic studies of the Bornean

voiceless frogs.

## MATERIALS AND METHODS

Frogs were collected at three localities, Site A near the Park headquarters (Figure 1a), Site B on the way to Keningau (Figure 1b) and Mahua waterfall. Site A was a mixed dipterocarp forest surrounded by disturbed forest. Bamboo tree was the dominant vegetation at the site. Site B, on the other hand, was situated near the road to Keningau. The vegetation here was that of a primary forest in general structure and interspersed by a few patches of submontane forest. Several streams of both small- and medium-sized (approximately 2-3m and 5-in respectively) were found to flow within the two localities. Several waterfall formations were found along the rivers, of which the Mahua waterfall had become a popular picnic spot among the local visitors. The vegetation around the Mahua waterfall was that of a secondary logged-over forest.

At each locality, a 600m of stream transect was surveyed and established during the day. Frogs were then captured by hand at night by wading along the stream banks for 2-3 hours. All ecological data (the position of the frog etc) were noted on site. Tissue samples were cut from frog thigh muscles and stored in DMSO buffer for phylogenetic analyses. Specimens were preserved in 4% formaldehyde on site and returned to the University Malaysia Sarawak as vouchers. The specimens were then put in 70% alcohol for long term preservation.

For data analysis, Shannon-Weiner Index was used to determine species diversity. A non-parametric test (Mann-Whitney test) was used to see whether site A was significantly different from site B in terms of species occurrence. Mahua was excluded from the comparison because frogs were collected only for one night from this site, compared to three nights at Site A and four at Site B.

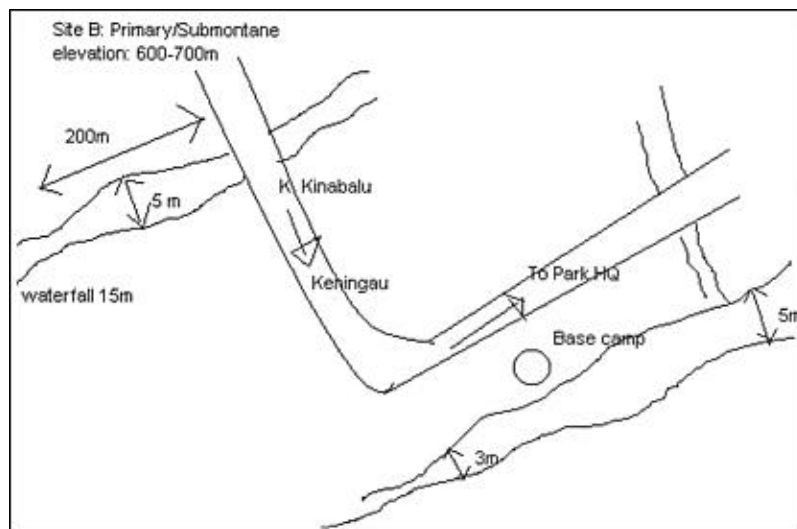


Figure 1a. Site A, (Mixed Dipterocarp / disturbed forest)

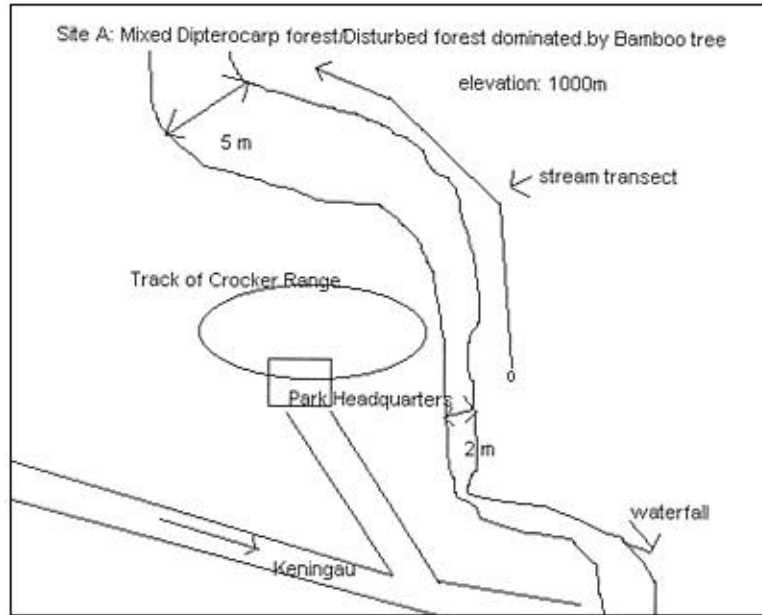


Figure 1b. Site B (Primary Forest in general structure)

## RESULTS AND DISCUSSION

A total of 18 species belonging to 5 families and 12 genera of anuran were captured from the study area (Table 1). Out of 18 species collected, 44% were represented by the family Ranidae, and 22% by the family Bufonidae and Megophryidae (Figure 2). The rest were from the family Microhylidae (6%) and Rhacophoridae (6%). In terms of the total number of individuals, dominant species were also from the family Ranidae with 81 individuals (Figure 3). The finding was consistent with a previous study on frog abundance along streams in Bornean forests (Voris and Inger 1995). They noted that fifteen common species representing four families (Bufonidae, Pelobatidae, Ranidae, Rhacophoridae) accounted for more than 90% of the frogs observed along streams at Nanga Tekalit, Sarawak. The family Ranidae commonly dominated the streams found in Borneo since most of the species were riparian species. Riparian frogs referred to stream dwelling species that spent their entire life cycles along streams or that utilized streams for breeding and larval development (Inger and Stuebing 1989). Most of the collections were from stream transects. Therefore it was to be expected that more riparian species were caught during the survey compared to only 3 individuals caught in forest floor quadrat (from species *Kalophrynus pleurostigma*). Individuals of anuran were found to be more abundant at Site A (11 sp and 73 individuals) compared to the other two localities (Table 2). However, there was no significant difference in terms of species occurrence for both sites A and B ( $H=47.50$ ,  $df=2$  at  $\alpha = 0.05$ , Mann-Whitney test), indicating that the vegetation was not influencing the distribution of the anuran species. The three localities showed almost the same number of species caught although more individuals were captured at site A than the others (Figure 4). The most dominant species caught here was *Rana kuhli* since the type of streams found were suitable for the species.

Table 1. List of anuran species and their numbers caught at Crocker Range

Family	Species	Number caught
Bufonidae	<i>Ansonia hanitschii</i>	2
Bufonidae	<i>Ansonia longidigita</i>	6
Bufonidae	<i>Ansonia leptopus</i>	1
Bufonidae	<i>Bufo juxtasper</i>	1
Microhylidae	<i>Kalophrynus pleurostigma</i>	6
Megophryidae	<i>Leptobrachium montanum</i>	3
Megophryidae	<i>Leptolalax gracilis</i>	2
Megophryidae	<i>Leptolalax pictus</i>	3
Megophryidae	<i>Megophrys nasuta</i>	4
Ranidae	<i>Occidozyga baluensis</i>	2
Ranidae	<i>Meristogenys poecilus</i>	2
Ranidae	<i>Meristogenys kinabaluensis</i>	1
Ranidae	<i>Polypedates macrotis</i>	1
Ranidae	<i>Rana finchi</i>	5
Ranidae	<i>Rana kuhli</i>	65
Ranidae	<i>Rana limnochoris</i>	4
Ranidae	<i>Staurois natator</i>	1
Ranidae	<i>Staurois tuberilinguis</i>	1

Table 2. The anuran caught at the three localities, Crocker Range.

Species	Site A	Site B	Mahua
<i>Ansonia hanitschii</i>	0	0	2
<i>Ansonia longidigita</i>	6	0	0
<i>Ansonia leptopus</i>	1	0	0
<i>Bufo juxtasper</i>	1	0	0
<i>Kalophrynus pleurostigma</i>	2	4	0
<i>Leptobrachium montanum</i>	1	2	0
<i>Leptolalax gracilis</i>	1	1	0
<i>Leptolalax pictus</i>	1	1	1
<i>Occidozyga baluensis</i>	1	1	0
<i>Megophrys nasuta</i>	0	3	1
<i>Meristogenys poecilus</i>	0	2	0
<i>Meristogenys kinabaluensis</i>	0	0	1
<i>Polypedates macrotis</i>	1	0	0
<i>Rana finchi</i>	2	3	0
<i>Rana kuhli</i>	53	12	0
<i>Rana limnochoris</i>	4	0	0
<i>Staurois natator</i>	0	0	1
<i>Staurois tuberilinguis</i>	0	0	1
Total number of species	11	10	6
Total number of individuals	73	30	7
Shannon-Weiner Index (H')	0.4947	0.829	0.759

Figure 2. Percentage in terms of the total number of species of each Family

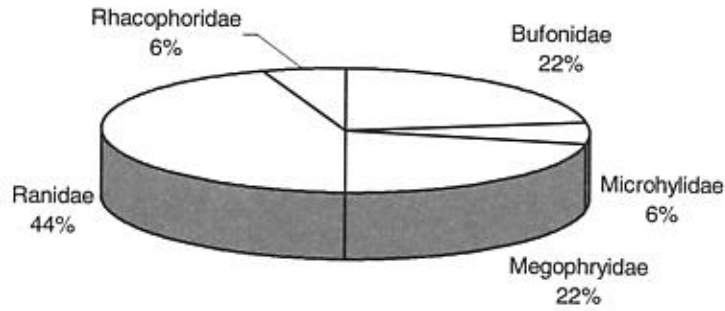


Figure 3. Total number of individuals and species of each family

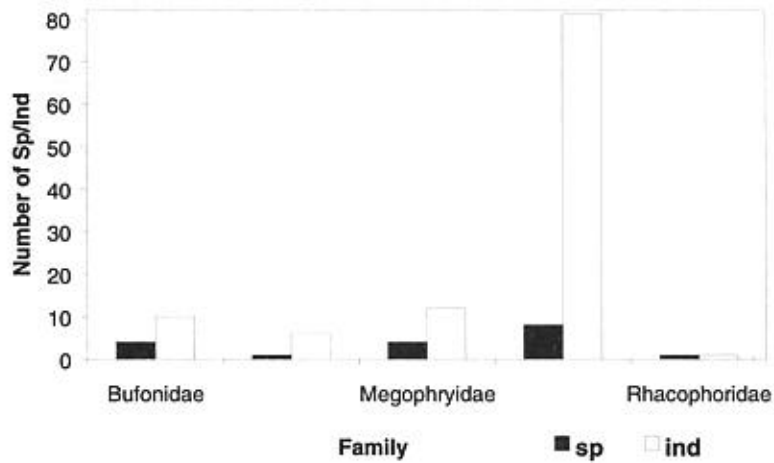
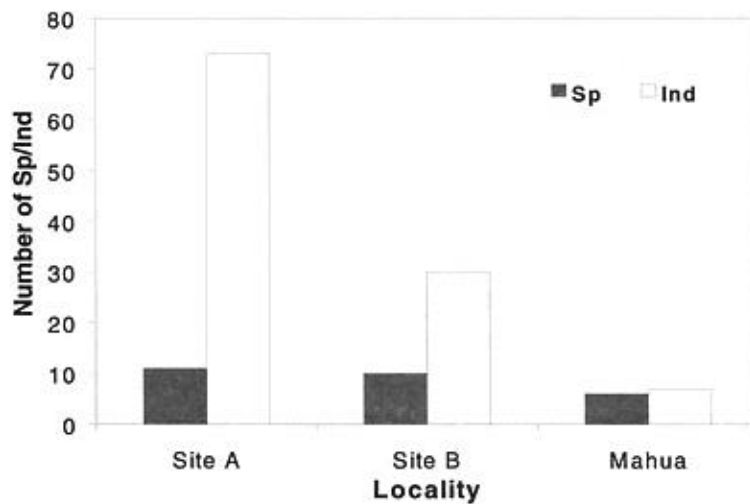


Figure 4. Total number of species and individuals for each locality



The Shannon-Weiner Index of diversity however, gave a clearer picture on the species diversity of the different sites surveyed. Site B was found to be more diverse ( $H=0.829$ ) compared to Site A ( $H=0.4947$ ) and Mahua ( $H=0.759$ ). The index may be influenced not only by the number of species but also by the number of individuals caught.

In comparison to the study on occurrence of frog species at Crocker Range in 1989, our study only managed to capture about 30% of the total collection made then (Table 3). One of the reasons for the lower number on individuals caught in our study may be due to type of habitat in which we did our collection. Most of the anuran caught in 1989 were species that live in primary and very old secondary forests with streams that had strong current and clear water, or on forest floors that were completely covered with leaf litter (Inger and Stuebing 1992). Although it was often reported from many distribution studies of frogs that vegetation type rarely influenced species occurrence, we believed that our collecting localities differed significantly with respect to the habitat of the 1989 collecting site in Sinsuran surveyed by Inger and Stuebing.

Although the Mahua forest was considered a primary forest in general structure, our frog collection data was only the outcome from a single trip there. In addition, Mahua forest could not be considered a typical primary forest habitat because, on the adjacent left of the forest, there existed a reasonably large area that had been cleared for agriculture. This might explain why some of the typical forest species like *Rana chalconota* and *Rana signata* were absent in the collection. Both Site A and Site B were secondary forest that failed to support some of the species normally collected in pristine primary forest. The type of streams found at the three localities were also not suitable for some species like *Rana leporina* since the species had been shown to dwell along medium and large streams with sandy and gravel substrata.

Sampling techniques could also have contributed to the absence of some tree frogs in our collection. Only stream and forest floor transects were used in the study and therefore minimizing our chance of any encounter with tree frog altogether.

Table 3: Occurrence of anuran at Crocker Range Sabah from the data of 1999 (recent study) and 1989 (below elevation of 1000m). The (+) indicates presence and (-) indicates absence.

ANURAN SPECIES	Data of 1999	Data of 1989 (Inger and Stuebing 1992)
<i>Ansonia hanitschii</i>	+	+
<i>Ansonia longidigita</i>	+	+
<i>Ansonia leptopus</i>	+	-
<i>Bufo juxtasper</i>	+	+
<i>Kalophrynus pleurostigma</i>	+	+
<i>Leptobrachium montanum</i>	+	+
<i>Leptolalax gracilis</i>	+	+
<i>Leptolalax pictus</i>	+	-
<i>Occidozyga baluensis</i>	+	+
<i>Megophrys nasuta</i>	+	+
* <i>Meristogenys poecilus</i>	+	-
* <i>Meristogenys kinabaluensis</i>	+	+

<i>Polypedates macrotis</i>	+	-
<i>Rana finchi</i>	+	+
<i>Rana kuhli</i>	+	+
<i>Rana limnochoris</i>	+	-
<i>Staurois natator</i>	+	+
<i>Staurois tuberilinguis</i>	+	+
* <i>Meristogenys cavitympanum</i>	-	+
* <i>Meristogenys orphnocnemis</i>	-	+
* <i>Meristogenys whiteheadi</i>	-	+
<i>Bufo asper</i>	-	+
<i>Chaperina fusca</i>	-	+
<i>Kalophrynus heterochirus</i>	-	+
<i>Kalophrynus subterrestris</i>	-	+
<i>Leptobrachella baluensis</i>	-	+
<i>Leptobrachella parva</i>	-	+
<i>Micrixalus baluensis</i>	-	+
<i>Nyctixalus pictus</i>	-	+
<i>Pedostibes rugosus</i>	-	+
<i>Polypedates otitophus</i>	-	+
# <i>Rana leporina</i>	-	+
<i>Rana chalconota</i>	-	+
<i>Rana palavanensis</i>	-	+
<i>Rana signata</i>	-	+
<i>Rhacophorus gauni</i>	-	+
<i>Staurois latopalmatus</i>	-	+

\* formerly known as *Amolops* spp.

# formerly known as *Rana blythi*

Few reptiles were caught during the survey. Only one species of snake (*Ahaetulla prasina*) was caught accidentally at Site B. Meanwhile, three species of lizards (*Cyrtodactylus baluensis*, *Cyrtodactylus matsui* and *Phoxophrys* sp) were captured at Site A and Site B. Overall, the total collection was quite low in terms of diversity compared to other parts of Borneo such as Nanga Tekalit (Inger 1966) but comparable to the anuran collection (18 sp) at Bario (Ramlah 1998).

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<sup>1</sup> Faculty of Resource Science & Technology, University Malaysia Sarawak, Kota Samarahan, Sarawak.