

PRELIMINARY SURVEY OF BATS OF THE CROCKER RANGE NATIONAL PARK SABAH, MALAYSIA

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ABSTRACT

*Based on fieldwork in conjunction with the Crocker Range Expedition during October 1999 eight species of bats were recorded. Examination of Sabah Park mammals collection from Trus Madi, Kinabalu Park and Poring Hot Spring as well as search of the available literature revealed an additional 33 species of bats, giving an overall record of 41 species. These include 11 species of megachiropteran and 30 species of microchiropteran. Fifteen of the bats listed are known to roost in caves. None of the bats are endemic to Crocker Range Park but the naked bat, *Cheiromeles torquatus*, may be threatened.*

INTRODUCTION

Crocker Range is a tropical highland that runs roughly parallel to the West Coast of Sabah and separates it from the interior areas. This highland is divided into two management area, Kinabalu Park and Crocker Range Park. Crocker Range Park (CRP), enacted in 1984 and covering an area of 139,919ha, is located on the southwestern part of this range. It was established to protect the watershed of several rivers and to conserve the hill dipterocarp and montane forest which are habitats for a diverse community of flora and fauna.

The park is surrounded by hundreds of villages of different ethnic communities who depended on the natural resources of Crocker Range for their livelihood. These communities have cleared large tracts of forest within the park and “declared” their rights to own and cultivate the land. An effective management plan is therefore imperative in order to protect the integrity of the park and the resources it sought to conserve. An inventory of the biological diversity of the park would provide the baseline data upon which a management plan can be drawn. It is towards this end that a scientific expedition to inventorise the biodiversity of Crocker Range Park was organised in October 1999. This paper reports the finding of the bat project.

The principal objectives of the bat project were to compile an inventory of the bat species found in the Crocker Range area, and to identify any specific species or group of bats which requires a priority in future management or research.

METHODS

Several methods for catching bats were used during the Crocker Range Expedition. The main method was the use of twelve mist-nets and two harp traps which were used at two sites at

Crocker Range Park Headquarters. Mist nets were set in a variety of locations in both primary and old secondary forest and in disturbed agricultural sites. The nets often served a dual research purpose in catching birds during the day (Mustafa et al. 2000), and bats at night. These sites were located in disturbed vegetation and often near human habitation. Bat ultrasonic calls were recorded with a QMC Bat Detector at several locations but due to the lack of a local reference library of ultrasonic calls, no identifications were made using this technique. One species (*Rhinolophus borneensis*) was observed at close range and its ultrasonic call recorded in a small cave near the Mahua Base Camp.

RESULTS AND DISCUSSION

During the period of the Crocker Range Expedition (15-24 October 1999) eight species of bats were caught, 5 megachiropterans and 3 microchiropterans (see column 1 of Table 1). This was a lower than expected capture rate and was probably due to several periods of heavy overnight rainfall.

To get a more extensive inventory of the bats found in the Crocker Range area, a search was conducted of specimens held in the Sabah Parks mammal collection (Table 1, columns 2 and 3). This collection commenced in 1997 and most specimens collected prior to this in the Crocker Range area have been lodged in the British Museum and the Sabah Museum. As data from many of these earlier specimens have been incorporated in Payne and Francis (1985), this source was also searched for records for the Crocker Range area (Table 1, columns 4 and 5). The surrounding areas of Trus Madi, Keningau, Kinabalu Park, Poring Hot Spring and Ranau were included in both searches as they were close and covered similar vegetation and altitudinal ranges.

Using these additional sources, forty-one species of bats have been recorded from the Crocker Range area (Table 1), 11 megachiropterans and 30 microchiropterans. No bats are endemic to the area, but the only known records for *Pipistrellus javanicus* and *P. petersi* from Borneo are from high altitudes (1200-1600m) on Mount Kinabalu and the Crocker Range. Both species are also found in other areas of Southeast Asia (Payne and Francis 1985). It is possible that additional species will be added when a search of the Sabah Museum and British Museum collections are conducted. A search through the literature may also reveal additional species.

An inventory of species is an important base for designing further studies and identifying species which may require specific management considerations. Further surveys at specific sites in the Crocker Range area (e.g. caves, buildings, in and above the forest canopy, high and low altitudes) are likely to add more species to the list. Schulz and de Oliveira (1995) showed that no single survey technique records all species of bats in an area and that a combination of techniques including mist-netting, bat traps, ultrasonic detection, roost-site searches (e.g. caves) and triplines over water produces the most extensive inventory.

Table 1. List of bat species found in the Crocker Range area, Sabah. Nomenclature follows Payne and Francis (1985)

Common Name	Scientific Name	1	2	3	4	5
Large Flying-fox	<i>Pterous vampyrus</i>		x			x
Short-nosed Fruit Bat	<i>Cynopterus brachyotis</i>	x	x	x		x
Horsfield's Fruit Bat	<i>Cynoterus horsfeildi</i>	x		x		
Dusky Fruit Bat	<i>Penthetor lucasi</i>			x		
Tailless Fruit Bat	<i>Megaerops ecaudatus</i>	x		x		
Dayak Fruit Bat	<i>Dyacopterus spadiceus</i>			x		
Spotted-winged Fruit Bat	<i>Balionycteris maculata</i>			x		
Grey Fruit Bat	<i>Aethalops alecto</i>	x		x		
Cave Nectar Bat	<i>Eonycteris spelaea</i>			x		
Greater Nectar Bat	<i>Eonycteris major</i>			x		
Long-tongued Fruit Bat	<i>Macroglossus minimus</i>	x	x	x		
Pouched Tomb Bat	<i>Saccolaimus saccolaimus</i>				x	
Long winged Tomb Bat	<i>Taphozous longimanus</i>					x
Lesser False Vampire	<i>Megaderma spasma</i>			x		
Bornean Horseshoe Bat	<i>Rhinolophus borneensis</i>	x		x		x
Acuminate Horseshoe Bat	<i>Rhinolophus acuminatus</i>					x
Trefoil Horseshoe Bat	<i>Rhinolophus trifoliatus</i>	x				x
Lesser Woolly Horseshoe Bat	<i>Rhinolophus sedulus</i>					x
Great Woolly Horseshoe Bat	<i>Rhinolophus luctus</i>					x
Fawn Roundleaf Bat	<i>Hipposideros cervinus</i>			x		
Cantor's Roundleaf Bat	<i>Hipposideros galeritus</i>			x		
Diadem Roundleaf Bat	<i>Hipposideros diadema</i>			x		
Whiskered Myotis	<i>Myotis municola</i>	x	x	x		x
Black Myotis	<i>Myotis gomentongensis</i>					x
Small-toothed Myotis	<i>Myotis siligorensis</i>					x
Javan Pipistrelle	<i>Pipistrellus javanicus</i>			x	x	x
Least Pipistrelle	<i>Pipistrellus tenuis</i>					x
Dark-brown Pi istrelle	<i>Pipistrellus celonicus</i>					x
Woolly Pipistrelle	<i>Pipistrellus petersi</i>				x	
Narrow-winged Pipistrelle	<i>Pipistrellus stenopterus</i>					x
Narrow-win ed Brown Bat	<i>Philetor brachypterus</i>					x
Thick-thumbed Bat	<i>Glischropus tylopus</i>			x		
Greater Bamboo Bat	<i>Tylonycteris robustula</i>			x	x	x
Bronzed Tube-nosed Bat	<i>Murina aenea</i>				x	
Lesser Tube-nosed Bat	<i>Murina suilla</i>			x		x
Papillose Wolly Bat	<i>Kerivoula papillosa</i>			x		
Hardwick's Wolly Bat	<i>Kerivoula handwickii</i>			x		
Clear-winged Wolly Bat	<i>Kerivoula ellucida</i>			x		x
Large Bent-winged Bat	<i>Miniopterus magnater</i>					x
Common Bent-winged Bat	<i>Miniopterus schreibersii</i>			x		
Naked Bat	<i>Cheiromeles torquatus</i>			x		

1 = Specimens caught or observed on Crocker Range Expedition, 15-24 October 1999. 2 = Specimens collected from Crocker Range and Keningau and now located in Sabah Parks

Museum collection. **3** = Specimens collected from Trus Madi, Kinabalu Park and Poring Hot Spring and now located in Sabah Parks Museum collection. **4** = Specimens listed from Crocker Range and Keningau by Payne and Francis (1985). **5** = Specimens listed from Trus Madi, Mount Kinabalu National Park and Ranau by Payne and Francis (1985).

Typically bat communities are analysed or compared using a number of classifications. These include assigning bats to guilds according to their main foraging habitats (within vegetation below the canopy, within the canopy layer, edge and gap, above canopy and open-space), diet (nectar, fruit, invertebrates, small vertebrates), or feeding strategies (aerial, gleaning, hovering, ambush). However as in many places in the world, the foraging habits, diet and feeding strategies of the majority of the bat species found in the Crocker Range area are poorly known and do not allow for these types of analyses.

An inventory or species list such as Table 1 can be used as an indication of biodiversity or species richness, which is useful in comparisons (e.g. Bourliere 1983 and Wilson et al. 1997). Using inventory species totals it can be seen that bats reach their greatest diversity in the tropical lowland forests of the New World (Kalko 1998). In the forests of Central Amazonia for example, more than 100 species may occur sympatrically in small areas (Voss and Emmons 1996). This high diversity is supported by an equally diverse range of bat diets from pollen, fruit, nectar, leaves, insects, fish, small vertebrates and blood (Kalko 1998). Bat diversity is not as high in the Old World tropics, possibly due to the lack of the extremely diverse Family Phyllostomatidae, members of which are restricted to the New World. In Sarawak, 27 species of bats have been recorded from Mulu National Park and 32 from Niah National Park (Hall 1996; and Hall, unpublished). Francis (1990) caught 32 species in lowland forests at Sepilok Forest Reserve, Sabah and 26 species at Pasoh in peninsula Malaysia. The 41 species recorded at Crocker Range is no doubt due to the large sampling area, diverse vegetation and altitudinal variation.

Not all bats listed in the inventory for the Crocker Range area are likely to be sympatric. Altitude is known to have an effect on species numbers and composition (Patterson et al. 1966), with higher altitudes supporting fewer species of bats. The species restricted to higher altitudes tend to be more specialised in terms of roost and food requirements. In the Crocker Range, *Aethalops alecto* appears to be restricted to elevations above 1000m which agrees with the observations on the species by Medway (1972) from Peninsular Malaysia.

For the microchiroptera listed in Table 1, Payne and Francis (1985) record that *Pipistrellus javanicus*, *P. ceylonicus* and *P. petersi* are confined to altitudes above 1,200m in Borneo. Most of the other microchiropterans in Table 1 are widespread in Borneo.

In the Crocker Range it is safe to predict that given the diversity in the body size of bats (e.g. 3.2g for *Murina suilla* to 1,100g for *Pteropus vampyrus*; Payne and Francis 1985) and body and teeth morphology, that bats will play diverse roles in pollination, seed dispersal and influencing insect numbers. Eight of the eleven megachiropterans recorded for the Crocker Range are fruit-eating species and are important in seed dispersal and forest dynamics. The remaining three (*E. spelaea*, *E. major* and *M. minimus*) are principally nectariferous and pollinate flowers while

feeding on nectar. Two of the five megachiropterans caught during the expedition (*C. brachyotis* and *C. horsfieldi*) were mainly caught in areas cleared for shifting agriculture. These fruit-eating species play an important role in the recolonisation of disturbed areas by forest tree species. Further studies could reveal them to be good indicator species of disturbed habitats as shown by other bats in studies by Fenton et al. (1992) and Wilson et al. (1996). *M. ecaudatus* and *Athelops alecto* were caught in primary or closed forest and may be restricted to these habitats.

Despite there being no large outcrops of limestone containing caves in the Crocker Range area (Wilford 1964), 15 species listed in Table 1 are known to roost in caves. However most of these species appear to be able to utilise alternate roost sites such as under rock piles, overhanging creek banks, tree hollows and shallow cracks. It is also possible that some strong flying cave-dwelling species feed in the Crocker Range area at night but return to spend the daytime in distant roosts (e.g. *Eonycteris spelaea*, *Miniopterus magnater*, *M. schreibersii* and *Cheiromeles torquatus*).

There are a number of bats in Table 1 which are known from Borneo by only a few specimens from Sabah (Payne and Francis 1985). This may be because they are rare, difficult to catch using conventional survey methods, or lack a suitable cave roost site. These bats include *Myotis siligorensis*, *Murina aenea* and *Rhinolophus acuminatus*.

The only bat in the Crocker Range area known to be threatened in any way is *Cheiromeles torquatus*. This spectacular bat generally roosts in large caves, often with swiftlets, but is also known to live in large tree hollows. Most colonies of this species in Sarawak have suffered dramatic declines in numbers over the last 30 years or have totally disappeared (L. Hall, pers obs).

This report has provided a baseline data on the diversity of bats in the Crocker Range Area. The following research projects will help generate a more complete inventory of bat species, reveal factors which promote bat diversity and an understanding of how various species partition themselves and resources in time and space. The projects will also lead to a better understanding of how environmental changes may influence bat diversity and in turn, the plants and animals with which they interact.

- a survey of cave-dwelling bats
- high-level canopy harp and mist-netting
- more harp trapping and mist-netting at different elevations and vegetation types
- survey bats for recently emerged diseases
- strictly controlled comparisons between logged and unlogged areas
- generate an ultrasonic call library for microbat species identification
- long-term monitoring of bats at select sites
- fur smears for pollen and faecal examination for seeds to identify bat/plant interactions

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