A Checklist of the bats (Chiroptera) of Bukit Mertajam, Pulau Pinang, Malaysia

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Abstract: A study was conducted at Bukit Mertajam Recreational Park, Penang between October and December 2010 to survey the diversity of Chiroptera in this area. A total of 379 individuals representing 13 species were captured over a period of nine trapping nights and the deployment of 23 harp traps. The most abundant bat species found at Bukit Mertajam is *Hipposideros bicolor* with 145 individuals. A preliminary checklist of the chiropteran fauna for Bukit Mertajam is presented.

Keywords: Chiropteran, Diversity, Bats, Bukit Mertajam, Penang, Harp trap

INTRODUCTION

With more than 125 species, Malaysia is at the centre of the Old World bat diversity and is considered the most important country for international bat conservation (Kingston et al., 2009). Bats are a crucial part of the ecosystem as the insectivorous bats eat insects and help to control an array of insect pests while fruit bats are important seed dispersers and known pollinators of many commercially important plant species in the tropics such as durian (*Durio* sp.) and petai (*Parkia speciosa*) (Kingston et al., 2009). Sadly, despite being vital components of global biodiversity, more than a quarter of Malaysia's bats are red-listed by IUCN as being at risk of extinction (Kingston et al., 2009).

There are seven families in Microchiroptera which include 26 genera and a total of 109 species in Peninsular Malaysia. The family Emballonuridae has a total of four species in three genera while Nycteridae, represented by a single genus with only one species. There are two species in Megadermatidae that can be found in Peninsular Malaysia which is represented by a single genus. For Rhinolophidae, there is only one genus with at least 18 species recorded in Peninsular Malaysia. The Hipposideridae, represented by three genera with 21 species while the Molossidae has three genera with four species. The

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largest family is the Vespertilionidae which contains nearly half of all the insectivorous bats found in the country. There are at least 42 species of bats in this family belonging to 14 genera and four sub-families. The subfamily, Miniopterinae is represented by two genera with only three species, the subfamily Murininae is represented by two genera with six species, the subfamily Kerivoulinae has 10 species in two genera while the subfamily Vespertilioninae is the largest with 23 species in eight genera (Kingston et al., 2009).

MATERIALS AND METHODS

The Bukit Mertajam Recreational Forest encompasses 37 ha of lowland dipterocarp forest. The highest peak in the area stands at 545m above sea level. Some of the tree species found in the area are included and some of the other species of fauna known from the area are included too. The study area is surrounded by oil palm plantations.

Three different sampling sites were selected which include a sampling site (A) at an upper elevation (534m, N: 05.36685°, E: 100.48389°), a sampling site at mid elevation (B) (235m, N: 05.36674°, E: 100.49407°) and also a sampling at the base of the hill (C), (67m, N: 05.35731°, E: 100.49065°). At sampling site A, the vegetation is not very dense while for sampling sites B and C, the vegetation is very dense and there are also boulders scattered around the site.

Bats were trapped from the beginning of October to December 2010 to the end of December 2010. A total of twenty three harp traps (4 layers of nylon) were set up over a total of nine trapping nights. The harp traps were set up at dusk (1800 hrs) and closed just after dawn (0730 hr). Traps were checked one hour after they were deployed and then left overnight before they were re-checked in the early morning. The times of peak bat activity are at dusk and dawn (Kingston, et al. 2003a; Lumsden and Bennett, 2005).

Captured bats were held overnight in cloth bags individually (Kingston et al., 2003a), and were sexed and identified based on their morphology (Bumrungsri et al., 2006) the following morning. Each individual was checked to determine if it was an adult or a juvenile according to the cartilage of their digit (Thabah et al., 2006). Specimens were weighed using an electronic weighing scale and the forearm and the ears were measured (in mm) using a stainless steel ruler. The coloration of the upper body and under parts, color of the tail, the shape of tail, texture of hair and mammary gland were noted to help in species identification. All the data was recorded in a data sheet. The bats were released the following morning at their site of capture after they were identified. Species identification was based on Kingston et al. (2009),

Payne and Francis (1998) and Medway (1978).

RESULTS AND DISCUSSION

A total of 379 individual bats representing 13 species were captured (Table 1). The species included two species of frugivorous bats; *Chironax melanocephalus* and *Penthetor lucasi* and 11 species of insectivorous bats; *Hipposideros bicolor, Hipposideros armiger, Hipposideros larvatus, Hipposideros cineraceus, Rhinolophus robinsoni, Rhinolophus lepidus, Rhinolophus affinis, Kerivoula pellucida, Murina suilla, Myotis ridleyi,* and *Miniopterus medius*. The total number of individuals captured at sampling site A was 36 individuals, sampling site B was 143 individuals and sampling site C, was 200 individuals.

The total bat taxa from Bukit Mertajam Recreational Forest represents 10.4 % of the 125 species of bats recorded for Peninsular Malaysia (Kingston et al., 2006). Of the 13 species captured, all the species are listed as of least concerned by the IUCN except for two species which are *Rhinolophus robinsoni* and *Myotis ridleyi*. These two species were categorized as near threatened by IUCN, 2011. From the species accumulation graph (Figure 1), the curve appears to reach an asymptote on the fifth night and turns stagnant at this point, which suggest that additional efforts may not be necessary because it may not yield many more species.

In Peninsular Malaysia, the species richness of bats in the southern portion of the peninsula is much lower than in the north and central areas of the country (Kingston et al., 2003a; Lane et al., 2006; Zubaid, 1993; Medway, 1983). The most abundant species in Bukit Mertajam is *Hipposideros bicolor* with a total 145 individuals captured and the rarest species captured were *H. cineraceus, C. melanocephalus* and *P. lucasi* with only one individual captured for each. The reason for this is probably due to their roosting behaviour. *Hipposideros bicolor* prefers to roost in large colonies (Kingston et al., 2009). They are known cave dwellers and can also be found in crevices of large boulders in primary lowland and hill forest (Francis, 2007). This is the most common species at all the three sampling sites. They are a wide ranging species and can be found around South East Asia (Kingston et al., 2001).

The foraging behavior of the bats usually determines their flight morphology and body size (Kunz and Fenton, 2003). The larger species with a high aspect ratio are bats with narrow, pointed wings and tend to forage over much greater distances (Fenton, 1997; Jones et al., 1995). Small bodied size bats such as *Hipposideros bicolor, Kerivoula*

pellucida and *Murina suilla*, are often recorded foraging in cluttered forest compared to larger species such as fruit bats that forage in mostly in open habitats (Ford et al., 2005 and Kingston et al., 2003a). This is probably due to the echolocation used by each insectivorous bat species. They use echolocation mostly to avoid colliding with all the vegetation and to search for food. They tend to have a much smaller wing size so that they can maneuver effectively.

Some species of bats may prefer habitats that are nearer to the large, open, and calm bodies of water (Mackey and Barclay, 1989). Water is a very important element that many bat species require to balance the heat of their bodies and also helps with their digestion and other bodily functions. This is illustrated by the highest number of individuals captured at sampling site C (nearest reservoir) with a total of 200 individuals even though the number of species is low with only 10 species. Most of bats require water so they prefer to roost and forage near to the dam. According to McCain (2007), the species richness of bats was highest where both temperature and water availability were high. In some species such as *Rhinolophus robinsoni*, the lactating and pregnant females will, visit places with watering holes to obtain more calcium and sodium (Barclay, 1995).

Two special species were captured during sampling: *Penthetor lucasi* and *Chironax melanocephalus*. Both of them are fruit bats but they were captured with the harp traps used at the mid elevation. We assume that they might be confused by the traps even though they can actually see the traps since they have large eyes. Situations like there have been recorded before (Azlan et al., 2005). *Chironax melanocephalus* forages at all heights below the canopy (Kingston et al., 2009). This species can be commonly found at lowland hill and upper hill most forest although they are most often reported above 600m (Francis, 2007; Francis, 1989). As for *Penthetor lucasi*, this species roosts mainly in caves but can also be found at any elevation. Apart from caves, they are also known to roost in rock shelters and crevices in large colonies (Kingston et al., 2009).

With increasing development in the surrounding areas near the Bukit Mertajam Recreational Forest, the forest dependent bat species are at risk. Their foraging and roosting site are being disturbed by humans and it is difficult for them to search for food with the fragmentation of the forest. For some of the species though, the plantations that surround the forest does help them find food as the plantation areas support a high abundance of insects (Sophia, 2010). In such situations, the abundance bats play a crucial role in controlling the population of insects in this area (Jones, 1990).

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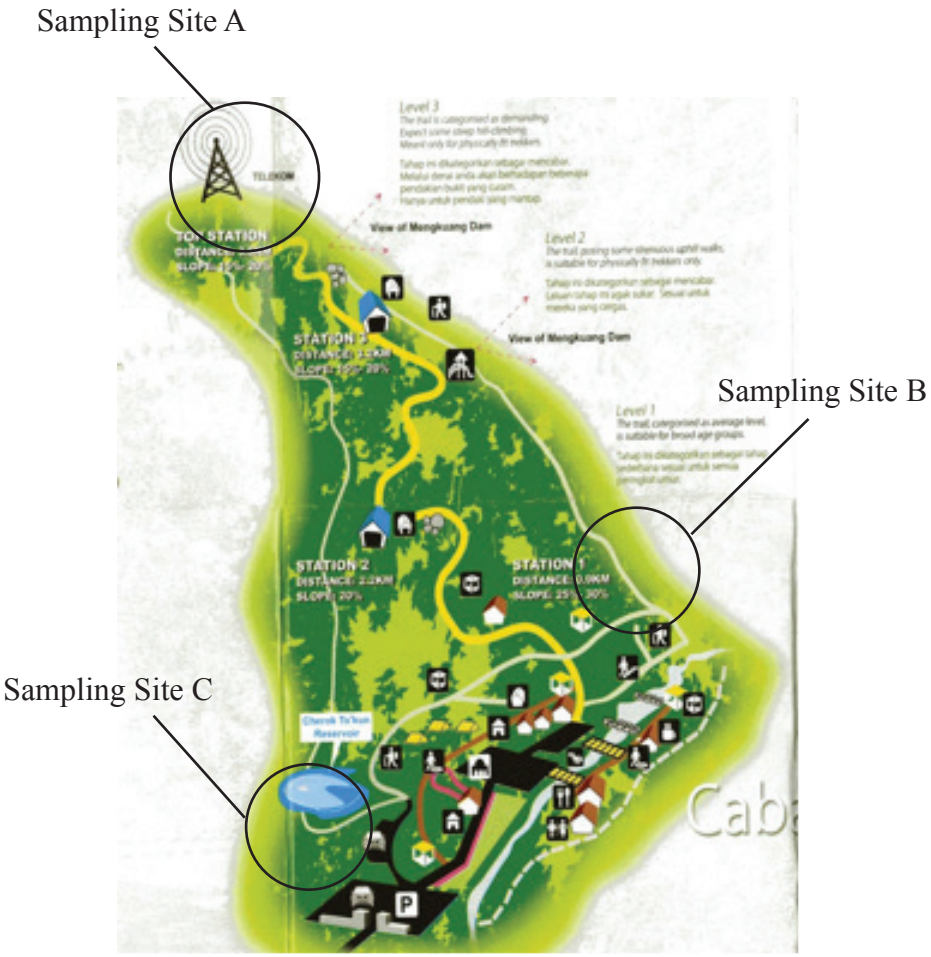
Table 1. List of bats captured at Bukit Mertajam Hill, Pulau Pinang.

Species	Common Name	Number Bat Captured	IUCNS (2011)
Hipposideridae			
Hipposideros bicolor Temminck (1834)	Bicoloured Roundleaf Horseshoe Bat	145	LC
Hipposideros armiger Hodgson (1835)	Great Roundleaf Horseshoe Bat	5	LC
Hipposideros larvatus Horsfield (1823)	Intermediate Roundleaf Bat	23	LC
Hipposideros cineraceus Blyth (1853)	Least Roundleaf Horseshoe Bat	1	LC
Rhinolophidae			
Rhinolophus robinsoni Andersen (1918)	Peninsular Horseshoe Bat	18	NT
Rhinolophus lepidus Blyth (1844)	Blyth's Horseshoe Bat	53	LC
Rhinolophus affinis Horsfield (1823)	Intermediate Horseshoe Bat	105	LC
Vespertilionidae			
Kerivoula pellucida Waterhouse (1845)	Clear-winged Bat	10	NT
Murina suilla Temminck (1840)	Lesser tube-nosed Bat	4	LC
Myotis ridleyi Thomas (1898)	Ridley's Myotis	2	NT
Miniopterus medius Thomas and Wroughton (1909)	Intermediate Long-fingered Bat	11	LC
Pteropodidae			
Penthetor lucasi Dobson (1880)	Lucas's Short-nosed Fruit Bat	1	LC
Chironax melanocephalus Temminck (1825)	Black-capped Fruit Bat	1	LC
TOTAL		379	

* Kingston et al. (2009), Francis (2008), IUCN (2011).



(Source http://jhn.penang.gov.my/index.php?option=com_contentandview=articleandid=55:taman-rimba-bukit-mertajamandcatid=37:eko-pelanconganandItemid=83)

Figure 1. The map of Bukit Mertajam Recreational Forest

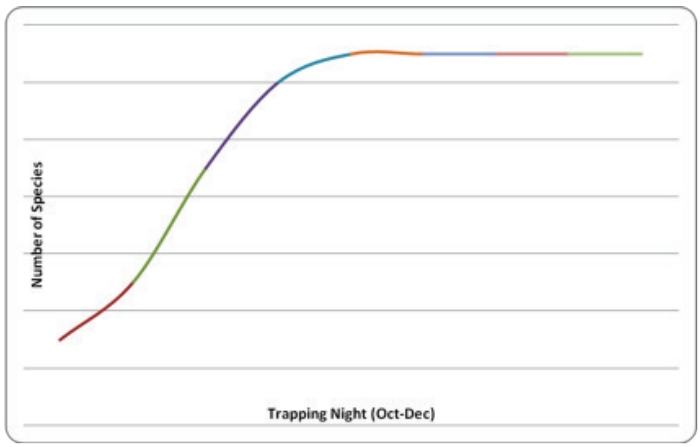


Figure 2. Species accumulation of bat species in Bukit Mertajam.