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Bats Diversity in Kolej Universiti Sains dan Teknologi Malaysia (KUSTEM)

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Abstract

The study of bats diversity was conducted in Kolej Universiti Sains dan Teknologi Malaysia (KUSTEM) from July until December 2004. The objective is to examine the diversity of bat species in KUSTEM area for conservation purpose. Ten mist nets were used as the capturing device. Species identification was based on the forearm measurement, weight, sex, maturity status and their reproduction. Bats were released after identification. A total of 99 individual bats were captured, comprising of two families and four species. Three species were frugivorous bats, Cynopterus brachyotis, Cynopterus horsfieldii and Eonycteris major from the family Pteropodidae. One insectivorous species, Kerivoulla papillosa was captured from the family Vespertillionidae. Cynopterus brachyotis is the highest captured individual and species, representing 70.97% of total capture. Shannon-Weiner index is 0.8569 and Simpson index is 0.4504. The bat diversity in KUSTEM is influenced by the capture device and duration of study.

1. Introduction

Malaysia is endowed with a great diversity of bat species with 132 species, 21 of them are Megachiropterans and 111 Microchiropterans, and 12 species of bats are endemic, where they can only be found in Malaysia [1]. More than a quarter of Malaysian bats, 34 species are red-listed by the International Union for the Conservation of Nature (IUCN) because of the risk of Extinction and the declining number of bat species [2]. Generally, bats in Malaysia are from the fruit-eating species, the frugivores or the insect-eating species, the insectivores.

Bats play an important role as seed dispersers, pollinators and consumers of various types of insects [3]. At least 31 Malaysian plant species rely on bats to pollinate them such as *Durio zibethinus* (durian), *Ceiba pentandra* (petai), *Mangifera indica* (mango), *Musa paradisiaca* (banana), guava, jackfruit and papaya. Bats also act as a natural biological control of insects by eradicating them as a source of food. Insectivorous bats are primary predators of vast number of night flying insects including leafhoppers and mosquitoes [4]. However, bats are facing a significant threat primarily from habitat loss [5]. Therefore, there is a vital need to

document their diversity to ensure their continuous survival in maintaining the ecosystem functioning.
Most of the studies in Peninsular Malaysia have focused on bats conservation in forest reserve such as Krau Wildlife Reserves, Pantai Acheh Forest Reserve, Temenggor Forest Reserve, Sekayu Forest Reserve and in national parks [5, 6]. The present study is another effort to increase awareness and further understanding of bats diversity which have never been conducted in Kolej Universiti Sains Malaysia (KUSTEM). KUSTEM was built on mangrove land, which is a potential area for high diversity of bats [7]. Thus, bat diversity in KUSTEM is assumed to be high according to the natural settings of KUSTEM surroundings. By conducting this study, a baseline inventory data can be established for conservation purpose and future monitoring in KUSTEM.

2. Methods

Five sampling plots was selected randomly in KUSTEM campus (05° 24' N, 103° 05' E) near mangroves, coconut tree, banana trees, jambu laut trees (*Eugenia grandis*) and open areas. The selection of this sampling plot is due to their possibilities as roosting sites for bats and expected flying paths of bats. A total of 10 mist nets (9 m × 4 m) were set for each sampling plot, respectively. The mist nets are made of nylon and black in colour. The mesh size is 2.5 mm. The mist nets are erected with the height reaching 4 m and each mist net was supported by two aluminium poles. The nets were set in the late evening and opened around 1830 to 1900 hour and re-checked the next morning during peak activity of bats. It was closed the next morning. The captured bats were kept in a soft cloth bag. Bats were held in the palm of the hand and the fingers curled around the body with the head between the thumb and first finger for measurements. Bats identification was done using keys from [2]. Bats were marked using wing bands to enable identification of recaptures for population size estimation and later released near the location of capture after all identification process has been completed. Data was analysed using Shannon Weiner diversity index and Simpson index. Net effectiveness, bat abundance, percentage of recapture, relative abundance and biomass were also calculated. Schnabel method is used to calculate the population size.

3. Results

A total of 99 individual bats from family Pteropodidae and Vespertillionidae were captured during the six months period of sampling (Table 1). Three species captured belongs to the family Pteropodidae, *Cynopterus brachyotis, Cynopterus horsfieldii* and *Eonycteris major* whereas only one species, Kerivoulla papillosa from the family Vespertillionidae. The most frequently captured bat during the sampling period was the lesser short-nosed fruit bat, *Cynopterus brachyotis* with a total of 71 individuals (70.97%).

Sampling carried out in July recorded the highest capture of individual bats with 29 individuals (29.3%). The lowest capture was in December with only 11 individual bats caught (11.1%). Sampling plots near to fruiting trees recorded the highest number of species and individuals (48) comprising of all the four species. 64.6% of the bats were captured in the earlier part of the night and 35.4% were captured in the period emerging to dusk. A total of 61 females and 38 males were captured with a majority of the bats are adults (83 individual) and only 16 individual are juveniles (Table 1). The net effectiveness was 0.33 individual/net/day, which implies that a

total of 3.3 individual were caught with 10 mist nets used during the sampling period. Bats abundance was 0.275 individual/m^2. 6.1% of individual bats were recaptured, 5 of which were *C. brachyotis* and 1 of *C.horsfieldii* (Table 1). *C.brachyotis* has the highest relative abundance (70.97%) and the lowest was *K. papillousa* (3.21%). The biomass for the bats is 37.48 g/individuals. The population size of the sampling plots is 632.83 (p=0.05) which was influenced by the percentage of recapture at the sampling plots.

Shannon Weiner index for this study is 0.8569 while evenness is 0.6181. Simpson index is 0.4504 with a maximum diversity of 0.7577. Daily species accumulation curve have reached an asymptote level during the fifth sampling night, with no additional species for the next 25 days of sampling.

Table 1 Summary of the data analysis for bats captured in this study

No. species	No. of individuals	Male	Female	Recapture	Relative abundance
Pteropodidae					
1.*Cynopterus brachyotis*	71	28	43	5	70.97 %
2.*Cynopterus horsfieldii*	9	2	7	1	8.60 %
3.*Eonycteris major*	16	5	11	0	17.20 %
Vespertillionidae					
1.*Kerivoula papillosa*	3	3	0	0	3.21 %
Total records	99	38	61	6	100.0

No. of species	4
No. of families	2
Biomass (g/individual)	37.48
Net/day	300
Net effectiveness (ind/net/day)	0.33
Bats abundance (ind/m^2)	0.275
Population size	632.83
Shannon-Weiner Index	0.8569
Evenness	0.6181
Simpson index	0.4504

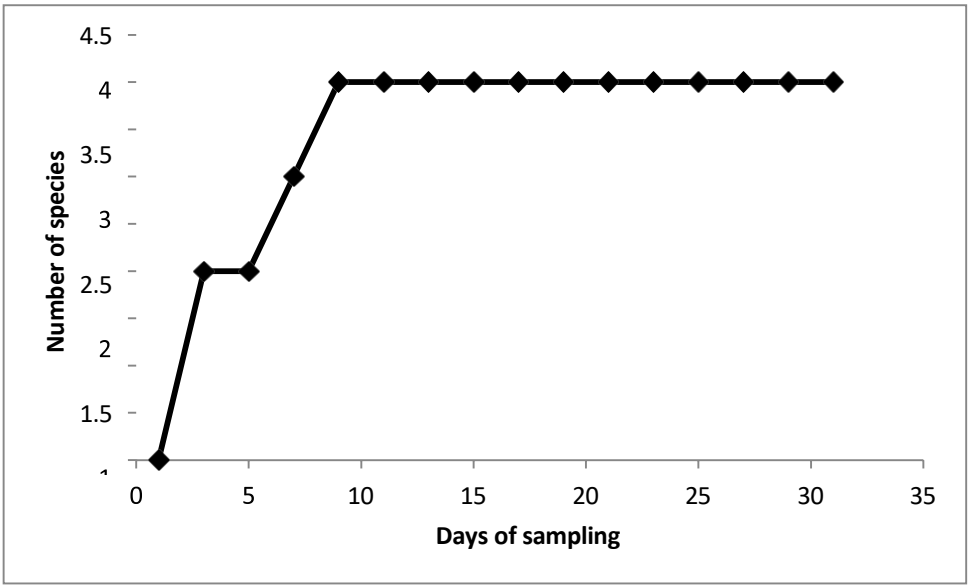

Figure 1 Species accumulation curve of bat species captured according to days of sampling in KUSTEM (July –December 2004)

4. Discussions

Overall, 99 individual bats were captured during the sampling period of 30 days within six months. The captured bats in KUSTEM only represent a small portion of bat communities distributed in Malaysia. In comparison with other studies in terms of sampling period, the capture of bats in KUSTEM is relatively lower than the others due to the nature of the sampling location. [4] reported a total of 329 individual bats captured along Kerian River, Perak sampled within February 2009 to February 2010. A total of 79 individual bats were captured in Kuala Atok, Taman Negara Pahang within 7 days of sampling [9]. Family Pteropodidae is the dominant family in the present study which belongs to the Megachiropterans or fruit bats.Megachiropterans are more dominant since KUSTEM surroundings consist of various fruit vegetations as well as mangroves. Banana trees are food sources for fruit bats and mangroves are known as a potential roosting and foraging area for bats [3, 7]. The highest capture of *C.brachyotis* is consistent with other previous studies [8, 9]. *C. brachyotis* and *C.horsfieldii* occupies most available habitats including coastal, urban, agricultural and disturbed areas. The high number of capture for this species is contributed by various vegetations reported as roosts such as beneath fronds of coconut tree, mast trees and man-made structures [10]. Sampling in July had the highest capture because of non-rainy nights compared to the monsoon season in December [11]. Highest number of bat captures occurred in the earlier part of the night as the first peak of bats activity occurs shortly after sunset as a form of initial foraging and emerging from day roosts [12]. A higher percentage of females were captured due to the earlier flight ability for females [13]. Net effectiveness is low for this study as the height of the mist net used only reach 4 m which is not sufficient to catch bats foraging in high areas [2]. The recaptures are also low due to the fact that the bats often avoid being trapped repeatedly. *Eugenia grandis*, a congeneric plant species available in KUSTEM and the presence of banana and coconut trees are factors in maintaining the weight of bats by ensuring continuous supply of food source to bats [14]. The diversity of bat species in KUSTEM appears to be relatively low in comparison with that reported for other disturbed habitats in Peninsular Malaysia [4]. The species accumulation curve has reached an asymptotic level on day 5

suggesting that additional effort may not yield species anymore in KUSTEM. This also indicates that the netting effort of 30 net-nights was adequate to sample the bats population in KUSTEM.

5. Conclusion

Overall, the diversity of bat species in KUSTEM is low with only four species captured. Low diversity of bats in KUSTEM is influence by the use of efficient capture device. The mist net used can only reached to a certain height which is only capable of capturing understorey bats. The probability of capturing insectivorous bat could be enhanced by using another sampling device, the harp trap. A baseline inventory of bats diversity in KUSTEM is provided which contributes as one of the conservation effort to ensure their survival and function as seed dispersers and pollinators.

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