

Short Communication

A Checklist of Bats at Ulu Senagang, Keningau, Sabah

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Abstract

A bat survey was conducted at Crocker Range Substation Ulu Senagang, Keningau, Sabah, from February 19 to 23, 2018. Harp trap and mist nets were used to capture bats. The four trapping nights resulted in the capture of five species of bats belonging to three families namely, Pteropodidae, Emballonunidae and Vespertilionidae. Three species were captured from the old logged-over forest, whereas two species were captured in the modified landscape. Generally, the recorded bat species are classified as Least Concern by IUCN.

Keywords: Bats, diversity, landscape, logged-over forest, modified

Introduction

Borneo is the third largest island in the world and is recognized as one of the world's mega-biodiversity regions. One of the significant factions of Borneo's biodiversity is the mammalian fauna with about 288 extant species of terrestrial mammals (Payne et al., 1985). Among the most interesting group of mammals in Borneo are bats, which represent at least 31.9% of the terrestrial mammals of Borneo (Payne et al., 1985), although still deemed as underrepresented (Khan et al., 2008). Among the type of bats that can be found in Borneo are the Old-World fruit bats and insectivorous bats. They are a significant portion in the ecosystem contributing significantly to local forest ecology as pollinators, seed dispersers and regulator of insect populations (Kunz et al., 2011). Furthermore, the distinctive adaptations and specialization make them as eminent models for ecophysiology, ecomorphology, trophic interactions, biogeography, emerging diseases, and conservation studies (Kunz & Fenton, 2005). However, most abundant animals in the world are threatened by habitat loss, which significantly contributes to the declining of bat populations locally, regionally and globally (Kunz et al., 2011).

Numerous surveys have revealed interesting information on the diversity of bats in Borneo (Suyanto & Struebig, 2007; Khan et al., 2008; Struebig et al., 2010; Struebig et al., 2012), although there are many more areas that are yet to be explored. One such place, for example, is Ulu Senagang, Keningau. To date, there is no published information on bats from this area, instigating this survey. The main aim of this study is to produce a taxonomic checklist of bats in Ulu Senagang, Keningau, as a baseline information on bats in the area. The results from the survey are reported herein.

Materials and Methods

Study Area

A bat survey was conducted in Ulu Senagang Substation, Keningau, which is situated at N 5° 21' 2", E 116° 1' 41" (Figure 1). The sampling site is close to the boundaries of Tenom and Keningau districts, and separated by the Mosolog River. Interestingly, this area is managed through a joint effort between Sabah Parks and the local communities of Ulu Senagang, identified as the Community Use Zone (CUZ). The study area is mainly covered by old logged-over forest and a mixed landscape of secondary forest and mixed-crop plantation, which include

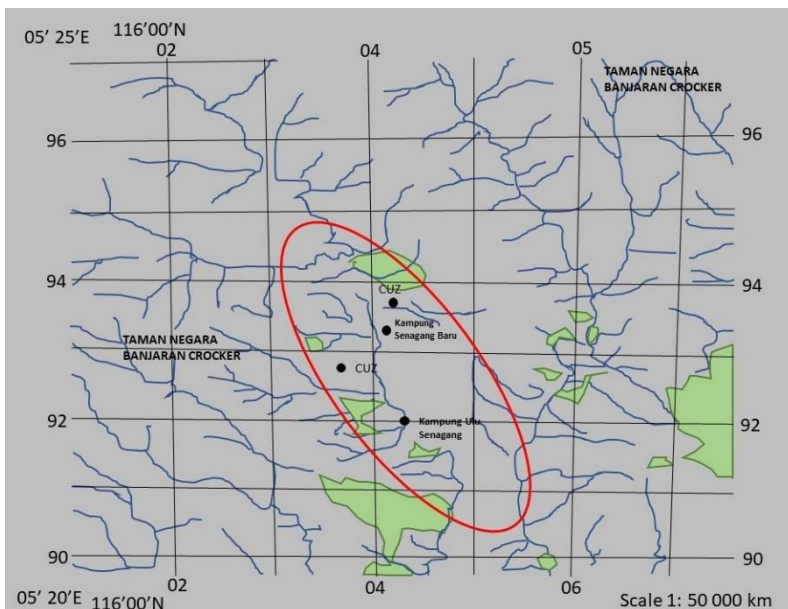


Figure 1. Map of the study area at Crocker Range Substation Ulu Senagang, Keningau.

rambutan (*Nephelium* spp.), mango (*Mangifera* sp.), durian (*Durio* spp.), tarap (*Artocarpus* sp.), cocoa (*Theobroma cocoa*) and mangosteen (*Garcinia mangostana*). The mixed landscape area is referred to as modified landscape in the current study.

Trapping methods and Sample Processing

Four nights of bat trapping was done using mist nets and harp traps that were set at distinctive landscapes, which are the old logged-over forest and a modified landscape (Table 1). The trap and nets were set up at potential bat flyways in the forest under storey and across small streams. The nets were opened from 1800 hours until 2100 hours and checked every 15 minutes to avoid casualties and over-stressing the captured bats. Meanwhile, harp traps were checked for every 1-2 hours until 2100 hours and left overnight and rechecked again at 0600 hours the following day.

All captured bats were identified to species level based on Payne et al. (1985) and Philips and Philips (2016). Information such as forearm length (mm), weight (g), sex and reproductive status were recorded (Brunet-Rossinni & Wilkinson, 2009). There were four categories of reproductive status assigned for female bats including nulliparous, pregnant, lactating and post-lactating. Measurements were taken using Vernier caliper and the bats were weighed using a Pesola spring balance. The total length of the cartilaginous region (total epiphyseal gap) between the bony diaphysis was used to estimate the age of bats (Brunet-Rossinni & Wilkinson, 2009).

Table 1. Coordinates of the respective locations where trapping were conducted.

Old Logged-over Forest	Trapping Site	Coordinate	Modified Landscape	Trapping Site	Coordinate
	A	5° 21' 58" N 116° 1' 34" E		G	5° 20' 37" N 116° 1' 59" E
B	5° 21' 56" N 116° 1' 32" E	H	5° 20' 31" N 116° 1' 50" E		
C	5° 21' 56" N 116° 1' 34" E	I	5° 20' 33" N 116° 1' 53" E		
D	5° 21' 54" N 116° 1' 32" E	J	5° 20' 30" N 116° 1' 49" E		
E	5° 21' 54" N 116° 1' 32" E	K	5° 20' 27" N 116° 1' 59" E		
F	5° 21' 51" N 116° 1' 32" E	G	5° 20' 37" N 116° 1' 59" E		

Results

A total of 11 individuals of bats representing five species were recorded from the four nights of sampling. The five species of bats represented three families namely, Pteropodidae (two genera, three species), Emballonuridae

(one genus, one species) and Vespertilionidae (one genus, one species) (Table 2; Figure 2).

Table 2. Taxonomic checklist of bats at Substation Ulu Senagang, Crocker Range Park Keningau, Sabah

Family	Species	Common Name	Relative Abundance (%)	Conservation Status	
				WCE 1997	IUCN Red List
Pteropodidae	<i>Cynopterus cf. minutus</i>	Forest Short-nosed fruit bat	18.2	NL	LC
	<i>Cynopterus cf. brachyotis</i>	Sunda Short-nosed fruit bat	18.2	NL	LC
	<i>Balionycteris maculata</i>	Spotted-winged fruit bat	27.3	NL	LC
Emballonuridae	<i>Saccolaimus saccolaimus</i>	Pouched Tomb bat	27.3	NL	LC
Vespertilionidae	<i>Glischropus tylopus</i>	Thick-thumbed Pipistrelle	9.1	NL	LC
Number of Families			3		
Number of Species			5		
Number of Individuals			11		

*NL - Not Listed

**LC - Least Concerned

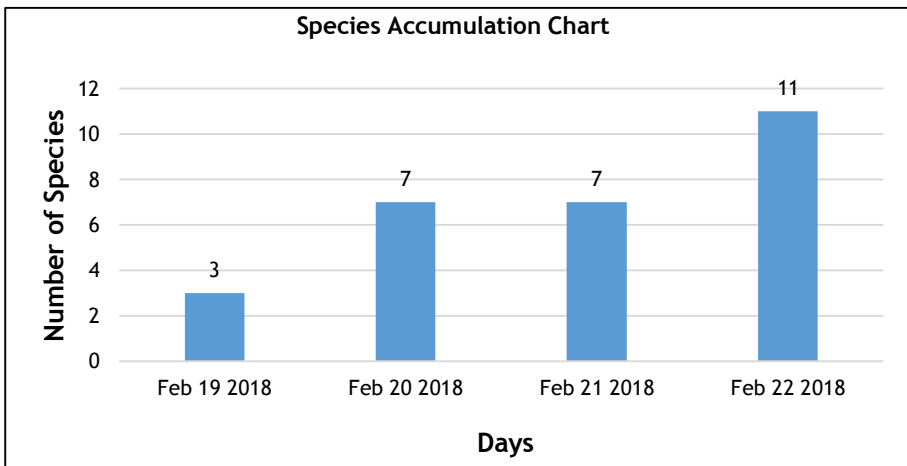


Figure 2. Species Accumulation Chart of Bats in Ulu Senagang, Keningau.

From the survey, *Balionycteris maculata* was the most abundant species, followed by *Cynopterus cf. brachyotis*. A colony of 30 – 40 individuals of *Saccolaimus saccolaimus* were observed in one of the buildings at SK Ulu Senagang. However, only three individuals were captured and examined. One species, *Glischropus tylopus* was caught in singleton during the survey.

However, the species accumulation graph generated from the results of the current survey did not reach asymptote (Figure 3).

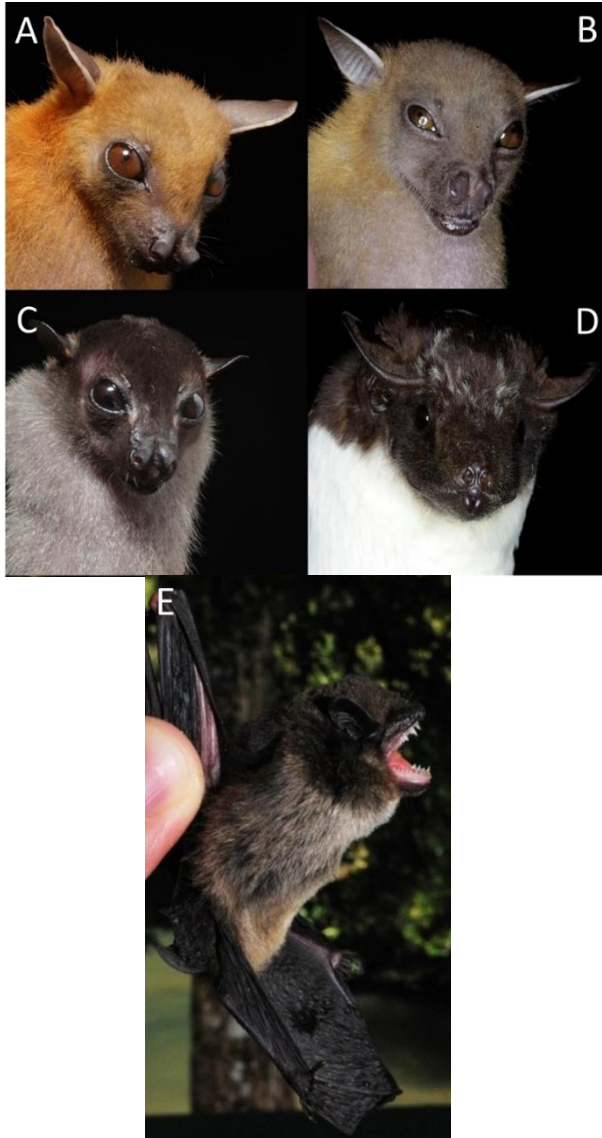


Figure 3. Photo A) *Cynopterus minutus*, B) *Cynopterus brachyotis*, C) *Balionycteris maculata*, D) *Saccolaimus saccolaimus*, E) *Glischropus tylopus*

*Species Account***Family Pteropodidae*****Cynopterus cf. minutus* Miller 1906 (Forest Short-nosed Fruit Bat)**

A total of two individuals were captured at the old logged over forest nearest to the substation. *Cynopterus cf. minutus* can be distinguished from other members of genus *Cynopterus* using forearm (FA) measurement. Both adult individuals have FA length of less than 60mm (Phillips & Phillips, 2016). This species feed on various fruits, leaves and nectars (Phillips & Phillips, 2016). This species is listed as of Least Concern by IUCN 2018.

***Cynopterus cf. brachyotis* Müller 1838 (Sunda Short-nosed Fruit Bat)**

Two adult individuals were captured in the old logged over forest nearest to the substation. Similar their smaller counterpart, *C. cf. brachyotis* can be distinguished using their forearm (FA) length. The two captured individuals have a forearm length of more than 60 mm (Phillips & Phillips, 2016). This species is a medium-sized fruit bat with a short muzzle, brown with brighter collar which dark orange in adult males, yellowish in females (Yasuma et al., 2003). Their diet is mainly small fruits, where they were reported to be sucking on the juice and soft pulps (Yasuma et al., 2003). This species is listed as of Least Concern by IUCN.

***Balionycteris maculata* Thomas 1893 (Spotted-winged Fruit Bat)**

A total of three individuals were captured from the old logged over forest nearest to the substation. The captured individuals have FA length between 40-45 mm. This species is easily recognized by the pale spots on their wings and face (Phillips & Phillips, 2016). They forage at all strata of the forest (Phillips & Phillips, 2016). This species is known to occur at a variety of habitat. Roosts include trees, crowns of palms and clumps of epiphytic ferns (Yasuma et al., 2003). *B. maculata* is listed as Least Concern by IUCN.

Family Emballonunidae***Saccolaimus saccolaimus* Temminck 1838 (Pouched Tomb Bat)**

A total of three individuals were captured from one of the buildings at SK Ulu Senangang. It is among the larger species of the tomb bat in Borneo (Phillips & Phillips, 2016). *S. saccolaimus* can be distinguished with the bare skin on their face, which normally appears black or dark grey. This is one of the distinct species where their upperparts are dark black or brown with white spot markings (Payne et al., 1985; Phillips & Phillips, 2016). Both sexes have a glandular chin-pouch. There were about 30 - 40 individuals of *S. saccolaimus* estimated to be roosting in the building. This species is listed as Least Concern by IUCN.

Family Vespertilionidae

Glischropus tylopus Dobson 1875 (Thick-thumbed Pipistrelle)

This is the only species caught in singleton in the harp trap placed across small streams in the modified landscape of Ulu Senagang. The capture area was covered with patch of secondary forests, with various fruiting trees and plants such as banana, rambutan and cocoa. *Glischropus tylopus* can be distinguished from similar species such as *Hesperoptenus blanfordi* and *Tylonycteris* spp. through pale to pinkish pads on their thumbs and feet (Payne et al., 1985; Phillips & Phillips, 2016). This species is known to occur in lowland dipterocarp forests and they usually roost in dead or damaged bamboo stems, as well as rock crevices or new banana leaves (Yasuma et al., 2003). This insectivorous bat is listed as Least Concern by IUCN.

Discussion

This survey has recorded five species of bats in Ulu Senagang, Keningau. The recorded bat species were listed as Least Concern in the IUCN Red List of Threatened Taxa 2018. However, the number of species recorded in the current study were low. In the current study, mist nets were more successful in catching bats compared to harp traps. There were only two species of insectivorous bats recorded however, only one species was captured using harp traps, which was placed across small streams in the modified landscape. Additionally, three individuals of *S. saccolaimus* were captured using mist nets erected at their roosting area. This however does not question the efficiency of harp traps in catching insectivorous bats over mist nets (Mohd-Azlan et al., 2005). Mist nets can be useful for catching insectivorous bats in certain situations. To improve the capture of insectivorous bats, nets should be checked regularly to ensure bats do not escape. Insectivorous bats are known to be able to escape from mist nets by chewing the nets using their sharp, fine teeth (Abdullah et al., 1997).

The physical presence of human impact on the landscape and its inhabitants in Ulu Senagang were quite apparent. Although there was no clear evidence of hunting in the area due to its Community Use Zone status, landscape modifications for agriculture is prominent and is a major source of income for the locals. This leads to a speculation consistent with Struebig et al. (2009) that habitat loss a major threat to bat populations in Borneo. The Paleotropical bats are very dependent on natural landscapes such as forests as it provides them with resources such as roosting areas and food. In relation to this, the suitability of an area as a roosting site is often judged as a sanctuary for bats as it

safeguards them from abrasive and unpredictable environmental conditions and predators (Kunz, 1982).

Ecosystem services provided by the pteropodids and insectivorous bats are increasingly recognized in Southeast Asia. Various bat researchers have conducted studies at varying degrees to further apprehend the role of bats and the impacts of the provided ecosystem services, both to the local ecosystem as well as the economy (see Bumrungsri et al., 2009; Bumrungsri et al., 2013; Acharya et al., 2015; Aziz et al., 2017). Modification of natural landscape driven by industrialization and urbanization in Southeast Asia will not ameliorate the situation that bats are facing at present. It is anticipated that constant modification of Ulu Senagang's landscape will aggravate the diminishing local bat populations and eventually will have a discernible effect on the surrounding forests as well as the local economy. However, a more comprehensive study is needed to reassert the assumptions derived from the observed intensification of landscape conversion towards the bat community of Ulu Senagang.

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