

DIVERSITY OF MICROCHIROPTERAN BATS IN FOREST FRAGMENTS AND RIPARIAN ZONES IN AN OIL PALM PLANTATION ESTATE

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ABSTRAK

Kelapa sawit merupakan salah satu tanaman meningkat paling pesat di dunia, dan mencakup lebih dari 13 juta ha di Asia Tenggara. Sumatera memiliki sejarah yang relatif panjang budidaya kelapa sawit komersial, dan banyak perkebunan telah menggantikan hutan hujan. Biasanya ini perkebunan monokultur mendukung spesies lebih sedikit daripada hutan, namun ada sangat sedikit informasi yang tersedia untuk kelelawar. Kami mencicipi kelelawar pemakan serangga di Sumatera Barat dalam perkebunan kelapa sawit matang di mana beberapa tutupan hutan dipertahankan di fragmen hutan di bukit-bukit dan di sepanjang sungai. Menggunakan total 180 kecap perangkap malam kami dibandingkan dengan komunitas kelelawar dalam tiga jenis habitat: patch hutan, zona riparian dan perkebunan. Total kami ditangkap 1108 kelelawar yang mewakili 21 spesies dan 5 keluarga, dan mayoritas ini (dalam hal spesies dan kelimpahan) ditemukan di fragmen hutan. perkebunan kelapa sawit ditemukan menjadi habitat miskin untuk kelelawar - hanya empat orang dari dua spesies ditangkap. daerah pinggiran sungai didukung keanekaragaman menengah, dan mungkin penting sebagai koridor satwa liar antara fragmen hutan.

Kata kunci : Biodiversitas, keleawar *Microchiropteran*

ABSTRACT

Oil palm is one of the world's most rapidly increasing crops, and covers over 13 million ha in Southeast Asia. Sumatra has a relatively long history of commercial oil palm cultivation, and many plantations have replaced rain forest. Typically these monoculture plantations support much fewer species than do forest, however there is very little information available for bats. We sampled insectivorous bats in West Sumatra in a mature oil palm plantation where some forest cover was retained in forest fragments on hills and along rivers. Using a total of 180 harp trap nights we compared the bat community in three habitat types: forest patches, riparian zone and plantation area. In total we captured 1108 bats representing 21 species and 5 families, and the majority of these (in terms of species and abundance) were found in forest fragments. Oil palm plantation was found to be a poor habitat for bats – only four individuals of two species were captured. Riparian areas supported intermediate diversity, and might be important as wildlife corridors between forest fragments.

Keyword : Diversity, *Microchiropteran Bats*

INTRODUCTION

Bats constitute the second most species-rich order of mammals (Wilson and Reeder, 2005) and up to half of mammal species in tropical forests (Findley, 1993). They are divided into two sub orders, the Megachiropteran and Microchiropteran. Megachiropteran (Old World Fruit bat) has important roles, they serve as pollinators, seed dispersers, and Microchiropteran bats serve as predator of insects as well as small vertebrates (Findley, 1993; Altringham, 1996). Microchiropteran bat has large number of species than Megachiropteran. Microchiropteran has 834 species and Megachiropteran has 167 species (Hutson *et al.*, 2001).

In recent decades, bat populations have experienced global declines, a trend linked to extensive, recent habitat loss (Mickleburgh *et al.*, 2002). In Southeast Asia, 20% of bat species are predicted to become extinct by 2100 (Lane *et al.*, 2006). Nonetheless, bats are frequently overlooked in biodiversity assessments and fragmentation research, possibly because they are widely perceived to be at low risk of extinction due to their ability to fly (Struebig *et al.*, 2008).

PT. Kencana Sawit Indonesia (KSI) has three habitat type, they are forest patches, riparian zone and plantation area. Hall *et al.* (2004) suggested most of bats occupy various types of habitat. The high diversity of habitat and various ecological structures resulted in high diversity of bats especially on primary forest or closed habitat while in the open habitat which are described as secondary habitat, the bats diversity tend to be low.

In the establishment of the oil palm itself, large area of forest, which form the habitat for the bats, are destroyed and thus removing their food source and roosting site that bats depend on and this may have serious consequences on bats diversity (Timoh, 2006). Little information about Microchiropteran bats in fragmented habitat and plantation area. Study about that will be gave much information to conserve bat and hope can reduce the rate of extinction. The aims of this study are to explore the species richness, diversity, abundance of Microchiropteran bats in forest patches, riparian and plantation area

METHODS

Study area

The study was conducted at Oil Palm Plantation Estate PT. KSI (ZSL Indonesia Research Station), Solok Selatan, West Sumatra, Indonesia. Captured bats in three different habitat types.

Forest patches around oil palm estate of PT KSI is a fragmented forest with an area of $\pm$ 300 ha. Struebig, *et al.* (2008) classify an area of 200-500 ha has a medium forest fragments. Some fragments show the abundance and species richness of bats is higher compared to continuous forest. Nevertheless, the decline may continue to occur in the future because of the effects of fragmentation in a long time. Riparian zone stretches along both sides of the river contained in the PT. KSI. This area has various topographies. Harp traps placed at locations that ramps topography with a clear trail forest. For plantation area, harp trap was setting in mature oil palm tree based on not too close to the riparian and forest patches.

Species capture and identification

Bat captured on three locations each habitat types and 20 trap position for each location. Each individual who was caught was taken and put into cloth bags and labeled. After that, measure of the important characters for identification, photographed by its special character. Bat

marked by *wing punch*, holes in the wing membranes using *biopsy punch*. Identification species following Payne *et al.* (2000); Kingston *et al.* (2005) dan Struebig dan Sujarno (2006).

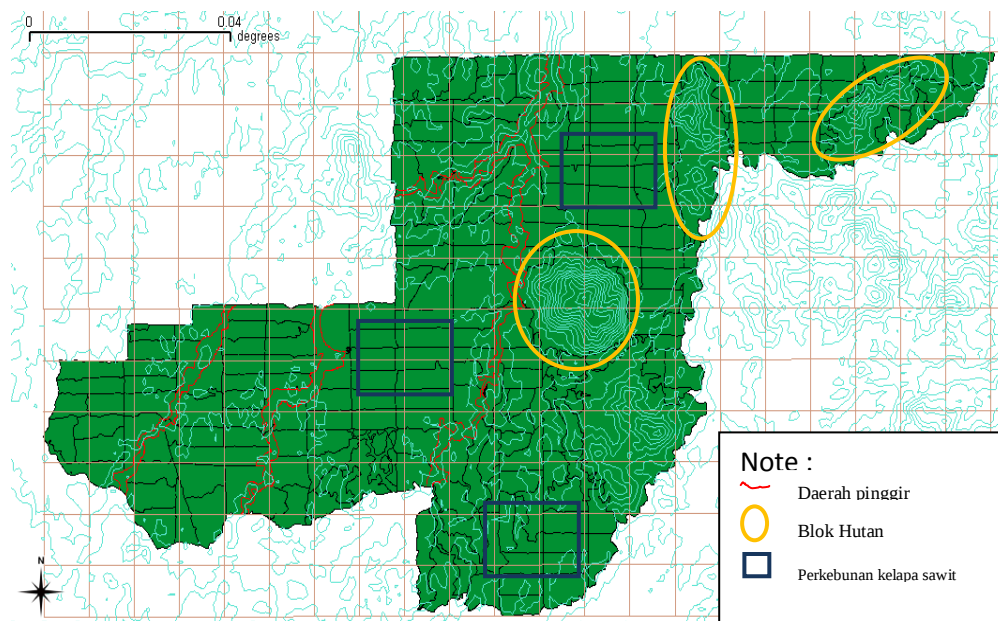


Figure. 1. Map of Sampling Location

Data Analysis

This research analyzed on species richness with species accumulation graph following Ludwig and Reynolds, 1988 *cit.* Estrada and Estrada 2001. Bat diversity estimate analyzed with Shannon Wiener index (H') following Stilling, 2002; Struebig dan Sujarno, 2005. Species abundance shown with rank abundance graph Whittaker plots following Stoner, 2005.

RESULT AND DISCUSSION

Bats captured in three habitat types in an oil palm plantation estate

Table1. Number of Captures Microchiropteran Species in Three Habitat Types in PT KSI

Family/Taxon	Species code	Redlist Status ^a	Category ^b	Number captures ^c			Σ
				F	R	P	
Hipposideridae							
<i>Hipposideros bicolor</i>	Hibi	LC	E	134	10	2	146
<i>Hipposidderos cervinus</i>	Hice	LC	E	755	65		820
<i>Hipposideros cf. diadema</i>	Hidi cf	LC	A		1		1
<i>Hipposideros cineraceus</i>	Hici	LC	A	1			1
<i>Hipposideros diadema</i>	Hidi	LC	A			1	1
<i>Hipposideros galeritus</i>	Higa	LC	D	16	4		20
<i>Hipposideros larvatus</i>	Hila	LC	B	4			4
Megadermatidae							
<i>Megaderma spasma</i>	Mesp	LC	A	1			1
Nycteridae							
<i>Nycteris tragata</i>	Nytr	NT	A	1			1
Rhinolophidae							
<i>Rhinolophus acuminatus</i>	Rhac	LC	D	7	7		14
<i>Rhinolopuhus affinis</i>	Rhaf	LC	B		4		4
<i>Rhinolophus borneensis</i>	Rhbo	LC	B	2			2
<i>Rhinolophus lepidus</i>	Rhle	LC	E	57	3		60
<i>Rhinolophus luctus</i>	Rhlu	LC	B	2	3		5
<i>Rhinolophus pusillus</i>	Rhpu	LC	D	11			11
<i>Rhinolophus sedulus</i>	Rhse	NT	A	1			1
<i>Rhinolophus stheno</i>	Rhst	LC	B	3	1		4
<i>Rhinolophus trifolius</i>	Rhtr	LC	C	6	2		8
Vespertilionidae (Kerivoulinae)							
<i>Kerivoula papillosa</i>	Kepa	LC	A	1			1
Vespertilionidae (Vespertilioninae)							
<i>Myotis muricola</i>	Mymu	LC	A			1	1
Vespertilionidae (Murininae)							
<i>Murina suilla</i>	Musu	LC	B	2			2
TOTAL				1004	100	4	1108

^a IUCN red list status following review by IUCN 2010 (accessed on Januari 2011): LC, Least Concern; NT, Near Threatened

^b Species categori based on number individual were captured: A, rare species (1); B, relative rare species (2-5); C, relative common species (6-10) ; D, Common species (11-50); E, most common species (>50).

^c Number capture each habitat types : F, Forest patches; R, Riparian; P, Plantation.

Bat species richness in three habitat type in an oil palm plantation estate

Bats diversity in three habitat types in Palm oil plantation estate

Table2. Diversity index of insectivorous bats in each habitat types

Habitat type	Diversity index
Forest patches	0,94
Riparian	1,36
Plantation	1,04

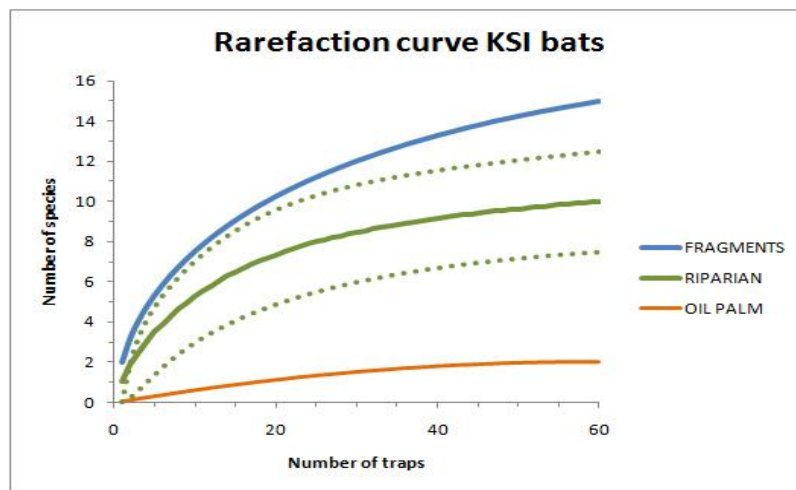


Figure 1. Rarefaction curves for Insectivorous Bats Captured in Three Habitat Types.

Bats abundance in three habitat types in Oil palm plantation estate

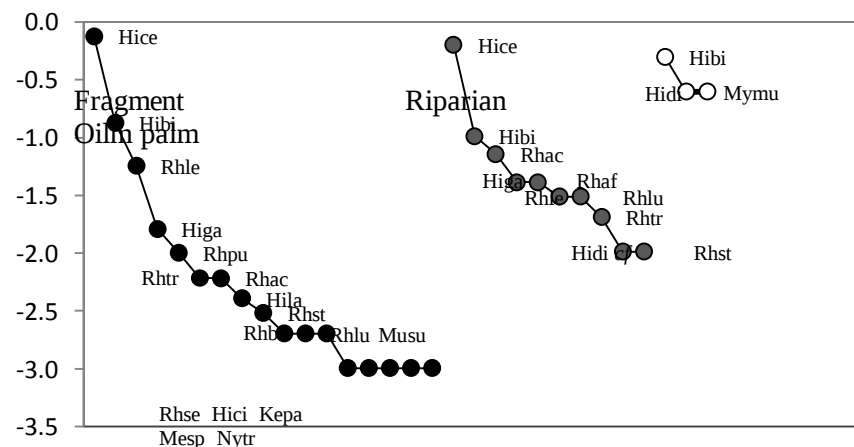


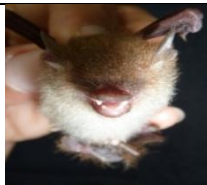
Figure2. Rank Abundance (Whittaker) Plots for Insectivorous Bats in Three Habitat Types in The Oil Palm Plantation Estate. Species are Ranked According to The Abundance of Each Species (n) and The Total Abundance of All Species for Each Habitat Types (N).

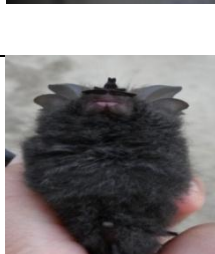
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Annex

Species account <i>Hipposideros bicolor</i> (Temminck, 1834) (Indonesian name: Barong Dwi Warna; Common name: Bicolored Leaf-nosed Bat, Bicolored Roundleaf Bat). FA range: 42.3-49.6 mm; Weight range: 7.5-10.25 g.	
<i>Ipposideros cf diadema</i> FA: 76.1 mm; Weight: 28.5 g.	
<i>Hipposideros cervinus</i> (Gould, 1863) (Indonesian name: Barong Rusa; Common name: Fawn-colored Leaf-nosed Bat, Fawn Horseshoe-bat, Fawn Leaf-nosed Bat, Fawn Roundleaf Bat, Gould's Leaf-nosed Bat). FA range: 45.6- 52.2 mm; Weight range: 8-13.5 g	
<i>Hipposideros cineraceus</i> (Blyth, 1853) (Indonesian name: Barong kelabu; Common name: Least Leaf-nosed Bat; Ashy Roundleaf Bat). Synonym: <i>Hipposideros cineraceus</i> (Peterris, 1872) ssp. <i>micropus</i>; <i>Phyllorhina micropus</i> Peters, 1872. FA: 39.1 mm; Weight: 6 g.	
<i>Hipposideros diadema</i> Geoffroy, 1813 (Indonesian name: Barong raksasa; Common name: Diadem Leaf-nosed Bat, Diadem Horseshoe-bat, Diadem Leafnosed-bat, Diadem Roundleaf Bat). Synonym: <i>Hipposideros nicobarensis</i> (Dobson, 1871); <i>Phyllorhina nicobarensis</i> Dobson, 1871; <i>Rhinolophus diadema</i> É. Geoffroy, 1813 FA: 83,9 mm; Weight: -	
<i>Hipposideros galeritus</i> Cantor, 1846 Indonesia: Barong Penang; Inggris: Cantor's Leaf-nosed Bat, Cantor's Roundleaf Bat) Sinonim: <i>Phyllorhina brachyota</i> Dobson, 1874; <i>Phyllorhina galerita</i> Dobson, 1876 FA range: 47.5- 51.3 mm; Weight range: 7.5-10 g.	
<i>Hipposideros larvatus</i>(Horsfield, 1823) (Indonesian name: Barong sedang; Common name: Horsfield's Leaf-nosed Bat, Intermediate Leaf-nosed Bat, Intermediate Roundleaf Bat) Synonym: <i>Phyllorhina leptophylla</i> Dobson, 1874; <i>Rhinolophus larvatus</i> Horsfield, 1823	

<i>Kerivoulla papillosa</i> (Temminck, 1840) (Indonesian name: Lenawai besar; Common name: Papillose Woolly Bat) FA: 40,2 mm; Weight: 8,5 g.	
<i>Myotis muricola</i> (Gray, 1864) (Common name: Nepalese Whiskered Bat, Nepalese Whiskered Myotis, Whiskered Myotis) Synonym: <i>Myotis mystacinus</i> (Tomes, 1859) ssp. <i>Caliginosus</i>; <i>Myotis mystacinus</i> (Gray, 1846) ssp. <i>Muricola</i>; <i>Vespertilio blanfordi</i> Dobson, 1871; <i>Vespertilio caliginosus</i> Tomes, 1859; <i>Vespertilio muricola</i> Gray, 1846; <i>Vespertilio muricola</i> Hodgson, 1841 FA range: 36.1 mm; Weight range: 3.75 g.	
<i>Murina suilla</i> (Temminck, 1840) (Indonesian name: Ripo coklat; Common name: Lesser Tube-nosed Bat) FA range: 30,1-30,9 mm; Weight range 4-4,5 g.	
<i>Megaderma spasma</i> (Linnaeus, 1758) (Indonesian name: Vampir palsu; Common name: Lesser False Vampire, Common Asian Ghost Bat, Lesser False Vampire Bat) Synonym: <i>Megaderma horsfieldii</i> Blyth, 1863; <i>Vespertilio spasma</i> Linnaeus, 1758 FA range: 58.4 mm; Weight range: 24.75 g.	
<i>Nycteris tragata</i> (K. Andersen, 1912) (Indonesian name: Kelelawar muka cekung; Common name: Malayan Slit-faced Bat) FA range: 51.7 mm; Weight: 12.5 g	
<i>Rhinolophus acuminatus</i> Peters, 1871 (Indonesian name: Kelelawar Ladam Loncos; Common name: Accuminate Horseshoe Bat, Acuminate Horseshoe Bat) FA range: 46,5-49,7 mm; Weight range: 11-15,75 g	
<i>Rhinolophus affinis</i> Horsfield, 1823 (Indonesia name: Kelelawar Ladam Umum; Common name: Intermediate Horseshoe Bat, Intermediat Horseshoe Bat) FA range: 49.6-51.3; Weight range: 12.25-17.25 g	
<i>Rhinolophus borneensis</i> Peters, 1861 (Indonesian name: Kelelawar Ladam Kalimantan; Common name: Bornean Horshoe Bat) FA range: 44.2-45.1 mm; Weight: 8.5 g.	

<i>Rhinolophus lepidus</i> Blyth, 1844 (Indonesian name: Kelelawar Ladam Kelabu; Common name: Blyth's Horseshoe Bat) FA range: 38.7-42.9 mm; Weight range: 5.5-7 g.	
<i>Rhinolophus luctus</i> Temminck, 1834 (Indonesian name: Kelelawar Ladam Lapet Besar; Common name: Great Woolly Horseshoe Bat, Woolly Horseshoe Bat) Synonym: <i>Rhinolophus perniger</i> Hodgson, 1843 FA range: 63.5-64.9 mm; Weight range: 29.75-31 g	
<i>Rhinolophus pusillus</i> Temminck, 1834 (Indonesian name: Kelelawar Ladam Kecil; Common name: Least Horseshoe Bat) Synonym: <i>R. blythi</i> Andersen, 1918; <i>R. calidus</i> Allen, 1923; <i>R. cornutus</i> Temminck, 1835; <i>R. cornutus</i> Andersen, 1918 ssp. <i>Blythi</i>; <i>R. gracilis</i> Andersen, 1905; <i>R. lakkhanae</i> Yoshiyuki, 1990; <i>R. imaizumii</i> Hill & Yoshiyuki, 1980; <i>R. minor</i> Horsfield, 1823; <i>R. minutillus</i> Miller, 1906; <i>R. minutus</i> Miller, 1900; <i>R. monoceros</i> K. Andersen, 1905; <i>R. pagi</i> Tate and Archbold, 1939; <i>R. parvus</i> Allen, 1928; <i>R. perditus</i> K. Andersen, 1918; <i>R. pumilus</i> K. Andersen, 1905; <i>R. szechwanus</i> K. Andersen, 1918 (IUCN, 2010) FA range: 37.2-41.2 mm; Weight range: 6.5-7 g.	
<i>Rhinolophus sedulus</i> K. Andersen, 1905 (Indonesian name: Kelelawar Ladam Lapet Kecil; Common name: Lesser Woolly Horseshoe Bat) FA range: -; Weight range:-	
<i>Rhinolophus stheno</i> K. Andersen, 1905 (Indonesian name: Common name: Lesser Brown Horseshoe Bat) FA range: 43.2- 46.1 mm; Weight range: 8.5- 9.25 g	
<i>Rhinolophus trifolius</i> Temminck, 1834 (Indonesian name: Kelelawar Ladam Lapet Kuning; Common name: Trefoil Horseshoe Bat) FA range: 46.9-54.3 mm; Weight range: 11-16 g	