

# Habitat Selection of Some Bats in Tada U Environs, Mandalay Region

Moe Moe Aung<sup>1</sup>, Kyaw Thet Oo<sup>2</sup>, Hnin Nu Htwe<sup>3</sup> and Thant Zin<sup>4</sup>

## Abstract

Habitat selection of some bats in Tada U environs was conducted from December 2018 to September 2019. In this study, three species of Pteropodidae, one species of Emballonuridae, three species of Hipposideridae and one species of Vespertilionidae were recorded. In the family Pteropodidae, *Rosettus leschenaulti* was found to roost in old pagoda and the remaining two species, *Cynopterus sphinx* and *Cynopterus brachyotis* roosted in the big trees. All of the insectivorous bats were found to occupy in the buildings, old pagodas and crevices of the caves. Among the insectivorous bats, *Taphozous melanopogon* and *Hipposideros larvatus* roosted in more than one roost site. This suggests that these bats found to prefer different structure of roost sites and the remaining bats preferred to roost in a single habitat. As Tada U is a famous cultural heritage site, local people and tourists have been visiting this place. Therefore conservation measures of bats and their habitats should be considered for their sustainability.

**Key words:** Habitat, pagoda, tree, building, caves, cultural heritage

## Introduction

Bat populations are declining world-wide as a result of a growing number of factors, including habitat loss and fragmentation, disturbances to roosts, exposure to toxins, human hunting pressures and introduced predators (McCracken, 1989; Fenton, 1997; Arita & Ortega, 1998; Fenton & Rautenbach, 1998; Marinho-Filo & Sazima, 1998; Pierson, 1998; Racey, 1998; Rainey, 1998; Richards & Hall, 1998). This makes it difficult to draw general conclusions about bat conservation, which may require species-specific conservation plans (Fenton, 1997).

Roosts are important structures to bats, providing mating and nursery sites, and protection from heat, cold, and predators (Kunz, 1982; Vonhof and Barclay, 1996; Fenton, 1997). Unlike the protection of caves, mines, or other permanent roosts, preservation of ephemeral roost sites such as trees may not be a viable option (Fenton, 1997).

Most tree and foliage dwelling bat species use a variety of tree species of different sizes in varying stages of decay (Brigham *et al.*, 1997; Carter and Feldhamer, 2005; Boyles and Robbins, 2006). The variety of roosts used indicates that simply describing the structural characteristics of roosts is insufficient (Cryan *et al.*, 2001), or perhaps even misleading, for determining the ecological and physiological underpinnings of roost selection.

Insectivorous bats are found to roost in the caves. Some of the largest bat colonies in cave contain millions of bats (Huston *et al.*, 2001). Some bats roost in cavities constructed by other animals, including bird nets and nests of ants and termites, whereas others roost in exposed places and trunks of trees (Kunz, 1982).

Day roosts are crucial resources for bats because they provide protection from the weather and predators; some also offer conditions favorable for raising young (Kunz 1982). In this study, bat species were known to occur in different places of roosting sites such as buildings, caves and trees in different population. Therefore we need to describe the roost requirements of bats in Tada U environs for the species- specific conservation.

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<sup>1</sup> Professor, Dr., Department of Zoology, University of Mandalay

<sup>2</sup> MSc Students, Department of Zoology, University of Mandalay

<sup>3</sup> MSc Students, Department of Zoology, University of Mandalay

<sup>4</sup> Professor and Head, Dr., Department of Zoology, University of Mandalay

## Materials and methods

### Study Area

Bat specimens were collected from Tada U environs; it is located about 32.19 km far from Mandalay. It is situated in the Mandalay Region.

### Study Sites

Mei Nu Oake Kyaung, 21°51'30" N and 95°59'04" E; mango tree near Win Ga Par Temple in U Ti Village at 21°50'39" N and 95°58'38" E; Palm tree near Gate of Mei Nu Oake Kyaung, 21°51'20" N and 95°59'09" E; Gugyi Thone Lone Pagoda, 21°47'402" N and 95°58'704" E in Pinya Village; Shin Ma Kyeing Pagoda, 21°48'16" N and 95°56'43" E at Thu Nge Taw Village; Taw Ya Cave, 21°40'30" N and 95°50'46" E at Kyat Pyan Village; Aung Tha Pyay monastery at Taung Ta Lone Village, 21°39'313" N and 95°48'836" E; Shwe Taung Daw Cave at 21°44'201" N and 95°58'29" E from Eain Myint San Village; Bar Ga Yar monastery at 21°50'53" N and 95°58'05" E in Innwa (Fig. 1 and Plate 1).

### Study Period

The study period lasted from December, 2018 to September, 2019.

### Capturing the Bats

For capturing the bats, mist net (9 ft & 4 shafts) and hand net were used. Mist net was set at the entrance of the cave to capture the emerged bat outside the cave. Hand net was used to capture the bat inside the buildings.

### Identification of the Specimens

The specimens were identified by Bates and Harrison (1997), Csorba *et al.* (2003) and Francis (2008).

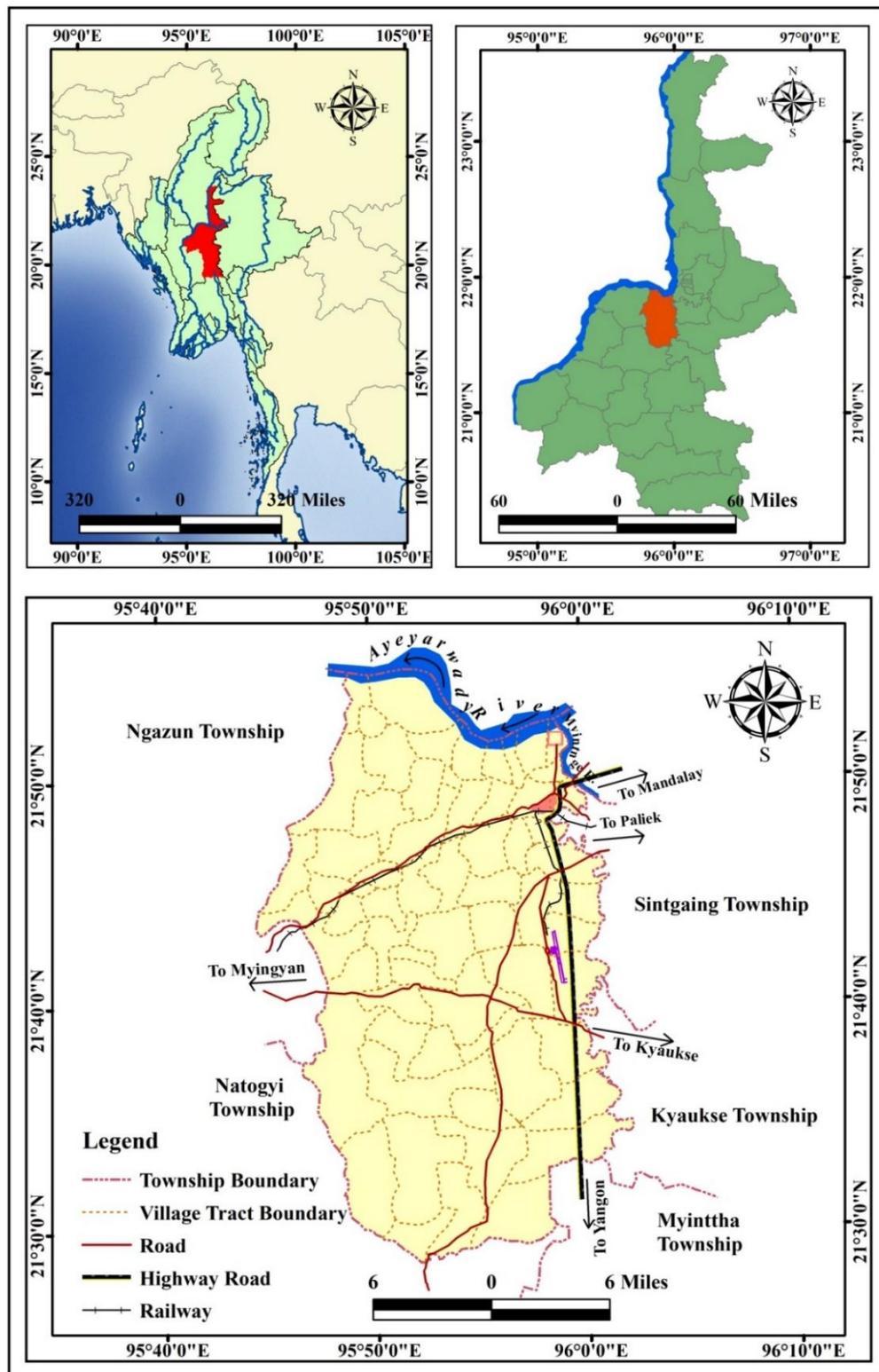


Fig. 1. Map showing the study site, Tada U Township, Mandalay Region  
 (Source: UTM Map-No-2195-13, 2196-01, 2195-14)

## Results

### Bat species recorded in Tada U environs

In the present study, a total of eight species of bats belonging to five genera and four families were identified and recorded. These bat species were collected from 10 different roosting habitats.

### Description of Species Recorded and their habitats

#### *Rousettus leschenaulti* (Desmarest, 1820)

##### Common Name – Fulvous Fruit bat/ Leschenault's rousette

**External Characters:** This species has a forearm length with 86.41 mm. The hind feet and thumbs are shorter. The second phalanx of the third digit is also shorter, usually less than 47 mm. The eyes are prominent. Ventral fur is grey or brown-grey, more greyish in the median area. It is fulvous brown on the crown of the head, back, flanks and throat, the belly is more greyish in the median area. The normal coloration of is a lighter brown, but there is also a brighter color phase with richer brown shades. The back of the neck and shoulder is sparsely haired. The ears have a notch at the lower edge (Plate A).

**Habitat :** This species was captured from Ancient Pagoda (No. 395) (21°51'30" N and 95°59'04" E) surrounded by shrubs and palm trees in Inn Wa, Tada U Township (Plate A).

#### *Cynopterus sphinx* Vahl, 1797

##### Common Name – Greater Short-nosed Fruit Bat

**External Characters:** This is a median-sized fruit bat with an average forearm length of 71.63±0.01 mm. The wings arise from the flanks so that there is no narrowing of dorsal pelage. The membranes are dark brown throughout, but with pale fingers on the wing. The fur is very fine and silky. The ears are simple and essentially naked. The muzzle is short, broad and covered with hairs as far as the nostrils which project well forwards. Lower cheek teeth rounded without accessory cusps (Plate B).

**Habitat :** This specimen was collected from palm tree near the east entrance of Mei Nu Oake Kyaung (21°51'30" N and 95°59'04" E). Shrubs and banana trees were grown up near the palm tree (Plate B and J).

#### *Cynopterus brachyotis* (Müller, 1838)

##### Common name – Lesser Dog-faced Fruit Bat

**External characters:** This species averages smaller than *Cynopterus sphinx* with a forearm length of 68.68 mm. *C. brachyotis* is generally brown to yellowish brown with a brighter collar. The head and body length is 86.39 mm. An indistinct collar is observed in some immature bats. The muzzle is short, broad and covered with hairs. The edges of the ears and the wing bones are usually white. Individuals have two pairs of lower incisors, a fox-like face and large dark eyes (Plate C)

**Habitat :** *Cynopterus brachyotis* was collected from mango tree near entrance of Min Ga Lar Yat Village (21°50'39" N and 95°58'38" E). This is surrounded by palm trees and fields (Plate C).

#### *Taphozous melanopogon* Temminck 1841

##### Common name: Black-bearded tomb bat

**External characters:** This species is comparable in size to *Taphozous longimanus* but with a longer average forearm length of 65.71±1.29 mm. Male has a characteristic beard which is variable in colour but usually has a jet black central part, surrounded by ginger hairs and in some instances paler hairs posteriorly. The hair bases are pale and may give the pelage a mottled appearance, especially in females (Plate D).

**Habitat** : *Taphozous melanopogon* was collected from Gugyi Thone Lone Pagoda (21°47' 402" N and 95°58' 704" E) beside Saga Inn to Pin Ya Road and another site is Mei Nu Oake Kyaung (21°51' 30" N and 95°59' 04" E). Mei Nu Oake Kyaung is built by two floors with cement and wood. Ground floor is the main place of bats for roost. Both sites are old-building and famous for architect (Plate D & J).

***Hipposideros pomona* Andersen, 1918**

**Common name – Andersen's leaf-nosed bat**

**External characters:** This is a small species with an average forearm length of 40.33±0.12 mm. The ears are large, broadly rounded off and nose-leaf without supplementary leaflets. The internarial septum is parallel-sided; the anterior leaf is rounded. The dorsal pelage is dull mid-brown on the back with hair roots pale. The hair tips on the dorsal surface are various shades of mid to dark brown with the hair bases significantly paler. The ventral surface is pale throughout. The wing membranes are a uniform dark brown (Plate E).

**Habitat** : This specimen was collected from Aung Tha Pyae Monastery (21°39' 313" N and 95°48' 836" E). This monastery is built on foothill of Min Thein Hill (Plate E).

***Hipposideros larvatus* (Horsfield, 1823)**

**Common name – Horsfield's Leaf-nosed bat/ Intermediate roundleaf bat**

**External characters:** This is a medium-sized species with an average forearm length of 62.96±1.48 mm. The ears are also relatively large with narrowly rounded-off tips and with a concavity on the posterior border beneath the tips. There are three lateral accessory leaflets on each side of the anterior noseleaf; the posterior leaf is divided into 4 compartments by 3 vertical septa. The crown of the head and back has relatively dark brown hair tips with paler hair bases. The shoulders and nape of the neck are paler throughout. The dorsal surface is a uniform cinnamon brown (Plate F).

**Habitat:** There were four males and two female specimens collected from, Gugyi Thone Lone Pagoda (21°47' 402" N and 95°58' 704" E), Taw Ya Cave (21°40' 30" N and 95°50' 46" E), Shin Ma Kyein Pagoda (21° 48' 16" N and 95° 56' 43" E) and Shwe Taung Taw pagoda's cave(21°44' 201" N and 95°58' 29" E). This cave is situated underneath of the Shwe Taung Taw Pagoda and covered with shrubs and woody plants. It is located in Eain Myint San Village (Plate D, F,G, & I).

***Hipposideros atrox* Andersen, 1918**

**Common Name - Lesser bicoloured leaf-nosed bat**

**External characters:** Forearm length of *H. atrox* averages 40.1±0.71 mm and with body weight of 14 g. The noseleaf is small and lacks supplementary lateral leaflets. The internarial septum is generally triangular in shape. The intermediate leaf is sparsely haired; in males, there is a well-defined frontal sac behind the posterior leaf. In the wing, the fifth metacarpal is about equal in length to the third and shorter than the fourth (Plate G).

**Habitat** : One male and one female specimens were collected from Taw Ya cave (21°40' 30" N and 95°50' 46" E). It is located in Kyat Pyin Village. Near this cave, tamarind trees, palm trees, mango trees and also bushy trees are found. Within the cave, a small ancient pagoda is situated (Plate G).

***Scotophilus kuhlii* Leach, 1821**

**Common name: Lesser Asiatic Yellow Bat/ Asiatic Lesser Yellow House Bat**

**External characters:** Dorsal fur is brown without yellow colour of *S. heathii*. Ventral fur is lighter than dorsal fur. Forearm length averages 49.43±0.74 mm. The tail is long and enclosed in the membrane between the hind legs. The pelage is chestnut brown above; paler below but usually without the characteristic yellowish tinge of *S. heathii*. The light brown yellowish fur is extremely soft to the touch (Plate H).

**Habitat** : This species was collected from Bar Ga Yar Monastery (21°50' 53" N and 95°58' 05" E). This site is surrounded by palm trees, paddy fields and mangoes. This is one of the most famous places in Myanmar's architect (Plate H).



(A) *Rousettus leschenaultia*



Ancient Pagoda No. 395



(B) *Cynopterus sphinx*



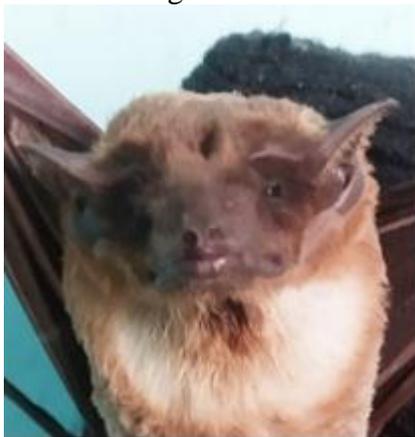
Palm tree near the gate of Mei Nu Oake Kyaung



(C) *Cynopterus brachyotis*  
at U Ti Village



Mango tree near Win Ga Par Temple



(D) *Taphozous melanopogon*



Gugyi Thone Lone at Pin Ya village



(E) *Hipposideros pomona*



Aung Tha Pyae Monastery at Taung Ta Lone Village



(F) *Hipposideros larvatus*



Shwe Taung Taw Cave at Eain Myint San Village



(G) *Hipposideros atrox*



Taw Ya cave at Kyat Pyin Village



(H) *Scotophilus kuhlii*



Bar Ka Yar Monastery



(I) Shin Ma Kyeing Pagoda  
at Thu Nge Taw Village,  
habitat of *Hipposideros larvatus*



(J) Mei Nu Oake Kyaung, Innwa,  
habitat of *Taphozous melanopogon*

Plate 1. Bat species recorded and their habitats in Tada U environs

### Discussion

A total of eight species comprising three species of megabats and five species of microbats were identified and recorded during the study period. The bats were known to occupy in 10 places of habitats. Roosting sites of the bats in this study were trees, ancient pagodas, buildings and the caves.

Among the fruit bats, *Rousettus leschenaultia* was occurred in old pagoda and *Cynopterus sphinx* and *Cynopterus brachyotis* preferred to roost in the trees of particular species. Similarly (Elmore et al., 2004) expected that tree species preferences of bats would differ between those roosting beneath loose bark and in cavities, but in both cases they would be related to differences in decay characteristics between tree species.

Among the insectivorous bats, *Taphozous melanopogon* and *Hipposideros larvatus* were occurred in more than one roosting sites. *Taphozous melanopogon* was found in Gugyi Thone Lone Pagoda and Mei Nu Oake Kyaung. *Hipposideros larvatus* were also occurred in Gugyi Thone Lone Pagoda, Taw Ya Cave, Shin Ma Kyein Pagoda and Shwe Taung Taw pagoda cave. This finding agrees with (Cryan et al., 2001; Lausen and Barclay, 2006). They described that many species use more than one type of structure for roosting and most species that naturally roost in tree cavities have also been recorded in buildings, bat houses or rock crevices, despite the obvious structural differences. This suggests that *Taphozous melanopogon* and *Hipposideros larvatus* found to prefer different structure of habitats and the remaining bat species in this study were occupied in a single habitat.

The bat species collected from Tada-U environs are abundant. But most of them are hunted by apothecary and children in this region. Moreover, local people and tourists have been visiting these places because Tada U is famous as a cultural heritage site. Therefore, conservation measures of bats and their habitats should be considered for their sustainability

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## References

- Arita, H.T. & Ortega, J. (1998) The middle American bat fauna: conservation in the Neotropical-Nearctic border. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 295–308. Smithsonian Institution Press, Washington, DC.
- Boyles, J. G., and L. W. Robbins. 2006. Comparison of summer and winter roost trees used by evening bats (*Nycticeius humeralis*) in Missouri. *American Midland Naturalist*, 155: 210–220.
- Brigham, R. M., M. J. Vonhof, R. M. R. Barclay, and J. C. Gwilliam. 1997. Roosting behavior and roost-site preferences of forest-dwelling California bats (*Myotis californicus*). *Journal of Mammalogy*, 78: 1231–1239.
- Carter, T. C., and G. A. Feldhamer. 2005. Roost tree use by maternity colonies of Indiana bats and northern long-eared bats in southern Illinois. *Forest Ecology and Management*, 219: 259–268.
- Cryan, P. M., M. A. Bogan, and G. M. Yanega. 2001. Roosting habits of four bat species in the Black Hills of South Dakota. *Acta Chiropterologica*, 3: 43–52.
- Elmore et al., 2004. Selection Of Diurnal Roosts By Red Bats (*Lasiurus borealis*) In An Intensively Managed Pine Forest In Mississippi. *Forest Ecology and Management*. 199: 11-20.
- Fenton, M.B. (1997) Science and the conservation of bats. *Journal of Mammalogy*, 78, 1–14
- Fenton, M.B. & Rautenbach, I.L. (1998) Impacts of ignorance and human and elephant populations on the conservation of bats in African woodlands. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 261–270. Smithsonian Institution Press, Washington, DC.
- Hutchinson, J. T., and M. J. Lacki. 2001. Possible microclimate benefits of roost site selection in the red bat, *Lasiurus borealis*, in mixed mesophytic forests of Kentucky. *Canadian Field-Naturalist*, 115: 205–209.
- Kunz, T.H. (1982) Roosting ecology. In: *Ecology of Bats* (Ed. by T. H. Kunz), pp. 1–55. Plenum Press, New York, NY.
- Lausen, C. L., and R. M. R. Barclay. 2006. Benefits of living in a building: big brown bats (*Eptesicus fuscus*) in rocks versus buildings. *Journal of Mammalogy*, 87: 362–370.
- Marinho-Filo, J. & Sazima, I. (1998) Brazilian bats and conservation biology: a first survey. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 282–294. Smithsonian Institution Press, Washington, DC.
- McCracken, G.F. (1989) Cave conservation: special problems of bats. *Bulletin of the National Speleological Society*, 51, 49–51.
- Pierson, E.D. (1998) Tall trees, deep holes, and scarred landscapes: conservation biology of North American bats. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 309–325. Smithsonian Institution Press, Washington, DC.
- Racey, P.A. (1998) Ecology of European bats in relation to their conservation. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 249–260. Smithsonian Institution Press, Washington, DC.
- Rainey, W.E. (1998) Conservation of bats on remote Indo-Pacific islands. In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 326–341. Smithsonian Institution Press, Washington, DC.
- Richards, G.C. & Hall, L.S. (1998) Conservation biology of Australian bats: are recent advances solving our problems? In: *Bat Biology and Conservation* (Ed. by T. H. Kunz & P. A. Racey), pp. 271–281. Smithsonian Institution Press, Washington, DC.
- Vonhoff, M.J. & Barclay, R.M.R. (1996) Roost-site selection and roosting ecology of forest-dwelling bats in southern British Columbia. *Canadian Journal of Zoology*, 74, 1797–1805.