

Lowland rainforest bat communities of Ulu Temburong National Park with two new records for Brunei Darussalam

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Abstract

Tropical rainforest ecosystems have high levels of both animal and plant biodiversity with many aspects of their ecology understudied. In particular, extensive research is still required to gather accurate estimates of distribution and abundance of forest-interior bat species in Borneo. Accurate abundance data and further knowledge of individual species' ecology is vital for implementing effective conservation. Bats were captured using a harp trap, set up along established trails and around buildings, at Kuala Belalong Field Studies Centre, Ulu Temburong National Park, Brunei Darussalam between 14th-19th January 2018. Ulu Temburong National Park is comprised of pristine primary mixed dipterocarp lowland rainforest that has not been exposed to logging or fragmentation. A total of nine bat species were recorded, with two new records for Brunei, *Miniopterus australis* (Lesser bent-winged bat, N = 1) and *Myotis horsfieldii* (Horsfield's myotis, N = 5). Furthermore, a coincidental sighting of a colony of *Megaderma spasma* roosting on the mangrove island Selirong, in Temburong District is reported here. The bat species captured and encountered in this small-scale study expand our understanding of bat communities in Temburong as well as indicate that current records for the area are far from complete. This affirms the need for further work in building up accurate abundance and diversity estimates, both for Ulu Temburong National Park and Brunei Darussalam.

Index Terms: Brunei, Chiroptera, conservation, tropical lowland rainforest, Ulu Temburong

1. Introduction

Bats have their highest diversity in the tropics and yet are the most understudied of the Bornean mammalian fauna.¹ Struebig *et al.*¹ reported thirty-six bat species for Brunei with highest diversity in Temburong district locations.

The diversity of bat species can be used to indicate ecosystem health² due to their sensitivity to habitat disturbances such as climate change and habitat degradation.³ In addition, bats are thought to provide important economic and ecological services.⁴ This includes pollination and seed dispersal for economically important fruiting plants such as bananas, mangos and

durian as well as many keystone rainforest plants. Bats are a key component in conservation through their roles as pollinators and seed dispersers. Their behaviour provides important services in aiding restoration of damaged and fragmented rainforests. These services re-establish and maintain biodiversity of forested areas.⁵ Insectivorous bats also act as a pest control species through predation on many small invertebrates.⁶

Global decline in bat species over recent years indicates that conservation and monitoring of bat species is of the utmost importance. With current deforestation rates continuing, it is predicted that

up to 40% of bat species could be extinct by the end of the century.⁷ Bat species' inventories in the tropics are far from complete and very little research has been done on the ecological importance of individual species. Compiling accurate inventories of bat species within areas such as the pristine rainforests of Temburong, is vital for assessing species diversity and their conservation needs. Effective conservation efforts for bats are likely to impact rainforest ecosystems as a whole.^{7,8}

In Brunei Darussalam, on the northwest coast of Borneo, 54% of the land area is still covered by unlogged forest.⁹ The Ulu Temburong National Park is the largest protected area in Brunei (50,000 hectares).¹⁰

Extensive logging, fragmentation and damage of forests in the Malaysian states of Sabah and Sarawak have impacted species diversity in those areas, emphasising the importance of producing accurate records of species diversity within Brunei. Furthermore, this highlights the importance of future protection for areas such as the Ulu Temburong National Park, where there has been no logging or forest fragmentation.⁹

Here we report on bats captured in the mixed-lowland dipterocarp forest around the Kuala Belalong Field Studies Centre (KBSFC), Ulu Temburong National Park, Brunei, over six trapping nights between the 14th and 19th of January 2018 as well as a bat sighting on the mangrove island of Selirong in April 2018.

2. Materials and Methods

Bats were captured using a harp trap placed at strategic locations across the Ashton trail and paths between the KBSFC buildings (N 4° 31', E 115° 08'). Traps were on trails and flight trajectories known to be used by bats based on previous trapping surveys¹⁰ and from observing bat flight patterns around the research centre. Traps were set between 5pm and 8am on the 14th-19th January 2018. Harp traps are the most effective and humane method of bat capture within a rainforest environment as there is less risk of entanglement that can occur in other bat

trapping methods.¹¹ The catching bag was removed from the trap during the day to prevent capture of other day-time species.

Captured bats were bagged and processed immediately at KBSFC. Measures of forearm length, tail, ears, tragus and feet were taken to determine individual species. Identification was done using Phillips and Phillips¹² and unpublished keys by Matthew J. Streubig based on Payne and Francis.¹³ Morphometric measurements were taken using callipers. Bats were returned to the location where they were captured and were then released.

3. Results

From our six trapping nights, there was a total of 17 individuals belonging to nine different species (Fig 1.).

Myotis horsfieldii (Horsfield's myotis) was the most abundant bat species encountered. This species, along with *Miniopterus australis* (Lesser bent-winged bat), are new records for Brunei. The five *M. horsfieldii* had moderately long ears each with a tapered forward-bent tragus typical of the genus *Myotis*. Forearm length varied between 35.6-37.5 mm and body mass varied between 6.2-7.3 g distinguishing *M. horsfieldii* from other *Myotis* known to occur on Borneo. Two males and three females were captured. The single *M. australis* was a female with forearm length of 38.0 mm, a body mass of 5.37 g and very dark fur. It showed the distinguishing features of the genus *Miniopterus* with the third finger having a short first phalanx and a very long terminal phalanx as well as having short, rounded ears each with a short blunt tragus. The small body size clearly distinguishes *M. australis* from other bent-winged bats.

Other abundant species were *Hipposideros cervinus* (Fawn roundleaf bat) and *Cynopterus minutus* (Forest short-nosed fruit bat). The majority of bats present at Ulu Temburong were insectivorous bats with *C. minutus* being the only frugivorous species present.

On 22 April, 2018, a small colony of six *Megaderma spasma*, one of them a female with infant, were found roosting midmorning in an abandoned building at Selirong.

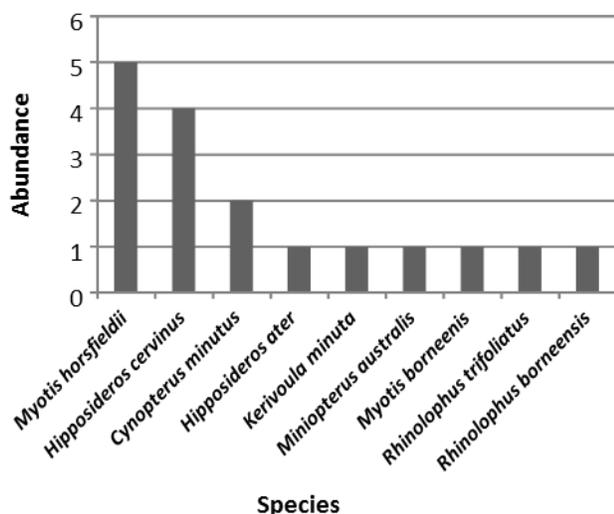


Figure 1. Rank abundance of bat species captured in the harp trap between the 14th-19th January 2018, at KBFSC and along the Ashton trail, Ulu Temburong National Park, Brunei Darussalam. Total number of individuals = 17, from 9 species.

4. Discussion

This study captured a total of nine bat species at KBFSC, Ulu Temburong National Park (UTNP), with two new records for Brunei: *Myotis horsfieldii* and *Miniopterus australis*. This brings the total number of bats recorded in Brunei to 65 species.

M. horsfieldii is thought to have a wide distribution with broad habitat preferences. It can tolerate some degree of habitat modification. The presence of this species in UTNP is not surprising as it occurs throughout Borneo and other SE Asian countries. They roost in a range of roost types, such as tunnels, caves, palm fronds, building crevices, beams and tree hollows.

M. australis is also found throughout Borneo and is tolerant of a broad range of habitats. These bats often roost in very large colonies within caves but have also been known to roost in palm

fronds. These bats are seasonal migrants which may account for their appearance in this survey. In addition, this species might have been absent in previous surveys using harp traps set along forest trails because it tends to be an open-space flyer. We suspect that *M. australis* was roosting underneath one of the KBFSC buildings in immediate vicinity to our harp trap.

With the exception of *M. australis*, the bats captured in this study were forest interior bats. Only *C. minutus* was frugivorous. The forests at UTNP have high canopies and the use of harp traps primarily within forest interior trails, accounts for this pattern, as harp traps are biased towards the capture of forest interior bats, such as Hipposideridae and Kerivoulineae¹⁴ which often follow established trails. In contrast, frugivorous bats are commonly canopy foragers¹⁵ and so would not have been captured using a harp trap in the forest interior. Frugivorous bats are also found in higher abundance in disturbed forests, and likely occur in relatively low numbers in the pristine forests of UTNP.^{11,16}

A high proportion of the bats recorded were forest-interior, insectivorous bats, with six of the seven species in the data set. These species have been described as sensitive to habitat disturbances.¹⁶ High abundance of these species indicates that there have been low levels of disturbance within UTNP. Previous studies by Struebig *et al.*⁸ and Masmin *et al.*¹¹ also found high diversity of insectivorous bats.

The high canopies and presence of *Kerivoula minuta*, at UTNP further emphasises the pristine nature of the forests. *K. minuta* is sensitive to habitat disturbances due to their preference for roosting in smaller trees (less than 20m).¹⁷ This makes *K. minuta* a good indicator species for the health and quality of forest ecosystems. The presence of this near-threatened species (as listed by the IUCN¹⁸) suggests that UTNP is an important location for conservation.

The discovery of a colony of the charismatic *Megaderma spasma* on Selirong Island is significant, because only a single individual has

previously been reported from Brunei. This individual was netted in the Peradayan Forest Reserve in Temburong by Struebig *et al.*¹ *M. spasma* is known to roost in tree cavities, caves and abandoned buildings.

This study was a small-scale study, with more trapping nights being required to make accurate diversity estimates. The study was also limited by using a harp trap, which captured mainly forest-interior bats. For accurate data on the presence and abundance of bat species in UTNP further use of multiple traps in a variety of locations would be required. Nevertheless, this diversity snap-shot is informative as it has increased our understanding of the bat communities in this forest.

This study recorded two new species for Brunei Darussalam, *Myotis horsfieldii* and *Miniopterus australis*. The capture of two new records in this small sample and in the case of *M. horsfieldii*, in high abundance, suggests that the bat species inventory for not only UTNP but also Brunei Darussalam is not complete. Brunei supports some of the most diverse bat assemblages in Borneo with approximately two-thirds of the Bornean bat fauna found in Brunei alone.¹ Further surveys should be undertaken to better understand the historical and current processes that shape these rich faunal assemblages.

5. Conclusion

This survey adds two new bat species records to both UTNP and Brunei Darussalam. This emphasises the need for further work to compile accurate bat inventories and species abundance data and also the high conservation value of pristine rainforest sites.

Acknowledgements

We thank the staff at the Kuala Belalong Field Studies Centre, the Universiti Brunei Darussalam, and the University of Otago for facilitating the field work as well as Amy MacIntosh for reviewing the manuscript.

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