Vertical Stratification of Bats in the Mossy Forest Of Mt. Hilong-Hilong, Mindanao Island, Philippines

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Abstract : A study of the vertical stratification of bats in mossy forest of Mt. Hilong-hilong, Diwata Range, Agusan del Norte was conducted to (1) compare species-level diversity of bats between ground and subcanopy levels and to (2) assess the conservation status of bats captured in the area. Mist nets set at or above 5 m above the ground were considered to be sampling the subcanopy; those below this level were considered to be sampling the ground-level. We achieved 134 net nights at the ground level and 134 net nights in the subcanopy. Species diversity of bats was higher at ground (1.733) than at the subcanopy (1.262) level. Low species similarity (40%) was noted between ground and subcanopy levels in the Bray-Curtis index. We captured 32 individuals belonging to eleven (11) species of bats in the mossy forest of Mt. Hilong-hilong; six (6) species were captured at ground level and five (5) in the subcanopy. Four (4) species are Philippine endemics, Ptenochirus jagori, Haplonycteris fischeri, Harpyionycteris whiteheadi and Ptenochirus minor, the last being endemic to Mindanao Island. All four endemics were taken at ground level. Seven species Rhinolophus arcuatus-s, Miniopterus schreibersi, Myotis horsefieldii, Macroglottis minimus, Pipistrellus javanicus, Harpiocephalus harpia and Kerivoula hardwickii are more widespread.

Key words: bats, Mt. Hilong-hilong, mossy forest, vertical stratification,

INTRODUCTION

Bats are important components of ecosystems because they disperse seeds, pollinate flowers, and prey on a wide range of invertebrate taxa. Despite their ecological importance and high diversity in SE Asia, basic ecological information is lacking for all but the most common bats (Heaney et al. 1998; Sedlock 2001; Esselstyn et al. 2004). For example, little is known about how (or if) bat species stratify vertically in forest ecosystems in the Philippines (Ingle 1993).

Mt Hilong – hilong, an important watershed in Agusan del Norte, has been designated a wildlife sanctuary. Although noted as a sanctuary for amphibian and reptilian diversity (Diesmos 2000), bat diversity has not been assessed. We studied the diversity and vertical stratification patterns of bats on Mt. Hilong-hilong during October 2006.

METHODS

Sampling Area

Mt Hilon-hilion (125.7004°9.09024°NW) is the highest peak in the Diwata Range, lying at the boundaries of the provinces of Agusan del Norte, Agusan del Sur and Surigao del Sur. The mountain reaches a maximum elevation of 1917 masl and is a prominent landmark over much of Agusan del Norte’s rolling topography.

Our sampling site was in the mossy forest of Mount Hilong-hilong at elevation ranging from 1400 to 1900 masl. During the period of study the air temperature readings ranged from 16-21 °C with mean of 19.42 °C. Relative humidity ranged from 84 to 88%. Sampling was conducted from 11 October 2006 to 21 October 2006, resampled in October 2016. Mossy forest at the site was dominated by trees of the families Meliaceae and Podocarpaceae; most trees were 20 m tall, but some reached 25 m. There was no trace of habitat disturbance in the mossy forest. Unlike montane forest there were abaca gathering.

Collection and Identification of Bats

Bats were sampled using mist nets set at different levels from the ground. Nets set at 0-5 m were considered as ground nets. And nets set at 5 m above were categorized as subcanopy nets. Collected bats were placed in cloth bags and their morphometrics were taken (Hindfoot, Forearm, Tail length, Total length and Weight). Bats were identified following Ingle and Heaney (1992). Voucher specimens and tissue
samples were collected from captured bats and deposited in CMU Museum. Some bats that were released were marked by clipping fur on the head.

**Analysis**

All bats captured from the mist nets including the bats released were considered in the determination of species diversity. We calculated the species richness, abundance and diversity using BIOPRO (McAleece, 1997)

Local populations of bats were counted according to the number of individual per species caught following the legend below. It was based on the gathered data, legend categories.

**LEGEND:** 1-7 Individuals- rare 7-up Individuals- common

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**RESULTS AND DISCUSSION**

**Adequacy of sampling**

The species accumulation curve for ground and sub canopy has reached the same level of abundance as shown in Fig 1. As cited by Gomez (2005) and Mohagan et al, 2015 a curves that reaches distinct plateaus indicates sufficiency of sampling effort beyond which additional sampling is unlikely to add additional species. Sampling is then considered adequate when a plateau is reach and further sampling may not produce a new species.

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**Bat Species Richness**

There were eleven (11) species (*Rhinolophus arcuatus*, *Miniopterus schreibersi*, *Myotis horsefieldii*, *Ptenochirus minor*, *Ptenochirus jagori*, *Macroglossus minimus*, *Haplonycteris fisheri*, *Hapyionycteris whiteheadi*, *Pipistrellus javanicus*, *Harpyiocephalus harpia* and *Kerivoula hardwickii*) captured in the mossy forest of Mount Hilong-hilong. Eight (8) species (*Ptenochirus minor*, *Ptenochirus jagori*, *Macroglussus minimus*, *Haplonycteris fisheri*, *Harpyionycteris whiteheadi*, *Pipistrellus javanicus*, *Harpyiocephalus harpia* and *Kerivoula hardwickii*) captured in the subcanopy layers.

Of the eleven (11) species of bats captured using mist netting: six (6) were captured in ground nets and five (5) were captured in the subcanopy.

Three (3) species (*Ptenochirus jagori*, *Haplonycteris fisheri*, *Harpyionycteris whiteheadi*) are Philippine endemic and one Mindanao endemic, *Ptenochirus minor*. Two of the captured species are categorized as vulnerable in the IUCN red list, *Haplonycteris fisheri* and *Harpyionycteris whiteheadi*. Local assessment of bats revealed, ten (10) rare species (*Rhinolophus arcuatus*, *Miniopterus schreibersi*, *Myotis horsefieldii*, *Ptenochirus minor*, *Ptenochirus jagori*, *Macroglussus minimus*, *Hapyionycteris whiteheadi*, *Pipistrellus javanicus*, *Harpyiocephalus harpia* and *Kerivoula hardwickii*) were captured at both ground and sub-canopy layers.
harpia and Kerivoula hardwickii) and one (1) common species (Haplonectes fischeri).

In addition, a total number of 25 individuals (Table 1) were captured in nets at both levels. The sub canopy nets (17 individuals) account for higher number of individuals but lower species-level diversity.

The above observations indicate 1) higher species richness at the ground compared to sub canopy level but 2) greater density in the sub canopy.

Ingle (1993) also suggests the occurrence of vertical stratification of bats in the rainforest of Mt. Makiling. Contra to our results, low species diversity was observed at the ground layer. This would appear to contradict the findings in the mossy forests of Mt Hilong-hilong in the present study undertaken. This difference could be due to variation in habitat, elevation, bat communities, and/or intensity of sampling between the surveys on Luzon and Mindanao islands. This result holds true with mamood and Nameer, 2006 and Mohagan et al,2015.

The Shannon diversity index is 1.733 for ground and 1.262 for sub canopy. It means that ground layer is higher as compared to subcanopy layer. (Table 1). Furthermore the dendrogram of species similarity between ground and the sub canopy is considered low at only 40%. This suggests that vertical distributions form an important component of a bat’s niche.

Table 1. Species Richness, Relative Abundance and Species Diversity between ground and subcanopy nets

<table>
<thead>
<tr>
<th></th>
<th>Ground</th>
<th>Subcanopy</th>
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<tbody>
<tr>
<td>1. Species Richness (Total species)</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2. Relative Abundance (Total Individuals)</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>3. Shannon Diversity Index</td>
<td>1.733</td>
<td>1.262</td>
</tr>
</tbody>
</table>

Two new observations should merit attention in this report particularly to two species, Pipistrellus javanicus and Harpiocephalus harpia collected in the mossy forest of Mt Hilong-hilong. The first is Harpiocephalus harpia which is reported by Heaney et al, 2000; Mahmood and Nameer, 2006 and Mohagan et al, 2015 to be widespread in Southern Asia and is primarily found in disturbed lowland areas at 475 to 750 masl. In the Philippines this species is also reported in Panay, Luzon. Leyte and Negros islands.

The second is for Pipistrellus javanicus species which is distributed in Korea, Java (Mammod and Nameer, 2006; Mohagan et al, 2015) and the Philippines particularly in the montane forests of Balbalasang, Kalinga province. The captures made at Mt Hamiguitan were at both the montane and mossy forests.

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LITERATURE CITED


