FIRST RECORDS OF BATS (Mammalia: Chiroptera) FROM SON LA CITY, NORTHWESTERN VIETNAM, WITH REMARKS ON THEIR CONSERVATION STATUS

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ABSTRACT
Son La is a well-known city in the Northwestern region of Vietnam for its outstanding landscapes. It contains a variety of ecosystems ranging from farming area, valleys, forests on hills and karst with cave systems. Natural habitats of the city would be suitable for many bat species. However, bats of the city were not included in any literature. Between March 2014 and June 2018, we conducted a series of bat surveys in this city using mist nets and harp traps. Results from our study indicated that Son La city is a home to at least 21 bat species belonging to 9 genera, 6 families. Of which, *Rhinolophus thomasi* was listed as “VU” (Vulnerable) in the 2007 Red Book of Vietnam and *Myotis annamiticus* was listed in the IUCN Redlist of the Threatened Species as “DD” (Data Deficient). This paper provides the first data on bats of Son La city with morphological measurements and conservation status of each recorded species.

Keywords: Biodiversity, conservation, mammal, northwestern Vietnam.
INTRODUCTION

Son La city, the capital of Son La Province, is one of the most important sites within the northwestern region of Vietnam for both nature conservation and socio-economic development. The first assessment of mammal diversity from the province was published by Tran Hong Viet et al. (2007a) which included records of 35 bat species belonging to 18 genera, 8 families. However, taxonomic status of several species were recently changed while some species were unconfirmed. Dao Nhan Loi (2017) provided an assessment of bat diversity of Son La province with records of 43 bat species belonging to 19 genera, 5 families. This updated assessment comprises original data from field surveys and information from previously published records of bats from Thuan Chau district (13 species, 9 genera, 5 families), Quynh Nhai (13 species, 9 genera, 4 families), Moc Chau (10 species, 7 genera, 4 families), Yen Chau (13 species, 8 genera, 6 families), Muong Do and Phu Yen (37 species, 18 genera, 8 families) (Tran Hong Viet et al. 2006a, 2006b, 2006c, 2006d; Tran Hong Hai et al. 2010). The above results indicated that Son La province is a hotspot in Vietnam for bat research and conservation. However, the previous mammal surveys were only carried out in protected areas and districts of the province. Bats and other animals of many areas including the Son La city had not received attention from scientist by 2013. Between 2014 and 2018, the author conducted field surveys throughout the habitats of the city and obtained the first data of bats of the Son La city. Many species, which were nationally rare but commonly recorded in Son La city. It is likely that the city contains important remaining habitats for bat species. This paper provides current information regarding diversity, distribution and conservation status of each bat species at the city.

MATERIALS AND METHODS

Field surveys were carried out during 109 days at seven selected communes of the Son La city: Chien Sinh, Chien Coi, Quyet Tam, Chieng Ngan wards, Chieng Xom, Chieng An, Hua La communes (Fig. 1). Bats were captured using mist nets in different sizes (10.0 m x 2.5 m; 12.0 m x 3.0 m; 7.0 m x 2.5 m) and harp traps. The nets and traps were set up under forest canopy, cave entrances, above the water bodies (streams and lakes) and other habitats. The nets were open from 5:30 pm to around 11:00 pm. The traps were often placed across trails in the forest, cave doors or trails under forest canopy. A total of 142 individuals were captured over the surveys. The following morphological measurements of every captured individuals were taken in the field for rapid identification: forearm length (FA), ear height (EH), Tibia length (TIB), hind foot length (HF), tail length (T). These measurements were illustrated in Bates & Harison (1997). Pregnant or lactating females were released immediately after quick taking of the above measurements. Selected individuals were kept as specimens which are preserved at Faculty of Agriculture and Forestry, Tay Bac University, Son La city, and the Institute of Ecology and Biological Resources, VAST, Ha Noi.

Figure 1. Study sites within the Son La city

Representatives of each species was kept as voucher specimen for craniodental characteristics to confirm their taxonomic status. All voucher specimens were identified with reference to the publications related to...
the bat fauna of Vietnam (Corbet & Hill 1992; Brisenenko & Kruskov 2003; Csorba et al. 2003; Kruskop 2013).

RESULTS AND DISCUSSION

Results from the surveys suggested that the Son La city is home to at least 21 bat species belonging to 9 genera, 6 families (table 1). Of which, 2 species are listed in the 2007 Red Data Book of Vietnam: *Rhinolophus thomasi* and *Myotis siligorensis*. Almost all remaining species are listed as LC (Least concern) in the current IUCN Red List of the Threatened Species except *Myotis annamiticus* which is listed as DD (data deficient) and an unassessed species (*Tylonycteris fulvida*).

| Scientific name | English name                          | Vietnamese name                        | Conservation status |
|-----------------|---------------------------------------|----------------------------------------|---------------------|
| Pteropodidae    | Old World fruit bats                  | Hồ doi quá                            | IUCN: LC            |
| *Megaerops niphanae* | Ratanaworabhan’s Fruit Bat           | Đơi quá không đuôi lông                 | VNRB: LC            |
| Emballonuridae   | Emballonurids                          | Hồ doi bao                               |                      |
| *Taphozous melanopogon* | Black - bearded tomb bat            | Đơi bao đuôi nâu den                   | LC                  |
| Hipposideridae   | Old - World leaf-nosed bats           | Hồ doi nép mủ                        |                      |
| *Aselillus stoliczkanus* | Stoliczka’s trident bat              | Đơi mủ ba l                          |                      |
| *Hipposideros larvatus* | Horsfield’s leaf-nosed bat            | Đơi mủ xâm                             | LC                  |
| *Hipposideros pomona* | Andersen’s leaf-nosed bat            | Đơi nép mủ xinh                       | LC                  |
| Miniopteridae    | Bent-winged bats                      | Hồ doi cánh dài                         |                      |
| *Miniopterus fuliginosus* | Eastern bent-winged bat              | Đơi gập cánh dài                     |                      |
| Rhinolophidae    | Horseshoe bats                        | Hồ doi lá mủ                           |                      |
| *Rhinolophus affinis* | Intermediate horseshoe bat          | Đơi lá đuôi                             | LC                  |
| *Rhinolophus siamensis* | Thai Horseshoe Bat                    | Đơi lá mủ thái lan                   | LC                  |
| *Rhinolophus malayanus* | Malayan horseshoe bat            | Đơi lá mã lai                           | LC                  |
| *Rhinolophus marshalli* | Marshall’s horseshoe bat            | Đơi lá rẹ quạt                           | LC                  |
| *Rhinolophus microglobosus* | Indo-Chinese brown horseshoe bat      | Đơi lá mủ bắc                                | LC                  |
| *Rhinolophus pearsonii* | Pearson’s horseshoe bat            | Đơi là pec-xôn                            | LC                  |
| *Rhinolophus pusillus* | Least horseshoe bat                  | Đơi là mói                               | LC                  |
| *Rhinolophus thomasi* | Thomas’s horseshoe bat              | Đơi là tô - ma                          | LC                  |
| Vespertilionidae  | Vesper bat                            | Hồ doi mói                              |                      |
| *Myotis annamiticus* | Annamite myotis                      | Đơi tai việt nam                        | VU                  |
| *Myotis hasseltii* | Lesser Large-footed Myotis           | Đdoi tài hat-xen                        | LC                  |
| *Myotis horsfieldii* | Horsfield’s Myotis                    | Đơi tai cánh ngán                       | LC                  |
| *Myotis laniger* | Chinese Water Myotis                 | Đôi tài trung hoa                      | LC                  |
| *Myotis siligorensis* | Himalayan whiskered bat              | Đôi tài sơ cao                          | LC                  |
| *Pipistrellus abramus* | Japanese pipistrelle               | Đôi muỗi sơ đệt                        | LC                  |
| *Tylonycteris fulvida* | Amber Bamboo Bat                     | Đôi ông tre                               | N/A                 |

Notes: VNRB: The 2007 Red Data Book of Vietnam; IUCN: IUCN Red List of the Threatened Species (http://www.iucnredlist.org).

Of the recorded bat families, Rhinolophidae comprises the highest species number which accounts for 38.10% of the total known species (table 2). Four species were commonly recorded at almost all study sites (*Rhinolophus thomasi*, *R. siamensis*, *R.
affinis) while four remaining ones were locally rare (R. malayanus, R. marshalli, R. pearsonii, R. pusillus). Vespertilionidae consists of 7 species, accounting for 33.3% of all known species from the study area (table 2). Of which, Myotis hordfieldii, Pipistrellus abramus were quite common throughout the city while three species (Tylonycteris fulvida, Myotis siligorensis, M. hasseltii) were rarely recorded.

Among the remaining families, Hipposideridae consists of quite common species but three other families (Pteropodidae, Emballonuridae, and Miniopteridae) were uncommon and less diverse (table 2).

Morphological measurements of every captured species are given in the table 3.

**Table 2. Bat species composition from the study area**

| Family name          | Genera | %   | Species |
|----------------------|--------|-----|---------|
| Pteropodidae         | 1      | 11.11 | 1       |
| Emballonuridae       | 1      | 11.11 | 1       |
| Hipposideridae       | 2      | 22.22 | 3       |
| Miniopteridae        | 1      | 11.11 | 1       |
| Rhinolophidae        | 1      | 11.11 | 8       |
| Vespertilionidae     | 3      | 33.33 | 7       |
| Total                | 9      | 100.00 | 21      |

**Table 3. External measurements of bat species from the study area**

| Species                     | n  | FA      | 17.07 ± 0.76 | 23.69 ± 1.25 | 10.00 ± 0.37 |
|-----------------------------|----|---------|---------------|---------------|---------------|
| M. niphrum                  | 3  | 59.27 ± 2.53 | 36.43 ± 1.28 | 16.47 ± 17.92 | 9.73 ± 10.42 |
| T. melanoposon              | 21 | 66.33 ± 1.38 | 64.15 ± 68.40 | 14.23 ± 19.1 | 12.50 ± 0.30 |
| A. stoliczka                  | 12 | 43.21 ± 0.93 | 41.52 ± 44.73 | 11.88 ± 0.71 | 19.83 ± 0.85 |
| H. latavus                   | 15 | 39.22 ± 1.77 | 54.92 ± 61.78 | 22.25 ± 2.42 | 24.64 ± 1.20 |
| H. pomona                   | 18 | 42.51 ± 1.08 | 40.82 ± 45.51 | 21.94 ± 2.47 | 19.70 ± 1.66 |
| M. fuliginosus              | 7  | 49.99 ± 0.83 | 49.07 ± 51.37 | 12.13 ± 1.24 | 20.89 ± 0.51 |
| R. affinis                  | 5  | 53.39 ± 0.56 | 52.91 ± 53.84 | 19.60 ± 2.84 | 25.40 ± 0.69 |
| R. siamensis               | 11 | 39.40 ± 0.99 | 37.52 ± 40.43 | 22.35 ± 2.54 | 15.63 ± 1.61 |
| R. malayanus                | 1  | 45.89                  | 15.14                  | 17.42                  | 7.42                  |
| R. marshalli               | 1  | 46.51                  | 25.88                  | 20.00                  | 8.19                  |
| R. microglobus              | 4  | 45.60 ± 1.33 | 43.66 ± 46.70 | 16.90 ± 2.19 | 2.18 ± 1.41  |
| R. pearsonii               | 1  | 53.95                  | 27.66                  | 25.84                  | 11.30                  |
| R. pusillus                | 1  | 37.76                  | 16.38                  | 16.62                  | 6.77                  |
| R. thomasi                | 7  | 44.44 ± 1.64 | 41.13 ± 46.08 | 17.31 ± 2.3 | 14.49 ± 20.34 |
| M. amnicpus               | 3  | 35.55 ± 1.63 | 33.76 ± 36.95 | 12.76 ± 1.13 | 11.70 ± 13.95 |
| M. hasseltii              | 1  | 35.55 | 12.7                  | 13.82                  | 7.48                  |
| M. hordfieldii            | 16 | 35.02 ± 1.43 | 31.62 ± 37.75 | 13.88 ± 1.72 | 13.98 ± 1.48 |
| M. laniger               | 4  | 35.04 ± 0.63 | 34.36 ± 36.67 | 14.40 ± 0.87 | 15.06 ± 0.43 |
| M. siligorensis          | 2  | 33.98 ± 3.43 | 8.94 ± 11.68 | 15.30 ± 15.16 | 14.49 ± 15.51 |
| P. abramus               | 7  | 31.86 ± 1.07 | 30.41 ± 33.07 | 9.69 ± 0.98 | 10.54 ± 15.83 |
| T. fulvida               | 2  | 25.15 ± 25.68 | 7.86 ± 7.91 | 11.28 ± 11.90 | 7.65 ± 5.77 |

**Notes:** Values are given as mean ± SD, minimum-maximum. Abbreviations are defined in the “Material and Methods”; n = sample size.
CONCLUSION

The Son La city is home to at least 21 bat species belonging to 9 genera, 6 families. Of which, two species (*Rhinolophus thomasi* and *Myotis siligorensis*) are listed in the 2007 Red Data Book of Vietnam; 16 species are listed as “Least Concern” in the current IUCN Red List of the Threatened Species (IUCN). *Myotis annamiticus*, which is listed as DD in IUCN, was also recorded from different study sites of Son La city.

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