

## FIRST RECORD OF BATS (CHIROPTERA) FROM RAKHINE STATE, MYANMAR (BURMA).

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### ABSTRACT

Two surveys were recently conducted in Rakhine State, western Myanmar. They were the first for bats in this area and resulted in the collection of sixteen species of five families, including second country records of *Hipposideros ater* and *Myotis hasseltii*. Reviews of the taxonomic status of *Rhinolophus lepidus shorridgei* and *Cynopterus brachyotis* in Myanmar are included.

Key words: Chiroptera, bats, Myanmar, Rakhine, diversity, distribution

### INTRODUCTION

BATES *ET AL.* (2000) summarised the history of bat research in Myanmar and included a review of the principal bat surveys undertaken since 1863 together with a checklist of bat species. Subsequently, BATES *ET AL.* (2001) described the collection of four bat species new to the country, which increased the number of bat families known from Myanmar to 10 and the number of species to 92.

BATES *ET AL.* (2000) suggested that future field surveys should be conducted in areas of Myanmar that have not been extensively studied for bats in the past. Consequently, between August and December, 2000, two surveys were carried out by the authors in Rakhine State (Fig. 1). The results represent the first published bat data for this area.

A brief description with a supporting table of external, cranial, and dental measurements for each of the 16 species collected is given together with notes on their ecology and distribution.

### MATERIALS AND METHODS

#### Study Area

Rakhine State (approximately 17° 24'N to 21° 29'N and 92° 11'E to 94° 56'E) lies wholly within the 'Burmese' Coast unit of the Indo-Chinese subregion: this unit has a fairly rich biodiversity but low endemism and acts as a corridor of faunal and floral

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Received 30 January 2003; accepted 15 May 2004.

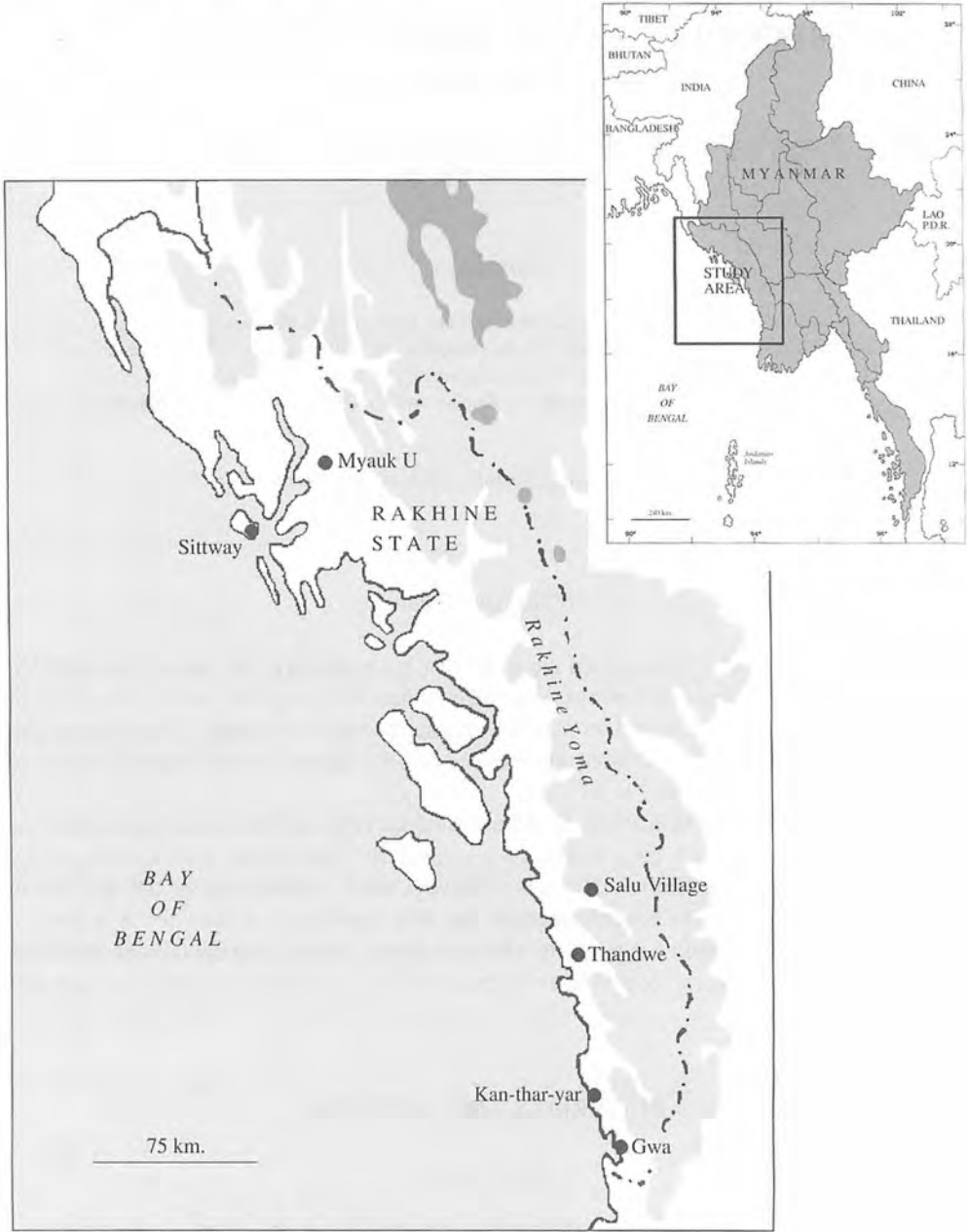


Figure 1. Map of study area, showing principal collecting localities in Rakhine State.

exchange between the Sundaic, IndoChinese and Indian Subregions (MACKINNON, 1997). Rakhine State was originally covered with lowland evergreen forest on the narrow coastal plain, with more extensive montane evergreen forest on the extensive hills of the Rakhine Yoma, which is a southerly extension of the eastern Himalayas (CHHIBBER, 1933). Today, much of this forest has been cleared for agriculture on the coastal strip, particularly rice production (Central Statistical Organization, 1997), whilst shifting cultivation in the hills has led to extensive areas of creeping bamboo (*Melocanna bambusoides*) (MACKINNON, 1997). The State has a tropical monsoon climate: the annual rainfall along the southern part of this coastal strip ranges from 4445 mm to 5334 mm (TYDD, 1962), with 5156 mm falling annually at Sittwe (Central Statistical Organization, 1997).

Field research was undertaken by scientists from Yangon University and the Harrison Institute in the southern half of Rakhine State in the vicinity of the coastal towns of Gwa, Kan-thar-yar, and Thandwe (Fig. 1). In the Rakhine Yoma, studies were conducted near the village of Salu. Khin Mie Mie's research took place in and around the towns of Sittway and Mrauk U in north-western Rakhine State.

### SPECIMENS AND MEASUREMENTS

Voucher specimens were taken for each taxon. Free-flying bats were caught in 18ft, 30ft, and 42ft Japanese two-ply, four-shelf, nylon mesh mist nets; bats roosting in caves were collected in hand-held butterfly nets and in specially adapted mist nets; and some bats were caught manually by local people. In the majority of cases, external measurements were recorded in the field before the specimens were transferred to 70% ethyl alcohol. Specimens are currently held in the collections of the University of Yangon and of the Harrison Institute. Those collected by Khin Mie Mie have field numbers with the prefix KMM. Those collected on subsequent field surveys have the prefix Z.

Tables 1 and 2 list a series of external, cranial, and dental measurements in millimetres (mm) of processed specimens. Measurements are defined as follows: HB: head and body length, from the tip of the snout to the base of the tail; T: tail length, from the tip to the base adjacent to the body; HF: (hind) foot length, from the extremity of the heel behind the os calcis to the extremity of the longest digit, not including the hair or claws; FA: forearm length, from the extremity of the elbow to the extremity of the carpus with the wings folded; E: ear length, from the lower border of the external auditory meatus to the tip of the pinna; GTL: greatest length of skull, the greatest antero-posterior diameter of the skull, taken from the most projecting point at each extremity; SL: the greatest length from the occiput to the front of the canine (after CSORBA *ET AL.*, 2003); CBL: condylo-basal length, from an exoccipital condyle to the anterior extremity of a premaxilla at the alveolar margin of the most forwardly projecting upper incisor tooth; CCL: condylo-canine length, from an exoccipital condyle to the alveolus of the canine; ZB: zygomatic breadth, the greatest width of the skull across the zygomatic arches; BB: breadth of braincase, the greatest width of the braincase at the posterior roots of the zygomatic arches; M: mandible length, from the condyle of the mandible to its most anterior projecting point, including the lower incisors; C-M<sup>n</sup>: maxillary tooththrow length, from the most anterior point of the upper canine to the back of the crown of the last upper molar; C-M<sub>n</sub>: mandibular tooththrow length, from the most anterior point of the lower canine to the back of the crown of the

| Species                       | n  | HB          | TAIL         | HF        | FA        | E             | MASS      |
|-------------------------------|----|-------------|--------------|-----------|-----------|---------------|-----------|
| Pteropodidae                  |    |             |              |           |           |               |           |
| <i>Cynopterus brachyotis</i>  | 1m | 85.0        | 9.8          | 11.0      | 61.3      | 18.0          | 30.0      |
|                               | 4f | 93.0-100.0  | 9.9-10.2 (3) | 11.5-14.9 | 62.0-63.0 | 16.0-19.0     | 35.0      |
| <i>Cynopterus sphinx</i>      | 1m | 96.9        | 7.6          | 11.8      | 67.6      | 16.9          | *         |
|                               | 1f | 88.5        | 3.8          | 16.9      | 66.0      | 17.3          | 48.5      |
| <i>Eonycteris spelaea</i>     | 2f | 112.0-116.0 | 10.8-14.7    | 14.6-15.0 | 72.1-74.6 | 17.9-18.0     | *         |
| Emballonuridae                |    |             |              |           |           |               |           |
| <i>Taphozous longimanus</i>   | 1m | 81.0        | 21.0         | 11.0      | 60.0      | 16.0          | 25.0      |
|                               | 2f | 75.0-84.0   | 21.0-25.0    | 9.4-11.0  | 58.0-61.0 | 15.5-16.5     | 25.0-30.0 |
| <i>Taphozous melanopogon</i>  | 1f | 83.0        | 25.0         | 9.5       | 61.0      | 17.1          | 30.0      |
| Megadermatidae                |    |             |              |           |           |               |           |
| <i>Megaderma spasma</i>       | 1f | 76.5        | *            | 14.7      | 62.8      | 40.4          | 25.0      |
| Rhinolophidae                 |    |             |              |           |           |               |           |
| <i>Rhinolophus lepidus</i>    | 1m | 43.0        | 16.2         | 8.0       | 40.1      | 18.7          | 6.0       |
| Hipposideridae                |    |             |              |           |           |               |           |
| <i>Hipposideros ater</i>      | 1f | 43.8        | 27.7         | 6.5       | 39.6      | 14.3          | *         |
| <i>Hipposideros larvatus</i>  | 2m | 75.6-79.0   | 28.1-28.2    | 11.5-12.5 | 61.2-65.0 | 21.0-21.5     | 30.5-34.3 |
|                               | 2f | 73.1-74.0   | 31.9-34.0    | 12.5-18.0 | 64.2-65.0 | 23.0-24.3     | 30.0-34.0 |
| <i>Hipposideros pomona</i>    | 3m | 42.7-45.2   | 27.8-31.5    | 6.0-7.1   | 40.9-41.2 | 17.2-20.7     | *         |
|                               | 3f | 44.3-47.3   | 24.6-29.4    | 6.2-7.0   | 41.5-42.4 | 18.3-21.3     | 6.0 (2)   |
| Vespertilionidae              |    |             |              |           |           |               |           |
| <i>Myotis hasseltii</i>       | 3f | 52.0-53.0   | 41.0-42.0    | 8.5-9.0   | 40.0      | 15.5-15.6     | 10.0      |
| <i>Pipistrellus javanicus</i> | 1f | 42.0        | 28.3         | 5.0       | 30.2      | 9.4           | 5.5       |
| <i>Pipistrellus tenuis</i>    | 2m | 41.2-44.9   | 20.0-24.9    | 6.9-7.9   | 27.5-27.7 | 9.1-10.2      | 3.7       |
|                               | 7f | 30.5-39.0   | 21.0-27.0    | 2.0-3.0   | 26.0-27.5 | 6.5-7.1       | 3.7-4.0   |
| <i>Scotophilus heathii</i>    | 7m | 74.5-94.0   | 43.0-55.6    | 10.0-14.1 | 58.0-63.2 | 13.3-18.0 (6) | 36.5-50.0 |
|                               | 1f | 73.0        | 49.0         | 11.0      | 56.5      | 15.0          | 40.0      |
| <i>Scotophilus kuhlii</i>     | 1m | 72.9        | 40.6         | 10.1      | 49.1      | 16.0          | 22.0      |
|                               | 2f | 65.0-72.5   | 42.3-50.0    | 8.0-11.0  | 49.4-53.0 | 11.4-13.0     | 20.0-21.5 |

Table 1. Range of six external measurements (in mm) of fifteen species of bat collected from Rakhine State, Myanmar, including head and body length (HB), tail length (TAIL), foot length (HF), forearm length (FA), and ear length (E). Body mass (MASS) is given in g. Sample sizes differing from those entered under *n* are given in parentheses after the measurement.

Table 2. Range of ten cranial and dental measurements (in mm) of fifteen species of bat collected from Rakhine State, Myanmar, including greatest length of skull (GTL), condylo-basal length (CBL), condylo-canine length (CCL), zygomatic breadth (ZB), breadth of braincase (BB), mandible length (M), maxillary tooththrow length (C-M<sup>n</sup>), mandibular tooththrow length (C-M<sub>n</sub>), posterior palatal width (M<sup>n</sup>-M<sup>n</sup>) and anterior palatal width (C<sup>l</sup>-C<sup>l</sup>). Sample sizes differing from those entered under *n* are given in parentheses after the measurement.

| Species                      | n  | GTL           | CBL           | CCL           | ZB        | BB            | M         | C-M <sup>n</sup> | C-M <sub>n</sub> | M <sup>n</sup> -M <sup>n</sup> | C <sup>l</sup> -C <sup>l</sup> |
|------------------------------|----|---------------|---------------|---------------|-----------|---------------|-----------|------------------|------------------|--------------------------------|--------------------------------|
| Pteropodidae                 |    |               |               |               |           |               |           |                  |                  |                                |                                |
| <i>Cynopterus brachyotis</i> | 1m | 30.0          | 28.0          | 26.9          | 12.9      | 22.7          | 9.5       | 10.7             | 8.5              |                                |                                |
|                              | 4f | 30.4-31.0 (3) | 28.1-29.4 (3) | 26.9-28.3 (3) | 18.2 (1)  | 12.5-12.8 (3) | 22.5-23.0 | 9.3-9.7          | 9.4-10.9         | 8.3-8.5                        | 5.7-6.1                        |
| <i>Cynopterus sphinx</i>     | 1m | 31.2          | 29.2          | 28.5          | 19.4      | 12.6          | 23.7      | 10.6             | 11.8             | 9.5                            | 6.5                            |
|                              | 1f | *             | *             | *             | *         | *             | 24.3      | 10.7             | 12.2             | 10.0                           | 7.1                            |
| <i>Eonycteris spelaea</i>    | 2f | 31.8-35.5     | 30.3-33.6     | 29.2-31.9     | 18.1-19.4 | 13.8-14.2     | 24.9-26.9 | 12.0-12.6        | 13.2-13.9        | 8.7                            | 6.3-6.8                        |
| Emballonuridae               |    |               |               |               |           |               |           |                  |                  |                                |                                |
| <i>Taphozous longimanus</i>  | 1m | 21.3          | *             | 19.9          | 12.8      | 9.8           | 15.7      | 8.7              | 9.7              | 8.9                            | 3.9                            |
|                              | 2f | 20.7-21.0     | *             | 19.2-19.7     | 12.0-12.3 | 9.7-10.0      | 15.5-15.7 | 8.3-8.4          | 9.2-9.8          | 8.3                            | 3.6-3.7                        |
| <i>Taphozous melanopogon</i> | 1f | 21.3          | *             | 20.1          | 12.6      | 10.0          | 16.1      | 8.6              | 9.5              | 8.5                            | 3.8                            |
| Megadermatidae               |    |               |               |               |           |               |           |                  |                  |                                |                                |
| <i>Megaderma spasma</i>      | 1f | 27.0          | *             | 23.5          | 14.4      | 10.7          | 18.7      | 10.1             | 11.4             | 9.1                            | 5.4                            |
| Rhinolophidae                |    |               |               |               |           |               |           |                  |                  |                                |                                |
| <i>Rhinolophus lepidus</i>   | 1m | 17.9          | 15.8          | 15.4          | 8.9       | 7.7           | 12.0      | 6.7              | 7.2              | 6.4                            | 4.4                            |
| Hipposideridae               |    |               |               |               |           |               |           |                  |                  |                                |                                |
| <i>Hipposideros ater</i>     | 1f | 15.7          | 14.2          | 13.5          | 7.4       | 7.7           | 9.3       | 5.0              | 5.7              | 5.6                            | 2.9                            |
| <i>Hipposideros larvatus</i> | 2m | 25.0-25.4     | 22.4-22.6     | 21.6 (1)      | 13.9-14.5 | 11.3          | 16.0-16.9 | 9.6 (1)          | 9.7-10.0         | 9.0-10.3                       | 5.9 (1)                        |
|                              | 2f | 19.7-24.6     | 17.0-21.7     | 16.1-21.4     | 13.0-14.0 | 9.2-9.7       | 10.6-13.8 | 6.4-9.0          | 7.1-10.4         | 8.5                            | 6.6 (1)                        |
| <i>Hipposideros pomona</i>   | 3m | 17.7-18.1     | 15.6-16.1     | 15.3-15.5 (2) | 8.7-9.1   | 7.9-8.5       | 10.4-11.0 | 6.0-6.1 (2)      | 5.6-6.5          | 5.8-6.4                        | 3.3-4.1                        |
|                              | 3f | 17.8-18.0     | 15.8-16.1     | 15.1-15.6     | 8.6-8.9   | 8.4-8.6       | 10.3-11.1 | 6.1-6.3          | 6.3-6.6          | 5.9-6.2                        | 3.4-3.6                        |

| Species                       | n         | GTL       | CBL          | CCL          | ZB        | BB          | M         | C-M <sup>n</sup> | C-M <sub>n</sub> | M <sup>n</sup> -M <sup>n</sup> | C <sup>1</sup> -C <sup>1</sup> |
|-------------------------------|-----------|-----------|--------------|--------------|-----------|-------------|-----------|------------------|------------------|--------------------------------|--------------------------------|
| Vespertilionidae              |           |           |              |              |           |             |           |                  |                  |                                |                                |
| <i>Myotis hasseltii</i> 3f    | 16.1-16.6 | 15.0-16.5 | 13.7-15.4    | *            | 7.5-7.6   | 10.6-12.0   | 5.8-5.9   | 6.3-6.5          | 6.3              | 4.4-4.5                        |                                |
| <i>Pipistrellus javanicus</i> | 1f        | 13.8      | *            | *            | *         | 7.6         | 9.8       | 4.8              | 5.4              | 6.1                            | 4.4                            |
| <i>Pipistrellus tenuis</i>    | 2m        | 11.5-11.6 | 10.3-10.8    | 9.9-10.5     | *         | 6.4         | 7.9-8.0   | 3.7-4.5          | 4.3              | 5.1                            | 2.5-3.6                        |
|                               | 7f        | 10.5-12.1 | 9.9-10.6 (6) | 9.4-11.0 (6) | *         | 5.7-6.0 (5) | 7.4-7.8   | 3.3-4.1          | 3.8-4.5          | 4.6-5.0                        | 3.2-3.6 (6)                    |
| <i>Scotophilus heathii</i>    | 7m        | 21.0-23.9 | 20.1-20.8    | 20.0-20.5    | 15.2-16.5 | 9.5-12.2    | 16.2-17.1 | 7.8-8.4          | 8.2-8.9          | 10.0-10.6                      | 7.5-8.0                        |
|                               | 1f        | 21.4      | 20.0         | 20.1         | 15.7      | 10.0        | 16.0      | 8.0              | 8.2              | 9.6                            | 7.3                            |
| <i>Scotophilus kuhlii</i>     | 1m        | 19.7      | 16.7         | 16.4         | 13.1      | 10.0        | 13.9      | 6.6              | 7.2              | 8.7                            | 6.3                            |
|                               | 2f        | 19.1-19.5 | 16.3-18.2    | 15.5-17.4    | 12.8-13.0 | 8.7-9.3     | 13.6-13.7 | 6.5              | 7.2-7.6          | 8.1-8.2                        | 6.2-6.3                        |

last lower molar;  $M^n$ – $M^n$  : posterior palatal width, taken across the outer borders of the last upper molar;  $C1$ – $C1$ : anterior palatal width, taken across the outer borders of the upper canine.

### SYSTEMATIC REVIEW OF SPECIES

***Rousettus leschenaulti*** (DESMAREST, 1820), Fulvous fruit bat

**New material.**— ♀♀♀ Z70, Z73, Z74 (juvenile) (all collected on 23.11.2000), Nay Pu Taung (Marble-mining Mountain), Rakhine Yoma. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—Specimens of *R. leschenaulti* together with *Eonycteris spelaea* were collected from chambers within the honeycombed rocks at Nay Pu Taung. The heavily forested hillsides support evergreen and dipterocarp forest and clusters of Kayin bamboo (*Melocanna bambusoides*), thinjan (*Hopea odorata*), pyinma (*Lagerstroemia speciosa*), and taungthayet (*Swintora floribunda*). Nay Pu Taung is an isolated limestone outcrop in the Rakhine Yoma, which is mined commercially. Dynamite is exploded within the rock faces to expose these deposits with consequent destruction of habitat and disturbance of roost sites. *R. leschenaulti* is a common species in Myanmar.

***Pteropus giganteus*** (BRÜNNICH, 1782), Indian flying fox

**New material.**— ♂♂ KMM4 (11.8.2000), KMM5 (21.8.2000); ♀♀♀ KMM1 (9.8.2000), KMM2 (9.8.2000), KMM6 (21.8.2000), all subadults, Sittway: Sittway University campus and U Ottama Park. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—Specimens were collected from two neighbouring colonies. The first comprised about 200 individuals and was located within Sittway University campus in the branches of three tall trees, which included banyan and koukou (*Albizia lebbek*). The second colony inhabited casuarina trees (*Casuarina equisetifolia*) in U Ottama Park, adjacent to the University campus. This is a widespread species and is not threatened in Myanmar. All specimens were collected in August and all were subadult.

***Cynopterus brachyotis*** (MÜLLER, 1838), Lesser dog-faced fruit bat

**New material and distribution.**— ♀ Z5 (14.11.2000), Alai Chaung village, Gwa Township; ♂ KMM 40 and ♀♀♀ KMM 41–43 (all collected on 8.11.2000), Kalar Chaung, Sittway.

**Taxonomic remarks.**—There is considerable confusion in the literature in distinguishing between *C. sphinx* and *C. brachyotis*. In the past, a number of specimens of *Cynopterus* from Myanmar were included in the taxon *angulatus*, which was considered to be a race of *C. brachyotis*. Subsequently, *angulatus* was included in *C. sphinx* (CORBET & HILL, 1992; BATES & HARRISON, 1997). However on the basis of the literature, BATES *ET AL.* (2000) erroneously included in *C. brachyotis* specimens referred to *C. b. angulatus* from

three surveys conducted in the early 20<sup>th</sup> century by the Bombay Natural History Society (WROUGHTON, 1915b; LINDSAY, 1926 and FRY, 1928, 1929). A subsequent examination of the specimens in the Natural History Museum, London suggests that these are in fact referable to *C. sphinx*, on the basis of forearm and ear length and cranial and dental measurements (*sensu* BATES & HARRISON, 1997). Therefore, the following records from Bankachon, Victoria Point and Tenasserim (WROUGHTON, 1915b); Tavoy Island and Malcolm Island (LINDSAY, 1926) and Toungoo (FRY, 1928, 1929) are now included in *C. sphinx*.

As a consequence, the recent collection of *C. brachyotis* from the Rakhine coast provides the first confirmed records of this species in Myanmar based on the current understanding of the taxon. The molecular systematics of the two species, including material from Myanmar, is currently being studied at a variety of international institutions.

**Ecological notes and conservation status.**—A single *C. brachyotis* was collected together with four *C. sphinx* in a mist net set above one of the principal pathways in the well vegetated village of Alai Chaung. Further voucher specimens were collected from a colony of about ten individuals, which inhabited palm trees growing along the banks of Kalar Chaung, within the urban area of Sittway. The stream at this point is about 1.5 m in width and shallow. The vegetation includes betel trees and various shrubs.

***Cynopterus sphinx* (VAHL, 1797)**, Short-nosed fruit bat, Indian fruit bat

**New material and distribution.**—♂♂♀♀ Z6/7/5/8 (14.11.2000) Alai Chaung village, Gwa Township; ♀ Z13 (14.11.2000), Sone Twin Monastery, Gwa; ♂♂♂♂♂ Z43–47 (17.11.2000), Tai-gyo village, nr. Kan-thar-yar, Gwa Township; ♂♂ Z57/56 (19.11.2000) Ngapali Beach, Nr. Thandwe; ♂♀ Z76 (juvenile)/77 (24.11.2000) Salu village, Rakhine Yoma. Previous records from Myanmar include: Pyaunggaung (RYLEY, 1914); Mingun, Pagan (=Bagan), and Mt. Popa (WROUGHTON, 1915a); Kin (WROUGHTON, 1916a); Kindat (WROUGHTON, 1916b); Pumsin (CARTER, 1943); Myitkyina (Los Angeles County Museum and the Smithsonian Institution). Records previously referred to *C. brachyotis* but now included in *C. sphinx* (see Taxonomic remarks of *C. brachyotis* above) include: Bankachon, Victoria Point and Tenasserim (WROUGHTON, 1915b); Tavoy Island and Malcolm Island (LINDSAY, 1926) and Toungoo (FRY, 1928, 1929).

**Ecological notes and conservation status.**—This was a widespread and common species throughout the study area. It was collected amongst trees both within the grounds of Sone Twin Monastery and within the perimeters of the villages of Alai Chaung and Tai-gyo; between a small area of marsh and a shallow lake at Ngapali Beach; and in dense primary forest at Salu village in the Rakhine Yoma. A villager at Tai-gyo was able to attract this species by whistling. The bats took up an aggressive posture towards the villager suggesting that the bat perceived that there had been an invasion of its territory. A juvenile specimen was collected on 24 November.

***Eonycteris spelaea* (DOBSON, 1871)**, Dawn bat

**New material and distribution.**—♀♀♀ Z71/72/75 (juvenile) (23.11.2000) Nay Pu Taung (Marble-mining Mountain), Rakhine Yoma. Previous records from Myanmar include: Moulmein (= Mawlamyine) (DOBSON, 1871) and Tagoot (WROUGHTON, 1915b).



**Ecological notes and conservation status.**—Three specimens of *Eonycteris spelaea* were collected at Nay Pu Taung together with specimens of *Rousettus leschenaulti* (see above).

***Taphozous longimanus*** HARDWICKE, 1825, Long-winged tomb bat

**New material and distribution.**—♂ ♀♀ KMM13 (27.8.2000), KMM38 (3.11.2000), KMM48 (19.11.2000) State High School No. 2, Tha-Win-Chaung Village, Sittway. Previous records from Myanmar include: Pagan (=Bagan) and Mandalay (WROUGHTON, 1915a); Tenasserim (=Tanintharyi) (WROUGHTON, 1915b); Kin, Yin, and Monywa (WROUGHTON, 1916a); Pegu (=Bago) and Sitpinzeik (WROUGHTON and DAVIDSON, 1918); and Toungoo (FRY, 1928, 1929).

**Ecological notes and conservation status.**—Specimens of *T. longimanus* were collected together with *T. melanopogon* from a mixed colony of about ten individuals roosting in the attic of the wooden, two-storey State High School No. 2 in Sittway. *T. longimanus* was secured also from a colony of about ten individuals located within the roof space of the primary school in Tha-Win-Chaung Village. The latter building was constructed from wood with a roof of *dhani* thatch. The area around the village is cultivated for rice, the paddy fields being interspersed with bushes and low vegetation. This is a widespread but never abundant species throughout its range and is apparently not common in Myanmar.

***Taphozous melanopogon*** TEMMINCK, 1841, Black-bearded tomb bat

**New material.**—♀ KMM37 (28.10.2000), State High School No. 2, Sittway. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—A specimen was collected together with *T. longimanus* (see above) at State High School No. 2 in Sittway. This is a common and widespread species in Myanmar.

***Megaderma spasma*** (LINNAEUS, 1758), Lesser false vampire

**New material.**—♂ ♀ Z4/5 (14.11.2000) Ywama Monastery, Gwa. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—*M. spasma* was collected by hand by villagers within the lightly wooded grounds of Ywama Monastery at Gwa. It appears to be a widespread and relatively common species in Myanmar.

***Rhinolophus lepidus*** (BLYTH, 1844), Blyth's horseshoe bat

**New material.**—♂♂♂ Z16–18 (14.11.2000) Mayan Haung, Gwa Township. Previous records from Myanmar include Pyay (Harrison Institute collection); Kanbalu (USNM collection) and are listed in BATES *ET AL.* (2000).

**Taxonomic remarks.**—The specimens from Gwa Township are included here in *R. lepidus feae* (ANDERSEN, 1907). *R. feae* was originally described from Biapo, north-east of Toungoo, probably in Kayin State, although the co-ordinates of Biapo cannot be traced.

A comparison of the measurements of *feae* listed in ANDERSEN (1907) with those listed by ANDERSEN (1918) for *shortridgei*, another member of the *R. pusillus* group (sensu CSORBA ET AL., 2003), subsequently named from Myanmar, suggests that these two taxa are synonymous. The measurements given for *feae* and *shortridgei* respectively are forearm length, 40–41 mm (n=2) as compared to 38–42.5 mm (n=?); skull length to front of canines, 17.2–17.7 mm and 16.8–18.7 mm and C–M<sup>3</sup>, 6.5–6.8 mm and 6.5–7.5 mm.

Despite the geographical proximity of the type localities of *feae* and *shortridgei*, (they are about 300 km apart), ANDERSEN (1918) did not compare the two taxa in his description of *shortridgei* from Bagan (=Bagan) in Mandalay Division. Subsequent authors treated the two taxa in a variety of ways. Some maintained *R. feae* as a separate species and accorded subspecific status to *R. lepidus shortridgei* on account of its apparent longer hind foot (based on measurements taken 90 years ago) and mandible (AGRAWAL AND SINHA, 1973). Others, such as HILL AND YOSHIYUKI (1980) considered (without comment) both *feae* and *shortridgei* to be distinct races of *R. lepidus* whilst others, such as CORBET AND HILL (1992), treated *feae* as a synonym of *R. lepidus lepidus* and *shortridgei* as a distinct race, *R. lepidus shortridgei* (without comment).

Most recently CSORBA ET AL. (2003) included *feae* as a race of *R. lepidus*, encompassing northern Myanmar and northern Thailand and *R. shortridgei* as a distinct Myanmar species. The reasoning for this was based on two individuals, one larger (USNM 577473, ♂) referred by them to *R. shortridgei* and one smaller (USNM 577474, ♀) referred to *R. lepidus* (*R. l. feae* by inference). Both were collected at Kanbalu Township near Chatthin Wildlife Sanctuary. They suggest that these individuals show that *lepidus* and *shortridgei* have a sympatric distribution in Myanmar, since the skull and teeth of the two individuals 'clearly differ' in their measurements. They also note that the canines, both upper and lower, of the latter specimen are much smaller. The skull length (SL) mm and upper toothrow length (C–M<sup>3</sup>) of the two specimens are given as 17.68 mm, 16.73 mm and 6.61 mm, 6.37 mm respectively.

In Fig. 2, the two specimens listed by CSORBA ET AL. (2003) are compared with the holotype and 13 topotypes of *shortridgei* from Bagan, two 'cotypes' of *feae* and 11 specimens of *R. l. lepidus* from India. The holotype of *shortridgei* is shown to be untypically large. The cotypes of *feae* are comparable in size to the medium and smaller individuals of *shortridgei*. Male *shortridgei* tend to exceed females in size. This is not apparent in *lepidus*. It is not known whether this is significant. Both male and female *shortridgei* and *feae* average larger than *lepidus* but there is an area of overlap in both the cranial and dental measurements. Specimen USNM 577474 is situated in this area of overlap and cannot be assigned to either taxon with confidence. The overlap in the measurements of *shortridgei* from Bagan, the cotypes of *feae* and specimens of *R. l. lepidus* from India is further evinced in Tables 3 and 4.

The above data based on morphometrics does not support the contention of CSORBA ET AL. (2003) that there are two separate species (*shortridgei* and *lepidus*) present in Myanmar. The canine character of CSORBA ET AL. (2003) is also not proven, for although the canines (both upper and lower) of specimens of *shortridgei* from Bagan average larger than those of *lepidus* from India, this is not a constant character. There is little difference in size between many individuals of the two taxa. For example, specimen HZM.24.32582 from Nyaung-Oo (=Bagan), Myanmar has a right upper canine length of 2.22 mm (and skull length [SL] of 18.06 mm) whilst HZM.20.28162 from New Delhi has an upper canine length of 2.14 mm (SL= 17.00). Both teeth are virtually unworn.

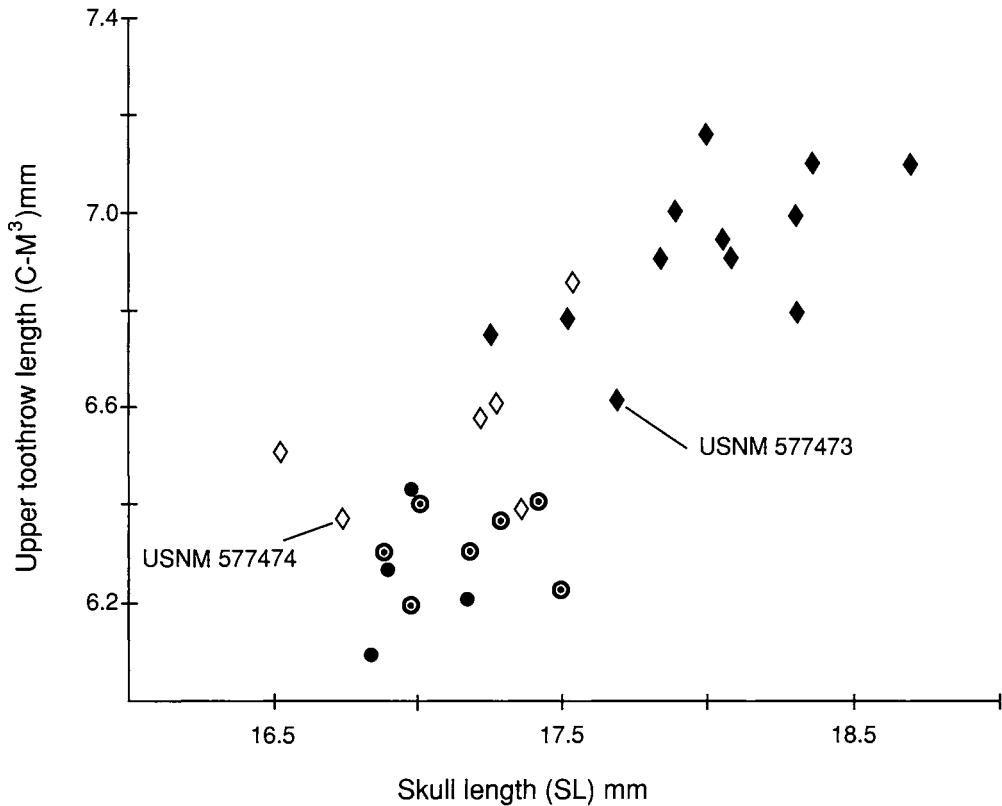


Figure 2. Comparison of upper tooththrow length and skull length of *Rhinolophus lepidus*. *R. lepidus* from Myanmar: black diamonds for males; open diamonds for females. *R. lepidus* from India: black circles for males; open circles with a dot for females. The two specimens discussed by CSORBA 2003 from the Smithsonian Institution have been indicated with their collection numbers.

As the morphometric evidence is not conclusive and there are no distinctive morphological characters, *shortridgei* is here considered to be conspecific with *lepidus* and as a junior synonym of *R. l. feae*. All specimens from Myanmar are referred to *R. l. feae*.

**Ecological notes and conservation status.**—*R. lepidus* was captured in concrete culverts running beneath a lightly compacted stony track in the Rakhine Yoma. Local vegetation comprised a mixture of evergreen and mixed deciduous forest, which included pyingadore (*Xylia dolabriformis*), taukyant (*Terminalis tomentoso*), and binga (*T. ekcbula*), as well as some extensive stands of bamboo (*Melocanna bambusoides*).

***Hipposideros ater* TEMPLETON, 1848, Dusky leaf-nosed bat**

**New material and distribution.**— ♀ Z36 (15.11.2000) Kan-thar-yar. Previous records from Myanmar include: Mergui (=Myeik) Town (LINDSAY, 1926).

Table 3. Mean, standard deviation and range of six external measurements (in mm) for both sexes of three taxa of *Rhinolophus* from Myanmar and India, including head and body length (HB), tail length (TAIL), foot length (HF), forearm length (FA), tibia length (TIBIA) and ear length (E). The length of the foot relative to the tibia (HF/TIB) is expressed as a decimal. Body mass (MASS) is given in g. Sample sizes differing from those entered under *n* are given in parentheses after the measurement.

|                                      | n   | HB                     | TAIL                   | HF                       | FA                     | TIB                        | HF/TIB                      | E                          | MASS         |
|--------------------------------------|-----|------------------------|------------------------|--------------------------|------------------------|----------------------------|-----------------------------|----------------------------|--------------|
| <i>R. shortridgei</i><br>(topotypes) | 8m  | 49.7, 2.5<br>44-52 (7) | 22.6, 3.1<br>19-27 (7) | 9.8, 0.2<br>9.5-10.0 (7) | 40.1, 1.4<br>37.5-41.8 | 17.1, 0.9<br>15.4-18.2     | 0.58, 0.03<br>0.54-0.65 (7) | 17.6, 1.3<br>14.7-18.5 (7) | 6.8<br>. (1) |
| <i>R. shortridgei</i><br>(topotypes) | 5f  | 49.5, 3.2<br>44-52     | 24.0, 3.0<br>22-29     | 9.6, 0.4<br>9.2-10.0     | 39.2, 1.3<br>37.0-40.5 | 16.3, 0.5<br>15.8-16.7     | 0.59, 0.03<br>0.55-0.63     | 17.6, 1.0<br>15.8-18.3     | 6.2<br>*     |
| <i>R. feae</i> (i)<br>(cotype)       | 1m  | *                      | 19.0                   | *                        | 40.0                   | 15.7                       | *                           | 16.2                       | *            |
| <i>R. feae</i> (i)<br>(cotype)       | 1f  | *                      | 22.0                   | *                        | 41.0                   | 15.8                       | *                           | 16.2                       | *            |
| <i>R. lepidus</i> (India)            | 7m  | 42.0, 2.0<br>39-44 (6) | 23.2, 2.6<br>20-27 (6) | 7.3, 0.5<br>6.5-8.0      | 39.9, 1.1<br>38.6-41.8 | 16.5, 0.6<br>15.8-17.3     | 0.44, 0.02<br>0.40-0.47     | 16.0, 1.3<br>13.5-17.0     | *<br>*       |
| <i>R. lepidus</i> (India)            | 10f | 46.6, 4.4<br>41-54     | 23.9, 3.0<br>18-28 (9) | 8.1, 0.3<br>7.5-8.6      | 39.7, 1.0<br>38.0-40.9 | 16.1, 0.7<br>14.9-17.0 (8) | 0.50, 0.03<br>0.46-0.55 (8) | 16.5, 0.7<br>15.0-17.0 (9) | *<br>*       |

(i): based on Andersen (1907).

Table 4. Mean, standard deviation and range of ten cranial and dental measurements (in mm) for both sexes of three taxa of *Rhinolophus* from Myanmar and India, including greatest length of skull (GTL), skull length (SL), condylo-canine length (CCL), zygomatic breadth (ZB), breadth of braincase (BB), maxillary toothrow length (C-M<sup>3</sup>), posterior palatal width (M<sup>3</sup>-M<sup>3</sup>), anterior palatal width (C<sup>1</sup>-C<sup>1</sup>), mandibular toothrow length (C-M<sub>3</sub>), and mandible length (M). The length of the mandible relative to the condylo-canine length (M/CCL) is expressed as a decimal. Sample sizes differing from those entered under *n* are given in parentheses after the measurement.

|                                | n   | GTL                         | SL                         | CCL                        | ZB                       | BB                      | C-M <sup>3</sup>    | M <sup>3</sup> -M <sup>3</sup> | C <sup>1</sup> -C <sup>1</sup> | C-M <sub>3</sub>        | MDL                        | M/CCL                       |
|--------------------------------|-----|-----------------------------|----------------------------|----------------------------|--------------------------|-------------------------|---------------------|--------------------------------|--------------------------------|-------------------------|----------------------------|-----------------------------|
| <i>R. lepidus</i> (Myanmar)    | 11m | 18.9, 0.5<br>17.8-19.5 (10) | 18.0, 0.4<br>17.2-18.7     | 15.9, 0.4<br>15.2-16.7     | 9.0, 0.2<br>8.7-9.3 (10) | 7.7, 0.1<br>7.4-8.1     | 6.9, 0.1<br>6.8-7.2 | 6.6, 0.2<br>6.3-7.0            | 4.6, 0.2<br>4.4-4.8 (5)        | 7.5, 0.2<br>7.2-7.9     | 12.4, 0.4<br>11.7-13.0     | 0.78, 0.01<br>0.76-0.79     |
| <i>R. lepidus</i> (Myanmar)    | 7f  | 17.6, 0.1<br>17.4-17.7 (3)  | 16.9, 0.8<br>16.5-17.5 (5) | 15.2, 0.3<br>14.8-15.7 (5) | 8.6, 0.3<br>8.2-8.8 (5)  | 7.3, 0.4<br>6.9-8.0 (6) | 6.6, 0.2<br>6.4-6.9 | 6.4, 0.2<br>6.3-6.7 (6)        | 4.3, 0.1<br>4.3-4.4 (6)        | 7.1, 0.2<br>6.8-7.5     | 11.8, 0.2<br>11.6-12.20    | 0.77, 0.01<br>0.74-0.78 (5) |
| <i>R. feae</i> (i)<br>(cotype) | 1m  | *                           | 17.2                       | *                          | 8.8                      | *                       | 6.5                 | *                              | *                              | 6.9                     | 11.2                       | *                           |
| <i>R. feae</i> (i)<br>(cotype) | 1f  | *                           | 17.7                       | *                          | 9.0                      | *                       | 6.8                 | *                              | *                              | 7.2                     | 11.8                       | *                           |
| <i>R. lepidus</i> (India)      | 7m  | 17.7, 0.3<br>17.4-18.0 (3)  | 17.0, 0.1<br>16.8-17.2 (4) | 15.0, 0.3<br>14.5-15.5 (7) | 8.3, 0.2<br>8.0-8.7      | 7.3, 0.2<br>7.0-7.7     | 6.4, 0.2<br>6.1-6.8 | 5.9, 0.2<br>5.6-6.3            | 4.1, 0.1<br>4.0-4.2 (3)        | 6.9, 0.2<br>6.6-7.1 (6) | 11.5, 0.3<br>11.3-12.1 (6) | 0.76, 0.01<br>0.75-0.78 (6) |
| <i>R. lepidus</i> (India)      | 10f | 18.0, 0.2<br>17.8-18.2 (3)  | 17.2, 0.2<br>16.9-17.5 (7) | 15.0, 0.2<br>14.7-15.3 (8) | 8.4, 0.2<br>8.1-8.8 (9)  | 7.5, 0.2<br>7.1-7.8     | 6.3, 0.1<br>6.0-6.4 | 6.2, 0.1<br>6.0-6.4 (9)        | 4.3, 0.1<br>4.0-4.4 (9)        | 6.7, 0.2<br>6.4-7.0     | 11.3, 0.2<br>11.0-11.8 (9) | 0.76, 0.02<br>0.74-0.79 (6) |

(i): based on Andersen (1907).

**Ecological notes and conservation status.** — The single specimen of *H. ater* was observed just before dusk flying around the bathroom of one of a row of wooden chalets next to the sandy beach at Kan-thar-yar. Numerous palm trees were growing between the beach and the chalets, behind which ran a little-used road with dense vegetation beyond. Although this is a widespread species from India to Australia, the current record is only the second from Myanmar and lies midway between the isolated records of Cherrapunji in Meghalaya, India and Myeik in southern Myanmar.

***Hipposideros larvatus*** (HORSFIELD, 1823), Horsfield's leaf-nosed bat

**New material.**— ♂ ♀ Z42/41 (17.11.2000) Kyway Chai village, nr. Kan-thar-yar; ♂♂ ♀♀ Z48/51/50/53 (18.11.2000) Kyauk Basat Cave, nr. Kan-thar-yar; ♀ KMM17 (23.10.2000) Htote-kan-thain Pagoda, Mrauk U. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—*H. larvatus* was captured by local people at Kyway Chai, a small village situated next to the sea amongst tall, robust palm trees. Further specimens were collected at the entrance of Kyauk Basat (= "stone mouth") Cave, 11 km. north of Kan-thar-yar. A mixed roost of *H. larvatus* and *H. pomona* numbering about 30 individuals occupied a spherical chamber approximately 2 m in diameter located at the base of a 15 m high rock. The bats hung from the ceiling of the chamber and were easily disturbed by the smallest movement within the confined space. Three or four *H. larvatus* were remarkable for their orange-red pelage on the ventral surface. A single female specimen was collected from a colony comprising five individuals at Htote-kan-thain Pagoda at Mrauk U. The bats hung from the ceiling of a narrow vaulted inner corridor measuring approximately 4.4 m in height and 3 m in width. The surrounding area supports mango, banyan, and bamboo, and there are numerous low hillocks surmounted by temples. Large colonies of bats were known to roost in this area but their numbers have declined noticeably since 2000, when construction work aimed at the regensis of many of the temples was commenced. *Hipposideros larvatus* is a widespread and common species in Myanmar.

***Hipposideros pomona*** (ANDERSEN, 1918), Andersen's leaf-nosed bat

**New material and distribution.**— 9x ♂, 6x ♀ Z21/23/24/28/30/32–35 and Z22/25–27/29/31 (15.11.2000) Gu-gyi Cave, Gwa Township; ♂ Z40 (17.11.2000) Kyway Chai village, nr. Kan-thar-yar; ♀♀ ♀ Z49/52/54 (18.11.2000) Kyauk Basat Cave, nr. Kan-thar-yar. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—Specimens were collected by local villagers from a large colony (100 + individuals) roosting in Gu-gyi Cave. The cave was formed from an eroded limestone hill so that daylight permeated the interior at some points. A series of narrow chambers was flanked by almost vertical, jagged limestone walls extending to a height of approximately 10 m. A single specimen was captured by local people at Kyway Chai village together with *H. larvatus* (see above). Three voucher specimens were taken from a mixed colony of *H. pomona* and *H. larvatus* at Kyauk Basat Cave. This is a widespread and common species in Myanmar.

*Myotis hasseltii* (TEMMINCK, 1840), Van Hasselt's bat

**New material and distribution.**— ♀♀♀ KMM49/50/52 (5.12.2000) Ponnagyun Township, E. of Sittway. Previous records from Myanmar include Mergui (Myeik) Town (LINDSAY, 1926).

**Ecological notes and conservation status.**—A colony of ten *M. hasseltii* were found inhabiting a meter box. The box measured 250 x 300 x 500 mm. and was located at a single storey, wooden government office block on the bank of the Kispnadi River at the foot of the low, tree-covered U Yit Hill in Ponggyun Township. This is only the second record from Myanmar of this geographically widespread but relatively uncommon species. The record lies between two isolated records: Calcutta in West Bengal, India (BATES AND HARRISON, 1997) and Myeik in southern Myanmar (LINDSAY, 1926).

*Pipistrellus javanicus* (GRAY, 1838), Javan pipistrelle

**New material and distribution.**— ♀ KMM20 (22.10.2000) Sittway Township: Bout-thi-su Quarter. Previously recorded from Myanmar (as *P. babu*) at Dalu (= *P. babu* in CARTER, 1943) and Bago (= Pegu) (= *P. peguensis* in SINHA, 1969).

**Ecological notes and conservation status.**—*P. javanicus* was found along with *P. tenuis* (see below) in Bout-thi-su Quarter in Sittway Township. A widespread species in Asia but little known in Myanmar.

*Pipistrellus tenuis* (TEMMINCK, 1840), Least pipistrelle

**New material and distribution.**— ♂ HZM.7.33360 (17.11.2000) Tai-gyo village, nr. Kan-thar-yar, Gwa Township; ♂ Z55 (22.11.2000) Ngapali Beach, Nr. Thandwe; ♀♀ Z68–69 and 4 of indeterminate sex, Z64–67 (22.11.2000) Chan-pyin village, nr. Thandwe; ♂♀♀ KMM19 (22.10.2000), KMM7/9 (21.8.2000) Bout-thi-su Quarter, Sittway Township; ♀♀♀♀♀ KMM18/21/26/27/29 (22.11.2000) Kya-ma-thaut Village, Sittway Township. Previous records from Myanmar include: Homalin (= *P. mimus* in WROUGHTON, 1916a); Kabaw Valley (= *P. mimus* in WROUGHTON, 1916b); Dalu, Nanyaseik, Phawzaw, and Maungkan (= *P. mimus* in CARTER, 1943).

**Ecological notes and conservation status.**—A single male *P. tenuis* was found roosting in the centre of a length of bamboo, which was acting as a support for the roof of a wooden house at Tai-gyo village. A second male specimen was netted at Ngapali Beach along with two *Cynopterus sphinx* (see above). Further collections were made at Chan-Pyin near Thandwe and in Bout-thi-su Quarter and Kya-ma-thaut Village in Sittway Township. In Bout-thi-su Quarter, it coexisted with *P. javanicus*. Both species roosted in older buildings, which were lined with wood or bamboo; the bats were observed hanging from rafters and roof beams. A colony numbering approximately fifteen individuals was found within two buildings located in urban areas near the Kispnadi River. This is a widespread and common species in upper and western Myanmar.

*Scotophilus heathii* HORSFIELD, 1831, Asiatic greater yellow house bat

**New material.**— ♂♂♂ Z58–60 (19.11.2000) Lin Thar Monastery, Thandwe; ♂♂♂♂♂♀ KMM15 (21.10.2000), KMM16 (23.10.2000), KMM39 (3.11.2000), KMM44 (11.11.2000), KMM45–46 (14.11.2000), KMM14 (28.11.2000) Sittway: State High School No.2. Previous records from Myanmar are listed in BATES *ET AL.* (2000).

**Ecological notes and conservation status.**—*S. heathii* was located at Lin Thar Monastery in a small, wooden pagoda, whose well-vegetated grounds included banana. The bats were roosting in the roof space. A colony of between fifteen and twenty individuals was observed roosting in the high, beamed ceiling of the vestibule of State High School No. 2 in Sittway and a male was collected from a small, brick building with a multi-tiered tin roof within the Shiet-taung Pagoda complex at Mrauk U. This is a very widespread and common species in Myanmar.

*Scotophilus kuhlii* LEACH, 1821, Asiatic lesser yellow house bat

**New material and distribution.**— ♀♀ Z1–2 (14.11.2000) Gwa; ♂♂♀♀ Z11/14/10/12 (14.11.2000) Sone Twin Monastery, Gwa; ♀♀ Z38–39 (17.11.2000) Kyway Chai village; ♀ KMM47 (18.11.2000) Pauktaw. Previous records from Myanmar include: Mandalay, Mingun, Pagan (=Bagan), and Ngazun (= *S. wroughtoni* in WROUGHTON, 1915a); Tenasserim (=Tanintharyi) and Pyinmana (= *S. wroughtoni* in WROUGHTON, 1915b); Kin, Kindat, Hkamti, Monywa, and Homalin (= *S. wroughtoni* in WROUGHTON, 1916a); Pegu (=Bago) (= *S. wroughtoni* in WROUGHTON AND DAVIDSON, 1918); Mergui (=Myeik) Town (= *S. castaneus* in LINDSAY, 1926); Toungoo (= *S. castaneus* in FRY, 1928); Homalin (= *S. temmincki* in CARTER, 1943).

**Ecological notes and conservation status.**—*S. kuhlii* were caught by local people within the perimeter of the well-vegetated coastal town of Gwa. Mangroves are prevalent along both the seaboard and the sides of the stream. Further specimens were taken at Sone Twin Monastery, Gwa, together with a single *Cynopterus sphinx* (see above). At Kyway Chai village, a colony was located in the crown of a 30 foot high palm tree. A single female was collected in the warehouse of a rice mill near Kywelu Creek in Pauktaw. The area is known for its high humidity. This is a common and widespread bat in Myanmar.

## DISCUSSION

The recent surveys were the first to take place on the coastal strip and associated fold mountains of Rakhine State. Although of limited duration, they contribute considerably to our understanding of the distribution of bats in Myanmar. Noteable records include those of *Hipposideros ater*, *Myotis hasseltii* and *Cynopterus brachyotis*. In the cases of *Hipposideros ater* and *Myotis hasseltii*, they are only the second records for the country and provide a geographical nexus between localities in north-east India and those in south-east Myanmar. The collection of *C. brachyotis* is the first confirmed record from Myanmar, following the reassessment of the taxon *C. b. angulatus* as a race of *C. sphinx* (for a more detailed discussion see the Taxonomic remarks of *C. brachyotis* above).



Bats in Rakhine State appear to be relatively abundant. Human interference appears to be limited to the disturbance of cave bats from roosts for cultural reasons, in particular the use of caves as Buddhist shrines. The predation of bats for food and/or medicinal purposes that is known to occur in other areas of Myanmar (BATES *ET AL.*, 2000) was not evident in Rakhine State, although local hunters at Salu in the Rakhine Yoma proved themselves proficient at procuring squirrels, tree shrews, and other small mammals.

Following this preliminary study of Rakhine State, it is proposed that more detailed research should be undertaken in the region, especially in the forests. The use of Harp traps may lead to the discovery of a rich Vespertilionid bat fauna in particular, since it is known that taxa such as *Murina* and *Kerivoula* tend to avoid conventional mist nets.

#### ACKNOWLEDGMENTS

In Myanmar, thanks are due to His Excellency the Minister of Education, U Than Aung, His Excellency the Deputy Minister of Education, U Myo Nyunt, the Director General of Higher Education (Lower Myanmar), U Saw Lin, the Director General of the Forestry Department, Dr. Kyaw Tint, the Deputy Director of the Forestry Department, U Shwe Kyaw, and the Advisor to the Forestry Department, Lt. Col. Myat Thinn.

We would like to thank the Rector of Yangon University, Professor Soe Yin, for his enthusiasm and support and all those in the Zoology Department, particularly Dr. Si Si Hla Bu, Khin Maung Swe, Soe Soe Aung, and Nilar Lwin, who contributed wholeheartedly to the success of this field study. The survey would not have been possible without the practical arrangements put in place by Harry (U Hpone Thant) and the staff of Swiftwinds Travel or without the skill and efficiency of our guides, Dr. Htay Aung and U Tah Zan, both of whom worked tirelessly for us in the field. In Yangon, we are grateful to John Hinchliffe of *The Road to Mandalay*, Victoria Billing of the British Embassy, and Graham Millington of the British Council for all their interest and encouragement.

In the UK, we would like to thank Paula Jenkins and all the staff at the Natural History Museum, London for providing access to the extensive collections. At the Harrison Institute, we are indebted to Dr. David Harrison for his help with the identification of specimens and Karen Bates for undertaking the majority of specimen curation and preparation. We would like also to thank Lorna McGregor, Janet Leakey, June Cree, Ditte Hendrichsen and Dr. Elizabeth Barratt for their enthusiasm and practical assistance in the field. We are most grateful to the Systematics Association, London for awarding us a grant for the purchase of bat nets and to the Department for Environment, Food and Rural Affairs (DEFRA) for the award of a Darwin Initiative grant, which has enabled us to undertake in-depth studies of the bat fauna of Myanmar.

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### Appendix 1. Gazetteer

|   |                    |
|---|--------------------|
| Alai Chaung village, Gwa Township .....                       | 17° 41'N, 94° 36'E |
| Chan-pyin village, nr. Thandwe .....                          | 18° 30'N, 94° 21'E |
| Gu-gyi cave, Gwa Township .....                               | 17° 26'N, 94° 42'E |
| Gwa .....   | 17° 35'N, 94° 35'E |
| Kan-thar-yar .....  | 17° 44'N, 94° 32'E |
| Kyauk Basat Cave, nr. Kan-thar-yar .....                      | 17° 49'N, 94° 30'E |
| Kyway Chai village, nr. Kan-thar-yar .....                    | 17° 52'N, 94° 29'E |
| Lin Thar Monastery, Thandwe .....                             | 18° 25'N, 94° 20'E |
| Mayan Haung, Gwa Township .....                               | 17° 35'N, 94° 40'E |
| Mrauk U .....   | 20° 37'N, 93° 11'E |
| Nay Pu Taung (Marble-mining Mountain), nr. Salu village ..... | 18° 42'N, 94° 32'E |
| Ngapali Beach, Thandwe .....                                  | 18° 24'N, 94° 20'E |
| Pauktaw, nr. Sittway .....                                    | 20° 11'N, 93° 04'E |
| Salu village .....  | 18° 44'N, 94° 30'E |
| Sittway .....   | 20° 08'N, 92° 54'E |
| Sone Twin Monastery, Gwa .....                                | 17° 36'N, 94° 34'E |
| Tai-Gyo village, nr. Kan-thar-yar .....                       | 17° 49'N, 94° 29'E |
| Thandwe .....   | 18° 28'N, 94° 23'E |
| Ywama Monastery, Gwa .....                                    | 17° 36'N, 94° 34'E |

