

# New country records for five bat species (Chiroptera) from Cambodia

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## មូលនិយមរង្វប

សត្វប្រចៀវ៦១ប្រភេទត្រូវបានកត់ត្រាក្នុងឯកសារស្រាវជ្រាវសំរាប់ប្រទេសកម្ពុជា។ តាមរយៈការសិក្សាកាយវិភាគឡើងវិញនៃសំណាកចាស់និងថ្មីដែលបានត្រូវប្រមូល យើងអាចបញ្ជាក់បានថាសត្វប្រចៀវប្រភេទបន្ថែមទៀតត្រូវបានកត់ត្រា៖ *Macroglossus minimus*, *Pipistrellus paterculus*, *P. javanicus*, *Hypsugo cadornae* និង *Miniopterus pusillus*។ បីប្រភេទក្នុងចំណោមប្រភេទទាំងនោះ ត្រូវបានទាយទុកមុនថាមាននៅក្នុងប្រទេសកម្ពុជា និងត្រូវបានជួបប្រទះទាំងអស់ក្នុងការសិក្សាស្រាវជ្រាវដោយប្រើអន្ទាក់មង (Mist nets) និងអន្ទាក់រាំង (Harp traps) នៅតាមតំបន់ការពារនិងតំបន់មិនការពារមួយចំនួនក្នុងប្រទេសកម្ពុជា។ ទោះបីជាមានការសិក្សាស្រាវជ្រាវតែក្នុងតំបន់មួយចំនួនក្នុងប្រទេសកម្ពុជាក៏ដោយ ក៏គ្មានប្រភេទណាមួយនៃប្រភេទដែលត្រូវបានកត់ត្រាថ្មីនេះបិតក្នុងការព្រួយបារម្ភនៃការអភិរក្សជាសកលឡើយ។

## Abstract

Sixty-one bat species are currently reported in the peer-reviewed literature for Cambodia. Through a morphological review of historical and recently collected specimens, we confirm the occurrence of five additional species: *Macroglossus minimus*, *Pipistrellus paterculus*, *P. javanicus*, *Hypsugo cadornae* and *Miniopterus pusillus*. Three of these species were previously predicted for Cambodia and all five were encountered during recent surveys using mist nets and harp traps in several protected and non-protected areas around the country. Though presently known only from a small number of sites in Cambodia, none of the newly recorded species are thought to be of global conservation concern.

## Keywords

Cambodia, bat taxonomy, new records.

## Introduction

Knowledge of the Cambodian bat fauna has grown in recent years. Following the checklist of Kingsada *et al.*

(2011), which cited 50 species in the peer-reviewed literature for Cambodia, three bat species new to science were described from the country (Csorba, 2011; Csorba *et al.*,

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2011). Ith *et al.* (2011) added a further seven species in a review of historical and more recently collected material, while Francis & Eger (2012) subsequently reassigned a specimen originally identified as *Murina peninsularis* by Matveev & Csorba (2007) to the newly described *M. fionae*. As a consequence, the known bat fauna of Cambodia currently stands at 61 species.

A number of additional bat species were included in range maps or reported for Cambodia by Corbet & Hill (1992) and Francis (2008) without explanation. The purpose of this paper is to confirm the presence of three such species and document the occurrence of two additional, previously unreported species through a morphological review of historical and recently collected specimens. All five species were encountered during an ongoing series of nationwide field surveys aimed at determining the composition, biogeography and status of Cambodian bats and subsequently identifying national priorities for conservation action. Notes on the distribution of each species are provided and future research needs are briefly discussed

## Methods

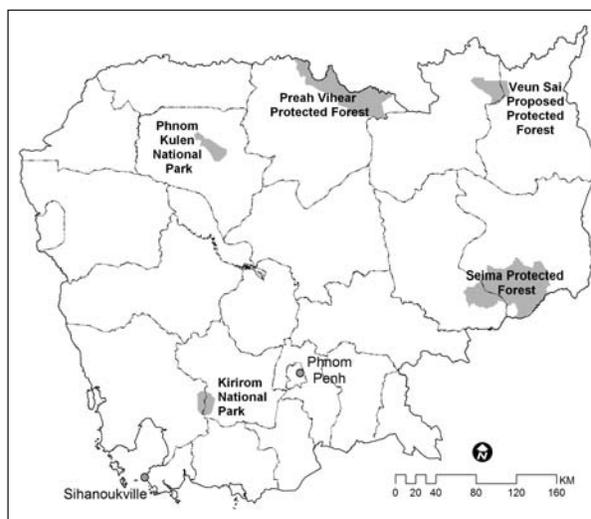
### Study areas

Bat specimens were collected by B. Hayes and J. Walston in Kirirom National Park and Seima Protected Forest in February 2001 and December 2003, respectively (Fig. 1). These were deposited at the Hungarian Natural History Museum (HNHM, Budapest, Hungary) and Harrison Institute (HZM, Sevenoaks, United Kingdom) and subsequently examined by the authors.

From February 2010 to April 2011, further specimens were collected during field studies by the authors in several parts of the country, as summarised below (Fig. 1). Four-bank harp traps and mist nets of varying sizes were employed in the surveys and selection of sampling locations largely focused on water bodies and flyways in forest areas, such as trails, watercourses and natural linear breaks in the vegetation.

Specimens from these studies were deposited at the Centre for Biodiversity Conservation (CBC) Zoological Collection, Royal University of Phnom Penh.

In February and March 2010, field studies were undertaken in the Veun Sai Proposed Protected Forest by Ith S., G. Csorba and Phauk S. The Veun Sai Proposed Protected Forest covers approximately 55,000 ha in Veun Sai District (Ratanakiri Province) and Siem Pang District (Steung Treng Province) in Northeast Cambodia. The



**Fig. 1** Location of bat survey areas in Cambodia.

habitats at this site comprise lowland evergreen and semi-evergreen forest at elevations of 100–400 m, with more northerly areas mountainous and southern parts characterised by grasslands (B. Rawson, pers. comm.).

From April to July 2010, Phauk S. and Phen S. undertook bat surveys in the Northeast section of Phnom Kulen National Park, in Siem Reap Province. The national park covers an area of 37,350 ha and consists of lowland areas and hills over sandstone that reach 450 m above sea level (a.s.l.). Habitats in this site include semi-evergreen forest on hillsides, while lowland areas were originally dominated by dry dipterocarp forest, of which only small, degraded areas now remain (Neou *et al.*, 1998). Phauk S. also undertook one night of opportunistic sampling in cultivated areas in Sihanoukville Town on the Cambodian coast in May 2010.

In February and March 2011, bat surveys were undertaken in Preah Vihear Protected Forest by Ith S., G. Csorba, N. Furey, Seng R., Nget C. and M. Csorba. Preah Vihear Protected Forest covers an area of 190,000 ha in the northern plains of Cambodia (Preah Vihear Province) and abuts the Cambodia–Thailand border. This area is dominated by dry dipterocarp forest and grassland, interspersed with patches of semi-evergreen forest (Walston & Bates, 2001) and includes areas used by local communities for rice cultivation (Clements *et al.*, 2010).

### Morphological assessment

Age and reproductive status were assessed following Anthony (1988) and Racey (1988). External measurements were taken from dry skins and alcohol preserved

specimens to the nearest 0.1 mm, while craniodental and bacular measurements were taken to the nearest 0.01 mm using digital calipers under a stereo microscope. Measurements herein include only those taken from non-juveniles, as indicated by the presence of fully ossified metacarpal-phalangeal joints.

Definitions for external measurements were as follows: FA – forearm length, from the extremity of the elbow to the extremity of the carpus with the wings folded; HB – head and body length, from the tip of the snout to the anal opening; T – tail length, from the anal opening to the tip of the tail; E – ear length, measured from the lower border of the external auditory meatus to the tip of the pinna, excluding any hair; TIB – tibia length, from the knee joint to the ankle; HF – hindfoot length, from the tip of the longest digit, excluding the claw, to the extremity of the heel, behind the os calcis. Illustrations of these measurements are provided by Bates & Harrison (1997).

Definitions for craniodental measurements were as follows: GTL – greatest antero-posterior length of the skull, taken from the most projecting point at each extremity along the median line of the skull; CBL – condylobasal length, from the exoccipital condyle to the anterior rim of alveolus of the first upper incisor; CCL – condylo-canine length, from the exoccipital condyle to the most anterior part of the canine; ZYW – zygomatic width, the greatest width of the skull across the zygomatic arches; MAW – mastoid width, the greatest distance across the mastoid region; CM<sup>3</sup>L – maxillary tooththrow length, from the front of upper canine to the back of the crown of the third molar; C<sup>1</sup>C<sup>1</sup>W – greatest width across the upper canines, taken across the outer borders of upper canines; M<sup>3</sup>M<sup>3</sup>W – greatest width across the upper molars, taken across the outer crowns of the last upper molars; ML – mandible length, from the anterior rim of the alveolus of the first lower incisor to the most posterior part of the condyle; CM<sub>3</sub>L – mandibular tooththrow length, from the front of the lower canine to the back of the crown of the third lower molar; CPH – least height of the coronoid process, from the tip of the coronoid process to the apex of the indentation on the inferior surface of the ramus adjacent to the angular process.

Species sequence and nomenclature follow Simmons (2005), with some modifications (Appleton *et al.*, 2004; Tian *et al.*, 2004). A full list of specimen material examined is given in Annex 1.

## Results

### *Macroglossus minimus* (E. Geoffroy, 1810)

Material examined: Single female from Sihanoukville (Fig. 1, Annex 1).

Although the single specimen had a forearm length intermediate between *M. sobrinus* and *M. minimus* (Table 1), the specimen was referred to *M. minimus* due to its dorsal buffy-brown pelage with paler, grey bases; presence of a distinct internarial groove on the muzzle; smaller and non-overlapping skull measurements (Table 2) compared to published ranges for *M. sobrinus* from Vietnam (Hendrichsen *et al.*, 2001a; Borissenko & Kruskop, 2003) and the Indian subcontinent (Bates & Harrison, 1997).

The single parous female was caught in a mist net at ca. 1800 h in a garden with bananas and durian trees in Sihanoukville. *Macroglossus minimus* is a widespread species ranging from Thailand to the Philippines, Indonesia and Solomon Islands through to northern Australia (Simmons, 2005), apparently occurring mostly in coastal habitats in mainland Southeast Asia (Francis, 2008). Previous reports of the species in Cambodia (Corbet & Hill, 1992; Hayes, 2000; Kock, 2000) were questioned by Hendrichsen *et al.* (2001b) due to lack of voucher specimens. Our record consequently validates the more recent suggestion of Francis (2008) that the species occurs in Cambodia.

Though also widespread in Southeast Asia, similarly little is known about the status of *M. sobrinus* in Cambodia, with only a single record confirmed to date (Matveev, 2005). It should be noted, however, recent DNA barcode analysis (Francis *et al.*, 2010) has shown little differentiation between *M. minimus* and *M. sobrinus*, with the observed genetic variation not closely matching the morphological species limits currently recognised.

### *Pipistrellus paterculus* Thomas, 1915 (Fig. 2)

Material examined: One male from Kirirom National Park, one female from Veun Sai Proposed Protected Forest, and 10 males and five females from Preah Vihear Protected Forest (Fig. 1, Annex 1).

Seventeen specimens were referred to *P. paterculus* on the basis of the following characteristics: dorsal pelage uniformly medium-brown (reddish-brown in some specimens), ventral hair with dark brown roots and sandy-brown tips; external and craniodental measurements (Table 1 and 2) according well with published ranges (Bates & Harrison, 1997; Hendrichsen *et al.*, 2001a); braincase variably bulbous and elevated; presence of slight concavity where rear of rostrum meets anterior part of



**Fig. 2** *Pipistrellus paterculus*: CSOCA251, Preah Vihear Protected Forest (© G. Csorba).



**Fig. 3** *Pipistrellus javanicus*: CBC01255, Preah Vihear Protected Forest (© G. Csorba).



**Fig. 4** *Hypsugo cadornae*: CBC00643, Veun Sai Proposed Protected Forest (© G. Csorba).



**Fig. 5** Baculum of *Pipistrellus paterculus*: CBC01239, Preah Vihear Protected Forest.



**Fig. 6** Baculum of *Pipistrellus javanicus*: CBC01256, Preah Vihear Protected Forest.

braincase in lateral view; upper canine ( $C^1$ ) unicuspid, not in contact with incisors and posterior premolar; anterior upper premolar ( $P^2$ ) approximately equal in crown area to anterior incisor ( $I^2$ ), sometimes visible in lateral view; lower molars nyctalodont; lower anterior premolar ( $P_2$ ) subequal in crown area to posterior premolar ( $P_4$ ); baculum very long (total length: 10.7–11.6 mm,  $n = 5$ ), with a relatively straight narrow shaft and strongly bifid tip with ventrally deflected horns (Fig. 5).

Aside from a singleton caught at 1830 h in a harp trap set along a dry streambed in dry dipterocarp forest, the remainder of specimens captured in Preah Vihear Protected Forest were caught in mist nets set near waterholes in clearings or on dry streambeds in forest areas before 2030 h. The single specimen encountered in Veun Sai Proposed Protected Forest was caught at 1915 h in a mist net set in semi-evergreen forest. Capture data were lacking for the single specimen collected at

**Table 1** Selected external measurements of specimens examined in this paper. Values are given as mean, standard deviation (if  $n \geq 5$ ), and range (min–max), number of specimens. Acronyms and definitions for measurements are given in the text.

Taxon	FA	HB	T	E	TIB	HF
<i>Macroglossus minimus</i>	45.4, – (–) 1	62.0, – (–) 1	0, – (–) 1	13.9, – (–) 1	17.7, – (–) 1	9.3, – (–) 1
<i>Pipistrellus paterculus</i>	29.0, 1.2 (26.0–31.2) 17	40.2, 1.5 (37.6–43.0) 17	27.9, 1.8 (25.1–31.1) 17	11.1, 0.6 (10.0–12.0) 17	11.1, 0.5 (10.0–11.8) 17	5.3, 0.4 (4.5–6.2) 17
<i>Pipistrellus javanicus</i>	33.3, – (32.0–35.1) 3	44.5, – (43.9–45.6) 3	33.1, – (30.3–34.8) 3	12.1, – (11.6–12.8) 3	12.4, – (11.8–13.3) 3	6.2, – (6.1–6.3) 3
<i>Hypsugo cadornae</i>	36.1, – (–) 1	45.8, – (–) 1	36.0, – (–) 1	15.4, – (–) 1	16, – (–) 1	7.3, – (–) 1
<i>Miniopterus pusillus</i>	41.0, – (39.8–41.8) 3	47.2, – (46.7–47.8) 3	49.8, – (49.8) 1	10.2, – (9.2–11.4) 3	17.0, – (16.5–17.2) 3	8.1, – (7.9–8.2) 3

Kirirom National Park. *Pipistrellus paterculus* is found in India, Myanmar, Laos, Vietnam and southwest China (Simmons, 2005; Francis, 2008) and the above specimens constitute the first records for Cambodia. Other pipistrelles confirmed for Cambodia are *P. coromandra*, *P. tenuis* (Kingsada *et al.*, 2011) and *P. javanicus* (below).

#### *Pipistrellus javanicus* (Gray, 1838) (Fig. 3)

Material examined: One male and two females from Preah Vihear Protected Forest (Fig. 1, Annex 1).

The three specimens were referred to *P. javanicus* on the basis of the following characters: dorsal pelage medium brown with lighter brown tips, ventral hair slightly paler with dark roots; external and cranio-dental measurements (Table 1 and 2) agreeing well with published ranges (Bates & Harrison, 1997; Hendrichsen *et al.*, 2001a); tragus moderately narrow, relatively straight with rounded tip; upper canine ( $C^1$ ) bicuspid; upper anterior premolar ( $P^2$ ) slightly displaced inwards, not greatly reduced, with crown area exceeding that of first upper incisor ( $I^2$ ); upper posterior premolar ( $P^4$ ) with distinct antero-lingual projection and wide anterior cingulum forming a distinct shelf; lower molars nyctalodont; baculum relatively long (7.5 mm), with narrow shaft and deeply bifid tip (Fig. 6).

The three specimens were caught before 2100 h in a mist net set beside a pool in semi-evergreen forest. *Pipistrellus javanicus* occurs from North Afghanistan eastwards through Southeast Asia to Indonesia and the Philippines (Simmons, 2005). Reports of this species in Cambodia (Corbet & Hill, 1992) were rejected by Kock (2000) due to lack of reliable evidence. The present records conse-

quently confirm its occurrence, as predicted by Francis (2008).

#### *Hypsugo cadornae* (Thomas, 1916) (Fig. 4)

Material examined: One female from Veun Sai Proposed Protected Forest (Fig. 1, Annex 1).

The single female specimen was referred to *H. cadornae* on the basis of chestnut brown dorsal pelage with darker roots; reduced calcar lobe; cranial profile essentially straight in lateral view; zygoma strong, with a well-defined dorsal process; basisphenoid pits large and deep; upper incisors ( $I^2$ ,  $I^3$ ) similar in crown area; upper canine ( $C^1$ ) unicuspid; upper anterior premolar ( $P^2$ ) very small, less than half the crown area of second upper incisor ( $I^3$ ); lower molars myotodont; lower anterior premolar ( $P_2$ ) half the crown area of posterior ( $P_4$ ) premolar.

The single specimen was caught in a mist net set over a stream in semi-evergreen forest at 2000 h. *Hypsugo cadornae* occurs in northeast India, northern Myanmar and Thailand, Laos and Vietnam (Simmons, 2005). The above specimen constitutes the first record of a member of the *Hypsugo* genus in Cambodia (Kingsada *et al.*, 2011).

#### *Miniopterus pusillus* Dobson, 1876

Material examined: Three males: two from Seima Protected Forest and one from Phnom Kulen National Park (Fig. 1, Annex 1).

Species within the *Miniopterus* genus in Southeast Asia are very similar in appearance, and our diagnosis

**Table 2** Selected craniodental measurements of specimens examined in this paper. Values are given as mean, standard deviation (if  $n \geq 5$ ), and (min–max), number of specimens. Acronyms and definitions for measurements are given in the text.

Taxon	GTL	CBL	CCL	ZYW	MAW	CM <sup>3</sup> L	C <sup>1</sup> C <sup>1</sup> W	M <sup>3</sup> M <sup>3</sup> W	ML	CM <sub>3</sub> L	CPH
<i>Macroglossus minimus</i>	26.96, – (–) 1	24.71, – (–) 1	23.05, – (–) 1	14.20, – (–) 1	9.59, – (–) 1	9.16, – (–) 1	5.07, – (–) 1	6.42, – (–) 1	20.16, – (–) 1	10.00, – (–) 1	6.02, – (–) 1
<i>Pipistrellus paterculus</i>	12.17, 0.21 (11.84– 12.65) 17	11.18, 0.23 (10.86– 11.70) 17	11.02, 0.26 (10.61– 11.55) 17	8.11, 0.30 (7.46– 8.61) 15	7.10, 0.22 (6.79– 7.62) 17	4.25, 0.14 (4.05– 4.56) 17	4.02, 0.13 (3.80– 4.21) 16	5.31, 0.21 (4.98– 5.66) 16	8.64, 0.23 (8.24– 9.05) 17	4.53, 0.13 (4.32– 4.76) 17	2.67, 0.13 (2.45– 2.91) 17
<i>Pipistrellus javanicus</i>	14.09, – (13.71– 14.77) 3	13.17, – (12.71– 13.86) 3	12.78, – (12.43– 13.38) 3	9.28, – (8.81– 9.75) 2	7.88, – (7.58– 8.20) 3	5.20, – (5.07– 5.44) 3	4.70, – (4.51– 5.03) 3	6.24, – (6.03– 6.60) 3	10.38, – (10.12– 10.88) 3	5.54, – (5.34– 5.78) 3	3.02, – (2.79– 3.15) 3
<i>Hypsugo cadornae</i>	13.93, – (–) 1	12.80, – (–) 1	12.79, – (–) 1	8.95, – (–) 1	7.82, – (–) 1	4.77, – (–) 1	4.75, – (–) 1	6.20, – (–) 1	9.86, – (–) 1	5.21, – (–) 1	2.81, – (–) 1
<i>Miniopterus pusillus</i>	14.30, – (14.15– 14.42) 3	13.46, – (13.26– 13.77) 3	12.63, – (12.30– 12.96) 3	7.86, – (7.72– 8.01) 3	8.14, – (8.05– 8.19) 3	5.23, – (5.08– 5.33) 3	4.12, – (4.07– 4.16) 3	5.70, – (5.58– 5.84) 3	10.08, – (10.05– 10.14) 3	5.61, – (5.46– 5.69) 3	2.37, – (2.26– 2.50) 3

was based on size. The three specimens from Cambodia were referred to *M. pusillus* on the following basis: forearm and all craniodental measurements (Tables 1 and 2) according with published ranges for *M. pusillus*, while being distinctly less than *M. fuliginosus* and *M. magnater* (Hendrichsen *et al.*, 2001a; Borissenko & Kruskop, 2003; Matveev, 2005; Francis, 2008); skull measurements (CBL, CM<sup>3</sup>L & M<sup>3</sup>M<sup>3</sup>W) also smaller than recorded for *M. medius*, for which the most northerly locality known at present is in southern Thailand (Francis, 2008).

The single specimen from Phnom Kulen National Park was caught in a harp trap at 2005 h in closed-canopy forest. No capture data were available for specimens collected from Seima Protected Forest. *Miniopterus pusillus* is presently thought to occur from South India (Nicobar Islands) through Myanmar to Vietnam and Hong Kong (Simmons, 2005; Francis, 2008). Borissenko & Kruskop (2003) referred three specimens from Cambodia to *M. pusillus* without details, but as the subsequent checklist of Matveev (2005) excluded the species, these were presumably the unnamed form discussed by Matveev (2005) and Matveev & Csorba (2007). Our specimens confirm the occurrence of *M. pusillus* in Cambodia, as predicted by Francis (2008).

Only one other species of *Miniopterus* is currently known to occur in Cambodia: *M. fuliginosus* (formerly included in *M. schreibersii*) (Kingsada *et al.*, 2011).

## Discussion

Our confirmation of five additional bat taxa for Cambodia increases the total number of bat species currently confirmed for the country to 66. While presently known only from a small number of sites nationally, none of the newly recorded species are thought to be globally threatened, being considered Least Concern by IUCN (2012).

Because national survey coverage remains limited, the discovery of additional species appears likely, particularly in understudied forests in the country's border regions. This may be especially true for forested areas of karst, which in Southeast Asia support exceptional and vulnerable bat assemblages that can comprise substantial portions of a national fauna (Furey *et al.*, 2010, 2011). While the total extent of Cambodian karst is not accurately known (estimated at 20,000 km<sup>2</sup>: Kiernan, 2010), large outcrops occur in the western and southern provinces of Battambang and Kampot. More than 100 caves have been registered in these areas by speleologists (Denneborg *et al.*, 2002; Laumanns, 2009), yet only a tiny minority have been surveyed for bats to date, and most of these only once, more than a decade ago.

Much research consequently remains to be done. While only three bat species in Cambodia appear on the IUCN Red List of Threatened Species (IUCN, 2012) in categories other than Least Concern (*Otomops wroughtoni*: Data Deficient; *Murina harrisoni*: Data Deficient; and *Pteropus lylei*: Vulnerable), rates of habitat destruction have

increased in this country in recent years and hunting of bats for bushmeat is commonplace in many areas. The fact that karst ecosystems in Cambodia, as throughout the region, are experiencing increasing habitat loss and pressure from tourism and extractive industries, coupled with the reality that few, if any, are legally protected for their biodiversity (Clements *et al.*, 2006), raises the need for basic species inventories and status assessments to provide cogent arguments for their conservation.

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GABOR CSORBA is responsible for development of vertebrate collections at the Hungarian Natural History Museum where he has worked for almost 30 years. He travels regularly to the Old World tropics to study bat systematics and populations in protected areas and also has a special interest in the conservation biology of European mammals.

## Appendix 1

Specimens denoted 'CSOCA' are presently held at the Centre for Biodiversity Conservation and intended for deposition at the Hungarian Museum of Natural History and the Cambodian Forestry Administration collection.

*Macroglossus minimus*: CBC01045, parous female, in spirit, skull removed, collected by Phauk S. in May 2010, Sihanoukville, 10°36.632N, 103°31.868E, 22 m a.s.l.

*Pipistrellus paterculus*: HZM 8.36144, mature male, in spirit, skull removed, collected by J. Walston in February 2001, Kirirom National Park, 11°30'N, 104°13'E; CBC00608, nuliparous female, in spirit, skull removed, collected by G. Csorba and S. Ith in February 2010, Veun Sai Proposed Protected Forest, 14°00.828N, 106°45.383E; CBC.020511.7, CBC.020511.8, CSOCA225, CSOCA226, CSOCA227, CSOCA229, five mature males and one nuliparous female, in spirit, skulls removed, collected by G. Csorba and N. Furey in February 2011, Preah Vihear Protected Forest, 14°03.556N, 105°17.017E, 110 m a.s.l.; CSOCA251, nuliparous female, in spirit, skull removed, collected by G. Csorba, N. Furey and Ith S. in February 2011, Preah Vihear Protected Forest, 14°00.686N, 105°39.900E, 130 m a.s.l.; CBC01239, CBC01245, CBC01246, CBC01247, CBC01249, CBC01254, three mature males and three nuliparous females, in spirit, skulls

removed, collected by G. Csorba and N. Furey in April 2011, Preah Vihear Protected Forest, 14°03.556N, 105°17.017E, 110 m a.s.l.; CBC01266, CBC01284, two mature males, in spirit, skulls removed, collected by G. Csorba and N. Furey in April 2011, Preah Vihear Protected Forest, 14°00.686N, 105°39.900E, 130 m a.s.l.

*Pipistrellus javanicus*: CBC01255, CBC01256, parous female and mature male, in spirit, skulls removed, collected by G. Csorba, N. Furey and Ith S. in February 2011, Preah Vihear Protected Forest, 14°03.556N, 105°17.017E, 110 m a.s.l.; CSOCA237, female, in spirit, skull removed, collected by G. Csorba, N. Furey and Ith S. in February 2011, Preah Vihear Protected Forest, 13°53.235N, 105°22.309E, 105 m a.s.l.

*Hypsugo cadornae*: CBC00643, parous female, in spirit, skull removed, collected by Phauk S., G. Csorba and Ith S. in March 2010, Veun Sai Proposed Protected Forest, 14°00.828N, 106°45.383E.

*Miniopterus pusillus*: HNHM 2005.82.14, HNHM 2005.82.15, adult males, in spirit, skulls removed, collected by B. Hayes and J. Walston in December 2003, Seima Protected Forest, 12°10'49N, 106°58'55E, 290 m a.s.l.; CBC00951, adult male, in spirit, skull removed, collected by Phauk S. and Phen S. in July 2010, Phnom Kulen National Park, 13°39.810N, 104°01.862E, 68 m a.s.l.