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The conservation status of Cambodian cave bats

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Caves and other subterranean sites such as mines are essential to the survival of hundreds of bat species worldwide and often shelter significant portions of national bat faunas (Furey & Racey 2016a). With ≈350 species currently recognised, Southeast Asia supports >25% of the world's bat diversity (Kingston 2013) and caves in the region provide bats with important advantages in the form of permanent, thermally stable and humid roosting environments that protect against inclement weather and reduce body water loss (Kunz 1982; Gunn 2003; Avila-Flores & Medellin 2004). Added to this are potential benefits in reduced predation risk and thermoregulatory advantages derived from aggregating in large numbers. Due to the solubility of the substrate, caves occur in high density in limestone karst areas and these support important bat diversity throughout Southeast Asia (Kingston 2010; Furey & Racey 2016a). For instance, three-quarters of the known bat faunas in North Vietnam and China comprise species that frequently roost in caves (Furey et al. 2010; Luo et al. 2013) and because these bats spend at least half their lives inside caves (Kunz 1982), protection of such sites is essential for their conservation.

The ecological services provided by Southeast Asian cave bats have been documented in recent years. In Thailand, the wrinkle-lipped bat (*Chaerephon plicatus*, Fig. 1) consumes economically significant quantities of white-backed planthoppers (*Sogatella furcifera*) which are major pests of rice crops (Leelapaibul et al. 2005; Wanger et al. 2014). Additionally, the cave nectar bat (*Eonycteris spelaea*, Fig. 2) is the primary pollinator of durian (*Durio zibethinus*) (Acharya et al. 2015a), a high value fruit (Bumrungsri et al. 2009) and commonly eaten tree beans (*Parkia* spp.) (Bumrungsri et al. 2008; Acharya et al. 2015a), alongside other important plant species (Bumrungsri et al. 2013; Zalipah et al. 2016). Mining of the guano produced by cave bats is also commonplace in Southeast Asia and its sale and use as plant fertilizer features prominently in many local economies in the region (Leh & Hall, 1996; Leelapaibul et al. 2005; Aye 2006; Thi et al. 2014; Thet & Mya 2015). Allied to this, bat guano constitutes a primary source of energy in cave ecosystems and survival of a considerable proportion of the terrestrial invertebrate fauna in tropical caves is dependent upon its deposition (Deharveng & Bedos 2012). The significance of this lies in the fact that subterranean invertebrates are globally diverse (Gilbert & Deharveng 2002) and caves are thought to rank among the hottest of biodiversity hotspots (*sensu* Myers et al. 2000) worldwide in terms of their levels of species endemism and threat (Whitten 2009).

Cave bats in Cambodia - What do we know?

Sixteen years on from being described as "one of the least explored countries" in terms of its bat fauna (when just 30 species were documented: Kock 2000), knowledge of Cambodian bats has increased markedly as a result of new surveys with wider coverage. These and recent taxonomic revisions have led to the discovery of many new country records and taxa new to science (e.g. Hendrichsen et al. 2001; Walston & Bates 2001; Csorba & Bates 2005; Matveev 2005; Bates et al. 2007; Matveev & Csorba 2007; Soisook et al. 2007, 2008; Csorba, 2011; Csorba et al. 2011; Ith et al. 2011; Kingsada et al. 2011; Francis & Eger 2012; Furey et al. 2012), such that number of bat species documented in the peer-reviewed literature for the country now stands at 70 (Chheang et al. 2013). This figure represents ≈43% of the known mammal fauna of Cambodia (Ministry of Environment 2016) but

Fig. 1: Wrinkle-lipped bat (*Chaerephon plicatus*), a champion colony builder in Cambodia (© Merlin Tuttle).

Fig 2: Cave nectar bat *Eonycteris spelaea* feeding on a Durian (*Durio zibethinus*) flower (© Merlin Tuttle).

undoubtedly still falls short of the true total, because additional specimens -representing at least four previously unconfirmed species- have yet to be described (N. Furey unpublished data) and because many bat species known from neighbouring territories have yet to be found in-country. As a consequence, discovery of additional species is likely, particularly in understudied forests in Cambodia's border regions.

Nonetheless, of the 74 bat species known to occur in Cambodia, half (37) comprise species that are frequently found in caves and other subterranean sites (Francis 2008; N. Furey unpublished data), though seemingly few of these appear to be wholly dependent on karst caves for roosting sites (Racey & Furey 2014). While the extent of karst in Cambodia is not accurately known (estimated at 20,000 km^2: Day & Urich 2000), the largest areas occur in the western portions of the country (Battambang & Banteay Meanchey provinces) where limestone outcrops occur intermittently along a ca. 250 km belt which extends westwards into Thailand (Kiernan 2010). Isolated hills rise above alluvial plains in southern Cambodia (Kampot and Kep provinces) and this range of hills extends into the Mekong Delta region of Vietnam, notably in the Ha Tien-Hon Chong area. Limestone also outcrops along the Mekong River valley in Stoeng Treng province in northern Cambodia, close to the Laos border. Cave explorations have registered 230 caves in these areas to date (Denneborg et al. 2002; Laumanns 2009 and this volume; N. Furey unpublished data), and of these, 98 have been rapidly surveyed for bats since 2014 (34 caves in Battambang, 47 in Kampot, six in Kep & 11 in Stoeng Treng province) using a mixture of direct observation, live-capture and acoustic sampling, supplemented by key-informant interviews (Appendix).

Information on cave locations was collected from the literature and local residents and recorded using a global positioning system. Caves were explored during the daytime by 2-4 surveyors, who recorded information on historical bat occupation, current colony size, bat species composition and human activities. Information on past bat occupation included interview data and the presence of old bat carcasses and guano accumulations and stains on walls and ceilings from bat skin oils. The current size of colonies with <10,000 bats was assessed using direct roost counts (Kunz et al. 2009) and rounded to orders of magnitude, whereas estimates of larger colony sizes were based on previous emergence counts (Yim & Mackie 2009). Bat species were identified through: i) photographs of bats at roost, ii) examination in the hand following capture in hand-held nets and mist nets of varying sizes, iii) analysis of echolocation call frequencies recorded using a D240x ultrasound detector (Pettersson Electronik AB) and Edirol HR09 digital recorder (Roland) with reference to recent literature (e.g., Phauk et al. 2013), and iv) examination of fresh bat carcasses found within caves. Evidence of human activities (e.g., footprints, garbage, rock scratches, graffiti, fire pits, guano harvesting, phosphate digging, stone harvesting and presence of ritualistic items such as shrines, incense and other offerings) was recorded at each cave and local residents (often field guides) were interviewed to determine the associated history and nature of human visitation and use. If interviews suggested a cave had not been used and no obvious traces of human activities were found, it was categorized as undisturbed. Alternatively, if interviews indicated that activities such as bat hunting had occurred or direct evidence of this was found in the form of net fragments and long sticks, this was recorded as such.

Most of the 98 caves rapidly surveyed supported a relatively depauperate bat fauna

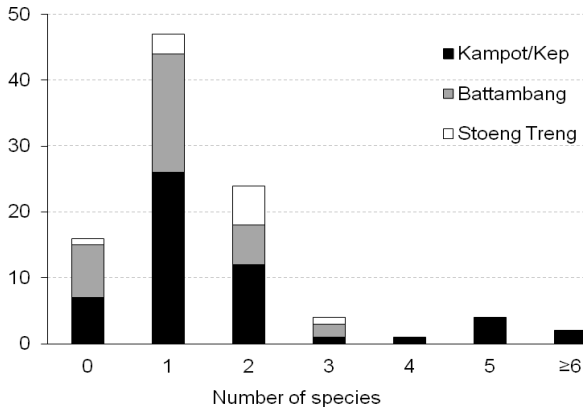

Fig. 3: Numbers of roosts in 98 caves rapidly surveyed in south (Kampot & Kep provinces, *n*=53), west (Battambang province, *n*=34) and north (Stoeng Treng province, *n*=11) in Cambodia that contained 0 to ≥6 bat species.

with 63 sites containing ≤ 1 bat species and 24 containing only two species (Fig. 3). Tomb bats (*Taphozous* spp.) were the most commonly encountered species (recorded in 42 caves), followed by intermediate leaf-nosed bat *Hipposideros larvatus* (17 caves), lesser brown horseshoe bat *Rhinolophus microglobosus* (14 caves), great leaf-nosed bat *H. armiger* (13 caves) and Shamel's horseshoe bat *R. shameli* (nine caves). All of these species are common cave-dwellers throughout their distributions in continental Southeast Asia (Francis 2008; Soisook et al. 2008). Only seven caves in the Kampot and Kep provinces of southern Cambodia were found to contain four or more bat species and the fact that four of these sites were repeatedly sampled (several on a monthly basis) between 2014 and 2016 suggests that further surveys would reveal the existence of additional bat species from at least some other sites. The same applies to colony sizes, as levels of occupancy undoubtedly vary seasonally at some and possibly many sites. However, as more than two-thirds of the sites rapidly surveyed (67 caves) supported less than 100 bats (Fig. 4) and well over half (54 caves = 21 in Battambang, 27 in Kampot & Kep & six in Stoeng Treng) showed evidence of greater bat numbers in the past (in the form of interview data or signs of significantly larger areas of guano deposition and/or wall stains relative to actual bat numbers present), there is also little doubt that human activities have widely affected cave-roosting bats in Cambodia (see below).

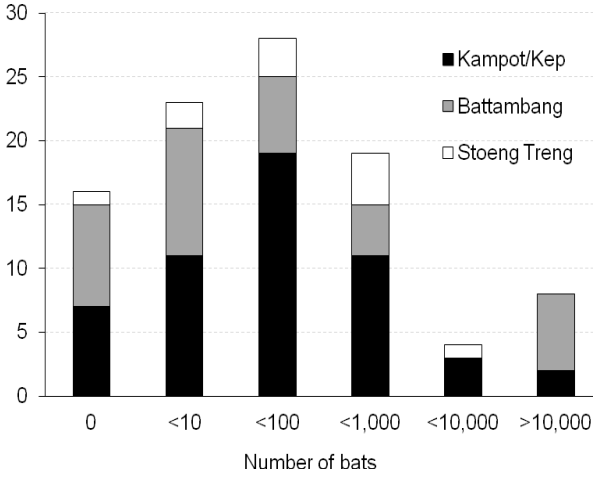

Fig. 4: Numbers of bats in 98 caves rapidly surveyed in south (Kampot & Kep provinces, *n*=53), west (Battambang province, *n*=34) and north (Stoeng Treng province, *n*=11) Cambodia.

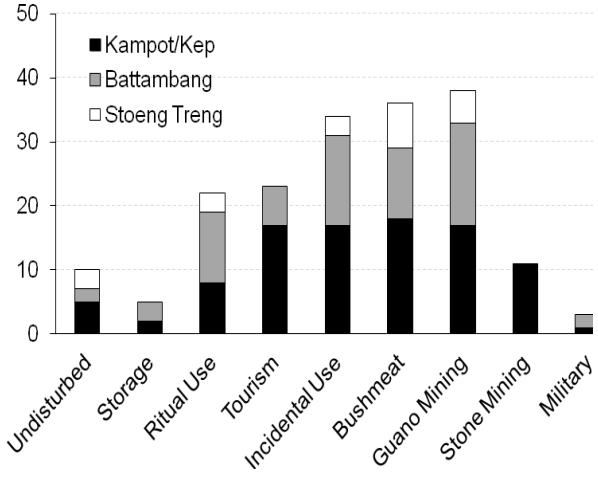

Fig. 5: Human uses of 98 caves in south (Kampot & Kep provinces, *n*=53), west (Battambang province, *n*=34) and north (Stoeng Treng province, *n*=11) Cambodia. Use categories: Undisturbed- No evidence of human use; Storage- including animal keeping and water impoundment; Ritual use- presence of altars & incense for solely domestic use; Tourism- heavily developed sites visited by foreigners and Khmer (mostly Buddhist shrines); Incidental use- opportunistic recreation & camping (excludes caves used for tourism and ritual purposes); Bushmeat- bat hunting for consumption; Guano mining- including phosphate digging; Stone mining- External quarrying & internal stone harvesting; Military- execution grounds during the Khmer Rouge era.

Following Luo et al. (2013), we regard caves that contain ≥6 species or >1,000 bats as being of special conservation importance. By this definition, 13 caves (six in Battambang, six in Kampot & one in Stoeng Treng) warrant recognition and protection as nationally significant sites for bat conservation in Cambodia (Table 1). At present, only one cave-roosting bat species in the country appears on the IUCN Red List in a category other than Least Concern: *Otomops wroughtoni* which is Data Deficient and in Cambodia known only from a single record in forest in Preah Vihear province (Walston & Bates 2001). However, colonies of other bat species exist which are functionally unique due to the substantial ecosystem services they provide. For instance, 13 colonies of wrinkle-lipped bats have been documented in the country, eight of which occur in limestone caves in the Battambang and Kampot provinces (Table 1). This species has a nightly foraging radius of 25 km (Wanger et al. 2014), equivalent to a foraging catchment of 1,963 km^2 per colony in these heavily cultivated regions. Estimates suggest the eight colonies may represent >95% (6,370,000 bats)

Table 1: Caves of special conservation importance for bats in Cambodia due to the presence of ≥6 species or >1,000 individuals. [1]Not included in Denneborg et al. (2002), Laumanns (2009) or this volume- names for caves and hills follow these publications, unless given in brackets; [2]Estimate based on Yim & Mackie (2009); [3]Combined estimate including both caves.

#	Cave name	Hill name, province	UTM (48 P)	Bat species	Number of bats	Dominant taxa
1	(Ta Rumm No.1) [1]	Sampeu, Battambang	1440440, 0293430	1	1,800,000[2,3]	*Chaerephon plicatus*
2	La Ang Pracheu (Ta Rumm No.2)	Sampeu, Battambang	1440842, 0293931	1	1,000,000[2]	*Chaerephon plicatus*
3	(Ta Rumm No.3) [1]	Sampeu, Battambang	1440464, 0293450	1	1,800,000[2,3]	*Chaerephon plicatus*
4	La Ang Prakiu No.2	Takriem, Battambang	1445273, 0288739	1	800,000[2]	*Chaerephon plicatus*
5	La Ang Pracheav (Reach Trop)	Reichiatra (Seisa), Battambang	1432910, 0294153	1	600,000[2]	*Chaerephon plicatus*
6	(La Ang Sankeur) [1]	(Sankeur), Battambang	1432924, 0297793	1	900,000[2]	*Chaerephon plicatus*
7	Loang	Loang, Kampot	1185533, 0428031	1	900,000[2]	*Chaerephon plicatus*
8	Bat Khteas	Chhngauk, Kampot	1176695, 0420153	11	>1,000	*Eonycteris spelaea*
9	Toeuk (Sam Pet)	Toeuk (Teuk Thom), Kampot	1154103, 0443154	1	>1,000	*Eonycteris* / *Rousettus* spp.
10	(Pracheav) [1]	Kampong Trach (Bak), Kampot	1168836, 0442059	2	>1,000	*Eonycteris* / *Rousettus* spp.
11	(Vihear Luong) [1]	(Koun Sat), Kampot	1178745, 0449475	1	370,000[2]	*Chaerephon plicatus*
12	Dei Ho / Thom Ken	Slaptaon (Kbal Romeas), Kampot	1173715, 0417195	7	<1,000	*Taphozous melanopogon* / *Hipposideros larvatus*
13	La Ang Chngork (C8)	(Chhngauk), Stoeng Treng	1523241, 0580878	1	>1,000	*Taphozous theobaldi*

of the national population (Yim & Mackie, 2009) and if conservative estimates from Thailand (Wanger et al. 2014) hold true for Cambodia, they may prevent the annual loss of >2,300 tons of rice; or one year of rice meals for >21,800 people, as a result of eating planthoppers which reduce rice yields. Three significant colonies (>1,000 bats) of cave-roosting pteropodids including the cave nectar bat are also known nationally, all of which are in Kampot province (Table 1) and threatened by bushmeat hunting. Recent research suggests the latter species has a nightly foraging area of up to 38 ha and moves up to 8 km between feeding trees (Acharya et al. 2015b), whereas commuting distances of 17.9 km and 38 km have been documented between roost sites and foraging areas in Thailand and Peninsular Malaysia respectively (Start & Marshall 1976; Acharya et al. 2015b). It visits many of the same plants in Cambodia as these countries, including *Durio zibethinus* and *Sonneratia* spp. (Hoem et al. 2015) and so contributes to the maintenance of the durian farming industry and coastal mangroves of the province (Sritongchuay et al. 2016; Zalipah et al. 2016).

Conservation challenges

Cambodia's karst bat populations face a range of threats and cave-roosting species in particular face a form of 'double jeopardy' due to threats to both their roost sites and foraging habitats. Limestone quarrying ("quarrying") for cement and construction materials poses a severe threat to all karst-dwelling bats because it can result in the total loss of outcrops (Fig. 6), leaving few options for remediation (Furey & Racey 2016a). Demand for these materials in Cambodia has boomed over the last decade

Fig. 6: Quarrying of limestone in Kampot province, southern Cambodia. The inset picture shows the opposite side of the hill on the same day (© Neil Furey).

Fig. 7: Cave developed as a Buddhist shrine in Kampot province, southern Cambodia (© Neil Furey).

(Open Development Cambodia, 2014) and because few if any limestone outcrops are included in the national protected area system, their future remains uncertain. There is also little doubt that persistent degradation and loss of foraging habitats threatens the viability of cave bat populations (Furey et al. 2010; Kingston 2013). Because Cambodia experienced the greatest acceleration of forest loss in the world between 2001 and 2014 (Petersen et al. 2015), karst outcrops throughout the country have become increasingly isolated in landscapes dominated by agriculture, typically wet rice cultivation. This is especially true for karst hills in the Battambang, Kampot and Kep provinces and raises a conservation issue because many cave bat species are morphologically restricted to foraging in areas of intact forest (Furey & Racey 2016b).

These issues are compounded by other direct threats to cave roosts. Due to their low annual reproductive rates, bat populations take a relatively long time to recover from population losses associated with human activities (Racey & Entwistle 2000). This poses a particular problem for cave bats, as any disturbance of the relatively small and confined spaces that caves provide tends to affect the entire aggregation (McCracken 1989). Caves in Cambodia are used for a wide variety of purposes and of the 98 caves rapidly surveyed since 2014, only ten were found to be undisturbed by humans (Fig. 5). Use of caves for guano harvesting (38 caves), bushmeat hunting (36 caves) and incidental uses such as opportunistic recreation and camping (34 caves) was common to all regions, whereas tourism (23 caves, almost invariably comprising Buddhist shrines visited by foreigners and nationals, Fig. 7) was confined to the more accessible Battambang and Kampot provinces. However, as 22 additional caves across the three regions were used for solely domestic shrines, half of all caves surveyed (45/98) were affected to varying extents by development and use for ritualistic purposes. These shrines tend to be located near cave entrances and bats roost close to these or deeper within and exit the caves each night by either flying over the shrines or through other entrances.

Because disturbance during pregnancy, lactation and weaning is highly detrimental to population recruitment (McCracken 1989; Sheffield et al. 1992; Jubertie 2000; Mitchell-Jones et al. 2007; Furey et al. 2011), protection during these critical reproductive periods is central to cave bat conservation. Recent research indicates that many insectivorous cave bats in Cambodia give birth at the start of the wet season (April-May) each year and unfortunately this is when domestic cave visitation peaks due to the prevalence of cave shrines and timing of Buddhist new year ceremonies (N. Furey unpublished data). While the impact of this cannot be assessed due to lack of historical data on Cambodian bat populations, it is likely to have been considerable as the negative effects of cave development and human visitation on bats are widely documented (Furey & Racey 2016a). Direct persecution of bats for bushmeat consumption also has a dramatic effect on populations (Mildenstein et al. 2016) and undoubtedly reduced these in caves throughout the country. Although interview data suggests that hunting activity may have lessened in recent years at some sites, it remains unclear whether this is the case, and if it is, also whether this might be due to population declines rendering the activity less profitable or because of improved food security, increased awareness of its illegality, or a combination of these.

Information & Conservation Needs

With over half of the caves known in Cambodia yet to be evaluated, clearly much remains to be learned regarding the country's cave bats. Despite its incompleteness however, this brief review represents a significant advance in knowledge. Given the present dearth of information on Cambodian karst biodiversity as a whole, there is no substitute for continued research and this is particularly true for the specialised invertebrate communities that permanently inhabit caves. Unlike cave-roosting bats, many of these taxa are highly range-restricted endemics incapable of dispersing to other sites (Vermeulen & Whitten 1999) and recent assessments have shown that the karst hills of the Ha Tien-Hon Chong area (<30 km southeast of the nearest hills in Kampot province) in South Vietnam support the world's highest concentration of threatened

species (Lim 2016). Because sampling effort for these and other groups characterized by high levels of endemism in karst (e.g., snails, orchids) remains extremely limited in Cambodia, further surveys would undoubtedly reveal additional sites of national and international significance for biodiversity and should therefore be considered a priority.

Of the 13 caves of national conservation importance identified in this study, eight shelter enormous colonies of *C. plicatus* that provide economically significant services in insect pest control. The large quantities of guano produced by the colonies at each site is harvested for plant fertilizer by local communities who have ensured their effective protection for many years. We consequently recommend these communities be supported to continue doing so through the promotion of sustainable guano harvesting practices (IUCN SSC 2014) and population monitoring programs to ensure continued colony health. More broadly, efforts to develop national capacity for research and conservation of plants and smaller-bodied and taxonomically complex animal groups (e.g., bats, herpetofauna and invertebrates, partly summarized in Walther et al. 2016) frequently overlooked by the mainstream conservation sector should also continue.

Although Cambodia has an extensive protected area system and recently extended this to cover 34% of the national land surface (Souter et al. 2016), few if any karst hills are currently included in national protected areas or are otherwise legally protected for their biodiversity. Karst ecosystems are also only referred to once in the country's national biodiversity strategy and action plan (Ministry of Environment 2016). This represents a major conservation gap as growing evidence indicates that limestone karsts in Southeast Asia frequently support globally important biodiversity (Vermeulen & Whitten 1999; Clements et al. 2006). The Cambodian Ministry of Environment has recently begun an initiative to create provincially-managed heritage parks which may provide an opportunity to rectify this omission, although it remains unclear what extent these parks will be dedicated to biodiversity conservation and if the resources necessary to achieve it would be made available. Nonetheless, because of the acute vulnerability of bats and other cave-dwelling biota and the multitude of threats these face, we advocate for increased emphasis on sustainable cave management practices e.g., Hildreth-Werker & Werker (2006), particularly for sites where tourism operations exist.

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Appendix: Caves rapidly surveyed for bats in Cambodia from 2014-2016

*** = Not included in Denneborg et al. (2002), Laumanns (2009) or this volume. Names for caves and hills follow these publications, unless given in brackets. † = Site of special conservation importance for bats due to the presence of ≥6 species or >1,000 individuals. [1]Repeatedly sampled during the years stated; [2]Estimate based on Yim & Mackie (2009); [3]Combined estimate including both caves.**

#	Cave name	Hill name, province	Survey date	UTM (48 P)	Bat species	No. of bats
1	La Ang Taing Kluen	Sampeu, Battambang	26-04-15	1440226, 0293691	0	0
2	La Ang Ang (Kong) Kaip	Sampeu, Battambang	26-04-15	1440254, 0293643	1	<100
3	La Ang Kaun	Sampeu, Battambang	26-04-15	1440254, 0293643	2	<100
4	La Ang Satani	Sampeu, Battambang	26-04-15	1440525, 0293979	1	<10
5	La Ang Pkhaa Sla	Sampeu, Battambang	26-04-15	1440650, 0293757	0	0
6	La Ang Choal	Sampeu, Battambang	26-04-15	1440650, 0293757	1	<10
7	(Ta Rumm No.1) *†	Sampeu, Battambang	2015–2016[1]	1440440, 0293430	1	1,800,000[2,3]
8	La Ang Pracheu (Ta Rumm No.2) †	Sampeu, Battambang	25-04-15	1440842, 0293931	1	1,000,000[2]
9	(Ta Rumm No.3) *†	Sampeu, Battambang	2015–2016[1]	1440464, 0293450	1	1,800,000[2,3]
10	La Ang Kess (La Ang Ta Ngorng)	Kdaong, Battambang	25-05-15	1439552, 0293593	2	<10
11	La Ang Tbalken (La Ang Ta Kong)	Kdaong, Battambang	25-05-15	1439686, 0293605	0	0
12	(La Ang Tbalken) *	Kdaong, Battambang	25-05-15	1439813, 0293467	1	<10
13	(M. spasma chamber)*	Kdaong, Battambang	25-05-15	1439814, 0293524	1	<10
14	(La Ang Kess No.2) *	Kdaong, Battambang	25-05-15	1439559, 0293722	0	0
15	(La Ang Yeay Sor) *	Kdaong, Battambang	25-05-15	1439801, 0293868	1	<10
16	(La Ang Thmor Sor) *	Kdaong, Battambang	25-05-15	1439847, 0293833	0	0
17	La Ang Kantoy Krapeou (No.1)	Krapoeu, Battambang	26-05-15	1440120, 0290562	2	<1,000

#	Cave name	Hill name, province	Survey date	UTM (48 P)	Bat species	No. of bats
18	Roung (La Ang) Khla	Krapoeu, Battambang	26-05-15	1439982, 0291514	2	<10
19	(La Ang Kantoy Krapeou No.2) *	Krapoeu, Battambang	26-05-15	1440113, 0290564	1	<100
20	Roung Taroung (La Ang Leaksnae)	Taroung Moan, Battambang	26-05-15	1441261, 0292598	1	<100
21	La Ang Muk Chniang	Takriem, Battambang	28-05-15	1443460, 0289060	1	<10
22	La Ang Prakiu No.1	Takriem, Battambang	24-05-15	1445273, 0288739	0	0
23	La Ang Prakiu No.2 †	Takriem, Battambang	24-05-15	1445273, 0288739	1	800,000[2]
24	(La Ang Prakiu No.3) *	Takriem, Battambang	24-05-15	1445283, 0288657	0	0
25	(La Ang Yeay Mex) *	Takriem, Battambang	27-05-15	1445208, 0288999	1	<100
26	(La Ang Ka Ngan - Yeay Mex No.2) *	Takriem, Battambang	27-05-15	1445194, 0288932	0	0
27	Unnamed Cave No.1 *	Takriem, Battambang	27-05-15	1445028, 0288329	1	<10
28	(La Ang Ka Orm) *	Takriem, Battambang	27-05-15	1445851, 0288116	2	<1,000
29	Reigohom 1 (Deikrohorm)	Bannon, Battambang	01-07-15	1432817, 0295969	2	<1,000
30	La Ang Pracheav (Reach Trop) †	Reichiatra (Seisa), Battambang	30-06-15	1432910, 0294153	1	600,000[2]
31	(La Ang Sankov) *	(Khpoh), Battambang	27-06-15	1443444, 0280756	1	<1,000
32	(La Ang Sleuk - Kach Sleuk) *	(Khpoh), Battambang	28-06-15	1445484, 0283278	3	<10
33	(La Ang Khla) *	(Khpoh), Battambang	29-06-15	1443670, 0281101	3	<100
34	(La Ang Sankeur) *†	(Sankeur), Battambang	30-06-15	1432924, 0297793	1	900,000[2]
35	Loang †	Loang, Kampot	10-02-14	1185533, 0428031	1	900,000[2]
36	Vihear Tuk-Bonn	Chhngauk, Kampot	2014–2015[1]	1176562, 0420043	5	<1,000
37	Pota Am (Prea Mea Kong Kea)	Chhngauk, Kampot	2015–2016[1]	1177047, 0420068	5	<1,000
38	Bat Khteas †	Chhngauk, Kampot	2014–2016[1]	1176695, 0420153	11	<10,000
39	Phum Tathy (Ta Phen)	Chhngauk, Kampot	12-02-14	1176167, 0420314	1	<1,000
40	Vihir Tathor (Vihear Ta Neav)	Chhngauk, Kampot	11-04-14	1176908, 0420310	3	<100
41	(Trai Lak / Ta Keav) *	Chhngauk, Kampot	2014–2016[1]	1176209, 0420116	5	<1,000
42	Dei Ho / Thom Ken †	Slaptaon (Kbal Romeas), Kampot	24/25-03-14	1173715, 0417195	7	<1,000
43	Nakta (Roung Preah Sinh)	Slaptaon (Kbal Romeas), Kampot	24-03-14	1173895, 0417160	0	0
44	Unnamed Cave No.3 *	Slaptaon (Kbal Romeas), Kampot	24-03-14	1173899, 0417250	1	<100

#	Cave name	Hill name, province	Survey date	UTM (48 P)	Bat species	No. of bats
45	Toeuk (Sam Pet) †	Toeuk (Teuk Thom), Kampot	26-03-14	1154103, 0443154	1	<10,000
46	(Teuk Touch) *	(Teuk Touch), Kampot	26-03-14	1154275, 0443323	1	<100
47	(Reap Touch) *	(Reap Touch), Kampot	26-03-14	1154684, 0443344	1	<10
48	(Pracheav) *	Toeuk (Teuk Thom), Kampot	26-03-14	1154103, 0443154	2	<100
49	Chamcar Morn No.1	Kampong Trach, Kampot	26-03-14	1169784, 0442272	1	<10
50	Chamcar Morn No.2	Kampong Trach, Kampot	26-03-14	1169701, 0442445	1	<10
51	Preah Nipean	Kampong Trach, Kampot	27-03-14	1168741, 0442262	2	<100
52	Sre Muoroy	Kampong Trach, Kampot	27-03-14	1168901, 0442431	1	<1,000
53	Tadong	Kampong Trach, Kampot	27-03-14	1168658, 0442287	5	<1,000
54	Khmoach	Kampong Trach, Kampot	27-03-14	1168836, 0442059	2	<100
55	Chhnam Kao	Kampong Trach, Kampot	27-03-14	1168741, 0442262	2	<100
56	(Teuk) *	Kampong Trach (Bak), Kampot	26-03-14	1169654, 0442181	1	<10
57	Unnamed Cave No.1 *	Kampong Trach (Bak), Kampot	26-03-14	1169654, 0442181	1	<10
58	Unnamed Cave No.2 *	Kampong Trach (Bak), Kampot	26-03-14	1169701, 0442445	0	0
59	(Wat Vietnam) *	Kampong Trach (Bak), Kampot	27-03-14	1168741, 0442262	0	0
60	(Pracheav) *†	Kampong Trach (Bak), Kampot	27-03-14	1168836, 0442059	2	<10,000
61	Unnamed Cave No.3 *	Kampong Trach (Bak), Kampot	27-03-14	-	1	<100
62	Kbal Khla	Damrey (north), Kampot	28-03-14	1171610, 0442881	2	<100
63	Kandor Vongveng (Pracheav)	Damrey (south), Kampot	28-03-14	1171365, 0442964	2	<100
64	(Deum Leip) #	Damrey, Kampot	28-03-14	1171610, 0442881	1	<10
65	Unnamed Temple Cave *	Damrey, Kampot	28-03-14	1172572, 0443656	1	<100
66	Prasat	Khchang, Kampot	05-05-14	1172978, 0447157	2	<100
67	Vihear Prasat Pram	Totung, Kampot	07-05-14	1182509, 0448014	2	<10
68	Vihear Preah	Totung, Kampot	07-05-14	1182439, 0447750	1	<100
69	Vihear Chan	Totung, Kampot	07-05-14	1182404, 0448522	1	<100
70	Unnamed Cave No.1	Totung, Kampot	07-05-14	1182528, 0447782	1	<10
71	Vihear Doem Po	Toch, Kampot	07-05-14	1183219, 0448120	0	0

#	Cave name	Hill name, province	Survey date	UTM (48 P)	Bat species	No. of bats
72	(Vihear Youn, Vihear Phnom Toch) *	Toch, Kampot	07-05-14	1183354, 0447843	1	<1,000
73	(Vihear Kbal Krabei) *	(Teuk Srok), Kampot	06-05-14	1179521, 0447194	1	<100
74	(Bdao Dambong) *	(Teuk Srok), Kampot	06-05-14	1179274, 0447242	0	0
75	(Vihear Teuk Srok) *	(Teuk), Kampot	06-05-14	1179619, 0447430	0	0
76	(Vihear Pongror) *	(Teuk), Kampot	06-05-14	1179608, 0449725	2	<100
77	(Vihear Teuk) *	(Vihear Teuk), Kampot	06-05-14	1179051, 0450136	1	<10
78	(Vihear Thmorsor) *	(Vihear Teuk), Kampot	06-05-14	1179177, 0450012	0	0
79	(Vihear Badak) *	(Vihear Teuk), Kampot	06-05-14	1179291, 0449973	2	<100
80	(Vihear Luong) * †	(Koun Sat), Kampot	06-05-14	1178745, 0449475	1	370,000[2]
81	(Vihear Kbal Botum) *	(Koun Sat), Kampot	07-05-14	1179457, 0450121	1	<10
82	Damrei Sar (Damrei Sor)	Tasier, Kep	12-02-14, 25-03-14	1168061, 0421622	1	<1,000
83	Loang Lok Nen	Tasier, Kep	25-03-14	1168061, 0421622	1	<100
84	Pracheav	Tasier, Kep	12-02-14, 25-03-14	1168061, 0421622	4	<1,000
85	Vihear Touch	Tasier, Kep	25-03-14	1168061, 0421622	1	<10
86	Russey	Tasier, Kep	25-03-14	1168061, 0421622	2	<100
87	Unnamed Cave *	Tasier, Kep	25-03-14	1168061, 0421622	1	<1,000
88	La Ang Phnom Thom 7 (C1)	Thom, Stoeng Treng	22-10-14	1525235, 0579103	2	<10
89	La Ang Phnom Thom 12 (C2)	Thom, Stoeng Treng	22-10-14	1525251, 0579089	2	<100
90	Rock Shelter (C3)	Thom, Stoeng Treng	23-10-14	1525281, 0579500	1	<1,000
91	(C4) *	Thom, Stoeng Treng	23-10-14	1525120, 0580539	3	<100
92	La Ang Phnom Thom 1 (C5)	Thom, Stoeng Treng	25-10-14	1525882, 0577543	2	<1,000
93	(C6) *	Thom, Stoeng Treng	26-10-14	1525747, 0577734	0	0
94	La Ang Phnom Thom 3 (C7)	Thom, Stoeng Treng	26-10-14	1525713, 0577735	2	<1,000
95	La Ang Chngork (C8) †	(Chhngauk), Stoeng Treng	27-10-14	1523241, 0580878	1	<10,000
96	(C9) *	(Chhngauk), Stoeng Treng	28-10-14	1523087, 0580388	1	<10
97	(C10) *	(Chhngauk), Stoeng Treng	28-10-14	1523138, 0580881	2	<1,000
98	La Anh Chngork 2 (C11)	(Chhngauk), Stoeng Treng	28-10-14	1523138, 0580933	2	<100