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## SMALL MAMMALS OF THE XISHUANGBANNA PREFECTURE OF YUNNAN PROVINCE, CHINA

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### ABSTRACT

During the period 1987–1990, mammal collections were made in the Xishuangbanna Prefecture of Yunnan Province, China. These collections were assembled from sites in and near the town of Menglun, in a tropical cloud forest near the borders of China, Myanmar, and Laos. Biological surveys help provide information about this region at a time of rapid industrial growth in China. In the three decades since these specimens were collected, much has changed in this region. This study provides a glimpse into the past for present and future comparisons of mammal diversity in the Xishuangbanna Prefecture consisting of tropical and mesic, to extremely hot and moist bioclimatic zones. Species recorded in this study include one shrew (*Crocidura dracula*), 18 bats (*Cynopterus sphinx*, *Macroglossus sobrinus*, *Rousettus amplexicaudatus*, *R. leschenaultii*, *Rhinolophus macrotis*, *R. sinicus*, *R. thomasi*, *Aselliscus stoliczkanus*, *Hipposideros armiger*, *H. lylei*, *H. gentilis*, *Lyroderma lyra*, *Taphozous theobaldi*, *Chaerephon plicatus*, *Eptesicus pachyomus*, *Scotophilus heathii*, *Pipistrellus javanicus*, and *Miniopterus magnater*), 1 mongoose (*Herpestes javanicus*), 1 squirrel (*Callosciurus erythraeus*), and 4 other rodents (*Rhizomys pruinosus*, *R. sumatrensis*, *Niviventer fulvescens*, and *Rattus* sp.).

Key words: China, Menglun, small mammals, survey, Xishuangbanna, Yunnan

### INTRODUCTION

Specimens in this collection were acquired in or near Menglun (21°55'40.38" N, 101°15'11.65" E), a town 45 km southeast of the city of Xishuangbanna in the Xishuangbanna Prefecture. In addition, specimens were taken from Gourd Island, which is located in the center of the Menglun Botanical Garden. Gourd Island also is referred to as Calabash Island in other accounts (Zheng 1981). The Xishuangbanna Prefecture has an average yearly temperature of 23.4° C in the low

elevation areas (574 m) and 16.5° C in high elevation areas (1,756 m). Rainfall ranges from 1,222 mm in low elevation areas to 1,624 mm in high elevation areas (Zomer et al. 2014). Climatically the Xishuangbanna Prefecture is defined as tropical and part of the Yunnan-Guizhou Plateau, with no clear distinction between the four seasons except for a wet and dry season (Zhang et al. 2017). Giant palms and rubber tree farms also characterize the region. The plant life is species-rich

in the mountains of Xishuangbanna, which includes trees reaching 60 to 70 m high. The forest floor in these areas is covered with short herbaceous plants, grasses, and vines (Zheng 1981). Gourd Island is surrounded by the Nanban River and is covered by primary forests (Zheng 1981).

The geographic location of Yunnan Province provides some explanation for the large diversity found there. The province is home to more than 18,000 plant species, representing 51.6% of plant diversity in China (Yang et al. 2003). The array of tropical ecosystems is a major factor in Yunnan Province containing 54.8% of China's vertebrate species, including 72.5% of protected vertebrates, within only 4.1% of the country's area.

During the period 1988–2003, all areas in Xishuangbanna Prefecture showed sizable increases in rubber plantations, which grew by 324% (Wenjun et al. 2006). Some specimens in this survey were collected

in primary and secondary forests, rubber plantations, and various caves. Increasing population and higher living standards have led to pressure on the environment. Rapid development has caused an increase in deforestation, leading to changing landscapes (Houghton 2002). These changing landscapes are partially due to the establishment and expansion of rubber plantations, which have affected forests, farmland, and fallow land (Liu et al. 2005). Most of the specimens were collected near the town of Menglun, where the rubber industry has expanded because it increased income for private landholders and provided tree cover to prevent soil erosion. Additionally, the Menglun region was selected by the local government to be one of the centers for growing fruit crops. As the size of rubber plantations in the Xishuangbanna Prefecture has increased, the levels of tropical forest cover have diminished. The increase in rubber plantations has led to detrimental effects on the natural environments such as the loss of forests and other natural habitats (Wenjun et al. 2006).

## MATERIALS AND METHODS

Most of the specimens acquired were captured in the immediate vicinity of Menglun, in the southern Yunnan Province of China (21°55'40.38" N, 101°15'11.65" E). Animals were collected using Tomahawk traps, mist nets, and Sherman traps during expeditions undertaken in the summers of 1987, 1988, and 1990. The most unconventional of the methods was the use of dynamite laced with nitroglycerine. This was done to facilitate the capture of bamboo rats by removing the tops of their mounds for easier specimen retrieval. These specimens were collected before the widespread use of GPS, so the localities are only as precise as they could be determined from maps.

Specimens were taken in forests, stream banks, orchards, caves, rubber plantations, and other habitats of the diverse region. The primary deciding factor in trap placement was to locate patches of intact forests. Many of the areas used for trapping were in bamboo and tropical hardwood forests. These areas were not exclusively pristine, as they had occasional road and bridge crossings in the immediate areas of sampling. Approximately 60 Sherman traps were set and checked daily.

The specimens reported in this study are housed in the Angelo State Natural History Collection, San Angelo, Texas (ASNHC). The specimens in the ASNHC were re-examined, 29 to 32 years after being collected, using morphological characters from the modern literature to identify them to species. The reexamination of these specimens should prove useful for future studies on the ecology of the region. Measurements listed on the original tags were used when available, and digital calipers were used for additional skull and postcranial skeleton measurements. The tag on each specimen usually listed the head-body (HB), tail (T), hind foot (HF), and ear (E) lengths, with some tags providing additional measurements, and others providing little to no measurements. Many tags did not mention the specific location where specimens were collected.

Some tags had misspellings of Menglun, such as "Menglung", "Meng Lun", "Munglun", "Munglung", and "Mengla". This last misspelling proved problematic to interpret because there is another town further south of Menglun named Mengla. It has been determined that no specimens were collected in this town, based on the distance from the other collected specimens and the limitations of transportation at the

time on dirt roads. Only three tags provided latitude and longitude coordinates. Some specimens were collected in caves in natural areas or in caves within rubber plantations. No additional geographical information for these caves was recorded. A few other specimens were recorded as being collected near Menglun station. No other identifying information has aided in the search for this location.

Measurements other than those provided on the tags were taken to compare with those reported in the

literature. These measurements, described in Martin et al. (2001), are the following: condylobasal length (CBL), condylocanine length (CCL), greatest length of skull (GLS), maxillary tooththrow length (MTR), and zygomatic breadth (ZB). Additional measurements taken are: lower tooththrow (LTR) from the incisor to the posterior edge of the last molar, forearm (FA) which is the length of the forearm from elbow to wrist, and tibia length (TIB) which is the total length of the tibia.

## RESULTS

Forty-five specimens from the collection were examined in this study, representing 25 species belonging to four orders. Four specimens did not have collection dates associated with them. All specimens were collected at six sites in or near Menglun, up to a 30 km radius (Fig. 1, Table 1). Eight species were collected at least 90 km from their previously documented range. These species are *Taphozous theobaldi*, *Hipposideros gentilis*, *Chaerephon plicatus*, *Rhinolophus macrotis*, *R. sinicus*, *R. thomasi*, *Eptesicus pachyomus*, and *Miniopterus magnater*. The nomenclature for both scientific and common names follow Wilson and Mittermeier (2018, 2019). Measurements recorded for all species are shown in Table 1.

### ORDER EULIPOTYPHLA

#### Family Soricidae

#### *Crocidura dracula* Thomas, 1912

#### Large White-toothed Shrew

Two male specimens (ASNHC 18499 and 18500) were collected, both on Gourd Island in Menglun (Fig. 1). Specimen ASNHC 18500 was taken on 15 August 1987, and specimen ASNHC 18499 on 18 July 1990. *Crocidura dracula* has three unicuspid. It also has eight pairs of teeth in the upper jaw, as opposed to the nine pairs found in *Suncus murinus* (Francis 2008). Skull measurements of these specimens (18499 and 18500, respectively) are as follows: CCL length (21.90, 22.16 mm), MTR (10.19, 9.13 mm), LTR (9.51, 9.39 mm), and length of the lower incisor (4.30, 4.54 mm). These measurements fell within the reported ranges (Jiang and Hoffmann 2001; He 2018). The specimens were collected within the recorded geographic range as given by Wozencraft (2013a).

### ORDER CHIROPTERA

#### Family Pteropodidae

#### *Cynopterus sphinx* (Vahl, 1797)

#### Greater Short-nosed Fruit Bat

One female (ASNHC 18491) was caught in Menglun, but the exact date of capture was not recorded in 1990. This species has a dark brown muzzle with a subtle orange tint, and 18–24 mm long ears with a white edge (Francis 2008). Identification was confirmed by comparing the skull with a photograph in a previous study (Storz and Kunz 1999). The specimen's CBL (27.06 mm), GLS (31.2 mm), and FA (67.5 mm) are within previously recorded ranges (25.7–30.5 mm, 32–34 mm, 67–74.5 mm, respectively) (Storz and Kunz 1999). The specimen was taken within the recorded geographic range for the species as given by Wilson (2013).

#### *Macroglossus sobrinus* Andersen, 1911

#### Greater Long-tongued Blossom Bat

Two male specimens (ASNHC 18489 and 19411) were collected two days apart (12 August and 14 August 1987, respectively) on Gourd Island, Menglun. *Macroglossus sobrinus* has a long rostrum and the small teeth characteristic of a nectivorous bat. The FA length of specimen ASNHC 18489 is 47 mm, which falls close to the range of 47.31–51.01 mm found in a previous study (Feng et al. 2007; Francis 2008). The other specimen (ASNHC 19411) did not have a recorded FA measurement. Photographs depicting external and cranial characters of *M. sobrinus* and of *Eonycteris spelaea* help to confirm the identification of *M. sobrinus*. Upper incisors, lower tooththrow, and the distinct curve of the



Figure 1. Map of collecting locations in Yunnan province, China. The study sites were as follows: Menglun/Gourd Island (21°56'12" N, 101°15'7" E), study site 2 (21°56' N, 101°18' E), study site 3 (21°39' N, 101°15' E), study site 4 (21°55' N, 100°57' E), study site 5 (21°55' N, 101°12' E), and study site 6 (21°53' N, 101°15' E). All locations shown above are placed as accurately as possible given the tag information from gathered specimens.

maxillary were compared with the figures in Feng et al. (2007). This species was found within the recorded geographic range as given by Wilson (2013).

***Rousettus amplexicaudatus* (É Geoffroy, 1810)**  
Geoffroy's Rousette

One adult male (ASNHC 18492) was collected in Menglun (24 July 1990). The head body length of this animal is more than 128 mm (Burgin 2019), whereas

the head body length of congeneric *R. leschenaultii* is less than 125 mm. This specimen was found within the recorded geographic range of the species as given by Wilson (2013) and Burgin (2019).

***Rousettus leschenaultii* (Desmarest, 1820)**  
Leschenault's Rousette

One juvenile female (ASNHC 18480) was collected on 23 July 1990 in Menglun. Specimen

Table 1. Range status, collection sites (refer to Fig. 1), and measurements for species collected near Menglun, Yunnan Province, China. Range designations are as follows: Known = the species has been previously documented in or near the recorded area; R = the species collected was at least 90 kilometers away from previously recorded specimens; NR = the measurement was not recorded when the specimen was collected; N/A = the measurement is not applicable for the specimen or species; and \* = the specimen was missing its tail, so no tail measurement could be recorded.

Species	Range	Sites	Total Length	Tail Length	Hind Foot Length	Ear Length	Forearm Length
<i>Crocidura dracula</i>	Known	1, 4	165–181	78–80	17–18	9–11	N/A
<i>Cynopterus sphinx</i>	Known	1	N/A	4.55	14.22	NR	67.5
<i>Macroglossus sobrinus</i>	Known	1	83–85	0	11–18	17–18	47
<i>Rousettus amplexicaudatus</i>	Known	1	143	11	20	20	86
<i>Rousettus leschenaultii</i>	Known	1	105	11	17	18	68
<i>Rhinolophus macrotis</i>	R	1	70	20	7	18	42.21
<i>Rhinolophus sinicus</i>	R	5	75–76	18–22	11	20–26	50
<i>Rhinolophus thomasi</i>	R	1	65	19	6	19	43.77
<i>Aselliscus stoliczkanus</i>	Known	2, 3	72–80	35–40	7	13–30	41–43
<i>Hipposideros armiger</i>	Known	1, 6	155–170	57–71	16.7–26	24–37	90–100
<i>Hipposideros gentilis</i>	R	2	73	27	6	22	42.05
<i>Hipposideros lylei</i>	Known	1	131	45	17	24	79.61
<i>Lyraderma lyra</i>	Known	1	89	0	23	26	72
<i>Taphozous theobaldi</i>	R	1, 2	121–125	30–35	15–16	26–27	72–74.89
<i>Chaerephon plicatus</i>	R	1	118–119	42–44	11–12	22	47–48.2
<i>Eptesicus pachyomus</i>	R	4	136	52	14	19	57.54
<i>Scotophilus heathii</i>	Known	1	141–150	58–65	11–15	12–15	62.4–65.0
<i>Pipistrellus javanicus</i>	Known	2	78	34	7	10	32.46
<i>Miniopterus magnater</i>	R	1	119	55	11	13	49
<i>Herpestes javanicus</i>	Known	1	535	238	53	12	N/A
<i>Callosciurus erythraeus</i>	Known	1	470	240	45	25	N/A
<i>Rhizomys pruinosus</i>	Known	1	262–430	77–125	41–54	16–20	N/A
<i>Rhizomys sumatrensis</i>	Known	1, 3	565	155	69	26	N/A
<i>Niviventer fulvescens</i>	Known	1	148	N/A*	26	NR	N/A
<i>Rattus</i> sp.	Known	1	390	210	35	24	N/A

ASNHC 18480 was collected from a 12 m bat net set on a hotel roof in Menglun, and it had a stomach full of pollen. The third lower molar is 1.5–2 times longer than wide in this species (Francis 2008). The breadth of the jugal, width of the ear, and maxillary toothrow of specimen ASNHC 18480 were all smaller than in other reported conspecifics, but appeared to be in proper proportion, suggesting immaturity. This species was found within the recorded geographic range as given by Wilson (2013).

Family Rhinolophidae  
***Rhinolophus macrotis* Blyth, 1844**  
 Big-eared Horseshoe Bat

Specimen ASNHC 18482 was caught on 12 August 1988 in a Menglun cave. Its sex was not specified on the tag. The upper P3 of *Rhinolophus macrotis* lies outside the toothrow. There is a faint sagittal crest and the ventral pelage is pale with brown tips. This specimen was collected ca. 210 km southwest of specimens previously reported (Molur et al. 2008; Wilson 2013).

***Rhinolophus sinicus* Andersen, 1905**  
 Chinese Rufous Horseshoe Bat

Two male specimens (ASNHC 18498 and 18512) represent *Rhinolophus sinicus*. ASNHC 18498 was taken from study site 5 on an unspecified date, whereas ASNHC 18512 was caught in study site 3 on 16 July 1990. The specimens both have FA 50 mm, HF 11 mm, and tail 18–22 mm. These measurements are within the recorded ranges provided by Wilson (2013), except the HF measurement, which is only 1 mm larger than the recorded HF range, and the tail measurement of ASNHC 18512 is 3 mm shorter than the reported tail range. These specimens were found ca. 200 km southwest of the previous reported locality as given by Wilson (2013).

***Rhinolophus thomasi* Andersen, 1905**  
 Thomas's Horseshoe Bat

ASNHC specimen 18477 was caught on 13 August 1988 in a Menglun cave. It was identifiable by means of its second upper premolar and third lower premolar, which are small and lie outside the rest of the toothrow. This specimen was taken ca. 400 km south of the closest previous record in Yunnan (Wilson 2013).

Family Hipposideridae  
***Aselliscus stoliczkanus* (Dobson, 1871)**  
 Stoliczka's Trident Bat

Two male *Aselliscus stoliczkanus* were collected on 16 July 1990. One (ASNHC 18493) was found from study site 3, and the other (ASNHC 18487) in a Menglun cave at 21°53' N 101°18' E, at Menglun station. This species has upper incisors with multiple cusps and a vertical process on its zygomatic arch (Wilson 2013). Specimen ASNHC 18487 has no skull, but appears nearly identical to specimen ASNHC 18493 in size and fur color. Both specimens were from near the middle of the geographic range for the species (Wilson 2013).

***Hipposideros armiger* (Hodgson, 1835)**  
 Great Himalayan Leaf-nosed Bat

Four males (ASNHC 18471, 18483, 18494, and 18510) and three females (ASNHC 18484, 19409, and 18485) were collected in Menglun. Specimens were collected on the following dates: ASNHC 18485 and 19409 on 14 August 1987; 18484 on 13 August 1988; 18471, 18483 and 18510 on 14 July 1990; and 18494 on 20 July 1990. Specimen ASNHC 19409 is missing its skull. The characteristic that sets *Hipposideros armiger* apart from *Hipposideros pratti* is that in the former there is a continuous uniform slope from the sagittal crest to the rostrum. *Hipposideros pratti* has a distinct depression just anterior to the sagittal crest. Forearm lengths of *H. armiger* range from 85.6 to 98.9 mm, which is within the range previously documented for the species (Thong et al. 2012). The TIB range is 33.62–44.98 mm with most measurements falling within the reported range of 36.6–43.4 mm (Thong et al. 2012). The GLS mean is 31.37 mm, which falls within the range of 30.8–32.3 mm (Thong et al. 2012). Additionally, out of five CCL measurements, three fell within a range of 27.4–28.5. The ZB of three of the specimens (ASNHC 18484, 18485, and 18494) was within a range of 17.3–18.1 mm, while two others (ASNHC 18471 and ASNHC 18483) were slightly larger than the reported range (Thong et al. 2012). The other two specimens (ASNHC 19409 and 18510) did not have recorded ZB measurements. Robinson et al. (2003) presented photographs of the skulls of *H. pratti* and *Hipposideros lylei*, which were useful in distinguishing these two species. This species was found within the recorded geographic range as given by Wilson (2013).

***Hipposideros gentilis* Andersen, 1918**

Andersen's Leaf-nosed bat

One female (ASNHC 18486) was taken on 5 August 1988. This specimen was caught in a dorm at the tropical research station in Menglun. *Hipposideros gentilis* ears are 20% longer than those of *H. bicolor*, on average (Francis 2008). The GLS of the specimen was 17.78 mm, which is within one standard deviation (of 0.32 mm) of a report in a previous study (Zhao et al. 2015; Tuneu-Corral 2019). The closest specimens obtained within Yunnan Province were from 245 km northeast and 500 km northwest of Menglun (Wilson 2013).

***Hipposideros lylei* Thomas, 1913**

Shield-faced Leaf-nosed Bat

On 18 August 1987, one female specimen (ASNHC 18488) was acquired in Menglun. *Hipposideros lylei* has gray pelage and a round protrusion in the rostrum. The specimen (ASNHC 18488) has a GLS of 29.11 mm, CCL 25.98 mm, and the ZB is 15.95 mm. All of the measurements of the specimen collected fall within the reported ranges by Robinson et al. (2003). The measurement of the MTR falls short by 0.1 mm of the reference material at 10.3 mm. The specimen's LTR falls in the recorded range at 12.72 mm. This species was found within the recorded geographical range as given by Wilson (2013).

Family Megadermatidae

***Lyroderma lyra* E. Geoffroy, 1810**

Greater Asian False-vampire

One female specimen (ASNHC 18473) was caught in Menglun in 14 July 1990. The tag indicates this specimen was collected in a cave associated with a rubber plantation. The bat was in a net eating a *R. sinicus*. The stomach (30 mm in diameter) was full of meat and fur. This species has large, ovoid ears that meet in the middle of the forehead, and the nose-leaf is simple, large, and elliptical (Wilson 2013). The tail is reduced or absent (Wilson 2013). This species was found within the recorded geographic range as given by Francis (2019).

Family Emballonuridae

***Taphozous theobaldi* Dobson, 1872**

Theobald's Tomb Bat

A female was collected on 14 August 1988 (ASNHC 18475) at 21° 55' N 101° 20' E. A male and a female were collected on 15 July 1990 (ASNHC 18479 and 18495, respectively) in a cave in Menglun (Fig. 1). This species has forearms of greater length than 69 mm (Wilson 2013) and the plagiopatagium attaches to the leg above the ankle. Only a single record of this species has been reported from Yunnan Province, from ca. 160 km northwest of Menglun (Wilson 2013).

Family Molossidae

***Chaerephon plicatus* (Buchanan-Hamilton, 1800)**

Wrinkle-lipped Free-tailed bat

On 14 August 1988, a female *Chaerephon plicatus* (ASNHC 18474) was caught in Menglun and a male (ASNHC 18497) on 15 July 1990. Both have a connection of skin between the ears. *Chaerephon plicatus* typically has a shorter FA length than sympatric *Tadarida* (Wilson 2013) and has short fur and a small premolar behind the canine that distinguishes it from the species of *Mops*. The mean FA of the two specimens is 47.6 mm, which is comparable to the mean of 48.24 mm given by Thong (2015). This species has not been previously recorded from Yunnan Province. The nearest previous record is from 580 km east of Menglun (Wilson 2013).

Family Vespertilionidae

***Eptesicus pachyomus* Tomes, 1857**

Oriental Serotine

On 18 July 1990, one female (ASNHC 18496) was taken at study site 4. *Eptesicus pachyomus* has a FA between 49 and 57 mm, the posterior molar has a v-shaped cusp, the wings, ears, and muzzle are brown with a touch of gray, the dorsal fur is dark brown with lighter tips, and the ventral fur is dark brown with white tips. This specimen was captured ca. 350 km south of the next closest specimen as recorded by Wilson (2013).

***Scotophilus heathii* (Horsfield, 1831)**

Greater Asiatic Yellow House Bat

*Scotophilus heathii* is represented by one male (ASNHC 18472) collected on 12 August 1987 and two female specimens (ASNHC 18478 and ASNHC 18490) collected on 11 August 1987 in Menglun, with one other female specimen (ASNHC 19412) collected on Gourd Island, Menglun, on 11 August 1987. *Scotophilus heathii* has a FA length between 55 and 66 mm and its ventral fur is khaki with a distinct yellowish tint (Wilson 2013). These specimens were collected in the recorded geographic range as given by Wilson (2013).

***Pipistrellus javanicus* (Gray, 1838)**

Javan Pipistrelle

One female (ASNHC 18476) *Pipistrellus javanicus* was captured on 10 August 1988 in Menglun at 21°55' N 101°16' E (according to the tag). The specimen has a forearm length of 32.46 mm, too long for *P. tenuis* (25–31 mm), but in the range of *P. abramus* (31–36 mm), and the upper incisor is unicuspid, indicating it is *P. javanicus* (López-Baucells 2019). The ventral fur is brown with pale brown tips. This specimen was collected within the recorded geographic range of the species as given by Wilson (2013).

Family Miniopteridae

***Miniopterus magnater* Sanborn, 1931**

Large Long-fingered Bat

One male specimen (ASNHC 18481) was caught in a Menglun cave on 14 July 1990. A high domed skull with a very low sagittal crest characterizes *Miniopterus magnater*. The closest recorded specimen was taken ca. 90 km west of Menglun (Wilson 2013).

ORDER CARNIVORA

Family Herpestidae

***Herpestes javanicus* (É. Geoffroy, 1818)**

Javan Mongoose

One female specimen (ASNHC 18509) was taken in Menglun (date unknown). The sympatric *Herpestes urva* has black fur on its legs, and *H. auropunctatus* is gray, whereas *Herpestes javanicus* has uniform agouti brown pelage color (Wozencraft 2013b). *Herpestes javanicus* has a large forehead with a short rostrum,

whereas *H. urva* has a much longer rostrum, resulting in a more conical face shape. This specimen was found within the recorded geographic range of the species as given by Wozencraft (2013b).

ORDER RODENTIA

Family Sciuridae

***Callosciurus erythraeus* (Pallas, 1779)**

Pallas's Squirrel

*Callosciurus erythraeus* (ASNHC 18503) has distinctive rich red ventral fur. This male specimen was caught on Gourd Island on 14 August 1987. The tail has black and gray banding with a black tip. HB, HF, and E fall within the ranges provided by (Lurz et al. 2013) for previously reported specimens. A hunter took this specimen within the recorded geographic range of the species (Hoffmann and Smith 2013).

Family Spalacidae

***Rhizomys pruinosus* Blyth, 1851**

Hoary Bamboo Rat

Two males (ASNHC 18507 and 19084) and one female (ASNHC 19407) represent *Rhizomys pruinosus*. Specimen ASNHC 18507 does not have a skull. Specimen ASNHC 18507 was a juvenile taken on 14 August 1987 on Gourd Island, and specimens ASNHC 19084 and 19407 were collected at study site 3 on 16 and 17 July 1990 respectively (Fig. 1). *Rhizomys pruinosus* has a dark brown dorsum with white guard hairs. Its skull is noticeably smaller than that of *Rhizomys sumatrensis* and is provided with low lyre-shaped temporal ridges. These specimens were collected within the recorded geographic range as recorded by Smith (2013).

***Rhizomys sumatrensis* (Raffles, 1821)**

Indomalayan Bamboo Rat

Three specimens (ASNHC 18505, 18506, and 19406) represent *Rhizomys sumatrensis*. All were collected in Menglun. Specimens ASNHC 18505 and 18506 (one female, one sex unknown) were collected on 24 July 1990. Female specimen ASNHC 19406 was collected on 24 July 1990 in Menglun. *Rhizomys sumatrensis* has a pronounced sagittal crest, lambdoidal crests, and a broad zygomatic arch. These specimens have a dark dorsal stripe on the head, with orange cheeks. Specimens reported herein were collected



within the geographical range of the species as given by Smith (2013).

Family Muridae  
*Niviventer fulvescens* (Gray, 1847)  
Indomalayan Niviventer

One female specimen (ASNHC 18504) was caught on 16 July 1990 in Menglun. This specimen is missing its tail and there was no ear length taken, which makes identification more difficult (Lu et al. 2015). Our specimen has orange-brown dorsal pelage and yellowish ventral pelage strongly demarcated from the dorsum. It is most likely *Niviventer fulvescens* based on these characters. This species was collected within the previously recorded geographic range of the species as given by Lunde (2013).

*Rattus* sp. G. Fischer, 1803

*Rattus* sp. is represented by a female (ASNHC 18502) caught in Menglun on an unspecified date between 1987 and 1990. This specimen has five pairs of mammae and brown pelage on the dorsum of the feet. Its dorsal pelage is brown, with buffy/cream ventral pelage. Its tail (210 mm) is longer than its head plus body length (180 mm). A karyotype analysis is necessary to differentiate between *Rattus rattus* and *Rattus tanezumi*, because the two groups are otherwise morphologically identical (Francis 2008). This species was taken within the recorded geographic ranges for both *R. rattus* and *R. sinicus* as given by Lunde (2013).

## DISCUSSION

The specimens reported herein were collected in southern China before the expansion of rubber plantations in the region. Natural tropical forests were already fragmented at the time these specimens were collected. Today, many of the areas that constituted the remaining fragments are now under cultivation or rubber tree silviculture. Maps of the region, generated between 1988 and 2003, show it to be increasingly dominated by rubber tree farms.

Logging in Yunnan has led to fragmentation and loss of natural habitats. Planting of such crops as sugar cane, tropical fruits, and rubber trees has led to extinction of various rare species (Yang et al. 2003). Because the Yunnan ecosystems are located in tropical and subtropical regions, they are especially sensitive to environmental change and generally are less resilient than ecosystems located in temperate zones (Yang et al. 2003).

Yang et al. (2003) have provided some insightful strategies for conservation in the province. First, it would be beneficial to establish a database of biodiversity conservation in Yunnan. These data could aid in conservation by monitoring changes throughout the

region with regard to rare, endangered, and endemic species. Conducting research on dynamic changes in biodiversity in different ecosystems would be especially advantageous (Yang et al. 2003).

Eight species reported within this study (*T. theobaldi*, *H. gentilis*, *C. plicatus*, *R. macrotis*, *R. sinicus*, *R. thomasi*, *E. pachyomus*, and *M. magnater*) were taken more than 90 km from the previous nearest records (Wilson 2013). These eight species collected far from previous records reveal a lack of extensive sampling in the area. Our records highlight the need for further collecting in the region to document the remaining biological diversity in an increasingly industrial and agricultural environment before that diversity is potentially lost.

The specimens reported herein demonstrate the growing importance of natural history collections that have been assembled during different periods. Undoubtedly, researchers working in southern Yunnan today will find a different assemblage of mammals than those collected from 1987 to 1990. This report on this collection should be helpful to conservationists if an ecological restoration project is ever attempted.

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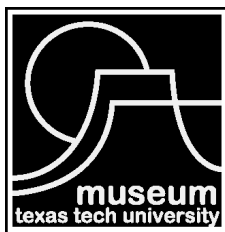
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