รายงานฉบับสมบูรณ์

โครงการวิจัย: การฝึกอบรมเรื่องการเก็บตัวอย่างและการจำแนกชนิดค้างคาว

โดย

นายสาระ บำรุงศรี

เมษายน 2551

รหัสโครงการ BRT S 548004

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ผู้วิจัย

นายสาระ บำรุงศรี

ภาควิชาชีววิทยา มหาวิทยาลัยสงขลานครินทร์

สนับสนุนโดยโครงการพัฒนาองค์ความรู้และศึกษานโยบายการจัดการทรัพยากรชีวภาพในประเทศไทย (โครงการ BRT)

บทคัดย่อ

จัดอบรมเชิงปฏิบัติการเรื่องการสุ่มตัวอย่างและการจำแนกชนิดค้างคาวจำนวน 3 ครั้งในภาคใต้ ภาคตะวันออก และภาคเหนือ ระหว่างเดือนธันวาคม 2547 ถึงเดือนพฤษภาคม 2549 มีผู้เข้าร่วมการอบรมทั้งสิ้น 22 คน พบค้างคาวทั้งสิ้น 56 ชนิด โดยบางชนิดเป็นรายงานใหม่ของประเทศและบางชนิดน่าจะเป็นชนิดใหม่ซึ่งต้องศึกษาอีกต่อไป เก็บรักษาตัวอย่างไว้ที่พิพิธภัณฑ์ธรรมชาติวิทยาสมเด็จพระเทพรัตนราชสุดา มหาวิทยาลัยสงขลานครินทร์ ปัจจุบันผู้เข้าร่วมอบรมบางคนกำลังศึกษาในระดับที่สูงขึ้นในเรื่องอนุกรมวิธาน นิเวศวิทยา และชีวภูมิศาสตร์ของค้างคาวในประเทศไทย

Abstract

Three training workshops on bat sampling technique and its identification were conducted in several sites from southern, south eastern and northern Thailand during December 2004 to May 2006. A total of 22 participants were joined the workshop. 56 species of bat were trapped, some of them were new to Thailand and some are potentially new to science. Some of bats were kept as voucher specimens deposited at the Princess Mahachakri Siridhorn Natural History Museum at Prince of Songkla University. These are very useful material for students studying bat taxonomy. At least 2 academic papers related to these workshops. Some participants are now perusing a higher degree in taxonomy, ecology and biogeography of Thai bat.

Acknowledgements

The author is grateful to Dr.Charles Francis for his devoting in helping us in training and set a standard protocol for bat sampling, and for loan us some equipment. Thanks are due to staffs of Khao Angrunai Wildlife Sanctuary especially Mr. Pornarin Kumthong and Mr. Sawai Wanghongsa, to staffs of Ton Nga Chang Wildlife Sanctuary, Taleban Natinal Park, Khao Bantat Wildlife Sanctuary, Thung Salang Luang National Park, and especially to P' Pae (Anuruth Suthivaringul), head of Phu Suan Sai National Park for their hospitality and support during our workshop in their areas. The author thank all participants especially Piyathip Piyaphun, Medhi Yokubol, Watcharee Leelapaibul in organized the trips. Thank Biodiversity Research and Training Program (BRT) for funding this project.

Sara Bumrungsri

29/04/08

contents

List of table

List of figure

There were three training workshops. The detail of each workshop as followed:

1st Training workshop

Date 14-19 December 2004

Sites: Ton Nga Chang Wildlife Sanctuary

Telaban National Park

Moderator: Dr.Charles Francis

Sara Bumrungsri

Participants

- Piyathip Piyaphun
- Medhi Yokubol
- Em Chansen
- Angsana Mongsap
- Nakhon Salangsing
- Amorn Prachakjitr
- Tuenjitr Srithongchuay

Activities

- Introduce to harp trap, and mistnet.
- Trapping bat, data collection and photographing
- Call recording and identification
- Tissue collecting for future genetic studies
- Skull preparation and measurement

Output/outcome

- 120 bats from 24 species were trapped. Some of them confirm the presence of new bats to Thailand (e.g. *Murina aenea, Murina suiila*) (see detail in appendix 1).
- 7 students have experience in trapping, sound recording, measuring, cleaning the skull and necessary protocol for tissue collecting.

Table 1 List of bats found during 1st field training 14-19 December 2004

Cynopterus brachyotis
Glisopus tylopus
Hipposideros bicolor
H. larvatus
H. cineraceus
Hesperoptenus blanfordi
Hipposideros diadema

Kerivoula hardwickii
Kerivoula minuta
Miniopterus magnater
Minopterus medius
Murina aenea
Murina cyclotis
Murina suiila
Myotis ater
Myotis horsefieldi
Myotis muricola
Rhinolophus acuminatus
R. affinis
R. stheno
R. lepidus
R. trifoliatus
Tylonycteris pachypus
T. robustula

2nd Training workshop

Date 19-23 May 2005

Sites: Khao Angrunai Wildlife Sanctuary, Khao Cha-kan limestone outcrop, Srakaew Province

Moderator: Sara Bumrungsri

Assistances: Watcharee Leelapaibul
Piyathip Piyaphan
Medhi Yokubol

Participants

- Teunchit Srithongchuay
- Khiyawat Yuthityanuwat
- Suwan Inphan
- Chaiwat Penchan
- Prasong Munchan
- Pipat Soisook
- Chenchira Phungchanteuk
- Kedsirin Uttarathammachai
- Wachanaporn Thepsorn
- Porninpa Boonmee

- Phutarate Pornprasit
- Kasidith Chanpradab
- Chanya Chetchareon
- M.L. Thosawan Dewhagul

Activities

- Capture technique for bats including harp trap and net.
- Processing technique for morphological measurement
- Terms and method for bat identification from external character
- Acoustic equpement and method for recording and identification
- Skull preparing, labelling and measurement
- Identification bat from skull

Output/outcome

- 14 students learn trapping technique, all necessary protocol for field survey of bat and species identification
- 76 bats from 16 species were trapped (see detail in appendix 2).

Table 2 List of bat found during 2nd training workshop

Cynopterus sphinx
Hipposideros galeritus
H. armiger
H. lekaguli
H. larvatus
Miniopterus medius
Myotis hasseltii
Myotis sp.
Pipistrellus sp.
Rhinolophus acuminatus
R. malayanus
R. siamenis
R. stheno
R. shameli
Taphozous longimanus

3rd Training workshop

Date 11-20 May 2006

Sites: Ton Nga Chang Wildlife Sanctuary

Telaban National Park

Khao Bantat Wildlife Sanctuary

Salaengluang National Park

Phu-Miang Phu-Thong Wildlife Sanctuary

Phu Suansai National Park

Moderator: Dr.Charles Francis

Dr.Sara Bumrungsri

Participants

- Chenchira Phungchanteuk
- Kedsirin Uttarathammachai
- Ariya Dejtharadol
- Pipat Soisook
- Wachanaporn Thepsorn
- Kwan Nuancharoen
- Piyathip Piyaphun
- Medhi Yokubol

Activities

Students conducted a bat survey with experts by misnetting and harp trapping. All other protocol necessary for survey were also practiced including field data collection, identification, echolocation recording, photographing, skull cleaning, morphometric measuring.

The trapping sites in northern Thailand were those requested by Office of Natural Resources and Environmental Policy and Planning (ONEP) for intensive survey as a 'national biodiversity hotspot', and our team also joined with those study bird, amphibian, reptile and fish. The budget in this trip was also partially subsidized by this department.

Outputs/outcome

- Participants learn on trapping techniques and all necessary field protocol for ecological and taxonomical study of bats. Most of these participants have been joined the previous workshop, thus they were extended their experience with bat survey.

- 127 bats which 59 bats in xx species were trapped from southern Thailand. 68 bats from xx species were trapped in those sites from northern Thailand. Some of them are very rare, or even a new recorded bat or potentially a new species (see detail in appendix 3).
- Some of data was used as a database for 'Biodiversity Hotspot'

Table 3 List of bats trapped at reserves in the south (Ton Nga Chang Wildlife Sanctuary Telaban National Park, Khao Bantat Wildlife Sanctuary)

Cynopterus horsefiedi
Eonycteris spelaea
Hipposideros bicolor
H. cineraceus
H. larvatus
He. tomesei
Hesperoptenus blanfordi
Kerivoula intermedia
Kerivoula hardwickei
Macroglossus sobrinus
Miniopterus sp.
Murina cyclotis
Myotis horsefieldi
Nycteris tragata
Penthelator lucassi
Rhinolophus marcrotis
R. robinsoni
R. stheno
R. trifoliatus
R.affinis
R. lepidus
Tylonycteris robustula

Table 4 List of bats trapped at reserves in the north (Salaengluang National Park Phu-Miang Phu-Thong Wildlife Sanctuary, Phu Suansai National Park)

Cynopterus sphinx
Megerops niphane
Sphaerias blanfordi
Coelops frithii
Eudiscopus denticulus
H. armiger
H. larvatus

H. pomona
Kerivoula hardwickii
Miniopterus magnater
Murina cyclotis
Murina sp.
Murina turbinaris
Pipistrellus sp.
Rhinolophus pusillus
R. stheno
R. affinis
R. malayanus
R. marshalli
R. pearsoni
Tylonycteris robustula

Conclusion

- At least 22 students joined these three workshops. Some of them decide to do a higher academic degree on bat, such as Medhi Yokubol and Piyathip Piyaphun study PhD on *Craseonycteris thonglongyai* in Prince of Songkla University(PSU). Kwan Nuanchareon do a PhD on biogeography of *Rhinolophus* in PSU. Pipat Soisook and Ariya Dejtaradol do MSc on bat taxonomy in PSU. Amorn Prajakjitr do a MSc on bat in PSU. Kedsirin Utarathammachai do a MSc in habitat use of *Tadarida plicata* in Kasetsart University. Phutarate Pornprasit and Chenjira Phungchanteuk did senior project/special problem on bats. These people are working close each others. Although somebody did not take a higher degree, they also used this experience in other various ways such as for education, for feature production etc. They also commit to help for further bat studies.
- At least 56 species of bat were found. Some of them were proved to be newly recorded bats to Thailand (see article below). Some of them rare and new information was collected. Some are new to science and waiting for further studies. All of voucher specimens, if collected, are deposited at Princess Mahachakri Sirindhorn Natural History Museum, and they are very useful for students in bat taxonomy (*R. stheno, R. malayanus, R. lepidus, R. pusillus, Rhinolophus sp., Hipposideros cineraceus, Kerivoula hardwickii*). These materials together with others collected bats are used for master thesis and also for training new students to bat studies.

- Two academic papers were published based on material collected during these training workshop including (appendix 4 and 5)

- Sara Bumrungsri, David L. Harrison, Chutamas Satasook, Amorn Prajukjitr, Siriporn Thong-Aree, and Paul Bates. 2006. A review of bat research in Thailand with eight new species records for the country. Acta Chiropterologica 8: 325-359.
-Pipat Soisook, Sara Bumrungsri, Ariya Dejtharadol, Charles M. Francis, Gabor Csorba, Antonio Guillen-Servent and Paul J. J. Bates. 2007. First records of *Kerivoula kachinensis* (Chiroptera: Vespertilionidae) from Cambodia, Lao PDR and Thailand. Acta Chiropterologica 9:339-345.

Table 5 Summary list of bat species recorded from all workshops.

Cynopterus brachyotis
C. horsefiedi
C. sphinx
Macroglossus sobrinus
Megerops niphane
Penthelator lucassi
Sphaerias blanfordi
Coelops frithii
Eonycteris spelaea
Eudiscopus denticulus
Glisopus tylopus
Hipposideros armiger
H. cineraceus
H. larvatus
H. lekaguli
H. pomona
H. bicolor
H. diadema
H. galeritus
Hesperoptenus tomesei
He. blanfordi
Kerivoula intermedia
K. hardwickei
K. minuta
Miniopterus magnater
Mi. medius

Miniopterus sp.
Murina aenea
Mu. cyclotis
Murina sp.
Mu. suiila
Mu. turbinaris
Myotis ater
My. hasseltii
My. horsefieldi
My. muricola
Myotis sp.
Nycteris tragata
Pipistrellus sp.
Rhinolophus acuminatus
R. marcrotis
R. pusillus
R. robinsoni
R. shameli
R. siamenis
R. stheno
R. trifoliatus
R. trifoliatus
R. affinis
R. malayanus
R. marshalli
R. lepidus
R. pearsoni
Taphozous longimanus
Tylonycteris pachypus
Ty. robustula

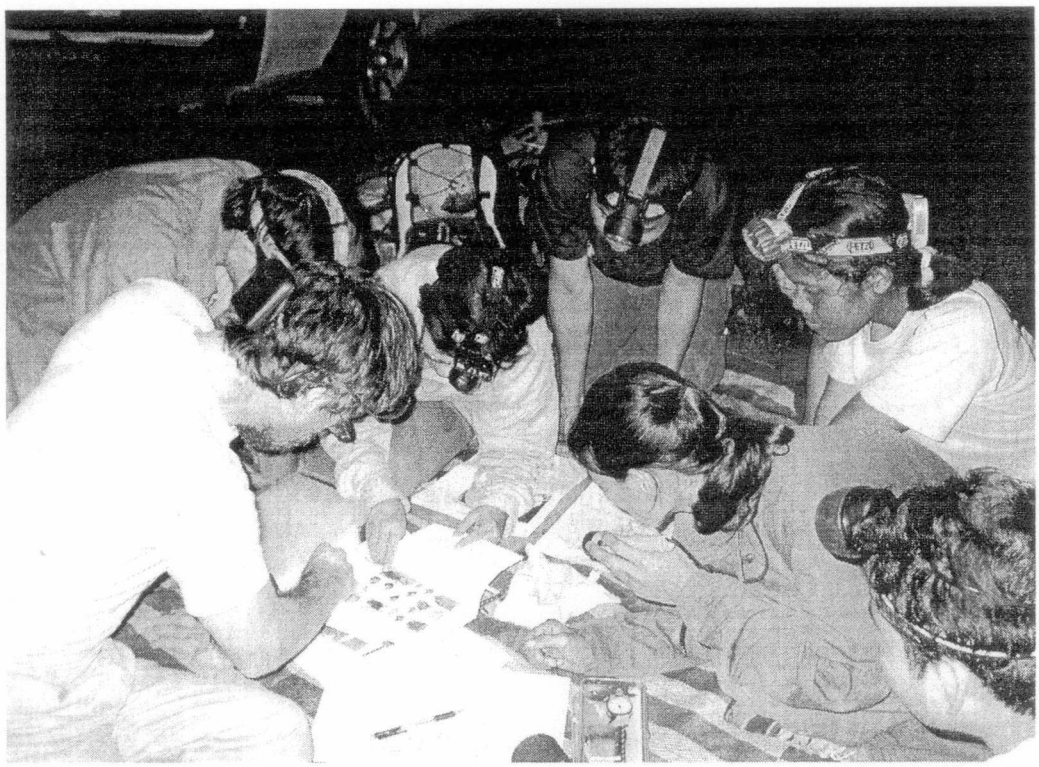

Figure 1 Dr. Charles Francis and students were using a book to identify captured bats in Ton Nga Chang in the first training workshop.

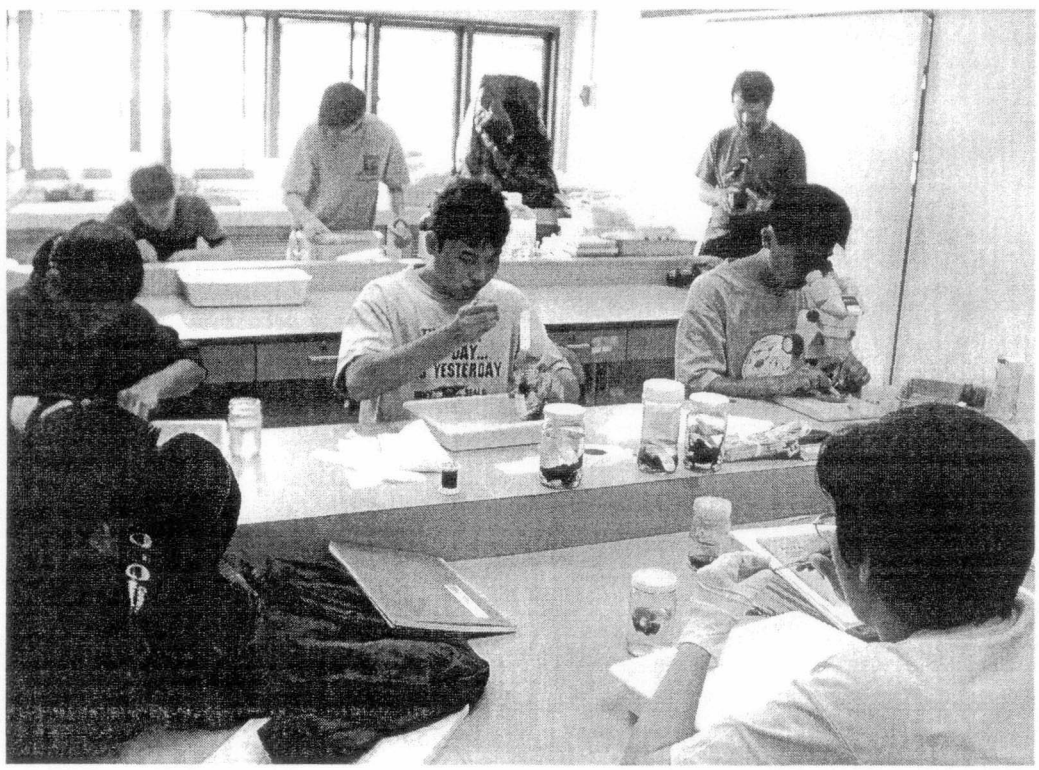

Figure 2 students were preparing skull for identification in PSU (1^{ST} workshop)

Figure 3 Students discussed with Dr. Charles Francis on captured results (1st workshop).

Figure 4 students were fixing the harp trap in Khao Angruanai (2nd workshop).

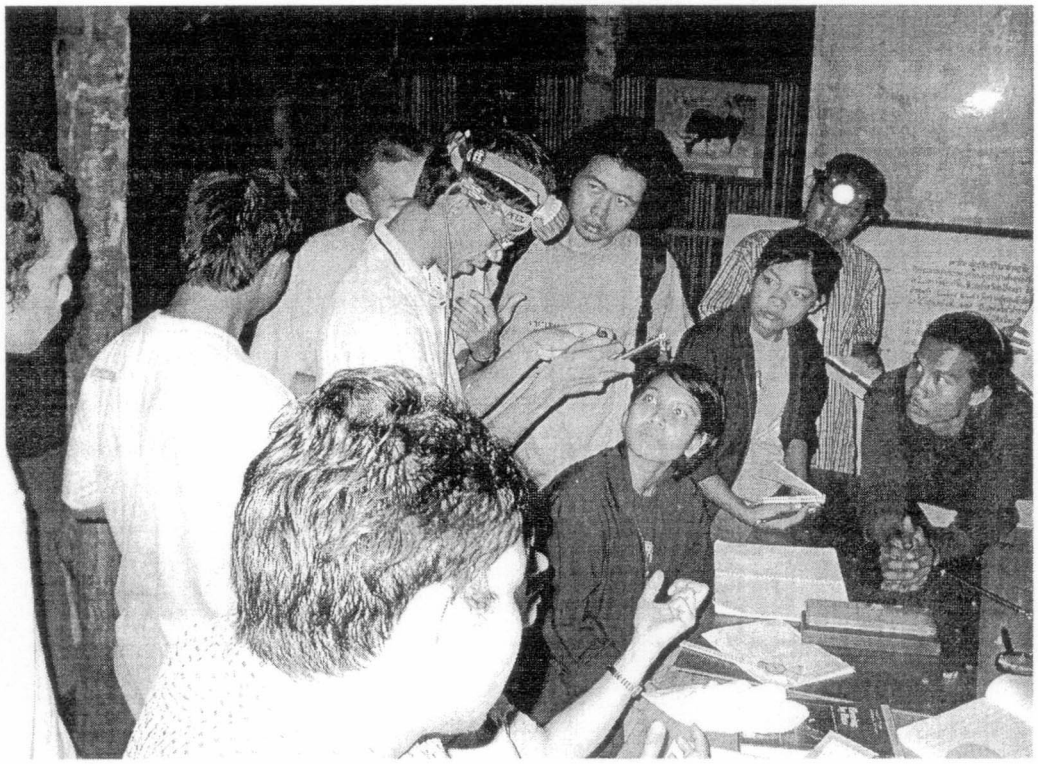

Figure 5 Dr. Sara Bumrungsri showed students how to estimate the reproductive status of captured bats (2nd workshop).

Figure 6 All participants have their dinner before capturing bats at the nearby cave (2nd workshop).

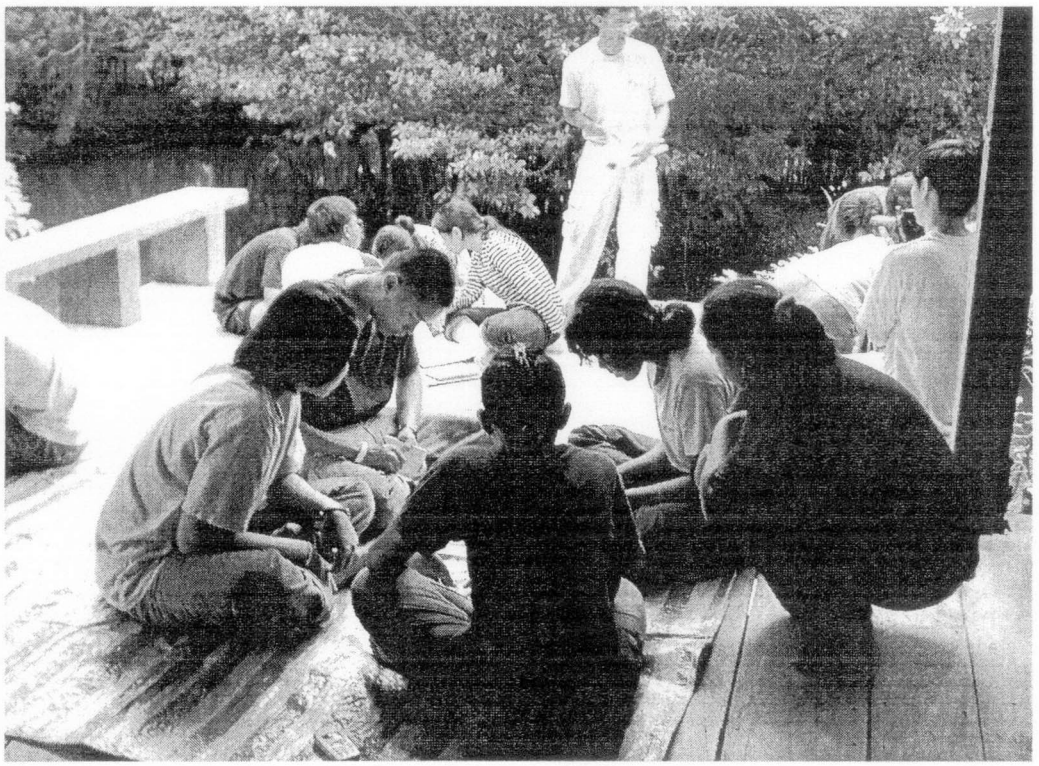

Figure 7 students were divided into small groups and practiced skull measurement (2^{nd} workshop).

Figure 8 All participants in the 2^{nd} workshop.

Figure 9 Dr. Charles and Dr. Sara showed students how to use key to identify bats (3rd workshop) at Phu Suan Sai National Park).

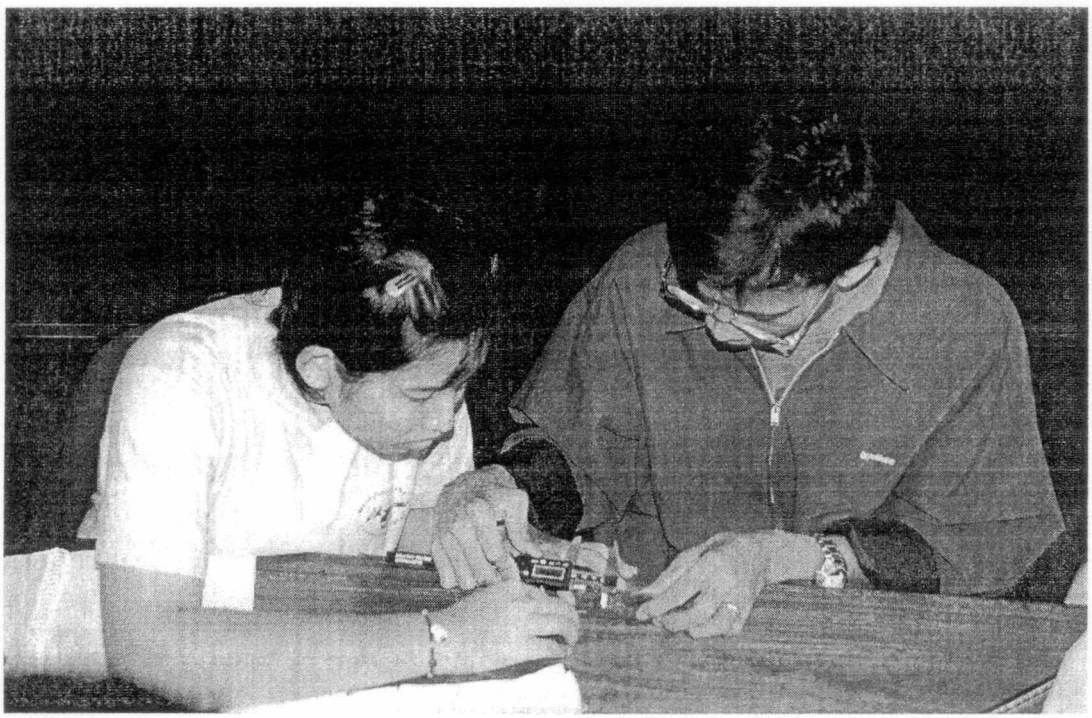

Figure 10 Dr. Sara showed students how to measure tail length (3rd workshop).

Figure 11 Dr. Charles with some students at Thai-Laos borders (3rd workshop).

Figure 12 A trapping site over the hill evergreen forest in Phu Suan Sai National Park where *Murina turbinaris* and *Spherias blanfordi* were found (3rd workshop).

Figure 13 *Penthelator lucassi*, a rare fruit bat captured at Ton Nga Chang Wildlife Sanctuary (3rd workshop).

Figure 14 *Kerivoula hardwickii* captured in northern Thailand. Later it was proved to be *K. depressa* (3rd workshop).

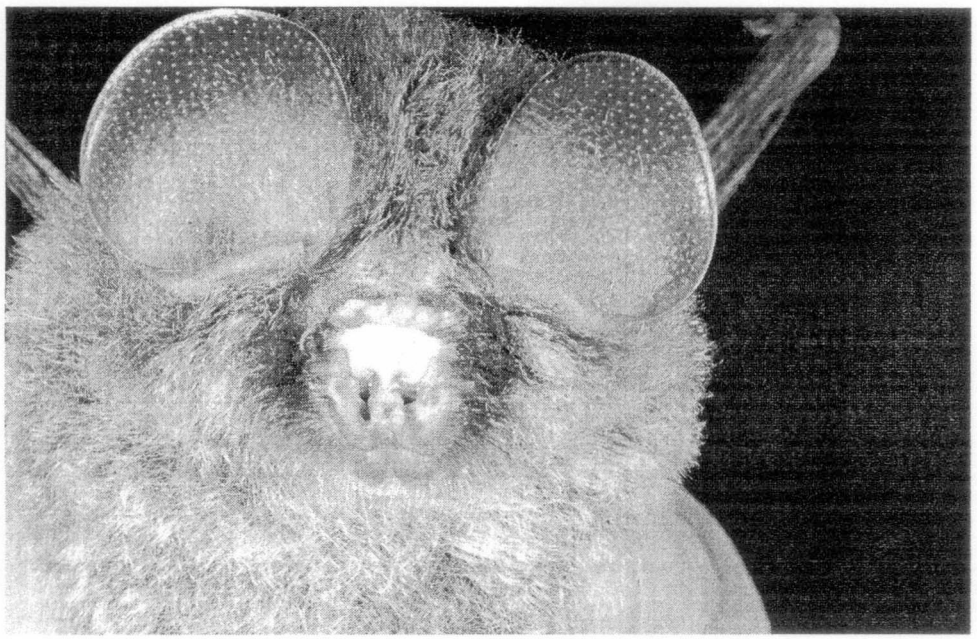

Figure 15 Coelops frithii from northern Thailand (3rd workshop).

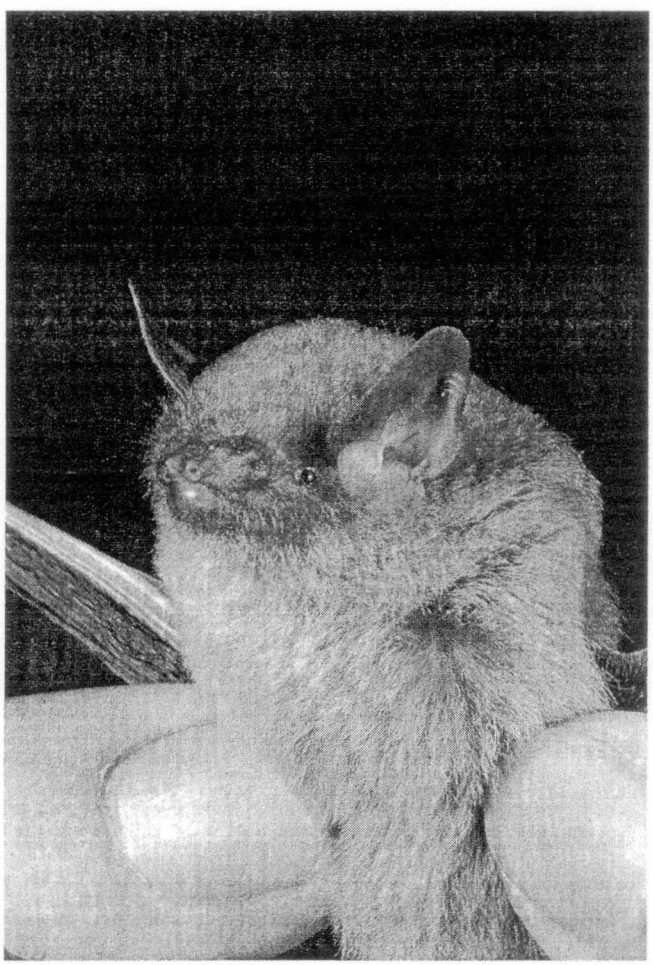

Figure 16 *Eudiscopus denticulus*, a very rare bat found in northern Thailand.

Bat/Small Mammal Trapping Records Date: 14 DEC ~~19~~ 2004

Locality: / Tom-nga-chang at carpark Thailand. Lat. ~~[illegible]~~ ° ~~[illegible]~~ 6° 56' Long. ~~[illegible]~~ ° ~~[illegible]~~ 100° 14' ± 0637000 0767800

Operator: SARA B., C. FRANCIS et al.

Habitat: Dry evergreen logged forest near stream

Weather:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	041214-01	Rhinolophus trifoliatus			Ad	M				51.0					13.0	20:20	T1	18:48	~~18:50~~	~ 51.5	~~Voice 001-006~~ Bag 96
	-02	R. affinis			Ad	F	NN	N	N	51.7		22.7	21.6		12.7	20:45	..	18:20		71.5	~~Voice 8-9.~~ Bag 82
	-03	"			Ad	M				49.6					13.5	21:00	"	18:14		72.0	~~Voice 10~~ Bag 87
	-04	R. acuminatus			Ad	M				47.1					15.1	21:10	"	18:40		85.8	~~Voice 11~~ Bag 17
	-05	C. brachyotis (forest)			Ad	F		N	N	(60.4) 59.5			13.6		31.	21:30	"	19:30			
	-06	Kerivoula minuta			Ad	M				27.3		36.3	10.1		2.5	22:30	T2	21:00	22:00		

Notes: Trap 18:00-21:00, 2 traps

both traps along opposite ends of a short trail

Bat/Small Mammal Trapping Records

Locality: 1 Ton- Plieu Thailand

Date: 15 Dec 19

Lat. 7 ° 00.056 Long. 100 ° 14 ' 113 Habitat:

Operator: SARA B., C. FRANCIS et. al.

Weather:

UTM. 47N 636442 0774031

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information (including claw)
	041215-1	Myotis horsefieldii				F				37.5				9.2	6.8	20:50	N.1	18:30	19:00		small net (N.1) foot-tibia 17.8 bag #42
	-2	Hesperoptenus blanfordi				F				26.3					7.0	22:00	N.2	18:45	19:00		large net (N2) bag #1
	-3	Myotis muricola				F				34.1				6.4	4.8	21:00	N.2	18:30	19:00		bag #99
	-4	Myotis horsefieldii				F				37.2				10.0	8.0	22:30	N.1	18:30	19:00		tibia = 18.6 bag #14
	-5	Tylonycteris robustula				F				25.4					4.9	22:30	N.1	18:30	19:00		bag 9
	-6	Myotis horsefieldii				F				36.7					7.3	22:30	N.1	18:30	19:00		bag #45
	-7	Myotis muricola				F				32.9					3.7	22:30	N.1	18:30	19:00		bag #98
	-8	Myotis horsefieldii				F				38.3					7.3	22:30	N.1	18:30	19:00		bag #15
	-9	Hipposideros diadema				M				87.0					39.0	23:30	T1	18:15	18:30	59.	Harp Trap bag #94
	-10	Rhinolophus affinis				M				47.9					20.8	23:37	T1	18:15	18:30	70.5	Harp Trap bag #22
	-11	R. lepidus				M				39.5					5.7	23:40	T1	18:15	18:30	103	Harp Trap bag #89

Notes:

N1 - 12m × 1m monofilament net. across same pool.

N1 - 18m × 3m - set ~~acros~~ across pool in stream, below waterfall.

T1 - across trail in forest.

T2 - across stream under bridge - no bats.

Bat/Small Mammal Trapping Records

Date: 16 Dec. 19 2004

Operator: SARA B, C. FRANCES et. al.

UTM 0644920 (WGS 84) 0774816 p. 1/2

Locality: 1 Kuan Kao-wang

Lat. 07 °00 '469 Long. 100 °18 '714 Habitat:

Weather:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information (Recorder Track)	
–	5804 1216-01	Rhinolophus lepidus				M				38.1	.	.	.	.	5.4	20:30	T1	18:30	19:00		0,1 on Peterson, 2 on PUSP	#2
	-02	Hipposideros bicolor				F	NN			43.0	.	27.6	17.4	.	7.7	90:45	T1	18:30	19:00		3 on Petterson	#98
	-03	Hipposideros bicolor				M				41.8	.	.	.	.	6.8	20:55	T1	18:30	19:00		4 on Petterson	#62
	-04	Rhinolophus affinis				F				50.4	.	.	.	.	13.5	21:05	T1	18:30	19:00		5 on pe	#71
	-05	Myotis muricola				M				37.7	.	.	.	.	5.6	21:10	T1	18:30	19:00		6 on Pet.	#15
	-06	Myotis muricola				F				36.5	.	.	.	.	5.4	21:15	N1	19:15	:		12 on Pettersson	#37
	-07	Rhinolophus lepidus				M				40.6	.	.	.	.	5.5	-:-	T1	18:30	19:00		7 on Petterson	#10
	-08	Myotis muricola				M				36.8	.	.	.	.	7.0	:	T1	18:30	19:00		14 on Pettersson	#16
	-09	Myotis muricola				F				35.3	.	.	.	.	5.9	:	T1	18:30	19:00			#5
C	-10	Myotis muricola				F		N	N	37.6	50.1	42.7	11.9	6.7	5.9		T1	18:30	19:00		15 - in room 20x then 10x 16 - 10x Tibia 15.4	#96
	-11	Myotis muricola				M				35.5 ~~30.5~~	.	.	.	.	5.3	:	T1	18:30	19:00		13 on Pettersson	#4
C	-12	Myotis muricola				M				33.8	43.5	38.4	11.5	6.2	5.2	21:30	T1	18:30	19:00		VF - 20x in room 18 - 10x Tibia 15.1	#14
	-13	Rhinolophus lepidus				M				39.4	.	.	.	.	5.1	:	T1	18:30	19:00		8 on Pettersson	#6
	-14	Rhinolophus lepidus				F				39.8	.	.	.	.	4.8	:	T1	18:30	19:00		9 on Pettersson	#7
	-15	Rhinolophus affinis				M				30.6	.	.	.	.	13.2	21:45	T1	20:00	21:00		10 on Pettersson	#45
	-16	Hipposideros bicolor				F	NN			43.4	.	.	.	.	8.4	21:50	T1	20:00	21:00		11 on Pettersson	#94
										.	.	.	.	.	.	:		:	:			
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Notes: N1 – 2.6 m x 2 m net across small nearly dry creek bed.

T1 – across trail

T2 – across same creek bed as N1. – several bats flew along creek but did not get caught.

Bat/Small Mammal Trapping Records Date: 16 Dec. 28 2004 Operator: _____

Locality: 1 KUAN KAO WANG Lat. 07 ° 00 '.488 Long. 100 ° 18 '.714 Habitat: _____

Weather: all released at trap.

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	S804121617	Rhinolophus lepidus				M				38.3	.	.	.	.	5.0	:	T1	18:30	19:00		released at trap.
	-18	Rhinolophus affinis				F				.	.	.	.	.	.	:	T1	18:30	19:00		
	-19	Rhinolophus lepidus				M				.	.	.	.	.	.	:	T1	18:30	19:00		
	-20	Rhinolophus lepidus				F				38.8	.	.	.	.	4.5	:	T1	18:30	19:00		
	-21	Myotis muricola				F				.	.	.	.	.	.	:	T1	18:30	19:00		
	-22	Rhinolophus affinis				F				30.2	.	.	.	.	12.0	:	T1	18:30	19:00		
	-23	Rhinolophus lepidus				F				38.7	.	.	.	.	4.5	:	T1	18:30	19:00		
	-24	Hipposideros diadema				U				.	.	.	.	.	.	:	T1	.	.		
	-25	Rh. lepidus				U				.	.	.	.	.	.	:	T1	:	:		
	-26	"				M				.	.	.	.	.	.	:	T1	:	:		
	-27	"				F				.	.	.	.	.	.	:	T1	:	:		
	-28	Rh. affinis				U				.	.	.	.	.	.	:	T1	:	:		
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Notes: - measure immediately and then release
- release immediately 1 Hipposideros diadema
3 Rhinolophus lepidus (1 unknown, 1 male, 1 female)
1 affinis Rhinolophus affinis

Bat/Small Mammal Trapping Records

Date: 17 / 12 / 20 04 Operator: SARA O L. FRANCIS ET. AL.

Locality: 1 Ton-nga chang Wildlife Sanctuary Lat. 6° 56.692 Long. 100° 14.434 Habitat: Dry evergreen logged forest

47N 0637097 0767835 WGS 84

Weather:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information (T1 = harp trap in stream) A00 = 20, A1 = 10	
C	041217-01	Miniopterus medius				M				43.1	53.7	49.7	9.4	7.8	8.5	21:00	T1	20:30	20:30		C^1-C^1 = 4.0, C^1-M^3 = 5.5, M^3-M^3 = 5.8	bag# 11
C	02	Murina suilla				M				30.6	40.3	29.9	12.2	6.2	3.7	21:20	T2	18:30	20:30		5340 - 5545 (T2 = harp trap in foot near stream)	bag# 5
	03	Murina cyclotis				M				36.5					8.9	21:40	N2	18:40			5333 - 5339 (N2 = large net over stream)	bag# 42
	04	Cynopterus brachyotis				M				56.0					27.1	21:55	T2	18:30	19:30			bag# 44
	05	Rhinolophus lepidus				F				41.1					6.7	22:00	T2	18:30	19:00		A00 × 20, A01 × 10	bag# 1
	06	Myotis ater (?)				M				35.1					5.9	22:10	T2	18:30	19:00			bag# 16
	07	Hipposideros diadema				M				88.1					54.2	22:20	N3	19:45		68.3	(N3 = small net over stream) A02 × 20	bag# 12
	08	Hipposideros bicolor / ater				M				43.4					9.1	22:30	T1	18:50		142.4	5320 - 26 A03 × 20, A04 × 20	bag# 35
	09	Hipposideros bicolor / ater				M				43.2					10.3	22:35	N3	18:30	19:30	141	27 - 32 A05 × 20, A06 × 10	bag# 37
	10	Hipposideros larvatus				F				58.7					23.3	22:40	N3	[illegible]	19:30	94.1	A07 × 20, A08 × 10	bag# 32

Notes: N1 + N2 – both 6m nets, regular mesh across creek bed.
N3 = 12m × 1m monofilament zig-zagged across pool in stream.

Bat/Small Mammal Trapping Records

Locality: 1 Khao Rak Kiat

Weather: Clear 1/2 moon dry.

Date: Dec 18 ~~19~~ 2004

Lat. 7°09'41 Long. 100°15'03 47N 638111 0782065

Habitat: Limestone hill with temple + many caves. Forest on hill. Rubber, open fields + 2° forest around hill

Operator: SARA B., C. FRANCIS et. al.

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	SB 041218 01	Rhinorophus affinis				F				51.4	.	.	20.7	.	12.1	19:18	T	18:00	18:30		NL=10.7 A00 bag#2
	02	Hipposideros bicolor				M				43.3	.	.	17.3	.	12.4	19:23	T	18:00	18:30		A01 bag#3
	03	R. affinis				F				51.7	.	.	.	.	11.7	19:26	T	18:00	18:30		NL=10.5 A02 bag#1
	04	H. bicolor				M				40.9	.	.	18.0	.	6.8	19:26	T	18:00	18:30		A03 bag#1
	05	R. affinis				M				48.6	.	.	.	.	12.8	19:30	T	18:00	18:30		A04 bag#
	06	R. affinis				F				50.0	.	.	.	.	12.7	19:32	T	18:00	18:30		A05 bag#1
	07	R. affinis				M				51.3	.	.	.	.	12.4	19:33	T	18:00	18:30		A06 -
	08	R. affinis				M				51.6	.	.	.	.	12.8	19:35	T	18:00	18:30		NL=11.2 A07 bag=
	09	R. affinis				M				51.9	.	.	.	.	12.7	19:35	T	18:00	18:30		A08 bag#3
	10	R. affinis				M				49.6	.	.	.	.	12.2	19:37	T	18:00	18:30		A09 bag#1
	11	R. affinis				M				50.9	.	.	.	.	13.2	19:38	T	18:00	18:30		A10 bag#1
	12	R. affinis				M				52.5	.	.	.	.	13.6	19:39	T	18:00	18:30		NL=11.3 A11 bag#
	13	R. affinis				F				51.2	.	.	.	.	13.4	19:40	T	18:00	18:30		A12 bag#1
	14	R. affinis				M				49.6	.	.	.	.	11.8	19:43	T	18:00	18:30		NL=10.6 A13 damaged lancet bag#
	15	H. bicolor				M				44.0	.	.	.	.	8.4	19:43	T	18:00	18:30		A14 bag#
	16	R. affinis				M				50.1	.	.	.	.	12.8	19:45	T	18:00	18:30		A16 bag#
	17	H. lavatus				M				60.7	.	.	.	.	15.7	19:45	T	18:00	18:30		A15 bag#
	18	R. stheno				F				42.9	.	15.2	15.8	.	7.6	19:47	T	18:00	18:30		NL=9.5 A23 bag#
	19	R. affinis				M				50.4	.	.	.	.	12.6	19:49	T	18:00	18:30		A17 bag#
	20	R affinis				M				49.8	.	.	.	.	13.2	19:52	T	18:00	18:30		A18 bag#

Notes: T1 + T2 both set on path around hill. ~100-200m from temple.
- did not separate bats from the two traps.

Bat/Small Mammal Trapping Records Date: Dec 18 ~~19~~ 2004 Operator:

Locality: 1 KHAO RAK KIAT Lat. 7 °04 ' 41 Long. 100 °15 '03 Habitat:

Weather: 47 N 638111 0782065

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	21	Miniopterus				M				42.5	.	.	11.8	.	8.5	19:54	T	18:00	18:30		A 20 bag#
	22	R. affinis				M				49.9	.	.	.	.	12.7	19:54	T	18:00	18:30		A 19 bag#
	23	Miniopterus medius				F				42.4	.	.	.	.	8.3	19:57	T	18:00	18:30		A 21 bag#
	24	Miniopterus medius				F				42.2	.	.	10.1	.	7.6	20:01	T	18:00	18:30		A 22 bag#
	25	Miniopterus magnater				M				48.9	.	.	9.8	.	14.5	20:03	T	18:00	18:30		— bag#
	26	Miniopterus medius				F				42.2	.	.	.	.	8.7	20:11	T	18:00	18:30		A 44 bag#
	27	Miniopterus magnater				M				49.8	.	54.1	12.5	.	13.9	20:14	T	18:00	18:30		— bag#
	28	R. stheno				M				45.4	.	16.5	.	.	9.0	20:19	Cave	18:00	18:30		NL=9.2 A 26 bag#
	29	H. cineraceus				M				35.8	.	24.0	.	.	4.4	20:20	Cave	18:00	18:30	153.5	NL=4.2 A25 A27, A30 flew, A28 A28, A29 flew bag#
	30	R. stheno				F				44.3	.	.	.	.	7.8	20:29	T	18:00	18:30		A 24 bag#
	31	R. stheno				M				46.4	.	.	.	.	9.3	21:14	T	18:30	20:30		A 32 bag#
	32	R. stheno				M				45.2	.	.	.	.	9.6	21:14	T	18:30	20:30		A 31 bag#
	33	M. magnater				F				49.9	.	.	.	.	12.9	21:24		18:30	20:30		~~A~~ bag#2
	34	M. magnater				F				51.1	.	.	.	.	.	21:24		18:30	20:30		fly bag#
	35	R. stheno				F				44.6	.	13.4	.	.	6.7	21:24		18:30	20:30		NL=9.2 A 34 bag#
	36	M. magnater				F				50.5	.	.	11.5	.	13.9	21:24		18:30	20:30		A 40 bag#6
	37	M. magnater				F				49.8	.	.	~~13.1~~	.	13.7	21:24		18:30	20:30		A 39 bag#1
C	38	M. magnater				M				49.2	52.3	59.6	~~13.7~~ 12.3	10.4	13.4	21:25		18:30	20:30		Tibia=21.57 ~~A~~ A45 bag#6
	39	H. larvatus				M				58.0	.	.	16.2	.	16.3	21:30		18:30	20:30		A 41 bag#1
	40	R. stheno				M				43.9	.	11.6	17.1	.	7.7	21:31		18:30	20:30		NL=8.6 orange A 33 bag#

Notes: 47 Miniopterus

35 Rhinorophus affinis

15 R. stheno 83-85 KHz

only #28, 29 were collected from cave (hand net), all others were from 2 harp traps. — both around base of cliff

C = # bats released without measuring

Bat/Small Mammal Trapping Records

Locality: 1 ~~Km~~ Rak Kiat Cave

Date: Dec 18 ~~19~~ 2004

Operator:

Lat. 7 ° 04 '41 Long. 100 ° 15 '03 Habitat:

47 N 638111 0782065

Weather:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	41	Minlopterus				M				42.8	.	.	11.5	.	8.7	21:34		18:30	20:30		A 42 bag #9
	42	Miniopterus				M				44.5	.	.	.	.	8.7	21:36		18:30	20:30		A 43 bag #10
C	43	H. cineraceus				F				35.6 ~~34.6~~	43.3	23.8	15.3	5.2	4.1	21:40		18:30	20:30	152	NL=4.0 A36 A37 [illegible] bag #8
	44	H. cineraceus				M				35.6	.	.	.	.	4.5	21:57		18:30	20:30	152.4	NL=3.9 A35 A38 [illegible] bag #5
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Notes:

โครงการอนุรักษ์ธรรมชาติและสัตว์ป่า สวนป่าพระนามาภิไธยภาคใต้ พื้นที่ส่วนที่ 2 ,

Date 19 Dec. 2004 Lat/Long 6° 59.651' 100° 08.456'

Location ~~Borip~~ BORIBHAT 47 N. 0826951 0773260

	No.	Specie	sex	f.n.	lact	preg.	HB	FA	Ear	Tail
	SB 041219-01	Murina cyclotis	M					34.6	13.0	
	-02	R. affinis	F					48.9		
	-03	R. affinis	F	NN				48.1		
C	-04	Murina aenea	F				42.6	34.6	12.6 ~~17.0~~	35.0 ~~32.5~~
	-05	R. lepidus	M					39.4		
C	-06	Kerivoula hardwicki	F	NN			38.4	34.7	13.3 ~~16.7~~	41.2 ~~46.5~~
	-07	K. hardwicki	F	NN				33.2	12.3	40.4
	-08	K. minuta	F	NN				28.1	10.1	35.0
	-09	R. affinis	M					48.3		
	-10	Tylonycteris pachypus	M					24.4	7.2	19.9
	-11	R. lepidus	M					40.2		
	-12	Cynopterus brachyotis	F					60.8		
C	-13	Myotis	F				32.1	31.7	10.2	~~37.1~~ ~~31.1~~ 36.8
	-14	Miniopterus	F					43.1	9.3	
C	-15	Glischropus tylopus	F				39.8	30.9	11.1 ~~10.2~~	~~34~~ 38
	-16	Hesperoptenus blanfordi	F	NN				27.2	9.9	
	-17	Tylonycteris robustula	F					26.3		
	-18	Hesperoptenus blanfordii	M					37.6	12.2	
	-19	H. blanfordii	M					26.5	10.8	
	-20	Miniopterus medius	M					42.0	10.4	
	-21	Myotis	F					32.4	12.7	

เพื่อโลกสีเขียวของเรา เพื่อหงส์เผ่าของสัตว์ป่า

เพื่อต้นไม้ที่มีคุณค่า ดูแล ฮาลา-บาลา ให้ดี

โครงการอนุรักษ์ธรรมชาติและสัตว์ป่า สวนป่าพระนามาภิไธยภาคใต้ พื้นที่ส่วนที่ 2

No.	HF	Weight	proc. time	capture min. time	capture max. time	trap	frequency	Note	
-01		6.6	20:40	20:10		T1		T1 = Trap in forest (trail)	bag#56
-02		13.9	20:44	18:00	20:00	T1			bag#62
-03		12.2	20:46	18:00	20:00	T1			bag#71
-04		6.9	20:47	18:00	20:00	T1		very worn	bag#68
-05		6.6	20.51	18:00	20:00	T1			bag#2
-06	7.9	5.3	20:57	18:00	20:00	T1			bag#12
-07		5.5	21:01	18:00	20:00	T1			bag#5
-08		2.5	21:04	18:00	20:00	T1			bag#97
-09		12.8	21:07	18:00	20:00	T1			bag#42
-10		3.6	21:13	18:00	20:00	T1		very large testis	bag#98
-11		5.8	21:12	18:00	20:00	N			bag#40
-12		38.3	21:23	18:00	20:00	N			bag#16
-13	6.1 ~~6.8~~	2.8	21:27	18:00	20:00	N		Tibia = 13.2	bag#4
-14	8.0	7.2	21:27	18:00	20:00	N			bag#31
-15	6.5 ~~6.7~~	4.2	21:44	18:00	20:00	N			bag#37
-16		6.4	21:47	18:00	20:00	N			bag#10
-17		6.0	21:50	18:00	20:00	N			bag#27
-18		7.4	21.54	18:00	20:00	N			bag#9
-19		5.2	21.56	18:00	20:00	N			bag#96
-20	9.0	8.4	22.05	18:00	20:00	N			bag#22
-21	7.3	2.4 4.0	22.03	18:00	20:00	N		Tibia = 13.2	bag#89 bag = 14

รักษ์ป่า ฮาลา-บาลา รักษ์สัตว์ป่าทุกชีวิต

รักษ์ต้นไม้ทุกชนิด ภาระกิจของทุกคน

Date 3/05/06

Location เขาคอหงส์

No.	Species	Sex	Status	time	FA	E
1	Rhinolophus ~~lepidus~~ acuminatus	♀	lactating	19.30	45.7	15

Date 4/05/06

Location เขาคอหงส์

No.	Species	Sex	Status	time	FA	E
1	Rhinolophus trifoliatus	♀	lact.	20.00	53.97	23.03
2.	Rhinolophus acuminatus	♂			50.01	17.5
3.	Rhinolophus acuminatus	♂				
4.	R. acuminatus	♂				

Date 11/05/06

Location น้ำตกบริพัตร (Boriphat Waterfall

bag No. (Harp trap)		No. / Species	Sex	Status	FA	E
25	CMF-2006-013	1 Kerivula	♀	post-lactating	32.5	13.8
✓ 27	CMF-2006-032, CMF-2006-033	2 Rhinolophus lepidus BL1	♀	lactating	38.63	16.59
✓ 82	CMF-2006-028, CMF-2006-029	3 Kerivula hardwickii BL2	♀	post lactating	33.05	13.01
I	CMF-2006-012 4	4 Rhinolophus affinis	♂		49	23
31	(Mist net)	5 Myotis horsfieldi	♂	imm	36.6	10.5
✓ M14	(spec) CMF-2006-016 (wing), CMF-2006-017 (Liver)	6 Hipposideros bicolor BL3	♂		43.24 ~~43.3~~	19.41 ~~19.2~~
L4	CMF-2006-010	7 Rhinolophus affinis	♀	lactating	48.2	18
N	CMF-2006-007	8 Myotis horsfieldi	♀	adult	38.1	12.5
✓ Z99	spec. CMF-2006-024 (wing) CMF-2006-025 (Liver)	9 Miniopterus BL4	♀	lactating	41.42	8.35
92		10 Myotis horsfieldi	♀	lactating	37	10.5
✓ 22	spec. CMF-2006-034, CMF-2006-035	11 Hesperoptenus blanfordi BL5	♂		26.88	10.84

HB	T	HF	Weight	sebastiam		
56	21.2	10	29 − 16	93.6 kHz	K060503.1	(bag)
52.43	30.13	10.34	35 − 20 = 15 g.	file AUDIO 133, 134	PP060504.1	(hand)
53.01	25.39	10.08	17 g	AUDIO 135	PP060504.2	(bag)
				file AUDIO 132	(release)	

40.3			26.5 − 22 = 4.5	AUDIO 165		
37.23	18.63	6.18	4.5	AUDIO 173	104.1 kHz	Noseleaf 7.47
37.46	43.29	7.68	4.5	AUDIO 171,		
	24.5		65 − 49 =	AUDIO 161		
43.2	27.6	9.2	28 − 21 =			
49.99	25.95 ~~31~~	6.73	~~32 − 21~~ = 8.7	AUDIO ~~167~~ 167, ~~166~~ 168, 169	143.4 kHz room	
	21.7		34.5 − 19 =	AUDIO 163	70.4 kHz	
	37.1		27 20 =	AUDIO 159		
44.70	49.04	7.36	7.0	AUDIO 172		
	36.8		24 − 16 =	AUDIO 153, 154		
43.84	21.89	6.17	6.5	AUDIO 170		

lactating
Hipposideros lepidus 8 ตัว
affinis 6 ตัว
lactating + late preg
kerivoula r jud 1 ตัว
M. horsfieldii 2 ตัว

THINKTHING

Date 11/05/06

Location

No.		Species	Sex	Status	time	FA	₹
62	CMF-2006-008 (12)	Myotis horsfieldi	♂			36.8	10.9
P	CMF-2006-011 (13)	Myotis horsfieldi	♀	lactating		38.8	10.9
✓ F102	CMF-2006-030 / CMF-2006-031 (14)	Tylonycteris	BL6			25.89	10.65
S2	(15)	Myotis horsfieldi	♀	Emaciated		36.86	
	CMF-2006-014 (16)	Myotis horsfieldi	♂	adult		35.2	
100	CMF-2006-015 (17)	Rhinolophus affinis	♂	adult		49.2	
98	(18)	Myotis horsfieldi	♀	immature		36.37	-
✓ 85	spec. CMF 2006-026 / CMF 2006-027 (19)	Rhinolophus affinis	BL7 ♂	mature		50.74	21.54
20	CMF-2006-009 (20)	Miniopterus sp.	♀	immature		42.41	-
X1	CMF-2006-006 (21)	Hesperoptenus blanfordi	♀	mature		26.98	-
✓ F83	CMF-2006-027 (wing) spec CMF-2006-028 (wing) (22)	Penthetor lucasii	BL10 ♂	BL11 mature		58.22	14.94
✓ F98	spec CMF-2006-019, CMF-2006-020 (Liver) (23)	Hesperoptenus tomesi	♀	pregnant		49.29	14.91
2	CMF-2006-005 (24)	Hesperoptenus horsfieldi	♀	immature		26	

HB	T	HF	Weight	
			25.5 - 16.0 < 9.5	
	35.0		29.5 - 20.5	9.0 AUDIO 1;2
			17.5	
43.51	26.01	5.24	6.5	AUDIO 174
			28.5 - 21	7.5
			~~29~~ 7.3	Harp trap
			15.8	AUDIO 160 Harp trap
-	-	8.17	7	AUDIO 158
55.33	21.64	10.29	13.5	AUDIO 175
-	50.08	8.42	10	AUDIO 164
-	28.03	-	8.5	AUDIO 155, 156 BL8 BL9
88.57	7.88	2.89	32.0	CMF 2006-022, CMF-2006-023 (Liver)
76.70	51.18	11.43	32.1 ~~53.5~~ -	AUDIO 176
	23,91		6.5	AUDIO 157

[illegible] เป็น lowland evergreen forest ที่ structure เหมือน Melesian type บริเวณใกล้ๆ เป็น lake ที่เกิดจาก sink hole

12/05/06 6° 42.725′ N, 100° 10.158 E

อุทยานแห่งชาติทะเลบัน 4 traps; 6:30– 20.00 น.

no.	bag no.	specimen	species	sex	repro	weight
1.	62	CMF - 2006 - 046 (wing) ✓ BL12	Rhinolophus macrotis	♀	non-repro	6.0 / 6.5
2	5		Hipposideros bicolor.	♀	lactating	9.0
3.	56	✓ BL13	Hipposideros larvatus	♂		16.0 / 19.0.
4.	15		Kerivoula hardwickei (~~intermedia/minuta~~)	♀		5.0.
5.	24		Hipposideros bicolor (Hardwicke)	♂		8.0
6.	X1.		Hipposideros bicolor.	♀	non repro.	8.5.
7.	S2.		Hipposideros bicolor.	♂	mature.	8.5.
8	25		H. bicolor.	♂	mature	7.5
9.	20.	✓ BL14	Murina cyclotis	♂		5.5 / 7.0.
10.	98.		H. bicolor	♀	lactating.	9.0.
11	I		Hipposideros labortor	♂	mature	18.5
12.	96	✓ BL15	Rhinolophus robinsoni	♂	mature	8.6
13.	92.		Murina cyclotis	♀	lactating	9.0.
14.	M6.		Kerivoula (intermedia/Minuta)	♀	lactating	4.0.
15	89.	✓ BL16	Nycteris tragata	♂	mature.	11.5 / 13.5
16.	1		H. bicolor.	♂	mature.	8.0.
17.	40.		H. bicolor.	♀	lactating.	
18.	28		Rhinolophus lepilus.	♂	mature.	6.0.

*** Audio 185 ffb

~~Audio 186~~

** ปล่อย H. bicolor ♂ 3 ตัว ♀ 1 ตัว

K. hardwickei Post lact. 1 ตัว

H. Cineraceous ♂ 2 ♀ 1

FA	E	T	HF	calibration	note	time
42.56 42.2	20.40 18.6	25.28 24.1	7.52	audio 190	1060 - 1073 CMF-2006-047 (Liver) lip: = 9.4 HB 45.50 trap 2 [illegible]	8.40 pm
42.9	17.4	30.7		audio 181	CMF 2006 - 038 trap 2	
59.87 59.8	17.35 19.7	35.58 30.2	9.58	audio 192	CMF 2006 - 054 (wing) CMF 2006 - 055 (Liver) HB 66 trap 2	
33.0	12.7	41.6		audio 178	CMF 2006 - 032 trap 1 [illegible]	
41.5	17.5	28.2		audio 179	DSC 1008 - 1014 CMF 2006 - 036 trap 2 [illegible]	
42.9	17.1	30.1		audio 182	1015 - 1018 CMF 2006 - 040 trap 2	
42.5	18.4	22.4		audio 179	CMF 2006 - 037 trap 3	
40.6	17.3	26.5			CMF 2006 - 041 trap 4	
34.7	13.7	42.8	7.9	AUDIO 187	CMF - 2006 - 052 (wing) CMF - 2006 - 053 (Liver) HB 49.2 trap 4	
44.0	18.9	30.2		audio 180	CMF 2006 - 045 trap 4	
56.62	15.28	28.33	9.8	audio 184	1019 - 1024 CMF 2006 - 042 trap 4	
42.77 43.17	17.5	23.80	7.98	audio 189	CMF - 2006 - 051 (Liver) 1025 - 1033 CMF - 2006 - 050 (wing) HB 49.33 trap 4 ≈ 63 kHz	
37.4	12.7	44.4		audio 183	CMF 2006 - 043 trap 4	
32.6	12.5	32.0			CMF 2006 - 044 trap 4	
47.27 47.48	28.09 24.29	67.36 67.49	9.14	audio 191	1034 - 1059 CMF - 2006 - 049 CMF - 2006 - 048 (wing) HB ~~50.70~~ 54.89 trap 4	
44.0	16.9	26.5				”
42.3	18.3	28.2				”
38.6	14.6	15.0		Audio 186	1074 - 1087	”

note

13/05/06 น้ำตกไพรวัลย์ Guard Station [illegible]

7° 21.645 'N, 99 ' 57.696 E

no.	bag no.	specimen	species	sex	repro.	weight
Trap₁ M. 1	25		Hipposiros bicolour	F	Lact.	31 - 22 = 9
net₁ C. 2	M/C		Myotis horsfieldi?	M		30 - 22 = 8
Trap₁ M. 3	4		Rhinolophus stheno	F	Lact.	30 - 23 = 7
net 1. 4	M/C		Myotis horsfieldi	F	Lact.	30 - 20 = 10
net 1. 5	1		Cynopterus horsfieldi	F	[illegible] post-lact.	90 - 35 = 55
net 2 6	F98		Myotis horsfieldi	M		26 - 19.5

FA	E	T	HF	echo			
					AUDIO192		
44.1	17.4	28.7					
35.9	11.6	33.8	10	AUD192	tibia 17		058
43.1	15.1	22.1		freq 85	NL 7.9	CMF 2001 -	056
36.9	10.5	34.4		Aul 94			057
74.3	20.8	[illegible]					059
35.7	12.1	33.1	8.6				

* 2ตัว immature Cynopterus จาก mist net ของ chanl

1 ตัว

Aud195 - 198 , P [illegible]

1→ Trap B

14/05/06

No	bag #	specimen	Species	sex	status	weight
1	Trap B M11		Hipposideros bicolor	♀	Lac.	8.5
2	Trap B 89		Hipposideros Lavatus	♀		20.2
3	Trap B 100		Macroglossus	♂		29.6
4	Trap B 31		Macroglossus	♀	Lac.	20.0
5	trap B 1		Hipposideros bicolor	♂		9.7
6	net B 28		ลังกา E. speleaea	♀	pregnant	
7	Trap B 4		Cynopterus	♀	immature	36.0
8	net B 25		Macroglossus	♂		
9	net B M2		Rhinolophus triforiatus	♂		14.4
10	27		R. lepidus	♀	pregnant	6.5
11	net B 2		H. bicolor	♀	pregnant	

Temp B 4
Act B 35
Wet B 28

FA	E	T	HF	Echo		
49.39	17.12	21.3	5.72	AUDIO 209	CMF - 2006 - 064	
60.60	18.09	32.90		AUDIO 204	CMF - 2006 - 062	
45.68	14.64				CMF - 2006 - 060	1414 - 1419
45.63	14.57				CMF - 2006 - 061	1878 - 1883
42.07	17.29	26.60		release AUDIO 203	CMF - 2006 - 063	
70.45	14.03	11.34			CMF - 2006 - 065	1361 - 1374
65.15	17.14	8.84		release	CMF - 2006 - 067	1375 - 137?
49.37	23.98	28.73	13.26	bag, release AUDIO 200, 205	CMF - 2006 - 066	1420 - 1428 200 bag, release
40.56	14.81	20.89	7.14	AUDIO 201,	CMF - 2006 - 068	201 bag,

16/05/06 ป่าเบญจพรรณผสมสัก และประกอบด้วยทุ่งหญ้าขนาดใหญ่ ที่ตั้ง trap : trap ริมห้วย ที่ระดับ [illegible] และอยู่ใกล้ลำห้วย ล้อมรอบด้วยพุ่มหญ้า และป่าร่ม ; trap กลางดง : เป็น trap ที่อยู่ริมท่อ [illegible] เป็น [illegible] ตรงนั้น ~~[illegible]~~ ถัดจากลำห้วย

Location ทุ่งแสลงหลวง (หนองแม่นา) 16°34.283', 100°52.583' ± 730 m.

No	bag #	Specimen	Species	Sex	Status	Weight
Trap 1 ใกล้ลำธาร ①	2		Cynopterus sphinx	♀	pregnant	56.1
Trap ริมห้วย ②	N	✓	Coelops	♀	lactating	5
Net ริมห้วย ③	32	✓	Megarops niphanae	♂		27.1
④ trap กลางดง	M3	✓	Rhinolophus sthena	♂	7.72, Noseleaf	9
Trap ริมห้วย ⑤	Z4		Kerivoula	♀		6
⑥ กลางดง	L25	✓	Rhinolophus marshali	♀	lactating	7.5
Trap ริมห้วย ⑦	F98		Tylonycteris robustula	♂		5.5
Trap ริมห้วย ⑧	F83	✓	Tylonycteris robustula	♂		5.3
Trap กลางดง ⑨	58	✓	Rhinolophus affinis	♀	Non-reproductive	13
Trap ริมห้วย ⑩	ABI	✓	Kerivoula hardwikii	♀	lactating	4.2
Trap ริมห้วย ⑪	1	✓	Hipposideros pomona	♀	lactating	6.5

release 1 Juvenile Ke

H. pomona : Internarial septum swollen a bulbous from base of internarial septum, large ear, laid forward cover muzzle : dorsal pelage chocolate brown at tip, light brown at base till middle, posterior noseleaf slightly larger than anterior noseleaf, ventral surface tawny brown

K. hardwickei : Dorsal pelage : ~~dark~~ dark brown base, light brown middle, brown tip, ventral : slightly buffy brown at tip, base

4 traps, 3 mist (ณ) (6:30-10.00น.)

trap ใกล้ลำธาร : trap ทั้ง 3 ระหว่างต้นไม้ใหญ่ อยู่ในทางเดิน ด้านข้างมีก้อนหินทับ อยู่ก่อนถึงลำธาร

FA	E	T	HF	HB	Echo	time	DNA	
70.46	18.94	15.70	15.03			20.00	F1/1	CMF-2006-070
36.24	13.36	–	8.33	33.98	Audio 213	21.30น.	VC1/4 VCL1/4 F1/2	CMF-2006-082 (Liver CMF-2006-071 (Wi
56.6	17.3	-	13.41	85.91		20.00น.	VC1/6 VCL1/6	CMF-2006-084 (Liver CMF-2006-073 (Wi
43.11	14.96	18.35	13.25	47.08	NF 7.88 (107.7) Audio214	9:30	VC1/3 VCL1/3 KP1/1(WP)	CMF-2006-081 (Liver) CMF-2006-072 (Wi
32.3	17.15	35.7	6.75			6:30		CMF-2006-075
45.79	24.94	18.73	9.07	46.87	Audio 216	2:30	VC1/5 VCL1/5 Noseleaf 9.07	CMF-2006-083 (Liv CMF-2006-074 (Wi
27.97	9.88	21.04			AUDIO 212	6:30		CMF-2006-078
26.5	11.26	30.6	7.23	39.99	Audio 215	6:30	VC1/8, VCL1/8	CMF-2006-077
48.42	19.43	22.73	14.03	54.24	Audio 216, 217	20:30	VC1/7 VCL1/7 Noseleaf 9.33	CMF-2006-085 CMF-2006-076
32.82	10.76	37.21	6.59	36.80	Audio 218	เช้า	VCL1/2 VC1/2	CMF-2006-[illegible] CMF-2006-080
40.99	20.89 ~~19.36~~	30.45	9.44	46.88	Audio 219 (135.2)	เช้า	Noseleaf 5.09 VCL1/1 VC1/1	CMF-2006-[illegible] CMF-2006-079

7.

16° 34.283′ N, 100° 52.583′ E Alt. 730

(ใกล้กับ mist net)

ตั้ง Trap 3 trap ใกล้ที่ทำการ เป็นชายป่า ลักษณะ[illegible] เป็น[illegible] ที่ประกอบด้วย
[illegible] เป็นป่าเบญจพรรณ[illegible] ในที่ราบ [illegible] และหมู่บ้าน

17/05/06 ตั้งตาข่ายหรือ 19:30 [illegible] ที่ trap.

Location เขตรักษาพันธุ์สัตว์ป่า ภูเมี่ยง-ภูทอง 17° 18.919' N, 100° 38.81[illegible]' Alt. 200m.

No	bag #	Specimen	Species	Sex	Status	weight
1	001	✓	Hipposideros lavatus	♂		19
2	28		Hipposideros lavatus	♂		21.7
3	100		Hipposideros lavatus	♂		21.1
4	89	✓	Rhinolophus malayanus	♂		6.5

trap 4 trap, ตาข่าย 2 ; 7.00-9.00 น. [illegible] harp trap [illegible] สภาพป่าทั้งหมดเป็นป่าเบญจพรรณ [illegible]
[illegible]
[illegible] 17° 30.323' N, 100° 56.517' E, ± 990 m

18/05/06

Location Na-Haew NP อุทยานแห่งชาติภูสวนทราย HQ = 17° 30.357, 100° 56.295, ±975m.

NO	bag	specimen	species	sex	status	weight
~~M12~~ 1	M12		Rhinolophus pearsonii	♀		17.1
✓ 2	001	✓	Rhinolophus	♂		15.8
3	J		Miniopterus magnater	♂		15.4
4	89		Miniopterus	♂		15.2
5	42		Hipposideros armiger	♀	lact.	68
✓ 6.	ABI	✓	Miniopterus	♂		16.5
7	L25		Miniopterus	♂		16.4
8	54		Miniopterus	♂		17.2
✓ 9	I	✓	Miniopterus	♂		15.9
10	31		Miniopterus	♂		18.9
11	MU1		Hipposideros armiger	♀	non-reproductive	68
ตอนเช้า ✓ 12	5	✓	Rhinolophus affinis	♂		15.4
13	54		Hipposiderus armiger	♀		59.00
✓ 14	M3	✓	Hipposiderus lavatus	♀	non-reproductive	21.5
✓ 15	62	✓	Rhinolophus affinis	♂		15.05

[illegible] ♂ 1 ♀ 2

FA	E	T	HF	HB	Echo	Time	
63.67	18.20	34.45	10.54	65.38	Audio 227, 228 97.5 kHz	CMF-2006-094 CMF-2006-090	VC 2/2 VCL 2/2 NF 6.83
58.9	18.76	30.47	10.57		AD 222, 223, 224 92.5 kHz	CMF-2006-091	NF 6.7
60.67	17.74	32.51	11.10		94.8 kHz 93 kHz [illegible] 226	CMF-2006-089	NF 7.57
40.68	16.64	21.14	7.59	46.19	AUDIO 220, 221 78.6 kHz	[illegible] VCL 2/1 CMF-2006-092	VC 2/1, KP 2/1

FA	E	T	HF	HB	Echo	Time		
51.67	21.57	19.83			AD 229	CMF-2006-095	NF 10.29	
50.75	23.20	27.57	9.93	56.61	AD 238	CMF-2006-110 (Live) CMF-2006-104	VCL 3/1 VC 3/1	1707-1717 [illegible]
48.24	10.96	53.19			AD 234	CMF-2006-096		
50.10	11.54	61.08	8.32		AD 233	CMF-2006-097		
20.46	28.1	52.07			AD 232	CMF-2006-098		(net)
50.70 50.88	9.06	62.31	8.81		AD 237	CMF-2006-112 (Live) CMF-2006-105	VCL 3/2 VC 3/2	1732-1741 32 36-1
49.09	10.51	52.81			AD 231	CMF-2006-099		
49.09	12.79	51.84			AD 230	CMF-2006-100		
51.14	8.97	64.15	9.9		AD 239	CMF-2006-111 (Live) CMF-2006-103	VCL 3/5 VC 3/5	
43.52	12.20	55.8			AD 235	CMF-2006-102		
91.90	29.30	49.23			AD 236	CMF-2006-101		1718-1731 18-22-1
53.26	13.91	30.75	11.49		AD 2401	CMF-2006-114 CMF-2006-106	VCL 3/3 VC 3/3	
94.22	28.51	64.71	14.73			CMF-2006-107		
67.5	14.38	36.53	9.7		AD 242	CMF-2006-108	VC 3/4	
50.14	16.87	26.92	8.98		AD 240	CMF-2006-113 (Live) CMF-2006-109	VCL 3/6 VC 3/6	

พิกัดกลางคืน : 17° 33.574 N, 101° 00.03' E

19/05/2006 Location :

	No	bag	specimen	species	sex	status	weight
	1	F83		Hipposideros larvatus	♀	lactating	20.4
✓	2	M6		Rhinolophus (lepidus) pusillus	♂		5.0
✓	3	96		Murina sp.	♀		5.1
✓	4	S2		Kerivoula hardwickii	♀	lactating	4.0
✓	5	Z4		Hipposideros larvatus	♂		21.5
	6	40		Hipposideros larvatus	♂		21.5
✓	7	M15		Hipposideros larvatus	♂		22.0
✓	8	25		Hipposideros pomona	♂		6.5
เช้า	9	F7		Hipposideros larvatus	♂		20.5
*	10	F82		Hipposideros larvatus	♂		20.5
	11	22		Hipposideros larvatus	♂		21.5
*	12	M12		Hipposideros larvatus	♂		21.0
	13	100		Hipposideros larvatus	♂		21.5
	14	44		Hipposideros larvatus	♂		22.0
	15	98		Hipposideros larvatus	♂		22.5
	16	S4		Hipposideros larvatus	♂		23.0
	17	89		Hipposideros larvatus	♂		21.5

NF = Noseleaf

FA	E	T	NF	HF	HB	Echo	Time	
62.5	21.2	38	8.3			AD 251, 243	CMF-2006-116	
						(Liver)	CMF-2006-136	VCL4/3
37.02	14.36	18.94		7.09	35.24	AD 244	CMF-2006-117	VC4/3
						(Bag) (Fly) (Liver)	CMF-2006-138	VCL 4/6
34.66	12.52	32.44		6.95	41.56	AD 262, 263	CMF-2006-139	VC 4/6
						(Liver)	CMF-2006-137	VCL4/1
33.00	10.85	41.33		3.81	35.85	AD 246	CMF-2006-118	VC4/1
						(Liver)	CMF-2006-134	VCL 4/5
62.93	20.75	32.53	7.2	10.54	65.14	AD 249	CMF-2006-119	VC4/5
59.7	16.8	29.33				AD 250	CMF-2006-120.	
							CMF-2006-133 (Liver)	VCL4/4
63.2	21.2	32.9	7.13	10.13	66.54	AD 247	CMF-2006-121	VC4/4
						(Liver)	CMF-2006-135	VCL 4/2
42.32	20.14	26.74	5.88	7.79	48.97	AD 248	CMF-2006-122	VC4/2
						AD 260 (bag)		
62	18.8	31.5				AD 261	CMF-2006-124	
60.23	17.25	31.49				AD 256	CMF-2006-127	
						AD 258 (bag)		
63.36	17.04	33.49				AD 259	CMF-2006-125	
59.2	20.5	32.3				AD 257	CMF-2006-126	
62.8	20.8	32.8	6.8			AD252	CMF-2006-132	
60.94	17.4	30.48				AD 255	CMF-2006-128	
61.6	21.1	31.1				AD 253	CMF-2006-131	
61.9	20.2	33.4	7.6				CMF-2006-129	
62.18	17.92	30.01				AD 254	CMF-2006-130	

No1 ขนาดเดียวกับ pipistrellus ขนาดกลาง ตัวเมีย. (species เดียวกับเบอร์ N

p = Photo

FA	E	T	NF	HF	HB	Echo	
52.91	16.91	-	-	12.77	76.77		VC 5/2 , VCL5/2. CMF-2006-142 , 164(Liver)
56.75	18.0	-	-	14.30	-		
43.92	18.38	26.78 23.92	-	11.56 10.51	58.22	AD 273	VC 5/1 , VCL 5/1 CMF-2006-141 , 156 (Liver)
30.21	8.15	31.02 28.85	-	5.26 4.59	38.07	AD 279	VC 5/3 , VCL 5/3 CMF-2006-143 , 166 (Liver)
35.97	9.74	36.37	-	5.80	40.11	AD 275	VC 5/5 , VCL 5/5 CMF-2006-145 , 172 (Liver)
41.15	15.49	24.81 19.46	-	7.44 6.92	45.22	AD276	VC 5/4 , VCL 5/4 CMF-2006-144 , 155 (Liver)
31.64	12.68	34.46	-	6.98	44.05	AD271, 274	VC 5/6 , VCL 5/6 CMF-2006-146 , 173 (Liver)
31.98	13.33	39.01 36.88	-	8.18 6.86	46.36	AD 277	VC 5/7 , VCL5/7 CMF-2006 147 , 157 (Liver)
41.63	15.66	25.49 26.24		7.94 7.45	48.11	AD 282	VC 5/9 , VCL 5/9 CMF-2006-149 , 159 (Liver)
42.59	15.74	21.12 24.48		7.44 7.49	48.47	AD 281	VC 5/8 , VCL 5/8 CMF-2006-148 , 154 (Liver)
28.34	8.18	28.74 29.94		5.03	43.84	AD280 (ไม่มี)	VC 5/14 , VCL 5/14. CMF-2006-165 , 167 (Liver)
40.25	19.61	29.84 28.84		6.90 7.23	45.83	AD 285	VC 5/12 , VCL 5/12 CMF-2006-153 , 161 (Liver)
49.93	20.29	21.99		9.53		AD 284	CMF-2006-152
50.20	16.99	26.29		11.05	-	AD 283	VC 5/10 CMF-2006-150
30.77	12.06	32.04		4.05	41.66	AD272	VC 5/13 , VCL 5/13. CMF-2006-162 , 163 (Liver)
73.55	18.07	9.60		15.54			CMF-2006-151
26.94	11.97	27.25		5.57	45.24		VC 5/11 , VCL 5/11 CMF-2006-158 , 160 (Liver)
36.99	11.92	39.99		6.02	49.99	F 2121-2129 AD 270	VC 5/16 , VCL 5/16 CMF-2006-169 , 171
37.46	13.08	39.23		5.87	45.48	P. 2130-2149 AD 278	VC 5/15 , VCL 5/15 CMF-2006-168 , 170
33.31 ~~[illegible]~~	10.38	34.54 ~~36.29~~		6.64	39.78 ~~43.23~~	AD 269.	VC 5/17 , VCL 5/17 CMF-2006-174 , 175
41.58	12.99	59.11		8.86	48.22		VC 5/18 , ~~[illegible]~~

THINKTHING

CMF : 1 trap, 4 net (14, 12x3) monofilament over reservoir front of waterfall : 17°28.492' 100° 58.539'E, ±620 m asl
SB • 3 traps, 3 (6m) net : 17°30.353, 100°56.904'E, ±1200 m. asl

20/05/2006 Location : Na - Haew Nation Park

	No	bag	specimen	species (ค้างคาวดอง)	sex	status	weight
	1	SB 89	✓	Sphaerias blanfordi	♂		26.9
ปล่อย.	2	SB 31		Sphaerias blanfordi	♀	lact.	-
	3	SB 44	✓	Rhinolophus affinis	♂		14.2
	4	SB M15	✓	Murina tubinaris	♀		4.8
	5	SB 25	✓	Murina tubinaris	♀		5.4
	6	CMF 5	✓	Rhinolophus pusillus	♀		7.2
	7	SB 27	✓	Murina cycotis	♂		6.1
	8	SB 62	✓	Murina cycotis	♂		5.8
	9	SB M12	✓	Rhinolophus pusillus	♂		7.6
	10	SB 001	✓	Rhinolophus pusillus	♂		6.9
	11	CMF 56	✓	Tylonycteris robustula	♂		6.1
	12	CMF M16	✓	Hipposideros pomona	♂		6.8
	13	CMF 4		Rhinolophus pearsonii	♂		14.2
ปล่อย.	14	SB L4		Rhinolophus affinis	♂		14.6
	15	CMF N (เชือกฟ้า)	✓	Pipistrellus			4.5
ปล่อย	16	CMF M1		Cynopterus sphinx	♀	lactating	45.6
	17	CMF 85.	✓	Tylonycteris	♀		5.7
	18	CMF - (เชือกเขียว)	✓	Pipistrellus	♂		~~5.5~~
	19	CMF L16	✓	Eudiscopus	♂		5.0
	20	SB - (ไม่มีเบอร์ ถุงเล็กๆ	✓	~~Murina~~ Pipistrellus	♀		5.4
	21			Kerivoula sp.	♂		6.3

Murina cyclotis ↔ tubinaris

pae_ruth@yahoo.com / hotmail.com 042-919 390

Bat/Small Mammal Trapping Records Date: 19 May 18 2005 Operator: S. Bunrungrit and BAT training Group

Locality: ___ / Khao Ang Rue Nai WS. Lat. ___° ___' Long. ___° ___' Habitat: _____

Weather: Lumchangwai Guard Station

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	050519-01	Hipposideros larvatus			sad	♀				55.5	.	34.4	20.0	.	16.0	:	T1	19:20	20-23:00		Acho. file 048 bag#11
	050519-02	Hipposideros larvatus			ad	♂				53.9	.	33.3	19.6	.	16.0	:	T1	18:50	20-23:00		large testis bag#7
	050519-03	Hipposideros larvatus			ad	♂				56.5	.	31.2	18.4	.	15.0	:	T1	19:00	20-23:00		bag#4
	050519-04	Rhinolophus shameli			ad	♂				44.4	.	20.5	16.4	.	8.5	:	T1	19:50	20-23:00		Acho. file 050 bag#12
	050519-05	Rhinolophus shameli			ad	♀				44.1	.	21.6	19.6	.	9.0	:	T1	19:32	20-23:00		Acho. file 049 bag#11
	050519-06	Hipposideros larvatus			ad	♂				54.3	.	32.7	18.8	.	15.0	:	T1	19:15	20-23:00		bag#6
	050519-07	Cynopterus sphinx			ju					63.8	.	.	20.3	.	31.5	:	T1	19:53	20-23:00		bag#2
	050519-08	Hipposideros larvatus			ad	♀				57.8	.	30.1	9.1	.	15.0	:	T1	19:00	20-23:00		bag#1
	050519-09	Miniopterus medius			ad	♂				42.85	.	48.1	12.35	.	9.2	:	T1	19:30	20-23:00		Acho. file 052 bag#5
	050519-10	Hipposideros galeritus			ju	♀				48.1	.	39.9	14.25	.	8.0	:	T1	19:35	20-23:00		bag#3
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Notes: _____

Bat/Small Mammal Trapping Records

Date: 20 May 19 2005 Operator:

Locality: / Lum-Chang-Wat Lat. 13 ° 21 02.8 Long. 101 ° 43 242 Habitat:

Weather: very cloudy /.

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Max	Echolocation Frequency	Additional Information
	050520-15	H. larvatus			Mat	M				53.9	.	34.0	18.8	.	16.0	19:25	T1	19:14	:		33-17 g [illegible]
	16	H. larvatus			Mat	M				55.0	.	39.0	17.9	.	17.5	20:08	T1	19:09	:		29-11.5 No.100
	17	R. malayanus			Mat	F		Y		[illegible]	.	24.0	18.2	.	[illegible]	[illegible]	T1	19:23	:		21.5-11.5 [illegible]
	18	R. malayanus			Mat	F		Y		40.0	.	20.0	15.0	.	6.7	19:52	T1	19:42	:		[illegible] 9.7, 25.5-18.75 No 36
	19	H. larvatus			Mat	F				[illegible]	.	32.0	17.0	.	17.5	20:[illegible]	T1	[illegible]	:		38.5-21.0 No.1[illegible]
	20	R. macrotis → [illegible]			Mat	F		Y		[illegible]	.	20.8	20.4	.	10.0	:	T2	:	:		File 056 31.5-21.5 No.[illegible]
	21	R. acuminatus			Im.	M				47.9	.	24.2	16.4	.	16.0	:	T2	:	:		32.0=16.0 No.[illegible]
	22	R. malayanus			Mat	F		Y		41.5	.	22.1	15.8	.	6.5	:	T2	:	:		file 58 27.5-21.0 No.5
	23	R. shameli			Mat	F		Y		47.7	.	21.6	17.2	.	9.9	:	T2	:	:		30.5-21.5 No.[illegible]
	24	R. Shameli			Mat	F		Y		46.0	.	19.6	16.0	.	10.0	:	T2	:	:		File 060, 061 30.0-20.0 No.[illegible]
	25	R. shameli			Mat	M				45.9	.	[illegible]	16.3	.	10.0	:	T2	:	:		27.5-17.5 No.1
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	100 [illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]						.		.	:		:	:		
	050521 01	R. acuminatus			Im	M				42.9	.	24.4	18.9	.	15.8	21:00	T2	19:31	:	89.9 File 066	Im [illegible] Mat 35.8-20.5, No.3
	02	H. larvatus			Mat	M				63.0	..	33.5	18.2	.	14.5	21:30	T1	20:09	:	90.9 File; 065	* [illegible] 45.0-20.5, No

Notes: [illegible]

T1 = harp trap in [illegible] + junction/intervention [illegible] Tubkrabok Guard station

21/5/47 / [illegible] 13°25'26 N 101°58'14 E, [illegible] [illegible]

Bat/Small Mammal Trapping Records Date: 26/05/25 19____ Operator: _____

Locality: ___ / _____ Lat.____°___' Long.____°___' Habitat: _____

Weather: _____

Status	Specimen Number (Filetag)	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	1	H. Lavatus	72			♂				55.5	.	34.2	19.9	.	15.3	:		:	:		39.8 -945 = 15.3
*	2	R. macrotis	97	053		♀				40.34 39.5	.	17.8	17.0	.	6.6	:		:	:	NL=4.7	28.8 - 16.2 = 6.6 lacta
	3	R. malayanus	55	055		♀				41.	.	19.7	16.6	.	8.3	:		:	:		23.3 - 17 = 6.3
	4	R. shameli	36			♀				44.	.	18.5	24.2	.	10.	:		:	:		30.4 - 20.4 = 10
	5	H. L	74	057		♀				55.7	.	33.4	20.14	.	.	:		:	:		47.5 41.5 - 25 = 16.5
	6	R.H. Lavatus	72	054		♀				54.78	.	35.	16.	.	.	:		:	:		33 - 18 = 15
	7	R. shameli	1			♀				41.6 40	.	20.55	20.75	.	.	:		:	:		22.5 - 12.5 = 10
	8	H. Lavatus	2			♀				39.5	.	31.9	18.4	.	.	:		:	:		27 25 - 10 = 17
	9	R. malayanus	3	059		♀				43 43.65	.	16.2	17.9	.	.	:		:	:		21 - 12 = 9
	10	R. malayanus	4			♂				38.1 36.5	.	20.4	16.	.	.	:		:	:		15 - 13 = 2
	11	R. Shameli	31			♂				45.95	.	20.	17.0	.	.	:		:	:		30.9 - 21 9.5
	12	R. sthero	50	062	adult	♀				43.1 41.42	.	19.3 19.69	13.9 20.29	.	.	:		:	:		29.5 - 21 = 8.5
	13	R. macrotis				♀ bad				40.78	.	18.60	19.48	tibia 19.14	.	:		:	:	NL. 8.03	29 - 20.8 = #40 70.8 kHz
	14	R. macrotis				♀ lact				40.07	.	18.54	19.40	.	.	:		:	:	NL. 8.66	36.5 - 20.9 = #N.11 F:b.64
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Notes: _____

Bat/Small Mammal Trapping Records Date: ~~11~~ May ~~18~~ 2005 Operator: อ.สำร. [illegible]

Locality: / ตำแหน่งรระ ~~[illegible]~~ (ลอง กล่องภูไหล) Lat. ~~18~~ 13 ° 79 ' 91.0 Long. 102 ° 05 ' 51.5 Habitat: [illegible]

Weather: [illegible]

Status	Specimen Number	Species	#	NL Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
	*	ค้างคาวปีกพับ Miniopterus	37		ad? m	♀			/	40.1	.	11.0	9.4 ~~10.~~	.	.	18:43		:	:		28.5 - 20.3 = 8.2
		ค้างคาวมงกุฎ ปลอม	40 ~~50~~		m	♂				45.8	.	18.7	19.9 ~~21.6~~	.	.	18:47		:	:		27.5 - 20 = 7.5
		[illegible]	11		m	♂				65.7	.	25.5	18.0	.	.	18:48		:	:	File 067	[illegible] 48.1 - 20. ~~[illegible]~~ = 28
		H. armiger	20		m	♀				~~72~~/5	.	53.65	32.5	.	.	18 57 ~~18:52~~		:	:		* 70.0 - 19.5 = 50.5
		[illegible]	50		m	♀		✓		35.1	.	30.7	13.7	.	.	19:08		:	:	File 076	28.5 - 20 = 8.5
		R. malayanus	[illegible]		-	~~[illegible]~~				41.4	.	14.11	13.7	.	.	19:01		:	:		17.5 - 11.5 = 6.0
		[illegible]	89		m	♀ -				65.2	.	~~[illegible]~~	13.12 ~~[illegible]~~	.	.	19:02		:	:		50 - ~~[illegible]~~ = ~~[illegible]~~ 28
		[illegible]	104		m	♀		✓		88.6 ~~36.5~~	.	53.2 ~~9.9~~	~~[illegible]~~	.	.	19:05		:	:	file 075	50.2 - 16 = 34.2
		[illegible]	20		Im ~~[illegible]~~	♂				42.1	.	31.8	54.1	.	.	-:		:	:	File ~~[illegible]~~	52 - 19 = 32
		[illegible]	74		m	♂				64.73	.	21.1	15.3	.	.	-:		:	:	File 078	54 - 24 = 30
		[illegible]	38	13.63	m	♀		✓		79.19	.	56.08	27.5.9	.	.	-:		:	:	File 077	63.5 - 24 = 39.5
		File 080; M5								.	.	.	.	.	.	:		:	:	~~074~~	
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Notes:

Bat/Small Mammal Trapping Records

Date: ______ 19____ Operator: ______

Locality: __ / ______ Lat. 13 ° 39 29.4 Long. 102 ° 05 ' 080 Habitat: ______

Weather: ______

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
C	* 14	Pipistrellus [Thai]	14		adult	♂				34.44 34.9	42.4 43.0	28.58 29.1	10.27 [illegible]	5.44 5.0	.	:		16:30	17	-21	~~[illegible]~~
.	97	Myotis [illegible]	97	074	adult	♀				39.4	50.	31.9	13.	7.0	11.	:		18:34	:		27 - 16 = 11 [Thai]
.	15	H. lavatus	15		adult	♂				64.2 [illegible]	.	31.0	14.4	.	19.	:		19:04	:		40.0 - 21 = 19
	7	H. lavatus	7		im	♂				64.9	.	31.5	16.6	.	21.2	:		18:34	:		~~43~~ 41.2 - 20 = 21.2
.	39	H. lavatus	31		adult	♀				64.7	.	31.4	18.2	.	19.	:		18:31	:		39 - 20 = 19
.	10	H. lavatus	10		adult	♀	≠			64.9	.	34.5	12.7	.	24.5	:		18:34	:		44.5 - 20 = 24.5
	107	[Thai]	107		adv	♀				96.5	.	59.5	24.6	.	60.5	:		11:30	17:35		78 - 17.5 = 60.5
.	32	H. lavatus	32		adult	♀	✓			~~37.5~~ 36	.	~~[illegible]~~	17.0	37.5	13.5	:		:	:		43.5 - 20 = 13.5
.	m7	H. lavatus	m7		adult	♂				64.5	.	30.1	20.7	.	22.5	:		18:40	:		42 - 19.5 = 22.5
.	m12	R. shameli			adult	♀		✓		45.2	.	34.0	19.3	.	21.	:		14:30	:		30.5 - 21
	.		31							~~64.5~~	.	~~17.?~~	.	.	.	:		~~[illegible]~~	:		~~40 - 21~~
	m15	H. lavatus			adult	♀				65.0	.	39.5	20.5	.	21.5	:		18:55	:		42.5 - 21 = 21.5
.	10	H. lavatus			adult					68.7	.	31.6	[illegible]	.	20.	:		18:57	:		41 - 21 = 20
	5	Myotis ~~[illegible]~~				♂				35.1	~~45~~	24.6	12.4	9.5	8.5	:		19:00	:		24 - 19.5 = 8.5
	26.	[Thai]			im	♂				99.4	.	40.0	29.1	.	25.	:		19:03	:		51.5 - 16.5 = 25 .
	m2	[Thai]			adult	♀		✓		97.9	.	50.1	23.5	.	36.	:		19:05	:		66 - 30 = 36
.	16	[Thai]		070	adult	♂				86.5	.	57.4	23.1	.	60.8	:		19:03	:		81.4 - 21 = 60.8
	6 .	Myotis [Thai]		073 072		♀				47.9	47.	37.3	14.5	9.9	11.	:		:	:		31 - 20 = 11
.	4	[Thai]		064	[illegible]	♀		✓		[illegible]	.	41.3	24.4	.	25.	:		:	:		55 - 20 = 25
	32	[Thai]		069	adult	♀	✓			81.6	.	53.0	26.3	.	25.	:		:	:		55 - 20 = 25

Notes: ______

Bat/Small Mammal Trapping Records

Date: ______________ 19____ Operator: ______________________

Locality: ___ / ____________________ Lat. ____ ° ___ ′ Long. _____ ° ___ ′ Habitat: ______________________

Weather: ____

Status	Specimen Number	~~[illegible]~~ Species hasseltii	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
C	*127	*My. horsfieldii [illegible]		[illegible]	[illegible]	♂				37.15 36.9	49.1	[illegible]	17.7	10.5 ~~35.5~~	.	:		:	:		26 − 17.5 = 8.5
	4									.	.	.	.	~~[illegible]~~	.	:		:	:		21
	7	H. [illegible]			adult	♂				36.7	52.9	38.1	11.9	7.9	10.	:		:	:	32-49	[illegible] 19.5 [illegible] = 3.6 min
	14	~~javanicus~~			~~adult~~	♂				33.8	45.3	33.2	8.8	.	5.5	:		:	:		26 − 20.5 = 5.5 [illegible] 16.7
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Notes: ____

Bat/Small Mammal Trapping Records

Locality: ___ / เขตรักษาพันธุ์สัตว์ป่าเขาอ่างฤาไน

Weather:

Date: 23/05/2005 19__

Lat. 13 ° 24 ' 57.5 Long. 101 ° 55 ' 46.4 Habitat: ป่าดิบแล้ง → ซับคุณ . Flat Area (กลาง ทาง)

Operator:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
		R. acuminatus	42		m	♂				47.9	.	25.6	12.4	.	15.7	19:12		:	:	File 090	38 - 22.3 = 15.7
		R. acuminatus	74		m	♂				48.3	.	28.3	15.5	.	16.5	19:19		:	:	File 091	41.5 - 25 = 16.5
C	* SB050523-03	myotis	104		m	♂				36.42 35.4	41.76 .	34.31 40.5	11.10 10.4	5.82 .	16.5	20:10		:	:	File 0	31 - 25.5 = 6.5 tibia 14.30
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Notes:

Bat/Small Mammal Trapping Records

Date: 23 May 19 2005 Operator: [illegible]

Locality: ___ / [illegible] Lat. 13 ° 25 ' 20 Long. 101 ° 50 ' 21 Habitat: ป่าดิบแล้งที่ถูกรบกวน → 2° forest อยู่ริมถนน (ห่างจากถนน 200-300 ม.)

Weather:

Status	Specimen Number	Species	#	Code	Age	Sex	f.n.	Lact?	Preg?	FA	HB	Tail	Ear	HF	Weight	Time Proc.	Trap or Net #	Time Caught Min	Time Caught Max	Echolocation Frequency	Additional Information
		Rhinolophus shameli			A	F	(1/3) ✓	✓		46.6		20.1	16.9		11 5	21:17		21:15			32.5 – 21.0 M 14
		R. acuminatus ♀			I	F				44.7		21.1	17.5		8 5	21:20		21:20		78 (75-80)	29.5 – 21.0 (ไม่มีกล้าม) M 16
		R. shameli			A	F		✓		45.3		20.2	17.0			21:45		21:32			30.0 – 20.5 " 42
										--											
		R. affinis / R. megaphyllus ♀																		file 092	คลื่นเสียง 76, 75-80 kHz
																				↓ 79 kHz	wing attach at ankle
																					sella not parallel, wider at base, seem concave at mi
																					1 lateral supplementary leaflet
																					lancet generally short
																					ของ connecting process [illegible]

Notes:

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A review of bat research in Thailand with eight new species records for the country

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A review of the literature relating to the history of bat research in Thailand (1821–2006) is included, together with lists of the 119 bat species currently recorded from the country and the 16 that are omitted for lack of supporting data. The geographical distribution within Thailand of the some of the more significant bat field studies (1896–2004) is mapped and briefly discussed. Based on field work conducted in peninsular Thailand in 1993 and 2003–2004, eight bat species (*Hipposideros ridleyi*, *Myotis hermani*, *Pipistrellus stenopterus*, *Hesperoptenus tomesi*, *Murina suilla*, *Murina aenea*, *Kerivoula pellucida*, and *Mops mops*) are recorded from the country for the first time; information is provided on their taxonomy, distribution, and ecology. Recommendations are made for further bat studies in Thailand, with emphasis placed on selecting less well known species groups, such as forest bats, in under-researched habitats in neglected geographical areas (for example, the deciduous dipterocarp forests of eastern Thailand and the semi-evergreen forests of peninsular Thailand). A need to develop in-country skills in bat acoustics and taxonomy is also highlighted.

Key words: Chiroptera, Thailand, systematics, literature review, faunal list, new records

INTRODUCTION

Although Thonglongya (1974) wrote a detailed review of the history of mammal studies in Thailand, to date, there has been no comprehensive summary of bat research. This contrasts with other Southeast Asian mainland countries such as Myanmar (Bates *et al.*, 2000), Vietnam (Hendrichsen *et al.*, 2001*a*) and Cambodia (Kock, 2000; Hendrichsen *et al.*, 2001*b*). It is more comparable to the situation for Lao PDR, where some data for recent surveys are included in Francis *et al.* (1999*a*) but there has been no synthesis of the historical literature.

In order to put previous studies of Thai bats in context and to provide a bench mark for future research, this paper gives a review of the literature; a list of currently recognised extant bat species with supporting references (Table 1); and taxonomic and ecological information on eight species, that are new records for the country. This latter material was collected by the senior author and others during a series of recent surveys, primarily in southern, peninsular Thailand. The paper also includes a list of bat species previously recorded from Thailand but now omitted for lack of supporting data (Table 2) and

TABLE 1. Bat species recorded from Thailand, with a list of supporting publications. Conserv. Status = IUCN conservation status based on Hutson *et al.* (2001) and www.redlist.org; lc = lower risk, least concern; NT = lower risk, near threatened; DD = data deficient; VU = vulnerable; EN = endangered; (E) = endemic; L&M (1988) = Lekagul and McNeely, 1988; C&H (1992) = Corbet and Hill (1992); Y = included the species from Thailand

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
			Pteropodidae	
Balionycteris maculata	lc	Y	Y	Hill, 1975; Yenbutra and Felten, 1986; Kanchanasaka, 1995
Chironax melanocephalus	lc	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986
Cynopterus brachyotis	lc	Y	Y	Andersen, 1912; Kloss, 1916*a*; Gyldenstolpe, 1917, 1919; Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; Kanchanasaka, 1995; TISTR, 1995; Bumrungsri, 2002; Bumrungsri and Racey, 2005, In press; Bumrungsri *et al.*, In press
C. horsfieldi	lc	Y	Y	as *C. harpax* in Gyldenstolpe, 1917, 1919; Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
C. sphinx	lc	Y	Y	as *C. marginatus* in Dobson, 1878*a*; as *C. angulatus* in Miller, 1898; as *C. marginatus* in Flower, 1900; Bonhote, 1900*a*, 1900*b*, 1902, 1903; Andersen, 1912; as *C. b. angulatus* in Andersen, 1912; Robinson and Kloss, 1914; Kloss, 1916*a*, 1917*b*; and Gyldenstolpe, 1917, 1919; as *C. b. angulatus* in Allen and Coolidge, 1940; Marshall and Nongnkork, 1970; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Melville, 1983; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Kanchanasaka, 1995; Robinson and Smith, 1997; Bumrungsri, 1997, 2002; Lumlertdacha *et al.*, 2005; Bumrungsri and Racey, 2005; Bumrungsri *et al.*, In press
Dyacopterus spadiceus	NT	–	?Y	provisionally in Corbet and Hill, 1992; Kanchanasaka, 1995
Eonycteris spelaea	lc	Y	Y	Bonhote, 1901; Pousargues, 1904; Andersen, 1912; Gyldenstolpe, 1919; Marshall and Nongnkork, 1970; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997; Kanchanasaka, 1995; TISTR, 1995; Bumrungsri, 1997; Robinson and Marshall, 1999; Lumlertdacha *et al.*, 2005
Macroglossus minimus	lc	Y	Y	Marshall and Nongngork, 1970; Yenbutra and Felten, 1986; TISTR, 1995
M. sobrinus	lc	Y	Y	as *M. minimus* in Horsfield, 1851; as *M. m. minimus* in Dobson, 1878*a*; as *M. minimus* in Bonhote, 1903; as *M. minimus* in Pousargues, 1904; *M. m. sobrinus* in Andersen, 1912; Gyldenstolpe, 1919; as *M. m. sobrinus* in Hill and Thonglongya, 1972; as *M. m. sobrinus* in Hill, 1975; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; TISTR, 1995
Megaerops ecaudatus	lc	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Harada *et al.*, 1982; Yenbutra and Felten, 1986
M. niphanae	lc	–	Y	Yenbutra and Felten, 1983, 1986; Hood *et al.*, 1988
Pteropus hypomelanus	lc	Y	Y	as *P. edulis* in Horsfield, 1851; Andersen, 1912; Kloss,

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
				1916*a*; Gyldenstolpe, 1919; Shamel, 1930; Hill, 1960; Marshall and Nongngork, 1970; Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; TISTR, 1995; Lumlertdacha *et al.*, 2005
P. intermedius	lc	–	Y	as *P. medius* in Miller, 1898 [following Andersen, 1912]; as *P. medius* in Flower, 1900; as *P. vampyrus intermedius* in Kloss, 1916*b*; Gyldenstolpe, 1919; Hill, 1975; Yenbutra and Felten, 1986; included in *P. vampyrus* in Lekagul and McNeely, 1988
P. lylei	lc	Y	Y	as *P. edwardsi* in Gray, 1861; Andersen, 1908, 1912; ?Gyldenstolpe, 1917; Gyldenstolpe, 1919; Chasen, 1935; Hill, 1975; Wathanakul, 1976; Boonneung, 1977; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Boonkird and Wanghongsa 2004; Lumlertdacha *et al.*, 2005
P. vampyrus	lc	Y	Y	Bonhote, 1900*b*, 1903; Andersen, 1912; Kloss, 1916*a*, 1916*c*; Gyldenstolpe, 1919; Hill, 1975; Yenbutra and Felten, 1986; Kanchanasaka, 1995; Lumlertdacha *et al.*, 2005
Rousettus amplexicaudatus	lc	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Melville, 1983; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997; Bumrungsri, 1997
R. leschenaultii	lc	Y	Y	Allen and Coolidge, 1940; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Kanchanasaka, 1995; Robinson *et al.*, 1995; Robinson and Smith, 1997; Lumlertdacha *et al.*, 2005.
Sphaerias blanfordi	lc	Y	Y	Allen and Coolidge, 1940; Hill and Thonglongya, 1972; Melville, 1983; Yenbutra and Felten, 1986
				Rhinopomatidae
Rhinopoma microphyllum	lc	–	Y	as *R. hardwickii* in Cantor, 1846 and Lekagul and McNeely, 1988 but referred to *R. microphyllum* following Hill, 1977 and Simmons, 2005
				Craseonycteridae
Craseonycteris thonglongyai	EN	Y	Y	Hill, 1974, 1975; Hill and Smith, 1981; Nabhitabhata *et al.*, 1982; Yenbutra and Felten, 1986; Duangkhae, 1990, 1991; Surlykke *et al.*, 1993; Yokubol, 2000; Hulva and Horáček, 2002
				Emballonuride
Emballonura monticola	lc	Y	Y	as *E. peninsularis* in Miller, 1898 and Robinson and Kloss, 1914; Thomas, 1916; Kloss, 1917*b*; as *peninsularis* in Gyldenstolpe, 1919; Shamel, 1942; Hill, 1975; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Bumrungsri, 1997; Lumlertdacha *et al.*, 2005
Taphozous longimanus	lc	Y	Y	Bonhote, 1903; as *T. leucopleurus albipinnis* in Gyldenstolpe, 1919; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986
T. melanopogon	lc	Y	Y	Flower, 1900; Pousargues, 1904; Thomas, 1916; Gyldenstolpe, 1919; Shamel, 1942; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; Hood and Baker, 1986; Hood *et al.*, 1988; Robinson and Smith, 1997; TISTR, 1995; Bumrungsri, 1997
T. saccolaimus	lc	Y	Y	as *T. crassus* in Thonglongya, 1974; Yenbutra and Felten, 1986

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
T. theobaldi	lc	Y	Y	Pousargues, 1904; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986
				Nycteridae
Nycteris tragata	lc	–	Y	as *N. javanica* in Bonhote, 1903; as *N. javanica* in Pousargues, 1904; Gyldenstolpe, 1919; Yenbutra and Felten, 1986; as *N. javanica* tragata in Lekagul and McNeely, 1988
				Megadermatidae
Megaderma lyra	lc	Y	Y	as *Lyroderma sinensis* in Shamel, 1942; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; TISTR, 1995; Robinson and Smith, 1997; Bumrungsri, 1997
M. spasma	lc	Y	Y	Dobson, 1878*a*; Blanford, 1888–1891; Miller, 1898; Bonhote, 1901; Pousargues, 1904; Andersen, 1918; Gyldenstolpe, 1919; Shamel, 1942; Sanborn, 1952; Hill, 1960; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997; TISTR, 1995; Bumrungsri, 1997; Lumlertdacha *et al.*, 2005
				Rhinolophidae
Rhinolophus acuminatus	lc	Y	Y	Dobson, 1878*b*; Pousargues, 1904; Sanborn, 1952; Hill and Thonglongya, 1972; Hill, 1975; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Csorba *et al.*, 2003
R. affinis	lc	Y	Y	Miller, 1898; Bonhote, 1903; Pousargues, 1904; Gyldenstolpe, 1919; Tate and Archbold, 1939; Allen and Coolidge, 1940; Hill and Thonglongya, 1972; Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Kanchanasaka, 1995; Robinson *et al.*, 1995; TISTR, 1995; Bumrungsri, 1997; Csorba *et al.*, 2003
R. coelophyllus	lc	Y	Y	Gyldenstolpe, 1917, 1919; Shamel, 1942; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Yoshiyuki, 1990; Robinson *et al.*, 1995; Robinson and Smith, 1997; Bumrungsri, 1997; Csorba *et al.*, 2003
R. lepidus	lc	Y	Y	Hill, 1975; also as *R. refulgens* in Hill, 1975; Yenbutra and Felten, 1986; also as *R. refulgens* in Lekagul and McNeely, 1988; Kanchanasaka, 1995; TISTR, 1995; Robinson and Smith, 1997; Csorba *et al.*, 2003
R. luctus	lc	Y	Y	Pousargues, 1904; Gyldenstolpe, 1919; as *R. morio* in Shamel, 1942; Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Kanchanasaka, 1995; Robinson *et al.*, 1995
R. macrotis	lc	Y	Y	Yenbutra and Felten, 1986; Csorba *et al.*, 2003
R. malayanus	lc	Y	Y	Bonhote, 1903; Gyldenstolpe, 1917, 1919; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; McFarlane and Blood, 1986; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997; TISTR, 1995; Csorba *et al.*, 2003

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
R. marshalli	NT	Y	Y	Thonglongya, 1973; Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; Yoshiyuki, 1990; Robinson and Smith, 1997; Csorba *et al.*, 2003
R. megaphyllus	lc	Y	Y	as *R. borneensis* in Robinson and Kloss, 1914; as *R. robinsoni* in Andersen, 1918; as *R. robinsoni* in Gyldenstolpe, 1919; Tate and Archbold, 1939; as *R. robinsoni siamensis* in McFarlane and Blood, 1986 which = *R. megaphyllus thaianus* in Corbet and Hill, 1992; Robinson *et al.*, 1995; Csorba *et al.*, 2003
R. paradoxolophus	VU	Y	Y	Thonglongya, 1973; Hill, 1975; Yenbutra and Felten, 1986; ? in Robinson and Smith, 1997; Csorba *et al.*, 2003
R. pearsonii	lc	Y	Y	Hill, 1975; Wathanakul, 1976; Hill, 1986; Yenbutra and Felten, 1986; Yoshiyuki, 1990; Robinson *et al.*, 1995; Robinson and Smith, 1997; Csorba *et al.*, 2003
R. pusillus	lc	Y	Y	as *R. minor* in Dobson, 1878*a*; as *R. minor* in Bonhote, 1903; as *R. minor* in Pousargues, 1904; as *R. minor* in Gyldenstolpe, 1917; as *R. minutillus* in Shamel, 1942; Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; Yoshiyuki, 1990; Kanchanasaka, 1995; Robinson *et al.*, 1995, 1996; Bumrungsri, 1997; Csorba *et al.*, 2003
R. shameli	NT	Y	Y	as *R. coelophyllus* in Shamel, 1942; as *R. coelophyllus shameli* in Tate, 1943; Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten 1986; Robinson *et al.*, 1996; Csorba *et al.*, 2003
R. siamensis	n.a.			as *R. macrotis siamensis* in Gyldenstolpe, 1917, 1919; Tate and Archbold, 1939; Hill, 1975; Csorba *et al.*, 2003
R. stheno	lc	Y	Y	Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; Robinson *et al.*, 1995, 1996; Bumrungsri, 1997; Csorba *et al.*, 2003
R. thomasi	NT	Y	Y	Hill, 1975; Yenbutra and Felten, 1986; Robinson and Smith, 1997; Csorba *et al.*, 2003
R. trifoliatus	lc	Y	Y	Miller, 1898; Kloss, 1916*b*; Gyldenstolpe, 1919; Shamel, 1942; Hill, 1975; Yenbutra and Felten, 1986; Kanchanasaka, 1995; Robinson *et al.*, 1996; Csorba *et al.*, 2003
R. yunanensis	NT	Y	Y	Hill, 1975; Harada *et al.*, 1985*b*; Yenbutra and Felten, 1986; McFarlane and Blood, 1986; Hill, 1986; Yoshiyuki, 1990; Csorba *et al.*, 2003
				Hipposideridae
Aselliscus stoliczkanus	lc	Y	Y	Hill, 1975; Harada *et al.*, 1985*a*; Yenbutra and Felten, 1986; Blood and McFarlane, 1988; Robinson *et al.*, 1995
Coelops frithi	lc	Y	Y	Blanford, 1888–1891; as *C. robinsoni* in Robinson and Kloss, 1914 (following Hill and Thonglongya, 1972); Gyldenstolpe, 1917; Hill and Thonglongya, 1972; Robinson *et al.*, 1995; Bumrungsri, 1997
C. robinsoni	NT	Y	Y	Chasen, 1940
Hipposideros armiger	lc	Y	Y	Bonhote, 1900*b*, 1903; Flower, 1900; Gyldenstolpe, 1917, 1919; Allen and Coolidge, 1940; Shamel, 1942; Sanborn, 1952; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Kanchanasaka, 1995; Robinson *et al.*, 1995; Robinson and Smith, 1997; TISTR, 1995; Bumrungsri, 1997; Lumlertdacha *et al.*, 2005

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
H. ater	lc	–	Y	Yenbutra and Felten, 1986
H. bicolor	lc	Y	Y	Bonhote, 1903; Kloss, 1916*c*; as *H. pomona atrox* in Gyldenstolpe, 1919 and Hill, 1960; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; TISTR, 1995; Bumrungsri, 1997
H. cineraceus	lc	Y	Y	Chasen and Kloss, 1930; Shamel, 1942; Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995, 1996; Bumrungsri, 1997
H. diadema	lc	Y	Y	Bonhote, 1900*b*; ? in Flower, 1900; as *Phyllorhina diadema* in Pousargues, 1904; Kloss, 1917*b*; Gyldenstolpe, 1919; Shamel, 1942; Hill, 1975; Yenbutra and Felten, 1986; Kanchanasaka, 1995; Robinson *et al.*, 1995; TISTR, 1995; Bumrungsri, 1997
H. galeritus	lc	Y	Y	Hill, 1975; Yenbutra and Felten, 1986; Bumrungsri, 1997
H. halophyllus	NT(E)	–	Y	as *Hipposideros* sp. in Hill, 1975; Hill and Yenbutra, 1984; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
H. larvatus	lc	Y	Y	as *Phyllorhina larvata* in Dobson, 1878*a*; Miller, 1898; Bonhote, 1903; as *Phyllorhina larvata* in Pousargues, 1904; Chasen and Kloss, 1930; Gyldenstolpe, 1919; Shamel, 1942; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997; TISTR, 1995; Bumrungsri, 1997; Lumlertdacha *et al.*, 2005.
H. lekaguli	NT	Y	Y	Thonglongya and Hill, 1974; Hill, 1975; Ardseungnoen, 1979; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Hood *et al.*, 1988; Bumrungsri, 1997
H. lylei	NT	Y	Y	Thomas, 1913; Gyldenstolpe, 1919; Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995; Robinson and Smith, 1997
H. pomona	lc	–	Y	as *Phyllorhina bicolor* var. *fulva* in Pousargues, 1904; as *H. fulvus* in Gyldenstolpe, 1917; as *H. gentilis sinensis* in Andersen, 1918; Gyldenstolpe, 1919; and Shamel, 1942; Hill, 1960; as *H. fulvus* in Harada *et al.*, 1985*a*; as *H. fulvus* in Hood *et al.*, 1988; Robinson *et al.*, 1995; Robinson and Smith, 1997 – (all *H. fulvus* are refered here to *H. pomona* after Hill *et al.*, 1986)
H. ridleyi	VU	–	–	this paper
H. turpis	EN	Y	Y	as *H. pendleburyi* in Chasen, 1936; Hill, 1975; Yenbutra and Felten, 1986; Topal, 1993; TISTR, 1995
			Vespertilionidae	
Arielulus aureocollaris	DD			as *Thainycteris aureocollaris* in Kock and Storch, 1996; Csorba and Lee, 1999
A. circumdatus	lc		?Y	Csorba and Lee, 1999
Eptesicus dimissus	VU	Y	Y	as *E. pachyotis* in Robinson and Kloss, 1914; Gyldenstolpe, 1919; Thomas, 1916; = *E. demissus* in Lekagul and McNeely, 1988 and Corbet and Hill, 1992 (for details concerning name see Myers *et al.*, 2000)
E. pachyotis	NT	Y	Y	Gyldenstolpe, 1917, 1919
E. serotinus	lc	Y	Y	Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
Eudiscopus denticulus	NT			Kock and Kovac, 2000; Schliemann and Kock, 2000

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
Glischropus tylopus	lc	Y	Y	as *Vesperugo tylopus* in Bonhote, 1900*b*; Gyldenstolpe, 1919; Yenbutra and Felten, 1986
Harpiocephalus harpia	lc	Y		Yenbutra and Felten, 1986
H. mordax	NT		Y	McBee *et al.*, 1986; Robinson *et al.*, 1995
Hesperoptenus blanfordi	lc	Y	Y	Robinson and Kloss, 1914; Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; McBee *et al.*, 1986
H. tickelli	lc	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; McBee *et al.*, 1986
H. tomesi	lc			this paper
Ia io	NT	Y	Y	Allen and Coolidge, 1940; Yenbutra and Felten, 1986; Blood and McFarlane, 1988; Robinson *et al.*, 1995
Kerivoula hardwickii	lc	Y	Y	Gyldenstolpe, 1917, 1919; Hill, 1975; Robinson *et al.*, 1995; Robinson *et al.*, 1996
K. minuta	NT	Y	Y	Miller, 1898; Gyldenstolpe, 1919; Yenbutra and Felten, 1986
K. papillosa	lc	–	Y	McBee *et al.*, 1986; Robinson *et al.*, 1995
K. pellucida	lc			this paper
K. picta	lc	Y	Y	Flower, 1900; Gyldenstolpe, 1919; Osgood, 1934; Shamel, 1942; Hill, 1975; Yenbutra and Felten, 1986
K. whiteheadi	lc	Y	Y	as *K. bicolor* in Thomas, 1904 and Gyldenstolpe, 1919
Miniopterus magnater	lc	–	Y	as *M. macrodens* in Blood and McFarlane, 1988; Yenbutra and Felten, 1986; Robinson *et al.*, 1995; TISTR, 1995; Robinson and Smith, 1997; Bumrungsri, 1997
M. medius	lc	Y	Y	Thomas, 1916; Gyldenstolpe, 1919; Hill, 1975; Hill, 1983; Yenbutra and Felten, 1986; TISTR, 1995
M. pusillus	lc	–	Y	? in Allen and Coolidge, 1940; as *M. australis* in Wathanakul, 1976; Hill, 1983; Yenbutra and Felten, 1986; as *M. australis pusillus* in Lekagul and McNeely, 1988; Robinson and Smith, 1997
M. schreibersii	NT	Y	Y	Hill, 1975; Wathanakul, 1976; as *M. haradai* in Maeda, 1982; Harada *et al.*, 1985*a*; Yenbutra and Felten, 1986; McBee *et al.*, 1986; Bumrungsri, 1997
Murina aenea	NT	–	–	this paper
M. aurata	NT	–	Y	Hill, 1983; Melville, 1983
M. cyclotis	lc	Y	Y	as *Harpiocephalus cyclotis* in Pousargues, 1904; as *M. toxopei* in Shamel, 1942; Hill and Thonglongya, 1972; Hill, 1975, 1983; Melville 1983; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
M. huttoni	NT	Y	Y	Hill, 1975; Yenbutra and Felten, 1986
M. leucogaster	lc	–	Y	McBee *et al.*, 1986;
M. suilla	lc	–	–	this paper
M. tubinaris	lc	–	Y	Hill, 1983; Melville, 1983
Myotis altarium	lc	–	Y	Blood and McFarlane, 1988
M. annectans	NT	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; Bickham *et al.*, 1986
M. ater	lc	–	–	Bickham *et al.*, 1986
M. chinensis	lc	Y	Y	Yenbutra and Felten, 1986
M. hasseltii	lc	Y	Y	as *Vespertilio hasseltii* in Dobson, 1878*a*; as *Vespertilio adversus* in Dobson, 1878*a*; as *V. hasselti* in Blanford, 1888–1891; as *V. adversus* in Pousargues, 1904; as *V. hasselti* in Pousargues, 1904; as *Leuconoe adversus* in

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
				Gyldenstolpe, 1919; as *M. adversus continentis* in Shamel, 1942; as *M. adversus* in Wathanakul, 1976; Yenbutra and Felten, 1986
M. hermani	DD	–	–	this paper
M. horsfieldii	lc	Y	Y	as *M. deignani* in Shamel, 1942; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
M. muricola	lc	–	Y	as *Vespertilio muricola* in Dobson, 1878*a*; Miller, 1898; as *V. muricola* in Bonhote, 1900*b*; as *V. muricola* in Pousargues, 1904; Robinson and Kloss, 1914; Thomas, 1916; Gyldenstolpe, 1919; Shamel, 1942; as *M. mystacinus muricola* in Hill, 1975; as *M. mystacinus* in Harada *et al.*, 1985*a*; Bickman *et al.*, 1986; Yenbutra and Felten, 1986; as *M. mystacinus muricola* in Lekagul and McNeely, 1988; Robinson *et al.*, 1995
M. rosseti	NT	Y	Y	Hill, 1975; Yenbutra and Felten, 1986
M. siligorensis	lc	Y	Y	Shamel, 1942; Hill and Thonglongya, 1972; Hill, 1975; Harada *et al.*, 1985*a*; Yenbutra and Felten, 1986; Surlykke *et al.*, 1993; Robinson *et al.*, 1995; Robinson and Smith, 1997
Phonicus atrox	lc	Y	Y	Kloss, 1916*b*; Gyldenstolpe, 1919; Thong *et al.*, 2006
P. jagorii	lc	–	–	Thong *et al.*, 2006
Pipistrellus cadornae	NT	Y	Y	Hill and Thonglongya, 1972; Hill, 1975; Yenbutra and Felten, 1986; Robinson and Smith, 1997
P. coromandra	lc	–	Y	as *P. abramus* in Bonhote, 1900*a*, 1900*b*; Hill, 1975; Yenbutra and Felten, 1986
P. javanicus	lc	Y	Y	Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995
P. pulveratus	NT	Y	Y	Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1985*a*; Yenbutra and Felten, 1986; McBee *et al.*, 1986; Robinson *et al.*, 1995;
P. stenopterus	lc	–	–	this paper
P. tenuis	lc	Y	Y	as *P. mimus* in Hill, 1975; Yenbutra and Felten, 1986; as *P. mimus* in Yenbutra and Felten, 1986; as *P. mimus* in McBee *et al.*, 1986; Robinson *et al.*, 1996
Scotomanes ornatus	NT	Y	Y	Hill, 1975; Yenbutra and Felten, 1986
Scotophilus heathii	lc	Y	Y	as *S. belangeri* in Kloss, 1917*b* and Gyldenstolpe, 1919; as *S. solutatus watkinsi* in Sanborn, 1952; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Yenbutra and Felten, 1986; Robinson and Smith, 1997; Lumlertdacha *et al.*, 2005
S. kuhlii	lc	Y	Y	Miller, 1898; Bonhote, 1900*a*; as *S. castaneus* in Bonhote, 1900*a*, 1900*b*, 1903; as *S. temminicki* in Pousargues, 1904; Gyldenstolpe, 1917, 1919; as *S. gairdneri* in Kloss, 1917*a*; as *S. castenus* and *S. gairdneri* in Gyldenstolpe, 1919; as *S. gairdneri* in Allen and Coolidge, 1940; as *Pachyotis kuhli* in Shamel, 1942; as *Pachyotis temminckii* in Shamel, 1942; Hill and Thonglongya, 1972; Hill, 1975; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986
Tylonycteris pachypus	lc	Y	Y	Miller, 1898; as *Vesperus pachypus* in Pousargues, 1904; as *T. rubidus* in Gyldenstolpe, 1917; as *T. fulvidus* in

TABLE 1. Continued

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
				Gyldenstolpe, 1919; Hill, 1975; Yenbutra and Felten, 1986; Robinson *et al.*, 1995, 1996
T. robustula	lc	Y	Y	Gyldenstolpe, 1917, 1919; Shamel, 1942; Hill, 1975; Harada *et al.*, 1985*a*; Yenbutra and Felten, 1986; McBee *et al.*, 1986; Robinson *et al.*, 1995
				Molossidae
Chaerephon plicata	lc	Y	Y	as *Nyctinomus plicatus* in Pousargues, 1904; Hill and Thonglongya, 1972; Wathanakul, 1976; Harada *et al.*, 1982; Yenbutra and Felten, 1986; Robinson *et al.*, 1995; Robinson and Smith, 1997; Mouret, 1997; Hillman, 1999; Boonkird and Wanghongsa 2000*b*, 2002; Leelapaibul *et al.*, 2005
Cheiromeles torquatus	NT	Y	Y	as *Dysopes cheiropus* in Temminck, 1826; Thomas, 1916; Gyldenstolpe, 1919; Yenbutra and Felten, 1986
Mops mops	lc	–	–	this paper
Tadarida latouchei	DD	–	Y	Kock, 1999

a list of bat taxa described from Thailand (Table 3).

For practical purposes, the literature review does not list every publication that has a minor reference to Thai bats. Such a list would obscure the important texts. Rather, the aim has been to provide a useful research tool by including information on the most relevant publications and by listing some of the important revisions and monographs that include a synthesis of previously published information, for example Corbet and Hill (1992). For the same reason it has not been possible to map every collecting locality in Thailand but rather it is hoped that Fig. 1 acts as a useful aid in putting previous studies in to their geographical context.

Bat Research: 1821–2006

The first scientific collection of bats from Thailand appears to have been made by George Finlayson, a British surgeon, who between 1821 and 1823 created an eclectic assemblage of zoological specimens (Finlayson, 1826). Temminck (1826), in his monograph of mammalogy, included one of Finlayson's (1826) records, *Cheiromeles torquatus*, whilst Horsfield (1851) included a more comprehensive list of Finlayson's (1826) bat material. Meanwhile, Cantor (1846) noted the first and only record of *Rhinopoma hardwicki* from Thailand, collected in the peninsula (approx. 8°N). Mouhot, a French naturalist, whilst travelling in Thailand, collected a number of bat specimens. Amongst them was a flying fox from Phetchaburi Province, which was misidentified and listed, mistakenly, as coming from Cambodia by Gray (1861) (see Andersen, 1912). Dobson (1878*a*) published a list of bat specimens held in the British Museum, which included eight species from Thailand, of which six were new to the country. Dobson (1878*b*) noted some additional Thai bat specimens in the collection of the natural history museum in Paris. Blanford (1888–1891) included three bat records from Thailand, one of which, *Coelops frithi*, was new to the country.

In 1896, Dr W. L. Abbott, an American naturalist, made an extensive mammal collection in Trang Province (= Trong) in southern Thailand (loc. 1, Fig. 1). Sixty-one bat specimens of 11 taxa were sent to the

United States National Museum. Three were new to science (Miller, 1898) (Table 3). Stanley Flower, in his review of mammals from Thailand and peninsular Malaysia, included 16 bat taxa from Thailand based on specimens seen in the 'Siamese Museum' and published records. Where available, locality data and information on ecology was also included (Flower, 1900).

During his service in Thailand, Mr. T. H. Lyle, a British Vice Consul, collected a large number of mammal specimens from Nan (loc. 2a, Fig. 1) and Chiang Mai (loc. 2b, Fig. 1) Provinces in northern Thailand. Some of the bats were included in three publications by Bonhote (1900*a*, 1901, 1902) and resulted in six new country records. Later, two bat species were named in Lyle's honour, *Pteropus lylei* from Bangkok (Andersen, 1908) and *Hipposideros lylei* from Chiang Mai (Thomas, 1913) (Table 3). Bonhote (1900*b*) included nine bat species from Yala Province (= Biserat, Jalor) (loc. 3, Fig. 1) collected on the Skeat Expedition of 1899–1900; four were new records. Subsequently, Nelson Annandale and Herbert Robinson collected 12 bat species from Malaysia and Yala (loc. 4a, Fig. 1) and Pattani (loc. 4b, Fig. 1) Provinces in southern Thailand (Bonhote, 1903). Two new species were described, *Rhinolophus malayanus* (Bonhote, 1903) and *Kerivoula bicolor* (= *whiteheadi*) (Thomas, 1904) (Table 3). E. de Pousargues from the Natural History Museum in Paris summarized and published the results of a series of mammal surveys undertaken in Indo-China and Thailand during the Mission Pavie of 1879–1885. Pousargues (1904) included 21 bat taxa for Thailand but without details on collecting localities. Andersen (1912), in his catalogue of the fruit bats (Pteropodidae) in the British Museum listed eight bat taxa from Thailand.

During November, 1911, Count Nils Gyldenstolpe, a Swedish zoologist from Naturhistoriska Riksmuseet, went to Thailand as a royal guest. For nearly two years, he undertook expeditions to collect birds, his primary interest, and mammals, particularly from the north of the country. He returned to Thailand again in 1914 for a further 14 months. Of his 176 mammal specimens, 17 bat taxa were reported including six new to Thailand (Gyldenstolpe 1917). Noteworthy was a new taxon of small rhinolophid bat, *Rhinolophus macrotis siamensis*, and four specimens of the very rare *Eptesicus pachyotis*, both from Mae Hong Son Province (loc. 5, Fig. 1).

About the same time, Herbert C. Robinson, the director of the Federated Museum of Malaya, and Cecil Boden Kloss, its curator, undertook a series of zoological expeditions to southern Thailand particularly in Surat Thani Province (= Bandon) (loc. 6, Fig. 1). They collected specimens of seven species, one of which was provisionally referred by them to *Rhinolophus borneensis* (Robinson and Kloss, 1914). Subsequently, it was described as a new species, *Rhinolophus robinsoni*, by Andersen (1918) (Table 3). Oldfield Thomas examined all the microbats in the collection of the 'Federated Museum of Malaya'. He published the results, which included six bat taxa from Thailand and a new species of vespertilionid bat, *Eptesicus dimissus* (incorrectly included as *demissus* in Corbet and Hill, 1992 — see Myers *et al.*, 2000), which is still only known from the holotype (Thomas, 1916 — Table 3).

C. Boden Kloss subsequently became director of the Raffles Museum in Singapore, where, as part of his duties, he carried out research on the systematics and zoogeography of Thai mammals. His researches on bats included the first confirmed records of *Pteropus intermedius* from central Thailand and *Phoniscus atrox* from the peninsula (Kloss, 1916*b*). Other publications followed (Kloss, 1916*c*, 1917*a*, 1917*b*), which

included a new bat taxon, *Scotophilus gairdneri* (= *S. kuhli* in Corbet and Hill, 1992). Although many of the specimens were sent to him by collectors, in 1914 he travelled to Trat Province in the southeast of the country (loc. 7, Fig. 1) and made a collection of 500 mammals, which included four bat taxa, all Megachiroptera (Kloss, 1916*a*). Andersen (1918) named three new microbat taxa from Thailand (Table 3). Gyldenstolpe (1919) published a compilation of previous Thai mammal records. Detailed distribution data were included (where available) for each of the 56 bat taxa.

Between 1923 and 1937, the United States National Museum became increasingly interested in Thailand's fauna. They sponsored Hugh M. Smith and H. G. Deignan to collect a variety of zoological specimens. All remain in the collections of the Smithsonian Institution. Twenty-five bat species and subspecies were collected and the results, which included three new bat taxa, were published by Shamel (1930, 1942). The collecting localities were widely distributed in north, central and peninsular Thailand. Subsequently, *R. coelophyllus shameli* was named in Shamel's honour by Tate (1943). Osgood (1934) examined a series of mammal specimens, including one bat species, collected in Thailand between 1932 and 1933 by the Academy of Natural Sciences of Philadelphia.

F. N. Chasen replaced Kloss as a director of Raffles Museum in 1923. They published a joint paper on the mammals of Tak Province (= Raheng District) western Thailand (loc. 8, Fig. 1) that included two bat species (Chasen and Kloss, 1930) and Chasen (1935 and 1936) recorded two further species including a new taxon, *Hipposideros pendleburyi* (= *H. turpis*) from the peninsula. In his handlist of mammals found in the Malaysian peninsula, Chasen (1940) listed 29 bat taxa known to inhabit Thailand.

Three species of *Rhinolophus* from Thailand were included in Tate and Archbold (1939). The Asiatic Primate Expedition to Thailand, Laos, Borneo and Sumatra of 1933–1937 collected 3,500 bird and mammal specimens including eight bat species from Chiang Mai Province in Thailand (loc. 9, Fig. 1). Two species, *Ia io* and *Sphaerias blanfordi*, were first country records (Allen and Coolidge, 1940). The Rush Watkins 1949 expedition to Thailand collected 200 mammal specimens representing 27 taxa; the six bat species from Kamphaeng Phet (= Kam Pang Phet) (loc. 10a, Fig. 1) and Satun (= Setul) (loc. 10b, Fig. 1) Provinces included one new country record and one new taxon (Sanborn, 1952). Twenty-five bat taxa from Thailand were included in the taxonomic review of Ellerman and Morrison-Scott (1951). Robert E. Elbel, between 1952–1955 and 1961–1963, collected over 5,000 zoological specimens from Thailand, of which about one quarter was mammals. They are deposited at the United States National Museum (Smithsonian Institution) and the Bishop Museum in Hawaii. According to Thonglongya (1974), most at that time had not been studied, although apparently there was at least one new bat record for Thailand, *Taphozous crassus* (= *T. saccolaimus*). Hill (1960) published on a collection of mammals, including three bat species, which were brought to England by H. C. Robinson after his retirement from the Federated Malay States Museum in 1926.

Between 1963–1973, Kitti Thonglongya, Thailand's first bat taxonomist, served as curator of terrestrial vertebrates at the Thai National Reference Collection, which is part of the Thailand Institute of Scientific and Technical Research (TISTR). It was Thonglongya's aim to establish a national science museum and it was his 'energy and knowledge that gave the initiative to build up a greater part of the scientific collections of TISTR (Felten, 1986). He described two

TABLE 2. Bat species previously recorded from Thailand but omitted for lack of supporting data. Captions as in Table 1

Species	Conserv. status	L&M (1988)	C&H (1992)	Publications
			Rhinopomatidae	
Rhinopoma hardwickii	lc	Y	–	as *R. hardwicki* in Cantor, 1846 and Lekagul and McNeely, 1988 but following Hill, 1977 this record is referred to *R. microphyllum*
			Nycteridae	
Nycteris javanica	VU	Y	–	all specimens of *Nycteris* from Thailand are referred by Corbet and Hill, 1992 and Simmons, 2005 to *N. tragata*
			Rhinolophidae	
Rhinolophus rouxii	lc	–	Y	based on Shamel, 1942 but measurements small in comparison those from elsewhere (Csorba *et al.*, 2003) more suited to *R. sinicus*
			Hipposideridae	
Hipposideros fulvus	lc	Y	–	treated as a separate species by Lekagul and McNeely, 1988 but following Hill *et al.*, 1986 specimens referred to *H. pomona*
Hipposideros pratti	NT	–	–	included in Hutson *et al.*, 2001 and Simmons 2005 but omitted by Robinson *et al.*, 2003
			Vespertilionidae	
Miniopterus australis	lc	Y	–	as *M. australis pusillus* in Lekagul and McNeely, 1988 but following Corbet and Hill, 1992 referred to *M. pusillus*
Myotis mystacinus	lc	Y	–	included as *M. mystacinus muricola* in Lekagul and McNeely, 1988 but following Hill, 1983 referable to *M. muricola* as a separate species
Myotis montivagus	NT	–	Y	included (provisionally) in Corbet and Hill, 1992 and Simmons, 2005 but there appear to be no published records
Myotis emarginatus	VU	–	–	included as *Vespertilio emarginatus* in Bonhote, 1900*b*, commented on by Gyldenstolpe, 1919, considerably outside known range
Eptesicus tatei	DD	–	–	included as *Vesperus atratus* (Blyth) by Pousargues, 1904 but omitted in all subsequent publications
Pipistrellus abramus	lc	?Y	–	included in Bonhote, 1900*a*, *b*; incorrectly treated as a race of *P. javanicus* by Lekagul and McNeely, 1988, awaits confirmation
Pipistrellus paterculus	NT	?Y	–	included (provisionally) in Lekagul and McNeely, 1988 as a race of *P. javanicus* and in Hutson *et al.*, 2001 but awaits confirmation
Pipistrellus imbricatus	lc	–	–	included in Sanborn, 1952 but omitted in all subsequent publications
Pipistrellus mimus	lc	Y	–	included as a separate species in Lekagul and McNeely, 1988 but included in *P. tenuis* by Corbet and Hill, 1992 and subsequent authors
Nyctalus noctula	lc	–	?Y	included in Corbet and Hill, 1992 but there appear to be no other published records
			Molossidae	
Tadarida teniotis	lc	–	?Y	included in Corbet and Hill, 1992 but probably refers to the specimen of *T. latouchei* included in Kock, 1999

new bat species, *Rhinolophus marshalli* from Chanthaburi Province (loc. 11a, Fig. 1) (Thonglongya, 1973) and *Hipposideros lekaguli* from Sara Buri Province (loc. 12, Fig. 1) (Thonglongya and Hill, 1974) and the second known specimen of *Rhinolophus paradoxolophus*; this latter specimen, collected from Chaiyaphum Province (loc. 11b, Fig. 1), was a first record for Thailand (Thonglongya, 1973). Despite his premature death, his position as one of the founding fathers of modern Thai bat research is recognised by the naming, in his honour, of a new species of bat, *Craseonycteris thonglongyai*, which also represents a new family of bats, the Craseonycteridae (Hill, 1974). Thonglongya had discovered this taxon during field work in Kanchanaburi Province (loc. 13, Fig. 1) in December, 1973. Subsequently, Hill (1975) produced a report on Thai bats, which was largely based on Thonglongya's collections. This report, which included 15 fruit bat and 55 microbat species, also included a list of collecting localities by province (from north, central and peninsular Thailand) and some short taxonomic notes. Sixteen taxa were new records for the country.

Working at the same time as Kitti Thonglongya was Joe T. Marshall, who served in the United States Army Medical Component, South East Asia Treaty Organisation (SEATO). He also collected mammals from throughout Thailand, principally to study arthropod-borne diseases. Over 2,000 mammal specimens were deposited at various institutions, including bat specimens from Koh Samui (loc. 14, Fig. 1) (Marshall and Nongngork, 1970). Hill and Thonglongya (1972) studied those in the British Museum and the Thai National Reference Collection and listed 23 bat species, of which six were first records for Thailand. External and cranial measurements, together with short taxonomic discussions, were included for the more significant specimens, which were collected from a variety of locations throughout Thailand. Wathanakul (1976) surveyed bats in Lop Buri Province, central Thailand and recorded 23 species (loc. 15, Fig. 1).

Boonsong Lekagul, a Thai conservationist, co-authored with the American zoologist John McNeely a monograph on the mammals of Thailand (Lekagul and McNeely, 1977, 1988). Although it is nearly thirty years since its original publication, it remains a classic text and is still used as the initial source book for most regional mammal studies. Ninety-three bat taxa were included with brief diagnostic descriptions, supported by photographs and line drawings (of skulls and external characters), and notes on the ecology, behaviour and distribution of each species.

Boonneung (1977) in her M.Sc. Thesis studied the daily activities and emergence behaviour of *Pteropus lylei* in central Thailand whilst Ardseungnoen (1979) concentrated on the reproductive biology and other biological aspects of *H. lekaguli* in Ratchaburi Province (loc. 16, Fig. 1). Hill and Smith (1981) summarised the current knowledge of *C. thonglongyai* and a preliminary study of its diet, based on stomach content, was carried out by Nabhitabhata *et al.* (1982). During 1980, David Melville collected six bat species from Chiang Mai Province (loc. 17, Fig. 1), including two new country records, *Murina aurata* and *M. tubinaris* (Melville, 1983, Hill, 1983). A new species of fruit bat, *Megaerops niphanae*, was described from Nakhon Ratchasima Province (loc. 18, Fig. 1) by Yenbutra and Felten (1983) and a new leaf-nosed bat, *Hipposideros halophyllus*, from Lop Buri Province (loc. 19, Fig. 1) by Hill and Yenbutra (1984 — Table 3).

In the 1980s, a series of cytological studies of bats was undertaken by two international groups, one from Japan, the other from the USA, in co-operation with TISTR.

TABLE 3. Bat taxa described from Thailand. Current status is based on Simmons (2005)

Species	Type locality	Author	Current status
Cynopterus angulatus	Trang Province	Miller, 1898	included in *C. sphinx*
Emballonura peninsularis	Trang Province	Miller, 1898	included in *E. monticola*
Kerivoula minuta	Lay Song Hong, Trang Province	Miller, 1898	valid
Rhinolophus malayanus	Biserat, Jalor (Yala Province)	Bonhote, 1903	valid
Kerivoula bicolor	Biserat, Jalor (Yala Province)	Thomas, 1904	included in *K. whiteheadi*
Pteropus lylei	Bangkok	Andersen, 1908	valid
Hipposideros lylei	Chiengdao Cave, Chiang Mai Province	Thomas, 1913	valid
Eptesicus dimissus	Khao Nawng, Surat Thani Province	Thomas, 1916	valid
Taphozous melanopogon fretensis	Tarutau Islands, Satun Province	Thomas, 1916	valid
Rhinolophus macrotis siamensis	Doi Pha Sakeng, north-west Thailand	Gyldenstolpe, 1917	as *R. siamensis*
Scotophilus gairdneri	Pak Nam Pho, Nakhon Sawan Province	Kloss, 1917*a*	included in *S. kuhlii*
Rhinolophus robinsoni	Bandon, Surat Thani Province	Andersen, 1918	included in *R. megaphyllus*
Megaderma spasma minus	Siam and Cambodia	Andersen, 1918	valid
Hipposideros gentilis sinensis	Siam and Fokien	Andersen, 1918	included in *H. pomona*
Hipposideros pendleburyi	Ban Thap Plick, Muang, Krabi Province	Chasen, 1936	included in *H. turpis*
Myotis siligorensis thaianus	Chiang Mai Province	Shamel, 1942	valid
Myotis adversus continentis	Bangkok	Shamel, 1942	included in *M. hasseltii*
Myotis deignani	Chiang Mai Province	Shamel, 1942	included in *M. horsfieldii*
Rhinolophus coelophyllus shameli	Koh Chang, Trat Province	Tate, 1943	as *R. shameli*
Scotophilus solutatus watkinsi	Pak Nam Pho, Nakhon Sawan Province	Sanborn, 1952	included in *S. heathii*
Rhinolophus marshalli	Khao Soi Dao Tai, Chanthaburi Province	Thonglongya, 1973	valid
Craseonycteris thonglongyai	Ban Sai Yoke, Kanchanaburi Province	Hill, 1974	valid
Hipposideros lekaguli	Phu Nam Tok Tap Kwang, Sara Buri Province	Thonglongya and Hill, 1974	valid
Miniopterus haradai	Chaehom, Lampang Province	Maeda, 1982	included in *M. schreibersii*
Megaerops niphanae	Amphoe Pak Thong Chai, Nakhon Ratchasima Province	Yenbutra and Felten, 1983	valid
Hipposideros halophyllus	Khao Samor Khon, Tha Wung, Lop Buri Province	Hill and Yenbutra, 1984	valid
Rhinolophus robinsoni siamensis	Big House cave, Angkang, Chiang Mai Province	McFarlane and Blood, 1986	reassigned to *R. megaphyllus thaianus*
Rhinolophus pusillus lakkhanae	Chom Thong, Chiang Mai Province	Yoshiyuki, 1990	valid
Thainycteris aureocollaris	Doi Pha Hom Pok, Amphoe Mae Ai, Chiang Mai Province	Kock and Storch, 1996	as *Arielulus aureocollaris* (Csorba and Lee, 1999)

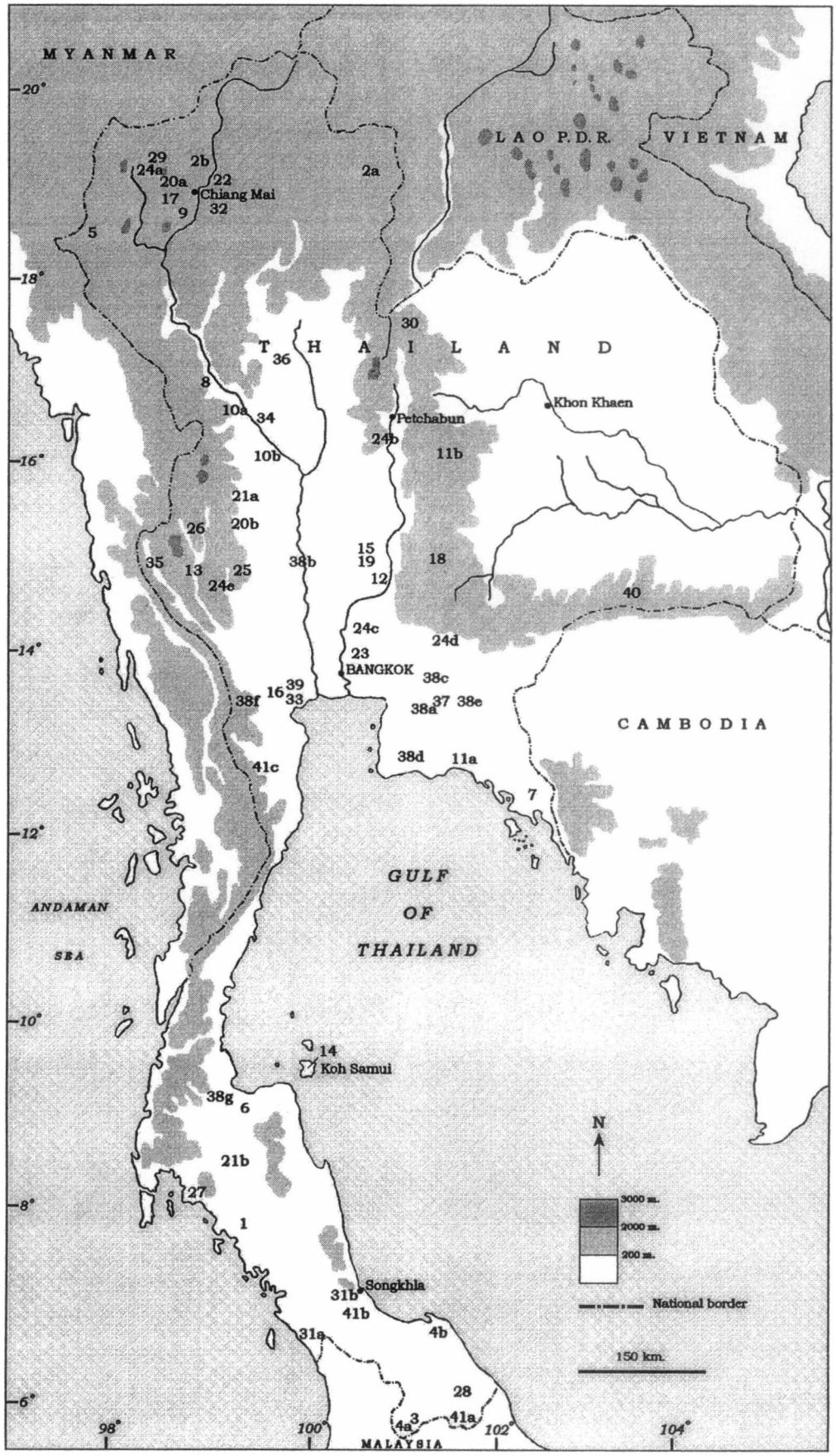
The Japanese group was led by Masashi Harada and collected bats principally from Chiang Mai (loc. 20a, Fig. 1) and Uthai Thani (loc. 20b, Fig. 1) Provinces. The karyotypes of 25 species of bat from Thailand were documented (Harada *et al.*, 1982, 1985*a*, 1985*b*) and Maeda (1982) described a new bat taxon from Thailand in honour of Harada, *Miniopterus haradai* (= *M. schreibersii* in Corbet and Hill, 1992).

The United States group comprised scientists from the Carnegie Museum of Natural History, Hofstra University, Texas Tech University, and Texas A&M University. During the summer of 1983, they made a collection of eight hundred and 48 specimens of small mammals, most of which were bats. The majority was collected from Uthai Thani (loc. 21a, Fig. 1) and Surat Thani (loc. 21b, Fig. 1) Provinces and were deposited in museums in the United States. A series of chromosome studies of 31 species was published, including the Emballonuridae (Hood and Baker, 1986); nine species of Vespertilionidae (McBee *et al.*, 1986); seven species of *Myotis* (Bickham *et al.*, 1986); and eight species of mega- and microbats (Hood *et al.*, 1988). These studies also provided additional information on bat distributions in Thailand. Four species, *Myotis ater*, *Kerivoula papillosa*, *Murina leucogaster*, and *Harpiocephalus mordax* were reported for the first time (Bickham *et al.*, 1986; McBee *et al.*, 1986). McFarlane and Blood (1986) published taxonomic notes on some Thai Rhinolophidae and Blood and McFarlane (1988) included the first record of *Myotis altarium*. Both papers were based on material collected in northern Thailand (loc. 22, Fig. 1).

Felten (1986) summarised the results of the nine years of collaboration between TISTR and the Forschungsinstitut und Naturmuseum Senckenberg (SMF). This volume included information on taxonomy, diet, ecology, the effects of pesticides on bats, and the interaction of man and bats. Yenbutra and Felten (1986) compiled a list of Thai bat species with information on their distribution from throughout Thailand. Data for 88 of the 101 species were based on specimens deposited in TISTR and SMF.

Hill (1986) studied the systematics of *R. pearsoni* and *R. yunanensis*. Miller *et al.* (1988) counted *Tadarida plicata* roost size in Khao Yai National Park (loc. 23, Fig. 1). In 1987, a joint Japanese/Thai team from the National Science Museum, Tokyo and TISTR, respectively, undertook surveys in northern [Chiang Mai Province (loc. 24a, Fig.1), central [Phetchabun (loc. 24b), Lop Buri (loc. 24c), Chachoengsao and Nakhon Ratchasima Provinces (loc. 24d, Fig. 1)] and western Thailand [Kanchanaburi Province, (loc. 24e, Fig. 1)]. A new taxon, *Rhinolophus pusillus lakkhanae* was described from Chiang Mai Province (Yoshiyuki, 1990). Suraphon Duangkhae working for the Wildlife Fund Thailand undertook two studies of *Craseonycteris thonglongyai*. The first was concerned with the bat's ecology and behaviour (Duangkhae, 1990) and the second with its geographical distribution (Duangkhae, 1991) (loc. 25, Fig. 1). Duangkhae summarized the results of his own researches and included information from a number of unpublished reports. Subsequently, Surlykke *et al.* (1993) undertook a study of the echolocation of *C. thonglongyai* together with that of another small Thai microbat, *Myotis siligorensis*.

Corbet and Hill (1992) included 102 bat species for Thailand in their review of Indo-Malayan mammals. This is an invaluable inventory of species. Primarily a taxonomic work, it listed synonymies and included hatched distribution maps, identification keys, and some information on the subspecific status of each species. Information on the conservation status, ecology and behaviour of fruit bats that occur in Thailand was included in Mickleburgh *et al.* (1992).


MYANMAR
LAO P.D.R.
VIETNAM
THAILAND
CAMBODIA
GULF OF THAILAND
ANDAMAN SEA
MALAYSIA
Chiang Mai
Petchabun
Khon Khaen
BANGKOK
Koh Samui
Songkhla
20°
18°
16°
14°
12°
10°
8°
6°
98°
100°
102°
104°
N
3000 m.
2000 m.
200 m.
National border
150 km.

Ninety-four bat species, whose ranges include Thailand, were listed in Koopman (1993). Topál (1993) made a study of *Hipposideros turpis*, including the Thai subspecies *H. t. pendleburyi*. Kanchanasaka (1993) studied the role of frugivorous bats in the pollination of durian trees. In 1993, Mark Robinson, carried out bat surveys in two wildlife sanctuaries in Kanchanaburi and Tak Provinces, western Thailand (loc. 26, Fig. 1). Forty-one species were recorded in Robinson *et al.* (1995) and eight in Robinson *et al.* (1996). They included locally rare bats such as *Rhinolophus megaphyllus*, *Hipposideros halophyllus*, *Eptesicus serotinus* and *Ia io*.

Staff of TISTR undertook a bat survey in Krabi Province (loc. 27, Fig. 1). Eighteen species were found and the presence of *Hipposideros turpis* was confirmed (TISTR, 1995). Waengsothorn (1995) made a field key to the family Hipposideridae of Thailand based on literature and specimens in TISTR. Kanchanasaka (1995), who studied the mammals of Toa-Dang peat swamp forest, Narathiwat Province (loc. 28, Fig. 1), included the first record of *Dyacopterus spadiceus*. Wathanakul (1995) reviewed and compiled information on the taxonomy and distribution of bats in Thailand. Based on specimens collected from Chiang Mai Province (loc. 29, Fig. 1), Kock and Storch (1996) described a new genus and species of vespertilionid bat. Originally, named *Thainycteris aureocollaris*, the genus was subsequently synonymized with *Arielulus* by Csorba and Lee (1999).

Robinson and Smith (1997) undertook a bat survey in Loei Province, north-east Thailand (loc. 30, Fig. 1). Twenty-four species of mega- and microbats were recorded. Mouret (1997) studied the cave habitat, biology and conservation status of *Tadarida plicata*. Bumrungsri (1997) carried out research on roost selection of cave-dwelling bats and recorded 21 species in Satun (loc. 31a, Fig. 1) and Songkhla (loc. 31b, Fig. 1) Provinces in southern Thailand. Mein and Ginsburg (1997) studied mammals of the Lower Miocene from Li Mae Long, Lamphang Province (loc. 32, Fig. 1). Nine bat taxa were found. Robinson and Marshall (1999) published a paper on the parasites of *Eonycteris spelaea*. Hillman (1999) carried out an ecological study of *T. plicata* in Ratchaburi Province (loc. 33, Fig. 1). Kock (1999) revised the taxonomic status of *Tadarida latouchei*, which he considered to be specifically distinct from *T. teniotis*. In May, 1999, *Eudiscopus denticulus* was collected from Kamphaeng Phet Province (loc. 34, Fig. 1) (Kock and Kovac, 2000). Further

FIG. 1. Locations of some of the bat field surveys in Thailand. 1 — Miller (1898); 2a and 2b — Bonhote (1900*a*, 1901, 1902); 3 — Bonhote (1900*b*); 4a and 4b — Bonhote (1903); 5 — Gyldenstolpe (1917); 6 — Robinson and Kloss (1914); 7 — Kloss (1916*a*); 8 — Chasen and Kloss (1930); 9 — Allen and Coolidge (1940); 10a and 10b — Sanborn (1952); 11a and 11b — Thonglongya (1973); 12 — Thonglongya and Hill (1974); 13 — Hill (1974); 14 — Marshall and Nongngork (1970); 15 — Wathanakul (1976); 16 — Ardseungnoen (1979); 17 — Melville (1983) and Hill (1983); 18 — Yenbutra and Felten (1983); 19 — Hill and Yenbutra (1984); 20a and 20b — Harada *et al.* (1982, 1985*a*, 1985*b*); 21a and 21b — Hood and Baker (1986), McBee *et al.* (1986), Bickham *et al.* (1986), Hood *et al.* (1988); 22 — McFarlane and Blood (1986), Blood and McFarlane (1988); 23 — Miller *et al.* (1988); 24a, 24b, 24c, 24d and 24e — Yoshiyuki (1990); 25 — Duangkhae (1990, 1991); 26 — Robinson *et al.* (1995, 1996); 27 — TISTR (1995); 28 — Kanchanasaka (1995); 29 — Kock and Storch (1996); 30 — Robinson and Smith (1997); 31a and 31b — Bumrungsri (1997); 32 — Mein and Ginsburg (1997); 33 — Hillman (1999); 34 — Kock and Kovac (2000); 35 — Boonkird and Wanghongsa (2000*a*); 36 — Boonkird and Wanghongsa (2000*b*); 37 — Bumrungsri (2002); 38a, 38b, 38c, 38d, 38e, 38f and 38g — Lumlertdacha *et al.* (2005); 39 — Leelapaibul *et al.* (2005); 40 — Thong *et al.* (2006); 41a, 41b and 41c — current study

information on this species was included in Schliemann and Kock (2000). Boonkird and Wanghongsa (2000*a*) assessed the potential factors that impact negatively on the cave-dwelling bats of Kanchanaburi Province (loc. 35, Fig. 1). They also studied the volume of guano produced by *T. plicata* in Chao Ram Cave, Sukhothai Province (Boonkird and Wanghongsa, 2000*b*) (loc. 36, Fig. 1). Yokubol (2000) revisited some of the diurnal roosts of *C. thonglongyai* and assessed the changes in population size since the work of Duangkhae in 1983. A species action plan for *C. thonglongyai*, together with information on the conservation status of Thailand's microbats, was included in Hutson *et al.* (2001). A molecular study of *C. thonglongyai* was conducted by Hulva and Horáček (2002).

Bumrungsri (2002) studied the foraging ecology of *Cynopterus brachyotis* and *C. sphinx* in the lowland forest of Chachoengsao Province, southeast Thailand (loc. 37, Fig. 1). Field keys and descriptions of *Cynopterus*, based on external morphology and morphometrics, are included in Bumrungsri and Racey (2005). Boonkerd and Wanghongsa (2002, 2004) assessed the distribution and colony sizes of *T. plicata* and *Pteropus lylei* throughout the country. A comprehensive review of the genus *Rhinolophus* by Csorba *et al.* (2003) included a summary of the systematics, distribution, ecology and behaviour of all those species known to occur in Thailand. Lumlertdacha *et al.* (2005) undertook a study of lyssaviruses based on samples taken from 932 bats of 11 species, collected from Chon Buri (loc. 38a, Fig. 1), Sing Buri (loc. 38b), Chachoengsao (loc. 38c), Rayong (loc. 38d), Prachin Buri (loc. 38e), Ratchaburi (loc. 38f), and Surat Thani (loc. 38g) Provinces. Most recently, the diet of *T. plicata* in Khao Chong Pran, Ratchburi Province (loc. 39, Fig. 1) was studied by Leelapaibul *et al.* (2005). Resource partitioning between sympatric *C. brachyotis* and *C. sphinx* and the reproductive biology of *C. brachyotis* are documented in Bumrungsri and Racey (In press) and Bumrungsri *et al.* (In press).

Currently, a series of national and international bat studies is being conducted in various regions of Thailand. Provisional results suggest that the diversity of bats present is greater than currently recognized and one new species record, *Phoniscus jagorii*, was published from Surin Province (loc. 40, Fig. 1) (Thong *et al.*, 2006). A further eight new records are included here: namely one hipposiderid, six vespertilionids and one molossid. These were collected in peninsular Thailand in Yala and Narathiwat Provinces (loc. 41a, Fig 1), Songkla Province (loc. 41b, Fig. 1) and Phetchaburi Province (loc. 41c, Fig. 1) and bring the number of currently recognised extant bat species found in Thailand to 119 (Table 1).

Materials and Methods

Study Area

The field studies took place in 1993 and between February, 2002 and October, 2003. They were conducted primarily in the wildlife sanctuaries of Hala-Bala and Ton Nga-chang. Unfortunately, there are no data for the total capture effort during this period. However, for indicative purposes, between February, 2002 and February, 2003, there were 16 nights of field studies at Bala Forest and 4 nights at Hala Forest. Together they comprised 144.5 harp trap hours and 69 mist net hours. Three hundred and twenty-five bats of 35 species were collected. In Ton Nga-chang Wildlife Sanctuary, during 12 nights of field surveys (60 harp trap hours and 35 mist net hours) 160 bats of 23 species were collected.

Hala-Bala Wildlife Sanctuary is located between 5°37'–6°14'N and 101°8'–101°52'E and covers 140,000 ha. It is situated on the Thailand-Malaysia border and includes two tracts of forest; Bala Forest in Narathiwat Province and Hala Forest in Yala Province (previously known as 'Jalor'). The Sanctuary is connected to Belum Forest in Malaysia. Together, they comprise one of the largest remaining forests in the Thai-Malaysian peninsula (Niyomtham, 2000). The vegetation is characterised as 'Malesian

type' tropical rain-forest (Whitmore, 1984) and is substantially wetter than the other types of tropical forest in Thailand. The average annual rainfall in the study area is more than 2,500 mm, with most falling in October and November; there is a short dry period from February to March.

In general, the vegetation can be divided into two types; lowland tropical rain-forest, which covers most of the Sanctuary, and lower montane rain-forest in areas which have an altitude in excess of 1,000 m a.s.l. Dipterocarp and legumes characterize lowland rain-forest while lower montane forest is dominated by members of the families Fagaceae and Podocarpaceae (Niyomtham, 2000).

Bala Forest covers an area of 17,000 ha. It is surrounded by fruit orchards and rubber plantations. It has an elevation range of about 100 to 963 m a.s.l. Numerous small streams are found in the narrow valleys between the mountain ranges. These tributaries join together with a main stream, the Ai-kading, which runs through the middle of the forest. Small patches of peat swamp forest are also present. There are apparently no caves in the forest.

Hala Forest (Fig. 2), the larger forest, covers an area of 26,400 ha, and is closely connected to Bang-lang National Park in Thailand, and Belum Forest in Malaysia. Its elevation ranges from 100 to 1,490 m a.s.l. A small area of the forest was cleared and flooded to form part of a reservoir. The Hala River runs from south to the north. The sanctuary supports high faunal diversity, including several critically endangered species such as two-horned rhinoceros (*Dicerorhinus sumatrensis*), tapir (*Tapirus indicus*), and a number of hornbill taxa. At least 118 species of mammal are known to inhabit the Sanctuary (Wildlife Research Station, 2003, unpublished report).

Ton Nga-chang Wildlife Sanctuary is located between 06°5'–6°7'N and 100°8'–100°16'E in Songkhla Province. Its elevation range is between 100 to 900 m a.s.l. The forest is classified as tropical rain-forest 'Thai type' (Whitmore 1984). The canopy comprises primarily dipterocarps with a few deciduous trees. The average annual rainfall is about 1,700 mm with most of the rain falling in October and November. The dry period lasts three to four months, between January and mid April. Although some logging took place on the edge of the Sanctuary during 1970–80s, the forest is slowly regenerating.

Specimens and Measurements

Bats were sampled using custom-made, four-frame harp traps and mist nets set at ground level across trails and small streams. Mist nets and harp traps were inspected every 20 minutes from 18:00 h to 23:00 h, when mist nets were taken down. Most bats were released at the capture sites after standard measurements and echolocation calls were recorded. Harp traps were left open until early morning. The bats collected in the morning were kept in cloth bags and held in dark, humid places before being released in the evening at the capture sites. Hand nets were used to capture bat in culverts, tree hollows, fallen logs, caves, and rock crevices.

In a small number of cases of considerable taxonomic interest, voucher specimens were taken and preserved in 70% ethanol. These are deposited at the Prince of Songkla Natural History Museum, Prince of Songkla University. Cranial and dental measurements were taken to the nearest 0.01 mm. using digital calipers following Bates and Harrison (1997). These measurements include 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; TAIL: tail length, from the tip of the tail to its base adjacent to the anus; HF: foot length, from the extremity of the heel behind the os calcis to the extremity of the longest digit, not including the claws or the hair; GTL: greatest length of the skull, the greatest antero-posterior length of the skull, taken from the most projecting point at each extremity; CBL: skull length, from the most projecting anterior point of the skull to the exoccipital condyle; CCL: condylo-canine length, from an exoccipital condyle to the alveolus of the anterior canine; ZB: zygomatic breadth, the greatest width of the skull across the zygomatic arches; BB: breadth of braincase at the posterior roots of the zygomatic arches; PC: post orbital constriction; C–M^3: maxillary toothrow length, from the alveolus of the upper canine to the back of the crown of the third upper molar; M^3–M^3: palatal width, taken across the outer borders of the third upper molar, taken at the widest part; C–M_3: mandibular toothrow length, from the alveolus of the lower canine to the back of the crown of the third lower molar; C^1–C^1: greatest anterior palatal width measured across the outer borders of the canines, taken at the widest part; MDL: mandible length, from the most posterior part of the condyle to the most anterior part of the mandible. These measurements are illustrated in Figs. i–v in Bates and Harrison (1997). Body mass (MASS) was taken using a 60 g pesola scale. Tooth size was measured using a Leica MZ8 stereo-microscope with a 12.00 mm lense.

Taxonomic notes and standard measurements (Tables 4 and 5), based on specimens held in the Prince of Songkla University, have been included for the eight species of bat that are new country records

for Thailand. A brief summary of the most important diagnostic characters is also provided. Comparisons with other bat taxa have been made for those species that are easily confused or where there is some element of taxonomic doubt. Ecological notes should be read in conjunction with the description of study sites included in the Materials and Methods section. Worldwide distributions are based on Corbet and Hill (1992) and Simmons (2005). Conservation status is based on Hutson *et al.* (2001).

Systematic Review of Species of Bat — New Country Records

Hipposideros ridleyi Robinson and Kloss, 1911 Ridley's leaf nosed bat

Hipposideros ridleyi Robinson and Kloss, 1911: 241, Botanical Gardens, Singapore.

New Material

PSU-M05.12 (field no. SB030222), ♂, 22 February 2003, Wildlife Research Station, Bala Forest, Wang, Narathiwat Province, 05°47'45"N, 101°49'56"E, collected by S. Bumrungsri and members of the Hala-Bala bat research team.

Taxonomic notes

This is a medium-small hipposiderid bat, with a forearm length in the recent specimen of 47.9 mm (Table 4) (47.2–49.8 mm in Francis *et al.*, 1999*b*). The pelage is dark brown on both the dorsal and ventral aspects (Fig. 2a). The ears are large and broad (23 mm long × 20 mm wide). The anterior noseleaf, which lacks supplementary leaflets, is wide (7.8 mm) and almost completely covers the muzzle. The internarial septum is expanded into a large circular disc (diameter = 2.74 mm). This clearly differs from the ovoid shape of its sibling species, *H. orbiculus*, which is also known from peninsular Malaysia (Francis *et al.*, 1999*b*). The narial lappets are well developed and form a pocket encircling the nostrils. The skull is elongated, with slightly elevated narial swellings. The first upper premolar (P^2) is small and situated within the toothrow.

Distribution and Ecological Notes

Hipposideros ridleyi is currently known from peninsular Malaysia, Singapore, Borneo (Sabah and Sarawak) (Simmons, 2005). This is the first confirmed record from Thailand.

The voucher specimen from Thailand was captured together with a pregnant female (forearm length of 50.2 mm) in a harp trap set along a nature trail in Bala Forest. The local area includes many streams, which join together and become a small peat swamp (2 ha in size). Much of the ground layer is densely covered with rattans and palms. The general habitat is pristine lowland evergreen forest at the elevation of 100 m a.s.l. and the topography is essentially flat. In peninsular Malaysia, a number of specimens was also collected from peat swamp forest and along trails in lowland dipterocarp forest (Zubaid *et al.*, 1986). This habitat type is currently threatened throughout Southeast Asia. In Thailand, breeding occurs as early as late February. Females were lactating between April and May (Kemper, 1988) and July in Borneo (Francis *et al.*, 1999*b*). Medway (1969) suggested it may roost in caves, although there is no evidence to support this suggestion. It was found roosting in road culverts in peninsular Malaysia (Gould, 1978). There are apparently no caves in the vicinity of the area of collection in Thailand.

Myotis hermani Thomas 1923 Herman's bat

Myotis hermani Thomas 1923: 252; Sabang, northwest Sumatra.

New Material

PSU-M 05.1 (field no. SB040509.17), ♀, 9 May 2004, Khuan Kaowang Forest Park, Rattaphum District, Songkhla Province, 07°00'00"N, 100°15'54"E, collected

by Dorothea Pio and Teunchitr Sritongchoy.

Taxonomic Notes

The recent specimen from Thailand, with a forearm length of 60.0 mm (Table 4) and a condylo-canine length of 19.1 mm (Table 5), agrees in size and morphology with the holotype of *M. hermani* from Sumatra (61 mm and 19.5 mm, respectively). It is significantly larger than *Myotis formosus* (FA: 44.5–49.1 mm, n = 5 and

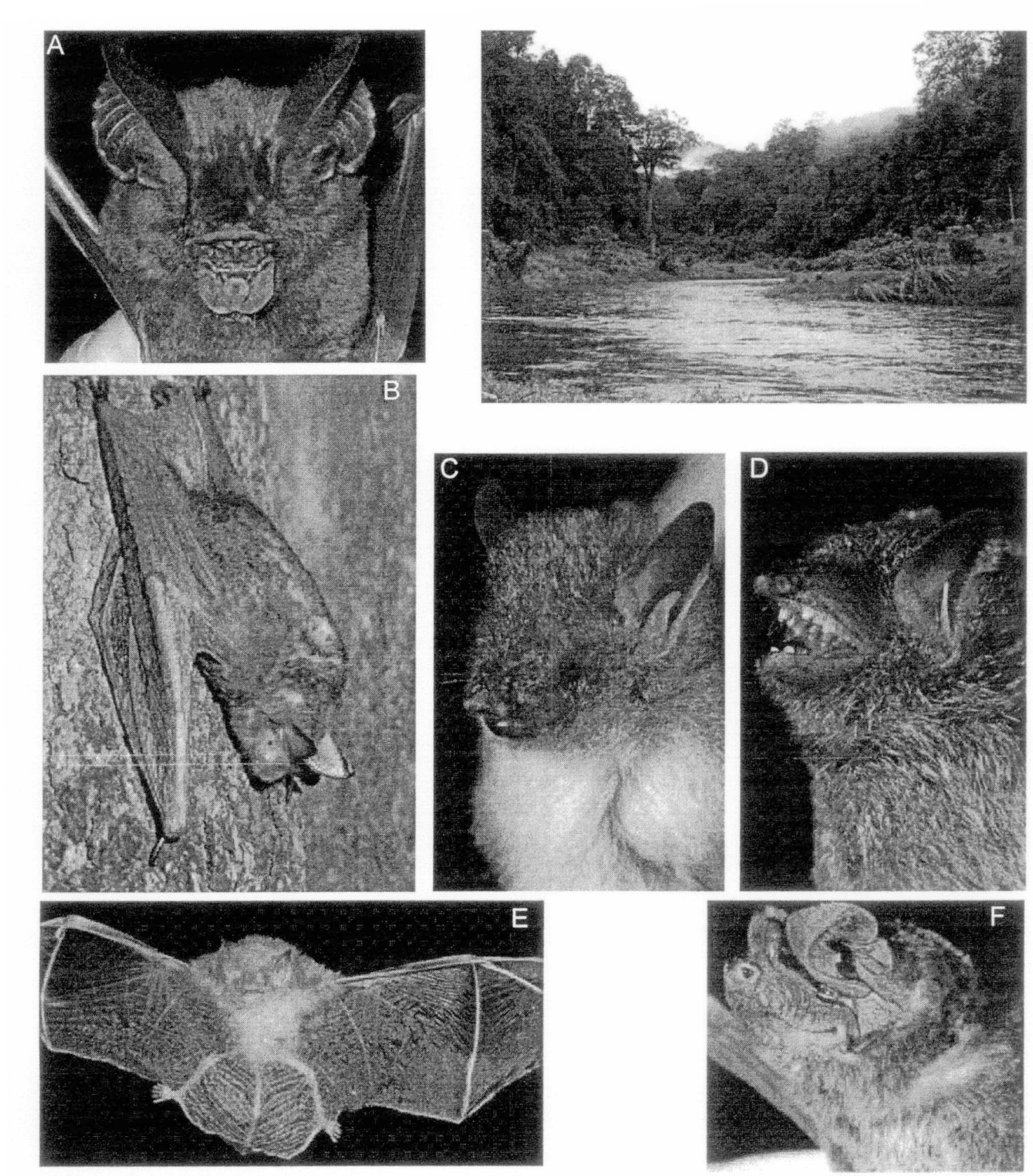


FIG. 2. A general view of part of Hala Forest and six bat species new to the fauna of Thailand: A — *Hipposideros ridleyi*, B — *Myotis hermani*, C — *Murina suilla*, D — *Murina aenea*, E — *Kerivoula pellucida*, F — *Mops mops*

CCL: 16.3–16.6 mm, $n = 4$; measurements listed in Bates and Harrison, 1997), which is the only other species of Asian *Myotis* currently included in the subgenus *Chrysopteron* (sensu Corbet and Hill, 1992). Size apart, it shares most of the external characters exhibited by *M. formosus*. It has conspicuously orange (of various hues) and black parti-coloured wings and interfemoral membrane (Fig. 2b). The ears are dark orange with black edges and have a concavity on the posterior border. The feet are not greatly enlarged. The hair roots are buff coloured and the tips orange, the latter frosted with black on both the dorsal and ventral aspects. Black frosting is not present in specimens of *M. formosus* seen from the Indian Subcontinent (Bates and Harrison, 1997) but the colouration is closely similar to that of an individual identified as *M. watasei* (= *M. formosus* sensu Corbet and Hill, 1992; Simmons, 2005), a photograph of which is included in Lin *et al.* (2004). The skull and dentition are comparable to those of *M. formosus* (for details see Bates and Harrison, 1997) in all aspects except for their considerably larger size.

Findley (1972) included *hermani* as a synonym of *M. formosus*, a view subsequently followed by Koopman (1993). However, Corbet and Hill (1992) argued that the size of *M. hermani* supports its specific distinction, a view supported by the discovery of this recent specimen in Thailand. As such, *M. hermani* and *M. formosus* are here considered to be two distinct species.

Distribution and Ecological Notes

This is the first record from Thailand and appears to be the first confirmed record of this bat since it was described from a single adult female collected from north-west Sumatra (Thomas, 1923).

The recent specimen, a mature female, was captured in a mist net set over a seasonal small stream (5 m wide) in Khuan Kaowang Forest Park. The capture site was on the edge of secondary tropical lowland rain forest (ca. 350 ha at 100–200 m a.s.l.), which is characterized by many large standing trees and a dense shrub layer. It appeared that the bat, which was caught at 20:00 hours at a height of 1.5 m, was travelling from the forest to an area of rubber plantations and dry scrub woodland. Its body was covered with a 3 mm layer of fat. Possibly this was an energy reserve for the breeding period.

Pipistrellus stenopterus (Dobson, 1875)
Narrow-winged pipistelle

Vesperugo stenopterus Dobson 1875: 470; Sarawak, Borneo.

New Material

PSU-M 05.2 (field no. SB030508.6), ♂, 8 May 2003, Ai-kading stream, Bala Forest, Hala-Bala Wildlife Sanctuary, Wang District, Narathiwat Province, 05°48'9"N, 101°49'15"E, collected by S. Bumrungsri and members of the Hala-Bala bat research team.

Taxonomic Notes

This is a large and robust pipistrelle bat. The specimen from Thailand has a forearm length of 38.7 mm (Table 4). Its pelage is dark brown (based on the wet specimen). In the wing, the fifth metacarpal (32.2 mm) is noticeably shorter than the fourth (36.9 mm). The ears are fleshy; each has a club-shaped tragus, which is expanded in the middle. The feet are large, longer than half the tibia length. The skull is robust with a flattened rostrum and a large nasal notch. The zygomata are slender and fragile. A sagittal crest is present and the lambdoid crests are well developed. The anterior palatal emagination extends posteriorly to the level of the front of the second premolar (P^4). The first upper premolar (P^2) is reduced, intruded from the toothrow, and compressed in a recess between the canine

TABLE 4. Four external measurements (in mm) and body mass (in g) of 10 specimens of seven bat species recently collected in Thailand, including the length of forearm (FA), tail (TAIL), ear (E) and foot (HF). For *Murina suilla*, the range, mean and standard deviation are given

Species	*n*	FA	TAIL	E	HF	MASS
Hipposideros ridleyi	1♂	47.9	27.1	23.2	7.6	9.0
Myotis hermani	1♀	60.0	54.0	19.8	19.8	24.2
Pipistrellus stenopterus	1♂	38.7	37.1	15.7	9.8	22.5
Murina suilla	3♂♂	30.4–30.8	26.0–35.4	11.2–12.2	6.1–8.4	3.5–4.0
		30.6, 0.2	30.8, 4.7	11.8, 0.5	7.1, 1.2	3.7, 0.3
Murina aenea	2♀♀	34.7, 35.7	31.6, 34.2	12.7, 13.7	7.6, 8.2	6.9
Kerivoula pellucida	1♂	30.1	46.2	15.8	9.0	6.0
Mops mops	1♂	43.3	33.6	19.3	17.7	29.0

(C^1) and P^4. The lower premolars are compressed; the first (P_2), which is 1.5 times larger in crown area than the second (P_4), is slightly extruded, its tip does not point vertically upwards but obliquely outwards. Over the years, this species has been variously referred to the genus *Nyctalus* as well as *Pipistrellus* (for comments, see Corbet and Hill, 1992 and Simmons, 2005).

Distribution and Ecological Notes

Recorded from Borneo, Sumatra, Malaysia, Riau Island and Singapore (Corbet and Hill, 1992), and Mindanao Island (Koopman, 1993). This is the first record for Thailand.

In Bala Forest, a single individual was caught in the early evening (ca. 19:00h) in a mist net set about 5 m above the surface of a running stream. The stream, which was about 15 m wide, flowed through a valley of pristine lowland forest. In Malaysia, it is thought to be a gregarious species and is commonly found roosting in hollow trees or the roofs of houses (Medway, 1969).

Hesperoptenus tomesi Thomas, 1905
Large false serotine

Hesperoptenus tomesi Thomas, 1905: 575; Malacca, Malaysia.

New Material

PSU-M 05.3, sex?, August 1993, 30th km Kangkachan-Phanernthung Road, Kangkachan National Park, Phetchaburi Province, 12°54'00"N, 99°24'45"E, collected by S. Bumrungsri and Vichak Chimchome.

Taxonomic Notes

The description is based on the skull only as the skin is not available. The skull, which has a greatest length of 21.2 mm (Table 5), compares favourably to the holotype. It is large and exceeds in size that of *Hesperoptenus tickelli* (17.2–19.9 mm — Corbet and Hill, 1992). It has prominent supraorbital ridges. Its posterior part is elevated. The well developed sagittal crest and lambdoid crests combine to make a high and posteriorly projecting lambda. The first upper anterior incisor (I^2) is large, both in crown area (with a transverse width of 1.3 mm) and crown height (2.0 mm). In *H. tickelli*, the comparable figures are 1.0–1.1 mm, 1.5–1.8 mm, $n = 4$, respectively. The second upper incisor (I^3) is virtually flat but with a relatively large crown (transverse width of 1.0 mm). It is intruded within the toothrow, so that I^2 and the upper canine (C^1) are almost in contact. C^1 is large (1.7 mm in crown width and 4.5 mm in height: 1.4–1.6 mm and 3.1–3.7 mm, $n = 4$ respectively in *H. tickelli*) and in contact with the upper premolar (P^4). The lower incisors are more robust than those of *H. tickelli*. The first lower premolar (P_2) is between one quarter and one third the crown area of the second (P_4).

TABLE 5. Eleven cranial and dental measurements (in mm) of 11 specimens of eight bat species recently collected in Thailand, including the greatest length of skull (GTL), condylo-basal length (CBL), condylo-canine length (CCL), zygomatic breadth (ZB), breadth of braincase (BB), postorbital constriction (PC), maxillary toothrow length (C–M^3), palatal breadth (M^3–M^3), anterior palatal breadth (C^1–C^1), mandibular toothrow length (C–M_3), mandibular length (M). For *Murina suilla*, the range, mean and standard deviation are given

Species	*n*	GTL	CBL	CCL	ZB	BB	PC	C–M^3	M^3–M^3	C^1–C^1	C–M_3	M
Hipposideros ridleyi	1♂	20.1	18.1	17.5	9.6	9.0	2.9	6.6	6.4	–	7.0	12.6
Myotis hermani	1♀	21.2	20.2	19.1	14.1	9.2	4.3	8.7	9.1	6.3	9.7	16.5
Pipistrellus stenopterus	1♂	16.2	15.9	15.4	11.9	9.1	5.0	5.8	7.8	6.2	6.3	13.2
Hesperoptenus tomesi	1?	21.2	20.5	20.0	15.3	10.6	5.6	7.9	9.9	7.8	9.0	16.4
Murina suilla	3♂♂	14.5–14.8	13.0–13.7	12.6–13.0	8.3–8.5	7.1–7.3	4.0–4.4	4.7–5.1	5.0–5.4	3.4–3.5	5.0–5.3	10.0–10.1
		14.8, 0.3	13.4, 0.3	12.8, 0.2	8.4, 0.1	7.2, 0.1	4.2, 0.2	4.9, 0.2	5.2, 0.2	3.5, 0.1	5.2, 0.2	10.1, 0.1
Murina aenea	2♀♀	17.2, 17.8	15.8, 16.0	15.0, 15.4	9.7, 10.2	7.8, 8.0	4.5, 4.6	5.7, 6.1	5.9, 6.2	4.5, 4.8	6.1, 6.3	11.9, 12.7
Kerivoula pellucida	1♂	14.6	13.3	12.9	8.2	7.1	3.0	5.5	5.1	3.1	5.8	10.4
Mops mops	1♂	21.5	19.1	18.4	13.4	10.4	4.7	7.4	9.6	5.3	8.0	15.2

Distribution and Ecological Notes

It is currently known from Sabah in Borneo and Malacca in peninsular Malaysia (Medway, 1969; Corbet and Hill 1992; Koopman, 1993). This is the first confirmed record from Thailand.

In Kangkachan National Park, a single individual was collected on the ridge of a hill in a mist net set over a small pool. The surrounding habitat was pristine lower evergreen montane forest.

Murina suilla (Temminck, 1840)
Brown tube-nosed bat

Vespertilio suillus Temminck, 1840: 224, pl. 56; Tapos, Java.

New Material

PSU-M 05.4 (field no. SB030519.23), ♂, 19 May 2003, Bala Forest, Hala-Bala Wildlife Sanctuary, Wang District, Narathiwat Province, 05°48'09"N, 101°49'45"E. PSU-M 05.5 (field no. SB031019.4), ♂, 19 October 2003, Namsai Ranger Station, Hala Forest, Hala-Bala Wildlife Sanctuary, Yala Province, 06°04'00"N, 101°22'00"E.

PSU-M 05.13 (field no. SB041217.2), ♂, 17 December 2004, Headquarters of Ton Nga-chang Wildlife Sanctuary, Songkhla Province, 06°56'N, 100°14'E. All specimens collected by S. Bumrungsri and members of the Hala-Bala bat research team.

Taxonomic Notes

This is a small, tube nosed bat with a forearm length in Thailand of 30.4–30.8 mm (Table 4). The dorsal pelage is brown, intermixed with golden hair tips; the roots are dark grey. Ventrally, the hair roots and tips are very pale, almost white (Fig. 2c). There is a well developed emargination on the posterior margin of each ear. Each wing is attached to a point close to the base of the claw of the outer toe. The dorsal aspect of

the tail membrane and the toes are hairy, buffy brown to orange buff in colour. The skull has a small, shallow rostrum relative to the size of the braincase. The sagittal and lambdoid crests are scarcely evident. The first upper incisor (I^2), which has a secondary cusp, is small with a crown area about one third that of the second (I^3). I^3 is situated postero-lateral to I^2, such that I^2, which is the same height as I^3, is visible when viewed laterally. The upper canine (C^1) exceeds the second upper premolar (P^4) in height and is about two thirds the crown area. The first upper premolar (P^2) is much reduced, its crown area is one third and its height about half of P^4. The lower canine (C_1) is about equal in height and slightly exceeds the crown area of the second lower premolar (P_4). The first lower premolar (P_2) is about one third the crown area of the second (P_4). The talonids of the first (M_1) and second (M_2) lower molars are about equal in crown area to the trigonids.

Distribution and Ecological Notes

Murina suilla is found in Malaysia, Sumatra, Nias Island, Java and Borneo. Its distribution in Sulawesi, Peleng Island and New Guinea is doubtful (Corbet and Hill, 1992). These are the first records from Thailand.

The specimen from Bala Forest was captured using a harp trap set across a trail in primary lowland evergreen forest. Three further individuals (forearm length of 30.1–31.7 mm), which were not taken as voucher specimens, were collected in adjacent areas, both along trails and over streams (5–12 m wide). A single individual was collected in Hala Forest on the edge of pristine forest, which was adjacent to the large dam of a reservoir. In Ton Nga-chang, *M. suilla* was captured along a nature trail in late successional forest that had been selectively logged 20–30 years previously. The elevations of these sites were less than 200 m a.s.l.

Murina aenea Hill, 1964

Bronzed tube-nosed bat

Murina aenea Hill, 1964: 57, pl. 44–45; Ulu Chemperoh, Bentong, Pahang, Malaysia.

New Material

PSU-M 05.6 (field no. SB031018.10), ♀, 18 October 2003, Namsai Ranger Station, Hala Forest, Hala-Bala Wildlife Sanctuary, Yala Province, 06°04'00"N, 101°22'00"E. PSU-M 05.7 (field no. SB041219.4), ♀, Boripatr Waterfall, Ton Nga-chang Wildlife Sanctuary, Songkhla Province, 06°59'N, 100°08'E. Both specimens collected by S. Bumrungsri and members of the PSU bat research team.

Taxonomic Notes

This is a small *Murina.* The forearm lengths of the Thai specimens are 34.7 and 35.7 mm. The hairs on the dorsal pelage are dark brown with golden tips. The ventral pelage is paler, with dark roots and buff-brown tips (Fig. 2d). The ears have a small emargination on their posterior borders. Each wing is attached near to the base of the claw on the outer toe. The dorsal aspect of the tail membrane and the feet are covered with golden hairs. The skull, with a condylo-canine length of 15.0–15.4 mm, is larger than that of *M. suilla* (Table 5). The rostrum is more robust and the anterior part is slightly bulbous when viewed laterally. There is a well developed rostral sulcus and a sagittal crest is present. The upper toothrows are not conspicuously convergent. The second upper incisor (I^3) is equal in height, has twice the crown area, and is situated alongside the bicuspid first (I^2), which in consequence is scarcely visible when viewed laterally. The first upper canine (C^1) is equal to, or larger than, the second upper premolar (P^4) when viewed laterally and has an equal crown area. The mesostyle of the first (M^1) and second (M^2) upper molars is greatly reduced. In the lower dentition, the first premolar (P_2) is about

60% of the crown area of the second (P_4). The talonids of the first (M_1) and second (M_2) lower molars are smaller than the trigonid.

Distribution and Ecological Notes

Currently, *M. aenea* is recorded from peninsular Malaysia and Sabah in Borneo (Medway, 1969; Hill and Francis, 1984). This is the first record from Thailand.

In Hala Forest, it was captured in a harp trap set over a small stream (4 m wide). The area is relatively flat, with an elevation of less than 200 m a.s.l. The vegetation comprises pristine lowland evergreen forest with a lower storey of dense shrub and sapling cover. It is ca. 500 m from a river. In Ton Nga-chang, it was caught in a harp trap set at ground level along a trail leading to a waterfall. The trail is on a foothill, which as has an elevation of about 200 m a.s.l. and is close to a stream. The vegetation is undisturbed lowland evergreen forest. The canopy (30 m in height) is dominated by large dipterocarps while the ground layer is moderately covered with shrubs and herbs.

Kerivoula pellucida (Waterhouse, 1845)
Clear-winged woolly bat

Vespertilio pellucidus Waterhouse, 1845: 6, Philippines.

New Material

PSU-M 05.8 (field no. SB 030508.18), ♂, 8 May 2003, Ai-kading stream, Bala Forest, Hala-Bala Wildlife Sanctuary, Wang District, Narathiwat Province, 05°48'9"N, 101°49'15"E, collected by S. Bumrungsri and members of the Hala-Bala bat research team.

Taxonomic Notes

This is a small *Kerivoula* with a relatively long tail (Table 4). The internal aspects of the ears, including the tragus, are orange; the ear margins are dark and there is an emargination on the posterior border (Fig. 2e). The snout is also orange. The dorsal pelage is pale orangebrown with grey hair bases. The ventral pelage is lighter. The wing membranes are dark brown with a thin, light creamy-white border. The tail is long and the membrane on the dorsal surface is hairy. A glandular diamond-shaped swelling (6.5 mm in length by 3.1 mm in greatest width) is present on the fourth vertebra of the tail. The skull has an abruptly elevated, bulbous braincase. The rostrum has a well developed sulcus and a deep U-shaped narial emagination. The post palatal extension is narrow (1.3mm). The crown width of the first upper premolar (P^2) slightly exceeds its antero-posterior length. The second premolar (P^3) is almost circular in outline with a crown area and height about equal to that of P^2. In the lower dentition, the first premolar (P_2) is about equal in crown area to the second (P_3), which is about 85% of the crown area of the third (P_4). They are all equal in height.

Distribution and Ecological Notes

Kerivoula pellucida is currently recorded from Malaysia, Sumatra, Java, Borneo, and the Philippines (Simmons, 2005). This is the first confirmed record from Thailand.

In Bala Forest, it was found in the dry season flying up and down small trails (2 m wide) in riverine pristine lowland evergreen forest. Additionally, two further individuals (forearm lengths of 30.1, 31.7 mm), which were not taken as voucher specimens, were caught over a small stream (4–7 m wide) in Bala and Hala Forests respectively. In Ton Nga-chang Wildlife Sanctuary, Songkhla Province, three individuals were captured in old growth secondary forest. None was kept as a voucher specimen. All the sites are less than 200 m a.s.l. A female captured in Bala Forest in mid May, 2003, was lactating.

Mops mops (Blainville, 1840)
Malayan free-tailed bat
Molossus mops Blainville, 1840: 101, Sumatra.

New Material

PSU-M 05.9 (field no. SB030508.8), ♂, 8 May 2003, Ai-kading stream, Bala Forest, Hala-Bala Wildlife Sanctuary, Wang District, Narathiwat Province, 05°48'9"N, 101°49'15"E, collected by S. Bumrungsri and members of the Hala-Bala bat research team.

Taxonomic Notes

As only a photograph (Fig. 2f) but not the skin is available, this description of the Thai specimen is based on the skull. The skull, with a condylo-canine length of 18.4 mm (Table 5) is large and has broad zygomata. The braincase is inflated anteriorly and the sagittal and lambdoid crests are prominent. The palatal branches of the premaxillae are ossified and fused anteriorly; the two small anterior palatal foramina are isolated. The lachrymal projections are prominent. The small 'first'upper premolar (P^2) is absent, and the canine (C^1) is in contact with the 'second'upper premolar (P^4). The third upper molar (M^3) is reduced and flattened antero-posteriorly, with its second commissure greatly shortened, the mesostyle reduced and the metastyle absent. In the lower dentition, the premolars are compressed in the toothrow; the first (P_2) is about equal in crown area to the second (P_4).

Distribution and Ecological Notes

Mops mops is found in peninsular Malaysia, Sumatra and Borneo (Corbet and Hill, 1992). The record from Java is doubtful (Hill, 1961).

This species was captured in the same mist net and almost at the same time as *P. stenopterus* (see above). *Cheiromeles torquatus* was also collected from this locality. Medway (1969) considered this to be a gregarious bat that roosts in dead or hollow trees and is often associated with the naked bat, *C. torquatus*.

Discussion

With 119 species, Thailand has a rich diversity of bats. Its species count exceeds the 95 recorded for Myanmar (Bates *et al.*, 2005), the 86 for Vietnam (Eger and Theberge, 1999; Hendrichsen *et al.*, 2001*a*) and the 76 for Lao PDR (Francis *et al.*, 1999*a*). The high diversity is, in part, a natural phenomenon. MacKinnon (1997) noted that 'Thailand supports an extremely diverse fauna and flora' since it is situated at a 'zoogeographical crossroads' and includes faunal elements that have 'Sino-Himalayan, Indo-Burmese, Indo-Chinese, Sundaic and Palaearctic'affinities. In part, it also reflects the greater effort devoted in the past to bat research in Thailand compared to neighboring countries. For example, field surveys have been more numerous and more intensive over a longer period than in Myanmar (Bates *et al.*, 2000), Cambodia (Hendrichsen *et al.*, 2001*b*) and/or Vietnam (Hendrichsen *et al.*, 2001*a*).

As outlined in the Introduction and as can be seen in Table 1, although there have been a fairly large number of publications concerned with the bats of Thailand, their rate of production and their impact on our understanding of the fauna has not been constant. There have been two very active periods of research. The first, reflected in a series of papers from 1898 to 1917, saw the addition of 39 bat species to the country's faunal list (indicated by line A–A in Fig. 3). It coincided with a worldwide interest in discovering, describing and recording mammal faunas and mirrors, for example, the many and varied surveys of the Bombay Natural History Society in the Indian Subcontinent (Bates and Harrison, 1997).

The second period (indicated by line B–B in Fig. 3) was inspired by the ideas and vision of Kitti Thonglongya, who as Thailand's first bat taxonomist helped establish the scientific collections of TISTR and promoted the National Science Museum in Bangkok as a centre of taxonomic excellence. His field surveys from 1963–1973 led, amongst other things, to the addition of 29 new records for the country in a series of four publications (mostly in conjunction with John Edwards Hill of The Natural History Museum, London) from 1972–1975. A further 13 records were added by a variety of researchers in the 1980s. At the same time Lekagul and McNeely (1977) published their monograph on the mammals of Thailand. This was a golden age of bat research. Unfortunately, the momentum could not be sustained such that between 1990 and 2005 the number of papers concerned with bat diversity in Thailand had declined and only five species were added to the faunal list. However, despite the relative paucity of publications in this latter period, some field surveys were being carried out, particularly by members of the Prince of Songkla University. It was these field studies, primarily in peninsular Thailand, that have provided the data for this paper and that of Thong *et al.* (2006).

If the research effort into the bats of Thailand has been uneven, so too has been the geographical distribution of the surveys (Fig. 1). Despite the fact that it has not been possible to map all the survey sites since some, such as those of TISTR in the 1970s, were too widespread (Felten, 1986), it is still apparent that the majority has been concentrated in four main areas: Chiang Mai in the north-west of the country; the central western districts towards the Myanmar border; the highlands to the north and south of Phetchabun in central Thailand; and, to a lesser extent, Koh Samui and some parts of southern peninsular Thailand. The remaining areas have been largely ignored by most field researchers.

Research effort has also been uneven in terms of the bat species studied. In the main, the more abundant species of pteropodids, emballonurids, megadermatids,

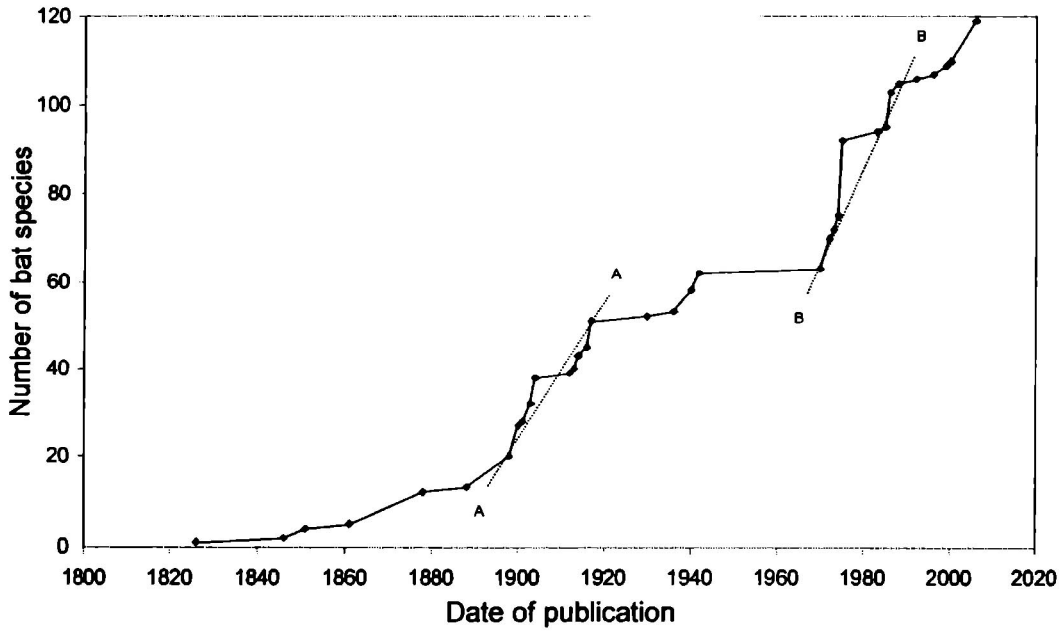


FIG. 3. A cumulative graph showing the number of bat species recorded from Thailand from 1800 to 2006. Date of publication is indicated with a diamond. The two periods which saw the greatest number of new country records are indicated with lines A–A (1898–1917) and B–B (1972–1988)

rhinolophids and hipposiderids have attracted the most research (Table 1). With the exception of some of the pteropodids, all these taxa tend to be cave-dwelling bats, which have made them more amenable to study. For this reason, the charismatic, vulnerable and formerly endemic species, *C. thonglongyai*, and the molossid bat, *T. plicata*, with its spectacularly large roosting colonies, have also attracted considerable research interest. In contrast, many of the vespertilionids, especially forest taxa such as *Murina* and *Kerivoula* have been little studied. Even genera such as *Pipistrellus* and *Arielulus*, which may or may not be forest and/or cave-dependent seem under-represented in Thai bat research publications. Thirteen species of these two genera are listed for the fauna of Myanmar (Bates *et al.*, 2005) but only eight for Thailand (Table 1). It is unlikely that this reflects a real difference in the biodiversity of the two countries.

Thailand has one endemic bat, *H. halophyllus*, and two endangered, three vulnerable and 24 near threatened species (Table 1), which suggests that the country has a significant role to play in both regional and global bat conservation. To maximize this potential, there is a need for bat researchers to focus their efforts in order to make the most of the limited available resources. Field studies should be designed to work in priority areas, especially those that have been under-researched in the past, such as the remaining deciduous dipterocarp woodlands of eastern Thailand and the semi-evergreen rain-forests of peninsular Thailand. They should also concentrate on some of the less well known species groups such as the forest dwelling bats.

For the full benefit of the field studies to be realized, there is a need to develop taxonomic skills. Good taxonomy, built on a strong foundation of morphometrics and genetics and supported by a range of identification keys and taxonomic descriptions, will permit important further advances in acoustic, ecological and behavioural studies, all of which are essential in providing a greater understanding of the role bats play in the ecosystem. Developments in bat acoustics also offer exciting possibilities for future advances in non-invasive, rapid survey techniques.

From a conservation viewpoint, the priority remains to monitor and research endangered, vulnerable and near threatened species in order to maximize their chances of survival. However, this must be done in a responsible way, ensuring the minimum disturbance of populations and with a clearly defined policy about the collection of voucher specimens for laboratory or museum based studies. Future studies will have to draw up a list of priority species, habitats, and geographical locations in order to help promote sustainable bat conservation in Thailand. In addition, future conservation programmes should consider the international as well as the national perspective. Priorities should be looked at from a Southeast Asian regional viewpoint and trans-boundary conservation projects involving co-operation with Myanmar, Cambodia and/or Lao PDR should be developed where appropriate.

Finally, data from bat research in Thailand should be disseminated to the widest possible audience, which includes local and international scientists, the general public and decision-makers. Currently, some of the recent bat literature is in Thai language and is restricted either to unpublished reports or to national journals of limited distribution. A number have been listed in the review section above, for example Wathanakul (1976); Boonneung (1977); Ardseungnoen (1979); Waengsothorn (1995); Bumrungsri (1997); Boonkird and Wanghongsa (2000*a*, 2000*b*). Unfortunately, information in this format will have a limited impact,

especially internationally both within and outside the scientific community.

After 185 years of research, there are still great opportunities for bat studies in Thailand. Rapid developments in bat acoustics and field survey techniques have already led to the discovery of many new bat records for the country (some are published above, some await publication). Bat genetics, still in its infancy in Thailand, also offers further possibilities. With a strong and growing interest amongst local scientists and students and with increasing financial support both nationally and internationally for example through the current Darwin Initiative of the UK government, the future for bat research in Thailand looks positive.

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First records of *Kerivoula kachinensis* (Chiroptera: Vespertilionidae) from Cambodia, Lao PDR and Thailand

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Kerivoula kachinensis is reported for the first time from Cambodia, Lao PDR and Thailand. In April, 2005 and January, 2006, three individuals were collected in deciduous dipterocarp forest, near bamboo, in the Seima Biodiversity Conservation Area, Mondul Kiri Province, Cambodia. In September, 2007, two individuals were collected in lower montane forest, which included some mixed deciduous forest, bamboo groves and banana trees, in the hills of Phu Suan Sai National Park, Loei Province, and a single individual was collected in mixed deciduous forest, near bamboo, in the Nam Nao National Park, Petchabun Province, Thailand. In 1996–1998, seven specimens were collected from five localities in north, central and southern Lao PDR; most were associated with evergreen forest at altitudes between 150–800 m a.s.l. The species appears to be relatively widespread in continental Southeast Asia. Locally common, it is probably not currently at risk.

Key words: *Kerivoula kachinensis*, Vespertilionidae, Thailand, Lao PDR, Cambodia, distribution, first record

INTRODUCTION

To date, 119 bat species, including 57 Vespertilionidae, are recorded from Thailand (Bumrungsri *et al.*, 2006). Six of these belong to the genus *Kerivoula*, including one, *K. pellucida*, which was first collected from the country as recently as May, 2003 (Bumrungsri *et al.*, 2006). In Cambodia, 50 species are known, including 20 Vespertilionidae of which three are *Kerivoula* (*K. papillosa*, *K.* cf. *hardwickii* and *Kerivoula* sp. nov. — Matveev, 2005; Bates *et al.*, 2007). In Lao PDR, at least 90 species have been recorded (Francis *et al.*, 1999), including at least four species of *Kerivoula*.

Kerivoula kachinensis was described from northern Myanmar (Bates *et al.*, 2004). Subsequently, it was recorded from north and central Vietnam (Thong *et al.*, 2006). Its recent discovery in eastern Cambodia, several localities in Lao PDR, and northern Thailand represents a considerable

range extension. These new data suggest that it is a widespread, if currently little known species in the forests of continental Southeast Asia.

Materials and Methods

Field Survey Sites

In Cambodia, Seima Biodiversity Conservation Area is situated in southern Mondul Kiri Province [centered on (= c.o.) 12°30'N, 107°15'E]. Extending for 3,034 km^2, it comprises grasslands, secondary deciduous dipterocarp forest mixed with bamboo and some evergreen hill forest. Annual precipitation averages between 1700 and 1800 mm, with a wet season from May to October and a dry season from November to late April (SCW, 2006).

In Thailand, Phu Suan Sai National Park (Na Haeo) is situated in central Loei Province (c.o. 17°31'N, 101°30'E). With an area of 117.16 km^2, it is mainly mountainous with a highest peak of 1408 m a.s.l. The vegetation comprises five forest types: lower montane, moist evergreen, dry evergreen, mixed deciduous and some dry dipterocarp (National Park, Wildlife and Plant Conservation Department, 2006*b*). The climate is tropical monsoon, with an annual precipitation of about 1200 mm. Most of the rains occur from May to October. The dry season lasts for six months. Mean monthly temperatures range from 20–24°C in the cool-dry season (November–January) to 25–29°C in the hot-dry season (February–April) (WorldClimate, 2005). Nam Nao National Park is situated in the Petchabun Range, in eastern Petchabun Province and northern Chaiyaphum Province (c.o. 16°44'N, 101°34'E). The national park covers a total area of 966 km^2 and comprises deciduous dipterocarp, mixed deciduous, dry evergreen, and pine forests and grassland. Annual temperature averages 22.7°C and annual precipitation is between 1300 and 1500 mm (National Park Research Division, 2004). The rainy season is between July and October. The coldest month is November, when temperatures may fall to 0°C (National Park, Wildlife and Plant Conservation Department, 2006*a*).

In Lao PDR, Nam Ha National Biodiversity Conservation Area (NBCA) is situated in Louang Namtha Province (survey locality 20°49'N, 101°28'E). It has a variety of habitats including evergreen and semi-evergreen lowland and hill forest with various degrees of disturbance, as well as some dry dipterocarp forest. Nam Et NBCA is situated in Houaphan Province (survey locality 20°27'N, 103°23'E).

TABLE 1. External, cranial and dental measurements (in mm) of specimens of *K. kachinensis* from Cambodia, Lao PDR and Thailand, including the length of head and body (HB); tail (TAIL); foot (HF); tibia (TIBIA); forearm (FA) and ear (EAR), greatest length of skull (GTL); condylo-basal length (CBL); condylo-canine length (CCL); zygomatic breadth (ZB); breadth of braincase (BB); greatest breadth of the braincase (GBB); braincase height (BH); postorbital constriction (PC); upper toothrow length (C–M^3); palatal width (M^2–M^{2ex}); lower toothrow length (C–M$_3$); mandible length (MDL); relative height of braincase (BH/GBB × 100). Body mass (MASS) is given in grams. The mean, SD, minimum and maximum are provided. Sample sizes differing from those reported under *n* are in brackets

n	sex	HB	TAIL	HF	TIBIA	FA	EAR	MASS
7	♂♂	49.7, 2.3	54.9, 2.3	9.1, 0.2	22.6, 0.6	41.5, 1.2	13.0, 1.5	7.7, 1.2
		48.2–53.6 [5]	52.3–57.5 [5]	9.0–9.4 [5]	21.7–23.4 [5]	40.4–43.2	11.9–15.5 [5]	6.5–9.5
6	♀♀	51.3, 3.6	58.3, 2.5	9.1, 0.4	23,1	41.7, 1.0	14.9, 1.1	8.6, 0.6
		47.9–53.0 [3]	55.8–61.0 [5]	8.6–9.4 [4]	[1]	40.1–42.6	13.2–16.0 [5]	7.8–9.1 [4]

Habitats include moist evergreen forest, disturbed areas with larger rivers and small streams. Both Nam Ha and Nam Et have been heavily affected by slash and burn agriculture. Phou Khao Khouay NBCA in Vientiane Province includes a mixture of logged semi-deciduous forest and evergreen riverine forest (survey locality around 18°26'N, 102°57'E). Lak Sao in Khammouane Province is a town in central Lao PDR, with extensive patches of secondary forest as well as hills with limestone karst nearby (survey locality 18°12'N, 104°58'E). The Bolaven Plateau in Champasak Province is an elevated area (about 800 m a.s.l.) with extensive, partially logged evergreen hill forest (survey locality 15°03'N, 106°34'E).

Specimen and Measurements

All external, cranial and dental measurements were taken using digital calipers. Skulls were extracted and prepared from wet specimens preserved in 70% alcohol (Lao specimens were originally fixed in 6% buffered formaline). The Thai material resides in the collections of the Prince of Songkla University (PSU), Hat Yai, Thailand and the Cambodian material in the Hungarian Natural History Museum (HNHM), Budapest. The Lao material has been deposited in the Royal Ontario Museum (ROM) in Canada or the Estación Biológica de Doñana (EBD) in Seville, Spain.

The following measurements were taken (Table 1): HB — head and body length, from the tip of the snout to the base of the tail, dorsally; TAIL — tail length, from the tip of the tail to its base adjacent to the anus; HF — from the extremity of the heel behind the os calcis to the extremity of the longest digit, not counting the claws; TIBIA — length of tibia, from the knee joint to the ankle; FA — forearm length, from the extremity of the elbow to the extremity of the carpus with the wings folded; EAR — ear length, from the lower border of the external auditory meatus to the tip of the pinna; GTL — greatest length of skull, taken from the tip of the incisors to the lambda; CBL — condylobasal length, from an exoccipital condyle to the anterior alveolus of an incisor; CCL — condylo-canine length, from an exoccipital condyle to the anterior alveolus of a canine; ZB — zygomatic breadth, the greatest width of the skull across the zygomatic arches; BB — breadth of braincase, taken at the posterior roots of the zygomatic arches; GBB — greatest width of the braincase; BH — braincase height, taken from the basisphenoid to the highest part of the skull; PC — post orbital constriction; C–M^3 — maxillary toothrow length, from the most anterior part of the upper canine to the back of the crown of the third upper molar; M^2–M^{2ext} — external

TABLE 1. Extended

n	sex	GTL	CBL	CCL	ZB	BB	GBB	BH	PC	C–M^3	M^2–M^{2ext}	C–M_3	MDL	BH/GBB × 100
5	♂♂	17.7, 0.6	16.1, 0.4	15.5, 0.6	10.4, 0.5	7.7, 0.4	8.1, 0.3	5.5, 0.3	3.4, 0.3	6.8, 0.4	6.4, 0.3	7.2, 0.4	12.6, 0.4	67.8, 2.7
		17.0–18.3	15.5–16.5 [4]	14.8–16.1 [4]	9.6–11.0	7.1–8.1	7.6–8.4	5.2–5.9	2.9–3.7	6.2–7.2	5.9–6.6	6.5–7.6	12.0–13.0	65.0–71.5
2	♀♀	17.3, 18.4	16.0, 16.6	15.5, 16.1	10.7, 11.0	8.1, 8.2	8.4, 8.4	5.6, 5.9	3.6, 3.7	6.7, 7.2	6.5, 6.5	7.3, 7.6	12.9, 13.0	66.1, 69.6

palatal width, taken across the outer borders of the second upper molar at the widest part; $C–M_3$ — mandibular toothrow length, from the most anterior part of the lower canine to the back of the crown of the third lower molar; MDL — mandible length, from the most posterior part of a condyle to the most anterior part of a crown of a first lower incisor. Body mass (MASS) was recorded to the nearest 0.1 g or 0.5 g using a 50 g or 100 g Pesola scale. The definitions of the measurements are according to Bates and Harrison (1997) and Bates *et al.* (2004).

Echolocation calls of the three Thai specimens were recorded with a Pettersson D 240× ultrasound detector (in 10× time-expansion mode) connected to a digital iRiver iHP-120 Multi-Codec Jukebox. Calls were recorded from free flying bats in a room (3 × 4 × 3 m). Calls were analysed using Bat Sound Pro sound analysis software (Pettersson Electronik AB, Uppsala, Sweden) on a laptop computer. The most energy frequency (peak frequency) and call duration were examined. At least ten calls from each individual were analysed.

Systematic Review of Species

Kerivoula kachinensis Bates *et al.*, 2004
Kachin woolly bat

Kerivoula kachinensis Bates *et al.*, 2004: 220; Namdee Forest, Bhamo Township, Kachin State, Myanmar, 24°34'N, 97°08'E.

New Material

Cambodia: ♀ HNHM 2005.82.3, Seima Biodiversity Conservation Area, Mondul Kiri Province, approx. 12°16'N, 107°04'E, April, 2005; ♂♂ HNHM 2006.34.50/51, Seima Biodiversity Conservation Area, Mondul Kiri Province, 12°16'N, 107°04'E, 360 m a.s.l., 29 January, 2006.

Thailand: ♂♂ PSU-M07.242/243, Phu Suan Sai National Park, Loei Province, 17°30'N, 100°57'E, 1300 m a.s.l., 11 September, 2007; ♂ PSU-M07.244, Nam Nao National Park, Petchabun Province, 16°45'N, 101°34'E, 958 m a.s.l., 14 September, 2007.

Lao PDR: ♀ ROM 106458, Lak Sao, Khammouane Province 18°12'N, 104°58'E, 16 April, 1996; ♀ ROM 110603, Bolaven Plateau, Champasak Province, 15°03'N, 106°34'E, 800 m a.s.l., 25 May, 1997; ♂ EBD 25122, Phou Khao Khouay NBCA, Vientiane Province 18°26'N, 102°57'E, 4 June, 1997; ♀ ROM 118063, Phou Khao Khouay NBCA, Vientiane Province, 18°23'N, 103°04'E, 4 February, 1998; ♂ EBD 25747, Nam Et NBCA, Houaphan

Fig. 1. *Kerivoula kachinensis*, ♂, Phu Suan Si National Park, Thailand

Province, 20°27'N, 103°23'E, 22 March, 1998; ♀ ROM 118279, Nam Et NBCA, Houaphan Province, 20°21'N, 103°22'E, 26 March, 1998; ♀ not catalogued, field number AGS980420-18; near Nam Ha NBCA, Louang Nam Tha Province, 20°49'N, 101°28'E, 20 April, 1998.

Description and Taxonomic Notes

This is a large sized *Kerivoula* with a forearm length of 40.1–43.2 mm for Cambodian, Thai and Lao material (Table 1) and 41.3 mm and 40.4–43.4 mm for Myanmar and Vietnamese material (Bates *et al.*, 2004; Thong *et al.*, 2006). The dorsal and ventral pelage has dark grey roots, the mid-parts are grey-brown and the tips whitish brown. The ventral surface is slightly paler than dorsal surface. The muzzle and lips are covered with hairs except for the nostrils, which are naked (Fig. 1). The wings are attached to the base of the toes. The tail is long (52.3–61.0 mm). The external and cranial morphology of the recent specimens is essentially similar to that described in Bates *et al.* (2004). In the skull, the most distinctive character is the flattened braincase. Its height relative to its width (BH/GBB × 100) is 65.0–71.5% in the Cambodian, Thai and Lao material (Table 1), which compares favourably to the 62.9–69.6% in the four Vietnamese specimens (Thong *et al.*, 2006) and 64.0% in the holotype (Bates *et al.*, 2004). In *K. lenis* and *K. papillosa*, the respective figures are 82.4–89.3% ($n = 4$) and 80.6–91.6% ($n = 22$) (Bates *et al.*, 2004).

DNA barcodes (sequences of the cytochrome *c* oxidase subunit I mitochondrial gene, COI) were obtained for six of the specimens from Lao PDR, and included as *K. kachinensis* in Fig. 3 of Francis *et al.* (2007). The sequences indicated all six were very similar to each other, but differed in their average sequences by more than 12% from any other species of *Kerivoula* examined, confirming the distinctiveness of this species. This gene provides no evidence that they are closely related to the similar sized *K. papillosa*, but the

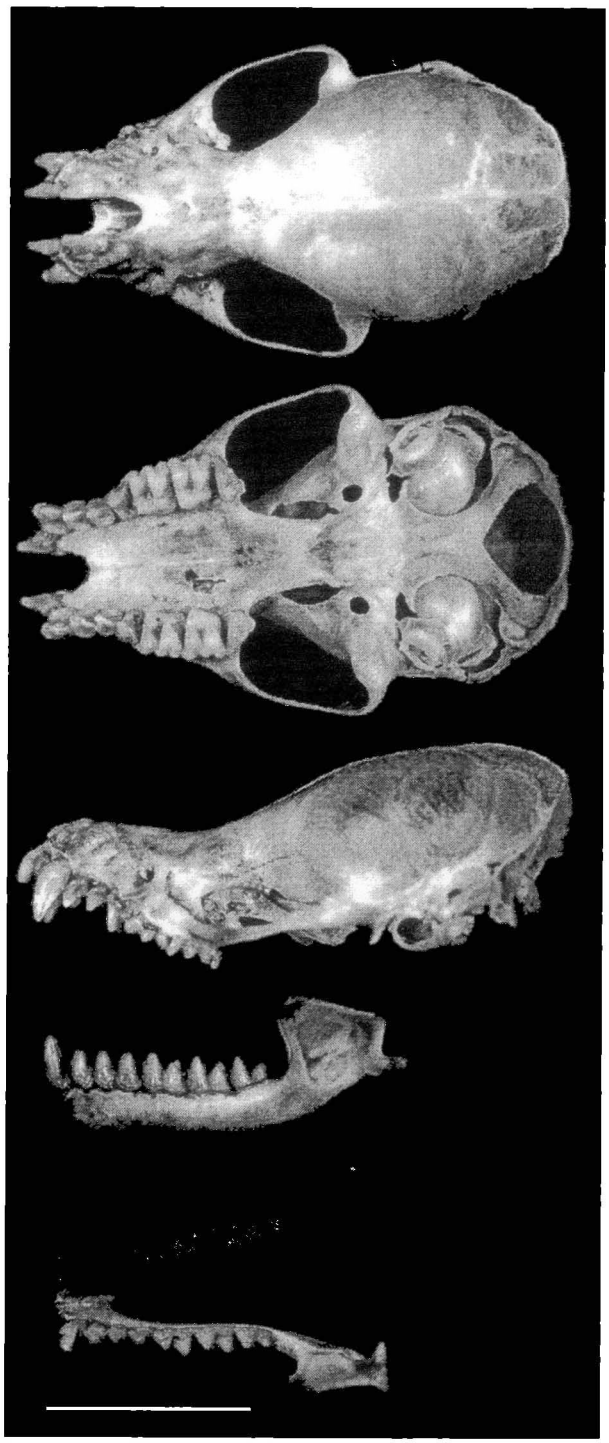

FIG. 2. Dorsal, ventral and lateral views of the cranium and dorsal and lateral views of the mandible of *K. kachinensis*, ♂, Phu Suan Sai National Park, Thailand. Scale 5 mm

divergences among the lineages are so great that the relatively rapidly evolving COI gene does not provide sufficient resolution to determine phylogenetic branching orders in this genus.

Echolocation

In Loei Province, Thailand, the echolocation calls of *K. kachinensis* are characterized by a broadband FM sweep with a peak frequency of 123.9 kHz (123.0–124.9). Calls are of low intensity and short duration (1.5–2.3 ms).

Breeding

In Lao PDR, females captured on 16 April 1996 near Lak Sao, and 20 April 1998 in Nam Ha were pregnant, while an individual caught on 25 May 1997 on the Bolaven Plateau was lactating. Females captured on 4 February 1998 at Phou Khao Khouay and 26 March 1998 in Nam Et were not visibly in breeding condition, though an early pregnancy might not have been detected.

Ecological Notes and Conservation Status

In the Seima Biodiversity Conservation Area, Cambodia, two specimens were collected in a harp trap that was set across a path in deciduous dipterocarp forest near bamboo. A small stream was present within 200 metres. No exact details are available for the third specimen, although it is known that it was collected in a similar manner from the same general vicinity.

In Phu Suan Sai National Park, Thailand, two individuals were captured in a harp trap, which was set across a small path (2.5 m wide) in the transition zone between lower montane forest and mixed deciduous forest. Bamboo groves and banana trees were also present in the area. The September night was foggy and wet, although the rain had stopped at the time of capture. *Kerivoula hardwickii* was collected at the same site. In Nam Nao National Park, Thailand, a single specimen was captured in a harp trap which was set across a nature trail at the edge of mixed deciduous forest near bamboo, 100 m far from a highway.

In Lao PDR, all specimens were captured in 4-bank harp traps. The individual captured near Lak Sao was in disturbed semi-evergreen forest at the edge of a limestone escarpment. On the Bolaven Plateau, one was caught along a small logging track in relatively intact hill evergreen forest. In Phou Khao Khouay, one individual was collected along a small path next to the Nam Leuk River in partially disturbed evergreen forest, while the other was caught a few kilometres away, flying over a narrow logging road. In Nam Et, one of the specimens was caught over a small creek in moist evergreen forest near the Nam Chong River. The other was collected over a 6 m wide stream flanked by riparian forest in a limestone area with caves and escarpments. There was some hill forest on the slopes but in the flatter areas the land was used intensively for paddy fields and other crops. The forest was actively being felled and burned on the slopes. An additional 10 specimens of large *Kerivoula* were captured and released in the same general area. Although originally recorded as *K. papillosa*, that species has not been confirmed from Lao PDR, and it seems likely they were also *K. kachinensis*. In Nam Ha, the only specimen examined was caught over a small creek near the banks of the Nam Tha River, in an area surrounded by active slash and burn agriculture with crop fields and recently burned and young secondary forest. Again, 9 additional individuals of large *Kerivoula* were caught in Nam Ha, most or all of which probably represent this species.

The conservation status of *K. kachinensis* has not yet been officially assessed. However, these recent records, together

with the previous ones from Myanmar and Vietnam (Thong *et al.*, 2006), suggest that it is a widespread and possibly locally common species in continental Southeast Asia. Further, survey work in forest habitats using harp traps will probably provide many additional records.

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