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Review Article

"Rodent Biodiversity Human Health and Pest Control in a Changing Environments"

Rodents within the Centre for Thai National Reference Collections (CTNRC), Past, Present and Future

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ABSTRACT

The Centre for Thai National Reference Collections (CTNRC) was officially established in 1965, but animal collections in Thailand had been continuously conducted long before this time. This paper gives an historical review of the main steps leading to the constitution of the current collections under the administration of TISTR, with a focus on the rodent collection, which represents about one fifth of the whole mammal specimens. An inventory of the species and genera represented is given. Statistics representing the sampling effort in the different Thai provinces are given. The paper concludes with considerations on the current and future needs and the means necessary to develop and support the efforts of the CTNRC.

Key words: CTNRC, ASRCT, NSM, rodent collection

INTRODUCTION

The Centre for Thai National Reference Collections (CTNRC) was officially established in 1965 under the administration of TISTR, previously known as the Applied Scientific Research Corporation of Thailand (ASRCT). During the 31-year period from 1966 to 1997, the CTNRC had collected a great variety of wildlife specimens of mammals, birds, reptiles and amphibians. In 1997, some personnel of CTNRC and herpetological specimens were transferred to the newly-established National Science Museum (NSM). Since that time, mammal and bird specimens have remained at TISTR where 7,627 samples of 189 mammal species and 5,848 samples of 662 avian species are stored and preserved. Therefore, CTNRC has the largest collection of mammal and avian specimens in Thailand. The number of specimens in the collection is extremely small relative to that of famous museums such as the Smithsonian National Museum of Natural History storing 575,671 mammal specimens and 388,943 bird specimens (Smithsonian National Museum of Natural History, 2008).

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Animal collections in Thailand had been continuously conducted long before the establishment of the CTNRC in 1965. The oldest specimen in the collection is a male *Lutra lutra* (Linnaeus, 1758) sampled on 10th August, 1949 from Nakhon Si Thammarat province, South of Thailand. It was the sole specimen collected in 1949. Since that time, the CTNRC has surveyed and collected wildlife specimens from all over the country. These activities led to the discovery of several new species of wild animals. The outstanding discovery was the finding of a White-eyed river martin (*Eurochelidon sirintarae*) in 1968, previously known as *Psuedochelidon sirintarae* and a new genus of swallow (Thonglongya, 1968). This species is now considered an endemic and critically-endangered bird of Thailand (Sanguansombat, 2005). In 1974, the CTNRC discovered a magnificent mammal, Kitti's hog-nosed bat (*Craseonycteris thonglongyai*), the smallest mammal in the world. This animal belongs to a new family and a new genus of bats (Hill, 1974). It is categorized as a "critically endangered species" in Thailand (Nabhitabhata and Chan-ard, 2005). Moreover, CTNRC has discovered 10 new species of animals, including: four species of bats - *Megaerops niphanae* (Yenbutra and Felten, 1983), *Hipposideros halophyllus* (Hill and Yenbutra, 1984), *Hipposideros lekaguli* (Thonglongya and Hill, 1974) and *Rhinolophus marshalli* (Thonglongya, 1973); five species of reptiles - *Gekko taylori* (Ota and Nabhitabhata, 1991), *Cyrtodactylus interdigitalis* (Ulber, 1992), *Cyrtodactylus jarujini* (Ulber, 1993), *Ptyctotarmus phuwuanensis* (Manthey and Nabhitabhata, 1991) and *Davewakeum miriamae* (Heyer, 1972), and one species of amphibian - *Quasioaa fasciculispina* (Inger, 1970).

During the years 1998 to 2005, the CTNRC was financially supported by the government under the project "Collecting and reserving the animal species" acquiring approximately 90,000 baht a year. All specimens in the collection were re-registered and their full information recorded in databases. Nevertheless, no further collection of animal samples was achieved by the CTNRC during this period and the number of staff decreased through retirement without any new recruitment.

Since 2005, two researchers and a technician have been employed by the CTNRC and encouraged to find financial support from external sources for their research projects. This has created good opportunities to restart collecting samples of small mammals, resulting in at least 324 mammal specimens being collected during the last four years - mostly bats and a few rodents. CTNRC has now gradually returned to its original purposes of collecting scientific specimens and reviewing the taxonomy of wild animals in Thailand.

However, in order to meet this objective, the CTNRC needs stronger support from the TISTR, in particular, with regard to new staff recruitment, additional technical means and increased financial props. Without this, the CTNRC will be unable to maintain its role in storing, accumulating and organizing ecological and biological data for Thai and foreign taxonomists in the future.

The rodent collection

The CTNRC currently maintains 1,661 samples of rodents: approximately 21.78% of the mammal specimen collection. In the past 43 years (1965-2008), the growth rate of the rodent collection has been roughly 38 samples each year. Thirty seven species of rodents were identified and four genera were unclassifiable e.g. *Rattus*, *Mus*, *Niviventer*, and *Rhyzomys*. Within this collection, five species make up more than 72% of the total specimens: *Rattus rattus*, *Maxomys surifer*, *Niviventer bukit*, *Rattus exulans*, *Bandicota indica* (Table 1).

Table 1 Number of rodent specimens deposited in CTNRC, Thailand.

No.	Species*	Male	Female	Unsexed	Total
1	*Bandicota indica* (Bechstein, 1800)	41	34	9	84
2	*Bandicota savilei* Thomas, 1952	25	12	0	37
3	*Berylmys berdmorei* (Blyth, 1851)	24	27	4	55
4	*Berylmys bowersi* (Anderson, 1879)	3	1	0	4
5	*Berylmys mackenziei* (Thomas, 1916)	0	0	1	1
6	*Cannomys badius* (Hodgson, 1841)	10	19	2	31
7	*Chiromyscus chiropus* (Thomas, 1891)	1	1	0	2
8	*Chiropodomys gliroides* (Blyth, 1856)	1	1	0	2
9	*Eothenomys miletus* (Thomas, 1914)	2	2	1	5
10	*Leopoldamys edwardsi* (Thomas, 1882)	0	1	1	2
11	*Leopoldamys neilli* (Marshall, 1976)	4	0	0	4
12	*Leopoldamys sabanus* (Thomas, 1887)	22	15	0	37
13	*Maxomys rajah* (Thomas, 1894)	4	1	0	5
14	*Maxomys surifer* (Miller, 1900)	119	115	13	247
15	*Maxomys whiteheadi* (Thomas, 1894)	3	5	0	8
16	*Mus caroli* Bonhote, 1920	9	10	0	19
17	*Mus cervicolor* Hodgson, 1861	11	4	2	17
18	*Mus cookii* Ryley, 1926	6	6	1	13
19	*Mus musculus* Linnaeus, 1761	2	2	0	4
20	*Mus pahari* Thomas, 1926	7	3	2	12
21	*Mus shortridgei* (Thomas, 1914)	1	2	0	3
22	*Niviventer bukit* Bonhote, 2019	65	44	10	119
23	*Niviventer cremoriventer* (Miller, 1900)	11	8	1	20
24	*Niviventer hinpoon* (Marshall, 1976)	1	0	0	1
25	*Rattus argentiventer* (Robinson & loss,1916)	7	9	0	16
26	*Rattus exulans* (Peale, 1848)	45	49	2	96
27	*Rattus losea* (Swinhoe, 1870)	33	19	2	54
28	*Rattus nitidus* (Hodgson, 1845)	4	6	0	10
29	*Rattus norvegicus* (Berkenhout, 1769)	8	22	0	30
30	*Rattus osgoodi* Musser & Newcomb, 1985	2	0	0	2
31	*Rattus rattus* (Linnaeus,1758)	277	280	15	572
32	*Rattus sikkimensis* Hinton, 1951	15	20	3	38
33	*Rattus tiomanicus* (Miller, 1900)	2	1	0	3
34	*Rhizomys pruinosus* Blyth, 1851	1	1	0	2
35	*Rhizomys sumatrensis* (Raffles, 1821)	0	1	0	1
36	*Sundamys muelleri* (Jentink, 1879)	5	5	0	10
37	*Vandeleuria oleracea* (Bennett, 1832)	1	0	0	1
38	*Mus* sp.	2	2	0	4
39	*Niviventer* sp.	1	2	1	4
40	*Rattus* sp.	42	31	10	83
41	*Rhizomys* sp.	1	0	2	3
	Total	818	761	82	1,661

* Species were mainly identified according to Lekagul and MacNeely (1988).

It must be noted, that the scientific names in Table 1, refer to the name on the sample tag. These names were mainly identified according to Lekagul and MacNeely (1988) and have not been updated. Consequently, the number of rodent species in the collection is lower than that of current checklist of about 42 species in Thailand (Musser and Carleton, 2005). This implies that the rodent specimens in CTNRC require taxonomic revision and that an intensive investigation of rodent diversity in Thailand is very desirable.

Within the CTNRC collection are specimens of two outstanding rodent species endemic to Thailand (Nabhitabhata and Chanard, 2005) - *Niviventer hinpoon* and *Leopoldamys neilli*, both of them discovered in 1976 (Marshall, 1976b). They were originally captured from the same type locality, the limestone mountains in Saraburi province, approximately 120 km northeast of Bangkok. Waengsothorn et al. (2008) reported that the distribution range of *N. hinpoon* seemed to be very restricted. Two locations were currently known and this species was not found in its type locality. Conversely, *L. neilli*, is likely to be widely spread and possibly found in neighboring countries. The holotype specimens of *N. hinpoon* and *L. neilli* are deposited in CTNRC.

The first 14 specimens of rodents were collected in 1951, including: 12 samples of *Cannomys badius*, one sample of *Sundamys muelleri* and one sample of an unidentified *Rattus*. The number of specimens significantly increased in 1962. The highest number of rodent specimens was collected in the first year that the CTNRC was establishmed in 1965. That year, CTNRC gained 225 samples or roughly 13.54% of its rodent specimens. Since its foundation in 1965, the CTNRC has collected as many rodent samples as it could. However, the rate of obtaining rodent specimens has reduced since then. From 1974, the rate was as low as about 50 samples per year due to the death of an outstanding curator, Mr. Kitti Thonglongya who concentrated on rodent taxonomic study in CTNRC and in Thailand. In 1998, there no samples were collected (Fig. 1).

In recent years (2005-2008), the CTNRC has initiated new collections of specimens, which has allowed it to obtain 324 additional samples of animals. However, the collecting rate of rodents has still been very low. Seventeen samples of rodents were collected during that period or approximately 5.25%, due to lack of skilled technicians to prepare the samples and the lack of funding support.

In the future, conducting research on Thai rodents will be very important because they are relevant to human health and wealth. They can be the host for many diseases such as leptospirosis

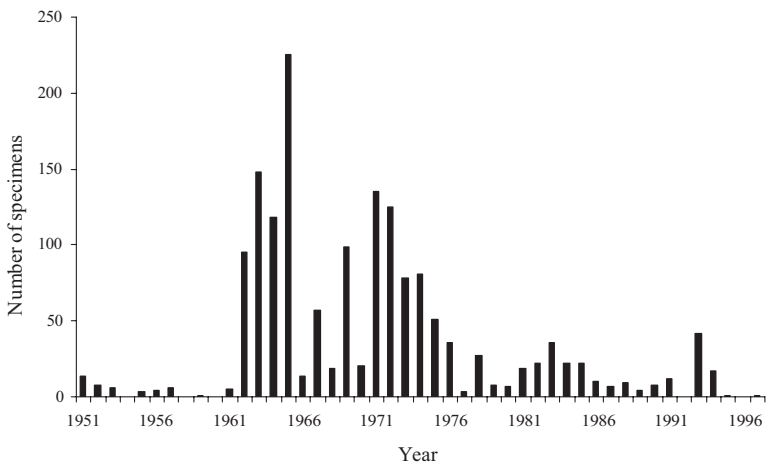

Figure 1 Annual rodent specimen collection by CTNRC, Thailand.

Table 2 List of Thai provinces that have never been explored for rodent species.

No.	Province	Area (km^2)
1.	Amnat Charoen	3,266.19
2.	Ang Thong	946.99
3.	Buri Ram	10,194.20
4.	Kamphaeng Phet	8,614.80
5.	Lamphun	4,490.51
6.	Mukdahan	4,216.95
7.	Phayao	6,154.05
8.	Phichit	4,265.44
9.	Phitsanulok	10,529.70
10.	Phra Nakhon Si Ayutthaya	2,546.35
11.	Phuket	562.92
12.	Samut Sakhon	860.02
13.	Samut Songkhram	391.83
14.	Sing Buri	837.14
15.	Songkhla	7,852.55
16.	Sukhothai	6,638.79
17.	Uttaradit	7,922.38
18.	Yasothon	4,129.19
	Total	84,419.99

and hantavirosis. Some species of rodents are the main food source of Thai people. Thailand is a country with a high potential for ecological and biological research on rodents. In the past 43 years since the establishment of the CTNRC, rodent surveys have been conducted in 58 of the 76 Thai provinces. The 18 unexplored provinces cover approximately 84,420 km^2 or 16.37% of the total area of Thailand (Table 2).

Although, fifty eight provinces in Thailand were marked as "surveyed areas" for rodents, very few intensive surveys had been performed. The highest numbers of rodent samples have come from only two provinces, Chiang Mai and Nakhon Ratchasima, with 217 and 224 rodent samples, respectively. Three provinces provided between 100 and 200 samples: Chon Buri (103 samples), Ubon Ratchathani (110 samples) and Bangkok (113 samples). The other 53 surveyed provinces have supplied less than 100 specimens of rodent samples in the past 43 years (Figure 2). These provinces also require re-surveying with

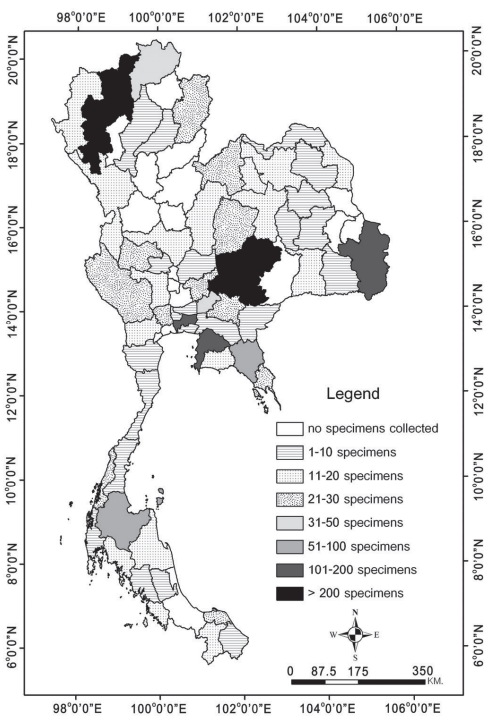

Figure 2 The distribution of provinces classified by number of rodent specimens.

regard to rodent diversity. This information indicates that Thailand has a severe lack of rodent information and an intensive survey of rodent biodiversity is strongly recommended. CTNRC also needs to learn how to use new technologies to accurately identify rodent species. This will require international cooperation. Moreover, the TISTR's policy of financial support for CTNRC should be revised to allow the employment of more skilled technicians.

CONCLUSION

CTNRC, founded in 1965, has collected up until now 7,627 mammal specimens and 5,848 avian specimens. In the past 43 year since its establishment, CTNRC has played an important role in collecting animal samples. It has discovered spectacular new species, such as the smallest mammal, *Craseonycteris thinglongyai* and the critically-endangered bird, *Eurocheliodon sirintatrae*. The CTNRC keeps 1,661 rodent samples including two holotype specimens of the Thai endemic rodents, *Niviventer hinpoon* and *Leopoldamys neilli*. Only 37 rodent species are recorded in the collection out of the 47 species reported for Thailand. In addition, the CTNRC has not collected animal samples, especially rodents, from all over the country. There are 18 provinces that have not been investigated. Less than 100 samples per province have been collected from 53 provinces. This information leads to an implication of the need for specimen revision and a re-survey of rodents all over the country.

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