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原著論文

Recent records of bats from south-western Hokkaido

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北海道南西部におけるコウモリ類の最近の記録

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ABSTRACT

Recent capture and observational records of bats from south-western Hokkaido contribute new knowledge of bat presence in this region and reconfirm past distributional records. We reconfirmed presence of 10 out of 15 bat species recorded previously in the area, and added one further species (*Vespertilio murinus*) to the area's assemblage. The results indicated clearly that bat faunal composition in this area is different from that of northern and eastern Hokkaido.

Key words: Chiroptera, Distribution, Fauna, South-western Hokkaido

INTRODUCTION

For appropriate conservation and ecological studies of wildlife, knowledge of distributions is essential. Capture and observational records are thus invaluable and deserving of publication, especially where records are scarce. Before the 1990's, our knowledge of the distribution of bats in Japan was relatively poor compared to other mammals, and made allocation of conservation status difficult. The situation has been much improved since then because of an increased number of researchers and growing public interest in the animals. However, our knowledge in many regions is still limited.

In Hokkaido, our knowledge of the richness and distribution of bats has expanded rapidly since 2000, with an increasing number of researchers, especially in northern and eastern Hokkaido (e.g. Kondo *et al*., 2003, 2005; Dewa *et al*., 2005, 2006; Satô *et al*., 2005, 2006, 2007; Yanagawa *et al*., 2005, 2006; Yamaga, 2006; Kawai, 2006; Serizawa, 2006; Akasaka *et al*., 2007; Fukui *et al*., 2007). In south-western Hokkaido (Ishikari, Shiribeshi, Iburi, Oshima and Hiyama regions), 15 species (*Rhinolophus ferrumequinum*, *R. cornutus*, *Myotis macrodactylus*, *My. ikonnikovi*, *My. frater*, *My. petax* [former *My. daubentonii*], *Eptesicus nilssonii*, *Nyctalus aviator*, *Pipistrellus abramus*, *Hypsugo alaschanicus* [former *Pi. savii*], *Vespertilio*

Table 1. Location of sites

Site number	Region	Municipality	Locality	Lat.	Long.	Alt. (m)	Habitat	Ambient environment
1	Ishikari	Sapporo	Hitsujigaoka	N 42°59'	E 141°23'	150	Forest	SF, CP, NS
2		Chitose	Chitose Highschool	N 42°49'	E 141°38'	30	Building	UA
3			Tunnel of Rankoshi drain	N 42°48'	E 141°37'	25	Tunnel entrance	SF
4			Suimei bridge, Chitose river	N 42°46'	E 141°24'	250	Forest	SF, NS
5			Naka-Morappu	N 42°45'	E 141°24'	305	Forest	MF
6			Bifue river	N 42°43'	E 141°11'	465	Forest	SF, NS
7	Shiribeshi	Kutchan	Centennial Woods	N 42°54'	E 140°46'	185	Forest	MF
8			Lake Hangetsu	N 42°51'	E 140°45'	300	Forest	MF
9		Niseko	Yotei	N 42°49'	E 140°44'	245	Building	SF
10		Makkari	Yashiro	N 42°47'	E 140°46'	260	Forest	SF
11		Akaigawa	Tokiwa	N 43°05'	E 140°57'	390	Building	RA
12	Iburi	Tomakomai	Uenae	N 42°42'	E 141°43'	10	Forest	SF
13			Uenae-2	N 42°44'	E 141°41'	15	Forest	SF
14			Akebono	N 42°40'	E 141°40'	10	Building	UA
15			Ipponmatsu	N 42°39'	E 141°38'	10	Building	UA
16			Yufutsu river	N 42°42'	E 141°33'	40	Forest	SF, NS
17			TOEF* Kumanosawa stream	N 42°41'	E 141°37'	25	Forest	MF, NS
18			TOEF forest tower	N 42°40'	E 141°35'	25	Forest	SF, NS
19			TOEF Horonai stream	N 42°40'	E 141°35'	25	Forest	SF, NS
20			TOEF Sobaya-no-sawa	N 42°40'	E 141°34'	40	Forest	SF
21			Omotemachi	N 42°38'	E 141°36'	10	Street	UA
22		Noboribetsu	Iwasaki, Horobetsu-mine	N 42°28'	E 141°02'	120	Mine entrance	SF
23		Muroran	Motowa-nishi	N 42°22'	E 140°59'	30	Building	UA
24	Oshima	Imakane	Oku-Pirika	N 42°32'	E 140°15'	210	Cave entrance	SF
25		Mori	Mori fishing port	N 42°06'	E 140°35'	0	Sea port	UA
26		Hokuto (former Ohno)	Honcho	N 41°53'	E 140°38'	30	Shrine	UA
27			Kama-no-senkyo	N 41°53'	E 140°33'	170	Forest	SF
28		Hakodate	Matsukura river	N 41°51'	E 140°50'	250	Forest	SF, NS
29	Hiyama	Matsumae	Ikenotai	N 41°27'	E 140°07'	60	Forest	SF

*TOEF: Tomakomai Experimental Forest, Hokkaido University. Abbreviations in ambient environment are as follows; SF: Secondary forest, MF: Mature forest, CP: Conifer plantation, NS: Near stream, UA: Urban area, RA: Rural area

sinensis, *Plecotus sacrimontis* [former *Pl. auritus*], *Barbastella leucomelas*, *Murina hilgendorfi* and *Mu. ussuriensis*) had been recorded previously (Hattori, 1971; Bat Research Group of Centennial Woods Fun Club, 2001; Fukui *et al*., 2005). However, especially in the regions of Iburi, Oshima and Hiyama, only 5 species (*R. ferrumequinum*, *N. aviator*, *V. sinensis*, *My. ikonnikovi* and *Pl. sacrimontis*) of bats were recorded historically (Peters, 1880; Nozawa, 1892; Kuroda, 1938; Hattori, 1966, 1971; Yoshiyuki, 1989). Following this, Fukui *et a*l. (2005) reported the presence of 11 species (*R. ferrumequinum*, *R. cornutus*, *My. macrodactylus*, *My. ikonnikovi*, *My. frater*, *N. aviator, Pi. abramus*, *V. sinensis*, *Pl. sacrimontis*, *Mu. hilgendorfi* and *Mu. ussuriensis*) in the area of Iburi, Oshima and Hiyama based on the capture of more than 100 individuals.

In this paper, we report recent unpublished capture and observational records of bats from throughout Iburi, Oshima and Hiyama from 2005 to 2008 and the Shiribeshi and Ishikari regions since 2001 (site details in **Table 1** and **Figure 1**).

METHODS

Bat recordings were obtained by three methods. (1) Capture of bats when active outside their roosts by mist nets (5 – 9 m width, 4 – 7 m height; Tokyo Tobari, Tokyo) or harp traps (Austbat 2 or 3 bank; Faunatech, Australia). Mist nets or harp traps were set on forest trails or roads, inside forests or at the

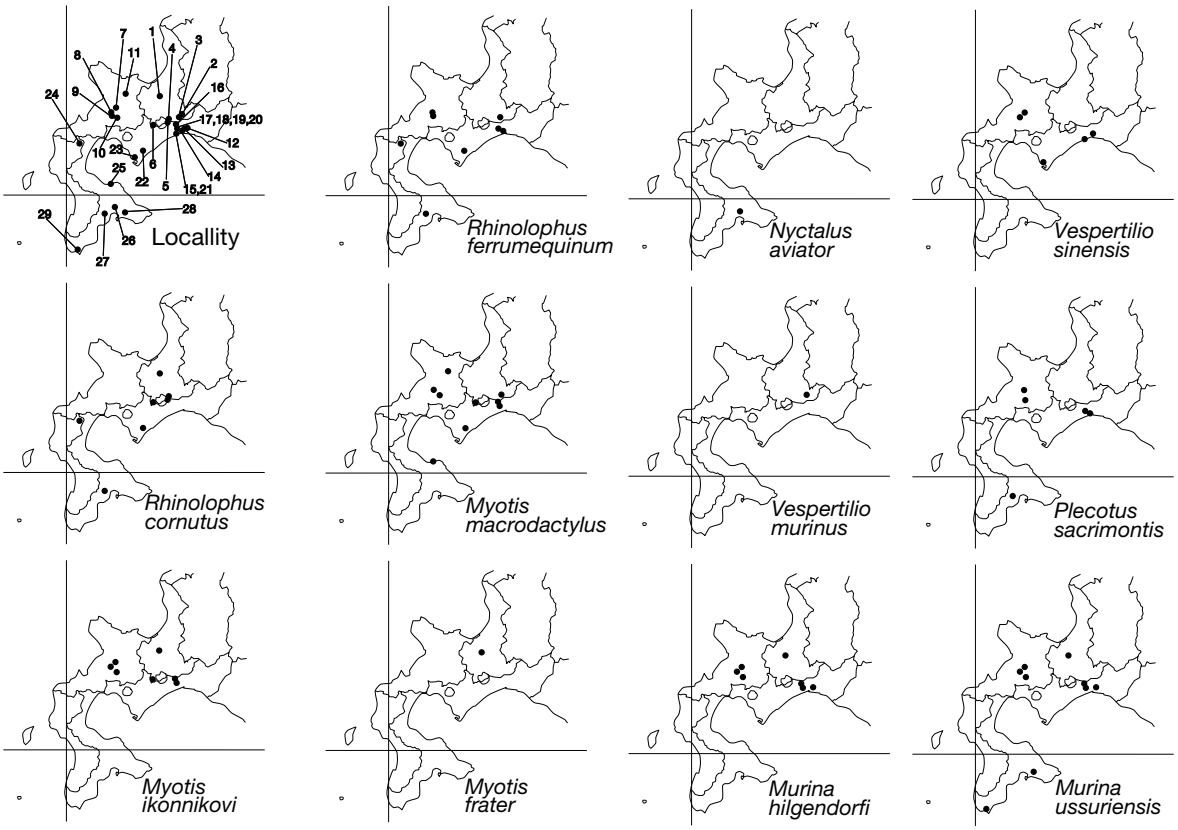

Figure 1. Localities of capture and observation for each species.
Site numbers correspond to those in Table 1.

entrance of tunnels and abandoned mines from sunset, and withdrawn at sunrise at the latest. (2) Bats were identified to species by visual recognition in roosts where possible, or else following their capture from buildings, caves, abandoned mines and tunnels by hand-net. (3) Acquisition of debilitated or dead bats brought to the authors.

Captured or acquired bats were identified to species based on Abe *et al*. (2005), and sex, age, maturity and reproductive status were noted. Age categories were defined as; 'young': from first flight to the end of their year of birth; 'adult': beginning after their first year following birth. Age was determined from the degree of epiphyseal fusion (ossification of the finger bones; Mitchell-Jones and McLeish, 1999) or reproductive status. When determination was difficult because the bones were fully ossified (e.g. males in late Autumn), we recorded age as 'unknown'. Body weight and forearm length were also measured using a digital balance (TANITA, Handy-mini-1476) and a slide caliper (Mitsutoyo Corporation, CD-20B), respectively. For individual identification, bats captured or acquired alive had their forearm banded with numbered aluminum bands (Lambournes Ltd., U.K.) before release. For bats acquired dead, skin and skull specimens were prepared, and external and cranial morphology was measured from these. English and scientific names follow Abe *et al*. (2005) except for the *Myotis petax*, *Hypsugo alaschanicus* and *Plecotus sacrimontis*. Although *M. petax* had been included in *M. daubentonii* in Japan, we follow Matveev *et al*. (2005), who proposed it as a valid species for the"eastern" group of *M. daubentonii*. Although *Hypsugo* (*Pipistrellus*) *alaschanicus* had

been treated as a subspecies of *Hypsugo* (*Pipistrellus*) *savii*, we follow Horácek *et al*. (2000), who argued that *Hypsugo alaschanicus* from Mongolia, China, the Russian Far East, Korea and Japan, is recognized as a valid species of the genus *Hypsugo* (*Pipistrellus*) and different from *H. savii*. For *Plecotus sacrimontis*, which was treated as *P. auritus* previously, we follow Spitzenberger *et al*. (2006) who showed that the Japanese population is distinct. All surveys were conducted under capture licenses issued from the Ministry of Environment.

RESULTS AND DISCUSSION

We recorded a total of 561 individuals comprising 11 bat species, along with 1 night and 6 day roosts (**Table 2**). Sex, age, body weight and forearm length of each individual are provided in Appendix 1. External and cranial morphology of preserved specimen are given in Appendix 2.

1. Greater Horseshoe Bat *Rhinolophus ferrumequinum* (Schreber, 1774)

Previously, this species was recorded frequently from central to southwestern Hokkaido (e.g., Hattori, 1966; Bat Research Group of Centennial Woods Fan Club, 2001; Fukui *et al*., 2005). In our surveys, 73 individuals were captured or observed at 8 sites (**Figure 1**, **Table 2**). Of these, sites 3, 9, 14 and 22 were day roosts. Site 3 was a drain tunnel 0.8 km long, described in Hattori (1966). In August, we observed the emergence of bats from the tunnel entrance with the help of bat detectors because rapid water flow in the tunnel prevented entry. In winter and early spring, we were able to access the tunnel but found no roosting bats (collected one carcass). Site 9 was an abandoned house described in Bat Research Group of Centennial Woods Fan Club (2001) as a nursery roost. Site 14 was a newly discovered day roost in an abandoned pillbox (approx. 50 m^2) from World War II, where up to 21 individuals were roosting from spring to summer. Pregnant females were confirmed in July, and one of them was a marked individual captured in the previous year at site 19, which is 7.3 km away from this roost. Site 22 was a newly discovered day roost in an abandoned mine. The poor condition of the mine made it too dangerous to enter, but individuals were captured in front of the entrance. The size and composition of this colony are unknown. At site 24, 2 individuals were captured at the entrance of a limestone cave. Use of this cave by *R. cornutus* was already known (Fukui *et al*. 2005), but the record of *R. ferrumequinum* was new. At site 27, this species was captured in forest near the large limestone caves that

Table 2. List of captured and observed species and sites.

Species	Male	Female	unknown	Site number
Rhinolophidae				
Rhinolophus ferrumequinum	9	10	54	**3**, 8, **9**, **14**, 19, **22**, **24**, 27
Rhinolophus cornutus	23	26	0	1, 4, *5*, 6, 22, 24, 27
Vespertilionidae				
Myotis macrodactylus	24	27	0	**3**, 6, 8, 10, 11, 16, 17, 18, 19, 20, **22**, 25
Myotis ikonnikovi	38	42	1	1, 6, 7, 8, 10, 16, 17, 19, 20
Myotis frater	1	8	0	1
Nyctalus aviator	7	1	0	26
Vespertilio sinensis	7	21	0	7, 8, 13, 15, 21, 23
Vespertilio murinus	0	1	0	2
Plecotus sacrimontis	5	2	1	7, 10, **14**, 19, 27
Murina hilgendorfi	32	27	1	1, 7, 8, 10, 12, 16, 17, 19
Murina ussuriensis	65	123	5	1, 7, 8, 10, 12, 16, 17, 18, 19, 20, 28, 29

Site numbers correspond to **Table 1**. Site numbers in bold mean the day roosts, and in italic mean a night roost.

were discovered in 2006 (Hokkaido Shimbun Press, 2006). Bats captured at site 27 were possibly roosting in these caves.

2. Japanese Little Horseshoe Bat *Rhinolophus cornutus* Temminck, 1835

In Hokkaido, this species was recorded mainly from central to south-western Hokkaido (e.g., Hattori, 1966; Bat Research Group of Centennial Woods Fan Club, 2001; Fukui *et al*., 2005). Forty-nine individuals were captured at 7 sites (**Figure 1**, **Table 2**). Among them, site 5 was a small summerhouse surrounded by a secondary forest and used as a night roost. Site 22 was a newly discovered day roost in an abandoned mine. In this survey, we captured individuals upon their emergence from the entrance (see *R. ferrumequinum* account above). Thus, size and composition of this colony is unknown. Site 24 was a known roost in a natural cave described in Fukui *et al*. (2005). In Akiyoshi-dai, Yamaguchi prefecture, males and females tend to be separated throughout the year except during the period of mating (Kuramoto, 1972). However, we captured males, non-pregnant females and pregnant females on the same night at the entrance of the cave in July. It would be useful to determine the size and composition of the colony at site 24 because males and females might form a single intermingled group here.

3. Japanese Large-footed Bat *Myotis macrodactylus* (Temminck, 1840)

We captured or acquired a total of 51 individuals at 12 sites (**Figure 1**, **Table 2**). This species is understood to forage above water surfaces. In our surveys, most bats were captured near or over streams. However, some individuals were also captured in forests far from streams (> 300 m; e.g. site 20).

At sites 3 and 22, we captured this species at the entrance of a tunnel and an abandoned mine, respectively. Bats captured at these sites are likely to use the tunnel and abandoned mine as day roosts.

Interestingly, one individual was recovered from the seawater surface in a fishing port. One of the authors (DF) has observed bats flying above seawater and heard feeding buzzes through a bat detector at several fishing ports. These bats were feeding on insects derived from either coastal edge habitats or streetlights in the fishing port.

4. Ikonnikov's Bat *Myotis ikonnikovi* Ognev, 1912

This species has been recorded from throughout Hokkaido (e.g., Kondo et al., 2003, 2005; Dewa *et al*., 2005, 2006; Satô *et al*., 2005, 2006, 2007; Yanagawa *et al*., 2005, 2006; Yamaga, 2006; Kawai, 2006; Serizawa, 2006; Akasaka *et al*., 2007; Fukui *et al*., 2005, 2007). In our surveys, 81 bats were captured at 9 sites (**Figure 1**, **Table 2**). All 9 sites were in forested areas. In Honshu, this species has been found at relatively high altitude (> 600 m), with exceptions to this in Aomori prefecture (e.g., Machida *et al*., 1986; Yasui *et al*., 2000; Kimura *et al*., 2002). All sites in our surveys were located at relatively low altitude (0 – 465 m) and this species was captured frequently, which is consistent with previous records from a wide range of altitudes in Hokkaido.

5. Long-legged Whiskered Bat *Myotis frater* Allen, 1923

A total of 9 bats was captured at site 1 (**Figure 1**, **Table 2**). This species has been recorded frequently from northern and eastern Hokkaido, but sporadically from south-western Hokkaido (e.g., Hattori, 1971; Maeda and Satô, 1995; Bat Research Group of Centennial Woods Fun Club, 2001; Dewa and Kosuge, 2001; Satô *et al*, 2001, 2005, 2006; Yanagawa *et al*., 2003, 2005, 2006; Kawahara *et al*., 2003; Kondo *et al*., 2003, 2005; Dewa *et al*., 2005; Fukui *et al*., 2005; Kawai, 2006; Serizawa, 2006). In our survey, we were only able to capture them at one site. The factors limiting their distribution are unknown.

6. Japanese Large Noctule *Nyctalus aviator* Thomas, 1911

A total of 8 bats was captured at site 26 (**Figure 1**, **Table 2**). As described in Fukui *et al*. (2005), this site

is located in a shrine, and this species was roosting in tree cavities of 3 large sacred trees (2 *Taxus cuspidata* and 1 *Cercidiphyllum japonicum*). In our survey, mist netting was conducted on one occasion in October.

There is only one known maternity colony of this species in Hokkaido (Dewa and Kosuge, 2001). Information on colony composition and size during periods when females are pregnant and lactating is required so as to direct their conservation.

7. Asian Parti-colored Bat
***Vespertilio sinensis* (Peters, 1880)**

A total of 28 bats was captured or acquired at 6 sites (**Figure 1**, **Table 2**). This species has been recorded throughout Hokkaido in the past, though is known to be relatively rare in the northern and eastern regions (e.g., Bat Research Group of Centennial Woods Fan Club, 2001; Dewa, 2001, 2002, 2005; Dewa and Kosuge, 2001; Yanagawa *et al*., 2005; Fukui *et al*., 2005; Akasaka *et al*., 2007). All individuals from site 15, 21 and 23 were found in urban areas in December or April. In Honshu, this species might migrate seasonally (e.g. Mukohyama, 1997), and hibernating roosts have been discovered previously in buildings (Yamaguchi et al., 2005). It is possible that sites 15, 21 and 23 are located within their hibernation range or on the migration route between summer and winter roosts. In a survey at site 7, several banded bats were recaptured, and all were banded at a nursery colony nearby. Bedbugs *Cimex japonicus* were confirmed from several individuals captured at site 7.

8. Parti-colored Bat
***Vespertilio murinus* Linnaeus, 1758**

In this survey, one debilitated bat was taken from a high school building at site 2 in December (**Figure 1**, **Table 2**), and this individual died soon afterward. We identified the specimen as *V. murinus* by cranial and external measurements as per Satô and Maeda (2003). The specimen (skull and skin) is held by one of the authors (DF). This species is distributed from Europe to the Ussuri region, China and Korea (Simmons, 2005). In Japan, only one individual had been recorded prior to this finding (Rebun Island, Hokkaido; Satô and Maeda, 2003). Non-artificial (natural migration or accidental migration by storms) or artificial (via sea or air vessels) translocation could be a possible source. To clarify the migration route and accurate species identification, a molecular phylogenetic study is required.

9. Japanese Long-eared Bat
***Plecotus sacrimontis* Allen, 1908**

This species has been recorded from a wide range of altitudes throughout Hokkaido (e.g., Maeda and Satô, 1995; Maeda and Uno, 1996; Uno *et al*., 1996; Kawai, 2000; Yamaga *et al*., 2000, 2002; Satô *et al*., 2001, 2006; Bat Research Group of Centennial Woods Fan Club, 2001; Dewa, 2001, 2002, 2005; Dewa and Kosuge, 2001; Kondo *et al*., 2003, 2005; Akasaka *et al*., 2007; Kawahara *et al*., 2004; Yanagawa *et al*., 2005; Fukui et al., 2005, 2007; Serizawa, 2006; Tatsugami *et al*., 2006). A total of 8 bats was captured at 5 sites (**Figure 1**, **Table 2**). Among those sites, only site 14 was recorded as a day roost. This roost seems to be transient because the species was apparently absent when we surveyed 6 times in other seasons from September 2007 to July 2008. All sites were surrounded by secondary or mature forest.

10. Hilgendorf's Tube-nosed Bat
***Murina hilgendorfi* (Peters, 1880)**

A total of 60 bats was captured at 8 sites (**Figure 1**, **Table 2**). This species is distributed throughout Hokkaido, though records are sporadic (e.g., Dewa, 2005; Fukui *et al*., 2005, 2007; Bat Research Group of Centennial Woods Fun Club, 2001 ; Kawahara *et al*., 2003; Kawai, 2000; Kondo *et al*., 2003, 2005; Maeda and Uno *et al*., 1996; Serizawa, 2006; Yanagawa *et al*., 2001, 2004). Around Tomakomai City, we captured this species frequently. It dominated captures at site 19 (39 of 126 individuals), which was also observed by Fukui *et al*. (2005). Further study on habitat preference in this species is required to determine the

reasons for the variability in abundance among regions in Hokkaido.

11. Ussurian Tube-nosed Bat
***Murina ussuriensis* Ognev, 1913**

A total of 193 bats was captured at 12 sites (**Figure 1**, **Table 2**). This species is distributed throughout Hokkaido and recorded frequently (e.g., Dewa, 2002, 2005; Dewa, and Kosuge, 2001; Dewa *et al*., 2005; Fukui *et al*., 2005, 2007; Hattori, 1966, 1971; Kawai, 2000; Kondo *et al*., 2003; Maeda and Satô, 1995; Maeda and Uno, 1996; Satô *et al*., 2001, 2005, 2006, 2007; Uno *et al*., 1996; Yamaga, 2006; Yamaga *et al*., 2000, 2002; Yanagawa, *et al*., 2004, 2005). It was the species captured most frequently in our surveys. In site 28, two roosting bats were found inside two dead leaves of *Polygonum sachalinense* at 2 m from the ground in September.

Conclusion

In the regions we covered in this study, 15 bat species had been recorded previously. In our surveys, 10 of these 15 species were recorded, and one further species (*V. murinus*) was newly discovered. According to the patterns apparent from past records from Hokkaido and this study, bats in Hokkaido can be divided into 5 distributional types: (1) widely distributed throughout Hokkaido (*Nyctalus aviator*, *Myotis ikonnikovi*, *M. macrodactylus*, *M. frater*, *Plecotus sacrimontis*, *Murina hilgendorfi* and *M. ussuriensis*); (2) common in south-western Hokkaido, and rare in northern and eastern Hokkaido (*Vespertilio sinensis*, *Rhinolophus ferrumequinum* and *R. cornutus*); (3) rare in south-western Hokkaido, and common in northern and eastern Hokkaido (*Eptesicus nilssonii*, *Babastella leucomelas* and *Myotis petax*); (4) restricted to south-western Hokkaido (*Pipistrellus abramus*, *Hypsugo alaschanicus* and *Vespertilio murinus*); and (5) restricted to northern and eastern Hokkaido (*Myotis garacilis*, *M. nattereli* and *Tadarida insignis*). There is an obvious difference in the bat fauna between south-western Hokkaido and northern and eastern Hokkaido. To explain this difference, further bat surveys and an assessment of potential factors limiting the distributions of each species are required.

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Appendix 1. Species, site, date, sex, age, BW and FA

Species	Site number	Date	sex	age	BW	FA	Notes
R. ferrumequinum	8	04-Sep-01	M		23.6	58.2	
R. ferrumequinum	9	11-Jun-02	F	A	31.6	59.2	
R. ferrumequinum	9	11-Jun-02	F	A	22.6	61.7	
R. ferrumequinum	9	11-Jun-02	F	A	33.4	60.9	
R. ferrumequinum	9	11-Jun-02	M	A	20.8	57.8	
R. ferrumequinum	9	11-Jun-02	F	A	24.4	58.7	
R. ferrumequinum	9	11-Jun-02	M	A	22.0	59.5	
R. ferrumequinum	9	11-Jun-02	F	A	20.8	58.1	
R. ferrumequinum	9	11-Jun-02	M	A	22.2	58.6	
R. ferrumequinum	24	08-Jul-05	M	A	18.6	57.8	
R. ferrumequinum	24	08-Jul-05	M	A	23.5	59.7	
R. ferrumequinum	22	09-Jul-05	M	A	21.6	60.2	
R. ferrumequinum	22	09-Jul-05	M	A	21.0	58.6	
R. ferrumequinum	9	03-Aug-05	F	A			recapture (11-Jun-02 at Site 9)
R. ferrumequinum	9	03-Aug-05	F	A			recapture (11-Jun-02 at Site 9)
R. ferrumequinum	3	01-Nov-05	M		24.6	59.4	
R. ferrumequinum	27	15-Oct-06	F	Y	27.2	57.6	
R. ferrumequinum	19	21-Jun-07	F	A	29.6	60.9	
R. ferrumequinum	14	07-Jul-07					day roost (21 individuals)
R. ferrumequinum	3	21-Apr-08					carcass
R. ferrumequinum	14	21-Apr-08					day roost
R. ferrumequinum	14	18-May-08					day roost (12 individuals)
R. ferrumequinum	14	10-Jul-08					day roost (20 individuals)
R. ferrumequinum	14	10-Jul-08	F	A			recapture (21-Jun-07 at Site 19)
R. cornutus	5	07-Jul-05	F	A	8.9	41.2	
R. cornutus	5	07-Jul-05	F	A	8.8	39.8	
R. cornutus	24	08-Jul-05	F	A	6.4	40.6	
R. cornutus	24	08-Jul-05	M	A	6.5	40.8	
R. cornutus	24	08-Jul-05	M	A	5.7	39.4	
R. cornutus	24	08-Jul-05	M	A	6.6	40.1	
R. cornutus	24	08-Jul-05	M	A	6.7	40.5	
R. cornutus	24	08-Jul-05	M	A	6.6	41.5	
R. cornutus	24	08-Jul-05	M	A	6.8	41.8	
R. cornutus	24	08-Jul-05	F	A	6.2	40.6	
R. cornutus	24	08-Jul-05	F	A	8.3	40.2	
R. cornutus	24	08-Jul-05	F	A	6.6	40.4	
R. cornutus	24	08-Jul-05	M	A	6.8	41.5	
R. cornutus	24	08-Jul-05	F	A	7.2	41.7	
R. cornutus	24	08-Jul-05	F	A	6.6	40.8	
R. cornutus	24	08-Jul-05	M	A	6.5	40.8	
R. cornutus	24	08-Jul-05	F	A	6.7	41.1	
R. cornutus	24	08-Jul-05	F	A	8.2	40.6	
R. cornutus	24	08-Jul-05	M	A	6.3	40.5	
R. cornutus	24	08-Jul-05	M	A	6.5	39.8	
R. cornutus	24	08-Jul-05	F	A	6.6	40.8	
R. cornutus	24	08-Jul-05	M	A	6.4	40.7	
R. cornutus	24	08-Jul-05	M	A	7.1	40.8	
R. cornutus	24	08-Jul-05	F	A	7.2	41.3	
R. cornutus	24	08-Jul-05	M	A	6.8	41.3	
R. cornutus	24	08-Jul-05	F	A	6.3	39.8	
R. cornutus	24	08-Jul-05	M	A	6.5	41.4	
R. cornutus	24	08-Jul-05	M	A	6.2	40.1	

Site numbers correspond to Table 1. Blank column in sex, age, BW and FA means 'unknown' or 'not measured'. Parenthetic reference after 'recapture' in Notes indicates the day and the locality that the recaptured individual captured first time.

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
R. cornutus	24	08-Jul-05	F	A	6.8	40.7	
R. cornutus	24	08-Jul-05	M	A	7.2	40.3	
R. cornutus	24	08-Jul-05	M	A	7.0	40.6	
R. cornutus	24	08-Jul-05	F	A	6.6	41.6	
R. cornutus	22	09-Jul-05	F	A	6.8	42.5	
R. cornutus	22	09-Jul-05	F	A	9.6	40.8	
R. cornutus	22	09-Jul-05	F	A	6.9	40.3	
R. cornutus	22	09-Jul-05	F	A	9.0	40.0	
R. cornutus	22	09-Jul-05	M	A	6.4	39.9	
R. cornutus	6	08-Aug-05	M	A	7.6	40.5	
R. cornutus	4	01-Nov-05	M	Y	8.4	41.5	
R. cornutus	4	01-Nov-05	M	Y	7.6	39.7	
R. cornutus	4	01-Nov-05	F	Y	9.7	41.2	
R. cornutus	4	01-Nov-05	M	Y	10.4	40.8	
R. cornutus	27	15-Oct-06	F	Y	9.6	40.4	
R. cornutus	27	15-Oct-06	F	Y	8.8	39.5	
R. cornutus	27	15-Oct-06	F	Y	9.1	41.2	
R. cornutus	27	15-Oct-06	F	Y	6.6	41.1	
R. cornutus	1	31-Oct-06	F		10.4	41.8	
R. cornutus	1	19-Oct-07	M	Y	9.3	40.2	
R. cornutus	1	31-Oct-07	F	Y	10.2	42.0	
M. macrodactylus	10	02-Sep-01	F	A	8.7	38.5	
M. macrodactylus	8	04-Sep-01	F	Y	9.6	38.6	
M. macrodactylus	11	24-Sep-03	F	A	4.7	38.5	carcass
M. macrodactylus	22	09-Jul-05	M	A	7.0	37.8	
M. macrodactylus	22	09-Jul-05	M	A	7.3	37.8	
M. macrodactylus	22	09-Jul-05	M	A	7.5	37.1	
M. macrodactylus	22	09-Jul-05	M	A	7.5	36.6	
M. macrodactylus	22	09-Jul-05	M	A	8.1	38.3	
M. macrodactylus	8	05-Aug-05	M	A	6.2	37.4	
M. macrodactylus	6	08-Aug-05	M	A	7.7	38.6	
M. macrodactylus	6	08-Aug-05	F	A	8.1	37.5	
M. macrodactylus	6	08-Aug-05	M	A	8.7	38.4	
M. macrodactylus	3	01-Nov-05	M	Y	9.4	38.1	
M. macrodactylus	3	01-Nov-05	M	Y	8.7	36.5	
M. macrodactylus	3	01-Nov-05	M	Y	8.9	39.4	
M. macrodactylus	19	13-Jul-06	F	A			
M. macrodactylus	19	25-Jul-06	F	A	8.4	39.4	recapture (21-May-03 at Site 19)
M. macrodactylus	19	25-Jul-06	M		7.4	36.9	
M. macrodactylus	19	25-Jul-06	F		8.7	38.8	
M. macrodactylus	19	25-Jul-06	F		7.9	36.9	
M. macrodactylus	19	25-Jul-06	F		8.2	36.4	
M. macrodactylus	19	25-Jul-06	M		8.3	37.7	
M. macrodactylus	19	25-Jul-06	M		8.1	38.9	
M. macrodactylus	19	25-Jul-06	M		7.9	37.4	
M. macrodactylus	19	25-Jul-06	M		8.0	36.5	
M. macrodactylus	19	25-Jul-06	M		8.0	37.3	
M. macrodactylus	17	01-Sep-06	M	A	8.1	38.1	
M. macrodactylus	16	02-Sep-06	F	A	9.6	38.8	
M. macrodactylus	19	03-Sep-06	F	A	7.9	38.3	
M. macrodactylus	19	03-Sep-06	M	A	4.7	34.2	
M. macrodactylus	19	03-Sep-06	F	A	8.5	37.6	
M. macrodactylus	19	03-Sep-06	M	Y	7.7	37.9	
M. macrodactylus	19	03-Sep-06	F	Y	7.6	38.1	
M. macrodactylus	20	22-Jun-07	F	A	7.9	39.0	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. macrodactylus	20	22-Jun-07	F	A	10.4	38.4	
M. macrodactylus	20	22-Jun-07	M	A	7.8	37.8	
M. macrodactylus	20	22-Jun-07	F	A	7.3	38.1	
M. macrodactylus	20	22-Jun-07	F	A	7.7	39.0	
M. macrodactylus	19	23-Jul-07	F	A	7.8	37.1	recapture (18-Aug-98 at Site 19)
M. macrodactylus	19	25-Sep-07	F	Y	7.4	38.2	
M. macrodactylus	19	25-Sep-07	M	Y	6.4	36.0	
M. macrodactylus	19	25-Sep-07	F	Y	6.5	36.9	
M. macrodactylus	18	01-Oct-07	F	A	7.0	37.4	
M. macrodactylus	19	04-Jun-08	F	A	8.5	38.6	
M. macrodactylus	19	04-Jun-08	F	A	8.1	38.2	
M. macrodactylus	19	08-Jun-08	F	A	7.0	38.5	
M. macrodactylus	19	24-Jun-08	F	A	8.8	39.0	
M. macrodactylus	19	01-Jul-08	F	A	7.2	40.0	
M. macrodactylus	19	02-Jul-08	M	A	7.4	37.5	
M. macrodactylus	19	27-Jul-08	M	A	7.2	37.1	
M. ikonnikovi	10	02-Sep-01	M	A	6.0	34.1	
M. ikonnikovi	10	02-Sep-01	F	A	4.7	33.5	
M. ikonnikovi	10	02-Sep-01	M	A	6.7	33.9	
M. ikonnikovi	10	02-Sep-01	F	A	4.9	32.5	
M. ikonnikovi	10	02-Sep-01	F	A	5.4	33.0	
M. ikonnikovi	10	02-Sep-01	M	Y	5.7	33.8	
M. ikonnikovi	10	02-Sep-01	M	Y	7.3	34.4	
M. ikonnikovi	7	03-Sep-01	M	A	6.1	34.3	
M. ikonnikovi	7	03-Sep-01	M	Y	6.0	33.2	
M. ikonnikovi	8	04-Sep-01	M	A	5.2	34.0	
M. ikonnikovi	8	04-Sep-01	M	Y	5.7	32.4	
M. ikonnikovi	8	04-Sep-01	F	A	5.4	34.7	
M. ikonnikovi	8	04-Sep-01	F	A	5.7	33.4	
M. ikonnikovi	8	04-Sep-01	F	A	4.9	32.3	
M. ikonnikovi	8	04-Sep-01	M	Y	5.9	33.3	
M. ikonnikovi	8	04-Sep-01	M	Y	4.4	32.2	
M. ikonnikovi	1	28-Jul-04	F	A	5.4	33.6	
M. ikonnikovi	1	28-Jul-04	F	A	5.0	32.5	
M. ikonnikovi	1	28-Jul-04	M	A	6.2	32.2	
M. ikonnikovi	1	14-Jun-05	F		4.6	32.7	recapture (28-Jul-04 at Site 1)
M. ikonnikovi	1	14-Jun-05	F		4.8	32.5	
M. ikonnikovi	1	14-Jun-05	F			33.9	
M. ikonnikovi	1	14-Jun-05			5.0	34.2	
M. ikonnikovi	1	24-Jun-05	M		6.2	33.5	
M. ikonnikovi	19	28-Jul-05	F		6.1	32.8	
M. ikonnikovi	8	05-Aug-05	M	A	6.2	33.7	
M. ikonnikovi	8	05-Aug-05	F	A	5.6	32.8	
M. ikonnikovi	6	08-Aug-05	M	A	5.6	34.4	
M. ikonnikovi	6	08-Aug-05	M	A	5.9	33.3	
M. ikonnikovi	19	04-Jul-06	M	A	5.4	32.8	
M. ikonnikovi	19	25-Jul-06	F		7.2	33.2	
M. ikonnikovi	16	02-Sep-06	M	A	5.5	33.1	
M. ikonnikovi	16	02-Sep-06	F	A	4.8	34.8	
M. ikonnikovi	19	03-Sep-06	F	A	6.6	33.4	
M. ikonnikovi	19	03-Sep-06	F	A	4.7	32.9	
M. ikonnikovi	19	03-Sep-06	F	A	4.7	34.1	
M. ikonnikovi	1	08-Jun-07	M		6.6	33.9	
M. ikonnikovi	1	08-Jun-07	M		5.8	34.4	
M. ikonnikovi	1	11-Jun-07	F		5.0	34.0	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. ikonnikovi	20	13-Jun-07	M	A	6.0	34.8	
M. ikonnikovi	1	19-Jun-07	M		8.0	33.7	
M. ikonnikovi	1	22-Jun-07	M		5.0	34.2	
M. ikonnikovi	20	22-Jun-07	F	A	5.2	33.9	
M. ikonnikovi	20	22-Jun-07	F	A	4.8	34.8	
M. ikonnikovi	1	28-Jun-07	F		6.6	39.1	
M. ikonnikovi	1	03-Jul-07	F		5.8	35.3	
M. ikonnikovi	1	03-Jul-07	F		5.0	33.6	
M. ikonnikovi	1	04-Jul-07	F		5.4	34.0	
M. ikonnikovi	1	23-Jul-07	F		5.2	33.8	
M. ikonnikovi	1	27-Jul-07	F		5.0	34.4	
M. ikonnikovi	1	27-Jul-07	F		5.5	34.2	
M. ikonnikovi	1	27-Jul-07	F		5.4	34.4	
M. ikonnikovi	1	27-Jul-07	M		5.9	31.8	
M. ikonnikovi	1	02-Oct-07	F	Y	4.1	33.0	
M. ikonnikovi	1	03-Jun-08	F		5.0	33.7	
M. ikonnikovi	19	04-Jun-08	M	A	5.8	32.1	
M. ikonnikovi	19	05-Jun-08	M	A	5.7	32.8	
M. ikonnikovi	1	08-Jun-08	M		5.1	33.9	
M. ikonnikovi	1	08-Jun-08	M		4.5	34.0	
M. ikonnikovi	1	22-Jun-08	M		6.8	34.9	
M. ikonnikovi	1	23-Jun-08	F		4.4	33.8	
M. ikonnikovi	19	27-Jun-08	F	A	5.1	32.1	
M. ikonnikovi	19	28-Jun-08	M	A	6.2	33.1	
M. ikonnikovi	19	29-Jun-08	F	A	5.5	33.1	
M. ikonnikovi	1	01-Jul-08	M		6.3	33.4	
M. ikonnikovi	19	01-Jul-08	F	A	5.5	33.1	
M. ikonnikovi	19	02-Jul-08	M	A	4.5	32.0	
M. ikonnikovi	19	02-Jul-08	F	A	4.2	34.1	
M. ikonnikovi	19	02-Jul-08	F	A	5.0	34.0	
M. ikonnikovi	19	05-Jul-08	M	A	6.7	33.8	
M. ikonnikovi	19	05-Jul-08	F	A	5.7	33.0	
M. ikonnikovi	19	06-Jul-08	M	A	4.8	33.0	
M. ikonnikovi	19	07-Jul-08	F	A	4.4	32.1	
M. ikonnikovi	19	07-Jul-08	M	A	5.3	33.9	
M. ikonnikovi	19	07-Jul-08	M	A		32.0	
M. ikonnikovi	17	08-Jul-08	M	A	6.1	34.3	
M. ikonnikovi	17	08-Jul-08	M	A	4.3	31.4	
M. ikonnikovi	1	13-Jul-08	F		5.5	33.3	
M. ikonnikovi	1	13-Jul-08	F		5.7	33.8	
M. ikonnikovi	1	06-Aug-08	M		5.8	33.6	
M. ikonnikovi	1	21-Aug-08	F		4.8	33.1	
M. frater	1	24-Jun-05	F		6.6	38.9	
M. frater	1	01-Jul-05	M		6.0	37.0	
M. frater	1	23-Jul-07	F		7.0	38.2	
M. frater	1	23-Jul-07	F		8.6	38.0	
M. frater	1	27-Jul-07	F		8.7	39.3	
M. frater	1	21-Jun-08	F		7.7	39.5	
M. frater	1	01-Jul-08	F		8.5	40.3	
M. frater	1	05-Aug-08	F		9.1	41.0	
M. frater	1	07-Aug-08	F		9.0	39.5	
N. aviator	26	17-Oct-06	M		36.8	60.4	
N. aviator	26	17-Oct-06	M		37.0	61.1	
N. aviator	26	17-Oct-06	M		35.6	59.0	
N. aviator	26	17-Oct-06	M		40.2	61.6	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
N. aviator	26	17-Oct-06	M		36.4	61.0	
N. aviator	26	17-Oct-06	F		43.0	63.8	
N. aviator	26	17-Oct-06	M		54.5	62.3	
N. aviator	26	17-Oct-06	M		49.6	62.0	
V. sinensis	7	03-Sep-01	F	Y	20.2	47.9	
V. sinensis	7	03-Sep-01	F	Y	17.8	48.0	
V. sinensis	8	04-Sep-01	F	Y	21.0	50.5	
V. sinensis	7	29-Jul-03	F	A	22.8	50.4	recapture (24-Aug-99 at Site 7)
V. sinensis	7	29-Jul-03	F	A	18.4	49.2	
V. sinensis	13	01-Oct-05	F	A	22.2	47.4	
V. sinensis	13	01-Oct-05	F	A	25.0	47.1	
V. sinensis	23	20-Dec-06	M	Y	13.8	47.9	
V. sinensis	21	26-Dec-06	F	A	19.6	48.5	
V. sinensis	15	18-Apr-07	F	A	13.0	45.7	
V. sinensis	7	21-Aug-08	F	Y	18.6	48.1	
V. sinensis	7	21-Aug-08	F	A	19.4	48.0	
V. sinensis	7	21-Aug-08	M	Y	14.8	48.0	
V. sinensis	7	21-Aug-08	F	Y			recapture (08-Aug-08 at Site 7)
V. sinensis	7	21-Aug-08	F	Y	18.4	50.4	recapture (08-Aug-08 at Site 7)
V. sinensis	7	21-Aug-08	F	Y	16.0	48.1	
V. sinensis	7	21-Aug-08	F	Y	17.4	49.4	
V. sinensis	7	21-Aug-08	M	Y	15.4	47.1	
V. sinensis	7	21-Aug-08	M	Y	14.4	49.5	
P. sacrimontis	10	02-Sep-01	M		7.4	40.8	
P. sacrimontis	10	02-Sep-01	M	Y	7.5	40.2	
P. sacrimontis	10	02-Sep-01	M	Y	8.7	39.3	
P. sacrimontis	7	03-Sep-01	F	A	10.2	42.4	
P. sacrimontis	7	03-Sep-01	F	A	8.8	42.2	
P. sacrimontis	19	27-Jul-05	M		7.3	40.4	
P. sacrimontis	27	15-Oct-06	M	Y	8.8	40.4	
P. sacrimontis	14	07-Jul-07					day roost
M. hilgendorfi	10	02-Sep-01	F	A	15.0	42.6	
M. hilgendorfi	10	02-Sep-01	M	A	15.2	41.6	
M. hilgendorfi	7	03-Sep-01	M	Y	11.6	40.2	
M. hilgendorfi	8	04-Sep-01	M	A	15.4	42.4	
M. hilgendorfi	8	04-Sep-01	M	A	10.6	39.6	
M. hilgendorfi	8	04-Sep-01	M	A	13.8	40.8	
M. hilgendorfi	8	04-Sep-01	F	A	12.4	41.7	
M. hilgendorfi	1	17-Jul-05	M		10.4	41.2	
M. hilgendorfi	19	27-Jul-05	F		11.4	40.4	
M. hilgendorfi	19	27-Jul-05	M		11.2	41.1	
M. hilgendorfi	19	27-Jul-05	F		13.6	43.2	recapture (18-Jun-03 at Site 19)
M. hilgendorfi	19	27-Jul-05	M		14.8	43.1	
M. hilgendorfi	19	27-Jul-05	F		13.0	41.9	
M. hilgendorfi	19	27-Jul-05	M		12.0	39.0	
M. hilgendorfi	19	27-Jul-05	F		14.8	42.7	
M. hilgendorfi	19	27-Jul-05	M		11.4	41.0	
M. hilgendorfi	19	27-Jul-05	F		12.8	40.9	
M. hilgendorfi	19	28-Jul-05	F		14.8	42.2	
M. hilgendorfi	19	25-Jul-06	M		13.2	41.1	
M. hilgendorfi	16	02-Sep-06	M	A	13.6	43.6	
M. hilgendorfi	16	02-Sep-06	M	A	12.0	40.9	
M. hilgendorfi	16	02-Sep-06	M	A	10.4	41.4	
M. hilgendorfi	16	02-Sep-06	M	A	11.8	40.3	
M. hilgendorfi	16	02-Sep-06	M	A	12.4	40.7	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. hilgendorfi	1	16-Jun-07	M		10.0	41.3	recapture (17-Jul-05 at Site 1)
M. hilgendorfi	1	16-Jul-07	M		11.2		recapture (17-Jul-05 at Site 1)
M. hilgendorfi	19	23-Jul-07	F	A	14.6	42.5	
M. hilgendorfi	19	23-Jul-07	M	A	11.2	41.1	
M. hilgendorfi	1	30-Aug-07	M				recapture (17-Jul-05 at Site 1)
M. hilgendorfi	12	16-Sep-07	F	A	13.4	41.2	
M. hilgendorfi	12	16-Sep-07	M	A	12.8	40.9	
M. hilgendorfi	12	16-Sep-07	F	Y	15.2	41.5	
M. hilgendorfi	12	16-Sep-07	M	Y	12.0	40.6	
M. hilgendorfi	19	05-Jun-08	F	A	11.6	41.5	
M. hilgendorfi	19	09-Jun-08	M	A	11.0	41.3	
M. hilgendorfi	19	09-Jun-08	F	A	11.4	41.0	
M. hilgendorfi	19	09-Jun-08	F	A	11.6	41.9	
M. hilgendorfi	19	24-Jun-08	F	A	14.8	40.4	
M. hilgendorfi	19	24-Jun-08	F	A	13.6	42.5	
M. hilgendorfi	19	25-Jun-08	F	A	13.8	43.1	
M. hilgendorfi	19	25-Jun-08	F	A	13.2	42.9	
M. hilgendorfi	19	25-Jun-08	M	A	9.9	39.1	
M. hilgendorfi	19	25-Jun-08	M	A	11.2	41.9	
M. hilgendorfi	19	26-Jun-08	F	A	13.8	43.5	
M. hilgendorfi	19	26-Jun-08	M	A			recapture (25-Jun-08 at Site 19)
M. hilgendorfi	19	27-Jun-08	M	A	11.0	40.8	
M. hilgendorfi	19	28-Jun-08	M	A	11.8	40.8	
M. hilgendorfi	19	28-Jun-08	F	A	14.8	43.0	
M. hilgendorfi	19	29-Jun-08	F	A	14.2	40.4	
M. hilgendorfi	19	29-Jun-08	F	A	15.0	41.8	
M. hilgendorfi	19	30-Jun-08	F	A	13.4	43.0	
M. hilgendorfi	19	02-Jul-08	M	A	11.8	40.6	
M. hilgendorfi	19	02-Jul-08	F	A	12.6	41.0	
M. hilgendorfi	19	07-Jul-08	M	A	11.4	40.6	
M. hilgendorfi	19	07-Jul-08	M	A	10.3	40.3	
M. hilgendorfi	19	07-Jul-08	M	A		39.0	
M. hilgendorfi	17	08-Jul-08	M	A	11.0	39.0	
M. hilgendorfi	19	19-Jul-08	F	A	13.4	40.5	
M. hilgendorfi	19	27-Jul-08	F	A	14.6	41.8	
M. hilgendorfi	19	27-Jul-08	F	A	14.6	43.1	
M. ussuriensis	10	02-Sep-01	F	A	6.7	32.3	
M. ussuriensis	10	02-Sep-01	F	A	6.0	31.9	
M. ussuriensis	10	02-Sep-01	F	Y	6.1	32.1	
M. ussuriensis	8	04-Sep-01	M	A	5.4	29.2	
M. ussuriensis	8	04-Sep-01	F	A	6.3	31.3	
M. ussuriensis	8	04-Sep-01	M	A	5.9	31.5	
M. ussuriensis	8	04-Sep-01	M	A	6.5	29.8	
M. ussuriensis	8	04-Sep-01	F	A	6.4	31.6	
M. ussuriensis	8	04-Sep-01	M	A	5.1	29.2	
M. ussuriensis	1	26-Jul-04	F	A	6.4	31.5	
M. ussuriensis	1	26-Jul-04	M	A	4.0	29.7	
M. ussuriensis	1	27-Jul-04	F	A	6.0	30.6	
M. ussuriensis	1	27-Jul-04	M	Y	5.0	29.4	
M. ussuriensis	1	27-Jul-04	F	A	6.6	32.5	
M. ussuriensis	1	28-Jul-04	M	A	6.0	30.3	
M. ussuriensis	1	28-Jul-04	F	A	6.8	31.7	
M. ussuriensis	1	16-Sep-04	F	A	9.2	31.1	
M. ussuriensis	1	16-Sep-04	F	A	6.0	31.5	
M. ussuriensis	1	14-Jun-05	F		5.6	31.8	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. ussuriensis	1	14-Jun-05	F		4.8	30.3	
M. ussuriensis	1	14-Jun-05	M		4.6	29.2	recapture (24-Jul-04 at Site 1)
M. ussuriensis	1	14-Jun-05			6.2	32.2	
M. ussuriensis	1	24-Jun-05	F		7.6	31.7	
M. ussuriensis	1	24-Jun-05	M		5.0	30.4	
M. ussuriensis	1	24-Jun-05	F		8.0	32.3	
M. ussuriensis	1	27-Jun-05	M		4.8	30.1	
M. ussuriensis	1	27-Jun-05	F		7.4	31.4	
M. ussuriensis	1	27-Jun-05	F		7.6	33.4	
M. ussuriensis	1	27-Jun-05	F		8.0	31.8	
M. ussuriensis	1	27-Jun-05	F		8.0	31.8	
M. ussuriensis	1	01-Jul-05	F		8.2	31.1	
M. ussuriensis	1	17-Jul-05	F		6.8	30.6	
M. ussuriensis	1	17-Jul-05	F		7.4	32.0	recapture (27-Jun-05 at Site 1)
M. ussuriensis	1	17-Jul-05	F		7.0	31.9	
M. ussuriensis	1	21-Jul-05	F		6.8	32.4	
M. ussuriensis	1	21-Jul-05	F		7.4	33.3	recapture (27-Jun-05 at Site 1)
M. ussuriensis	1	24-Jul-05					recapture (27-Jun-05 at Site 1)
M. ussuriensis	1	24-Jul-05	F		7.0	25.8	
M. ussuriensis	19	27-Jul-05	M		5.9	30.5	
M. ussuriensis	19	27-Jul-05	M		5.5	29.4	
M. ussuriensis	19	27-Jul-05	M		5.3	29.8	
M. ussuriensis	19	27-Jul-05	F		6.5	31.2	
M. ussuriensis	19	28-Jul-05	M		5.6	29.1	
M. ussuriensis	19	28-Jul-05	M		6.1	29.8	
M. ussuriensis	8	05-Aug-05	M	A	5.4	28.4	
M. ussuriensis	1	10-Sep-05	M		5.4	29.5	
M. ussuriensis	1	10-Sep-05	M		5.2	30.6	
M. ussuriensis	1	01-Aug-06	F				recapture (14-Jun-05 at Site 1)
M. ussuriensis	17	01-Sep-06	M	A	5.5	28.7	
M. ussuriensis	17	01-Sep-06	F	A	6.5	31.8	
M. ussuriensis	17	01-Sep-06	F	A	6.4	31.3	
M. ussuriensis	17	01-Sep-06	M	A	5.5	29.0	
M. ussuriensis	17	01-Sep-06	F	A	7.5	31.4	
M. ussuriensis	16	02-Sep-06	F	A	5.9	31.3	
M. ussuriensis	16	02-Sep-06	F	A	6.1	31.8	
M. ussuriensis	16	02-Sep-06	F	A	6.2	31.7	
M. ussuriensis	16	02-Sep-06	F	A	7.1	31.9	
M. ussuriensis	16	02-Sep-06	M	A	6.1	31.1	
M. ussuriensis	16	02-Sep-06	F	A	7.0	33.2	
M. ussuriensis	16	02-Sep-06	F	A	7.3	31.3	
M. ussuriensis	16	02-Sep-06	F	A	6.2	31.2	
M. ussuriensis	16	02-Sep-06	M	A	6.1	31.2	
M. ussuriensis	16	02-Sep-06	F	A	6.7	32.1	
M. ussuriensis	19	03-Sep-06	F	A	7.0	31.1	
M. ussuriensis	19	03-Sep-06	M	A	5.5	30.2	
M. ussuriensis	19	03-Sep-06	F	A	6.0	31.8	
M. ussuriensis	29	16-Oct-06	M	A	5.8	29.3	
M. ussuriensis	1	05-Jun-07	F		6.2	31.0	
M. ussuriensis	1	08-Jun-07	F		7.0	33.2	
M. ussuriensis	1	11-Jun-07	F		8.0	31.9	
M. ussuriensis	1	12-Jun-07	M		5.0	29.8	
M. ussuriensis	1	19-Jun-07	F		7.8	31.6	
M. ussuriensis	1	22-Jun-07	F		7.2	31.3	
M. ussuriensis	20	22-Jun-07	F	A	10.8	31.9	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. ussuriensis	1	26-Jun-07	M		5.2	30.0	
M. ussuriensis	1	26-Jun-07	M		5.8	29.6	
M. ussuriensis	1	28-Jun-07	M			28.4	
M. ussuriensis	1	28-Jun-07	M		5.6	29.0	
M. ussuriensis	1	28-Jun-07	F		8.4	31.3	
M. ussuriensis	1	28-Jun-07	F		7.8	31.4	
M. ussuriensis	1	28-Jun-07	F		8.2	31.0	
M. ussuriensis	1	03-Jul-07	F		8.2	31.8	
M. ussuriensis	1	04-Jul-07	M		5.2	30.4	
M. ussuriensis	1	04-Jul-07	F		9.4	33.0	
M. ussuriensis	1	10-Jul-07	M		5.6	29.7	
M. ussuriensis	1	10-Jul-07	M		5.0	29.7	
M. ussuriensis	1	23-Jul-07	F		6.4	30.5	
M. ussuriensis	1	23-Jul-07	F		7.4	32.5	recapture (24-Jun-05 at Site 1)
M. ussuriensis	1	23-Jul-07	F		6.4	34.1	
M. ussuriensis	1	23-Jul-07	F		7.4	32.3	
M. ussuriensis	1	25-Jul-07	M		6.0	30.5	
M. ussuriensis	1	25-Jul-07	M		5.8	28.6	
M. ussuriensis	1	25-Jul-07	F		7.9	32.3	
M. ussuriensis	1	27-Jul-07	F				recapture (23-Jul-07 at Site 1)
M. ussuriensis	1	27-Jul-07	M		6.5	30.1	
M. ussuriensis	1	24-Aug-07	M		5.9	30.2	
M. ussuriensis	1	24-Aug-07	F		5.8	32.2	
M. ussuriensis	1	30-Aug-07	M		5.7	30.6	
M. ussuriensis	1	13-Sep-07	F	Y	6.1	31.8	
M. ussuriensis	12	16-Sep-07	M	A	5.8	28.2	
M. ussuriensis	12	16-Sep-07	M	Y	5.5	29.4	
M. ussuriensis	12	16-Sep-07	F	A	7.3	32.0	
M. ussuriensis	12	16-Sep-07	F	Y	7.4	33.2	
M. ussuriensis	12	16-Sep-07	F	A	9.6	32.1	
M. ussuriensis	28	18-Sep-07					day roost
M. ussuriensis	28	18-Sep-07					day roost
M. ussuriensis	28	18-Sep-07	F	A	5.5	30.8	
M. ussuriensis	28	18-Sep-07	F	A	6.8	30.2	
M. ussuriensis	1	23-Sep-07	F	Y	5.9	31.2	
M. ussuriensis	19	25-Sep-07	F	A	6.5	30.8	
M. ussuriensis	19	26-Sep-07	M	A	5.3	29.7	
M. ussuriensis	18	01-Oct-07	F	Y	5.9	30.9	
M. ussuriensis	1	02-Oct-07	M		6.0	33.1	
M. ussuriensis	1	25-Oct-07	M		7.9	31.9	
M. ussuriensis	1	03-Jun-08	F		7.7	31.7	
M. ussuriensis	1	03-Jun-08					
M. ussuriensis	1	08-Jun-08	M		5.7	29.8	
M. ussuriensis	1	08-Jun-08	F		6.3	32.8	
M. ussuriensis	19	09-Jun-08	F	A	7.7	31.2	
M. ussuriensis	1	24-Jun-08	M		4.8	29.1	
M. ussuriensis	1	24-Jun-08	F		8.9	32.0	
M. ussuriensis	1	24-Jun-08	M		5.4	29.9	
M. ussuriensis	19	24-Jun-08	M	A	5.9	30.1	
M. ussuriensis	19	25-Jun-08	M	A	5.6	31.2	
M. ussuriensis	19	25-Jun-08	M	A	5.4	29.8	
M. ussuriensis	19	25-Jun-08	F	A			
M. ussuriensis	19	25-Jun-08	M	A	6.0	31.1	
M. ussuriensis	19	25-Jun-08	M	A	5.2	29.9	
M. ussuriensis	19	26-Jun-08	F	A	8.8	32.9	

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. ussuriensis	19	26-Jun-08	F	A	6.1	31.1	
M. ussuriensis	19	27-Jun-08	F	A	8.8	31.2	
M. ussuriensis	19	27-Jun-08	F	A	9.2	33.0	
M. ussuriensis	19	27-Jun-08	F	A	7.3	30.8	
M. ussuriensis	19	28-Jun-08	F	A	8.9	31.8	
M. ussuriensis	19	29-Jun-08	F	A	9.1	31.1	
M. ussuriensis	19	29-Jun-08	F	A	7.3	29.4	
M. ussuriensis	19	30-Jun-08	F	A	8.6	30.5	
M. ussuriensis	1	01-Jul-08	F		9.5	33.9	recapture (23-Jul-07 at Site 1)
M. ussuriensis	1	01-Jul-08	M		5.8		
M. ussuriensis	19	01-Jul-08	F	A	8.3	32.1	
M. ussuriensis	19	04-Jul-08	M	A	5.4	29.8	
M. ussuriensis	19	05-Jul-08	M	A	4.6	29.3	
M. ussuriensis	19	05-Jul-08	F	A	6.7	30.9	
M. ussuriensis	19	05-Jul-08	F	A	9.5	33.1	
M. ussuriensis	19	05-Jul-08	F	A	6.7	32.0	
M. ussuriensis	1	06-Jul-08	F		6.1	31.3	
M. ussuriensis	19	06-Jul-08	M	A	5.9	31.5	
M. ussuriensis	19	06-Jul-08	M	A	5.9	30.8	
M. ussuriensis	19	07-Jul-08	F	A		31.5	
M. ussuriensis	19	07-Jul-08	M	A		29.2	
M. ussuriensis	1	08-Jul-08	F		6.5	30.4	
M. ussuriensis	1	10-Jul-08	F		6.4	32.3	
M. ussuriensis	1	13-Jul-08	F		7.1	31.4	
M. ussuriensis	1	20-Jul-08	F		7.1	31.1	
M. ussuriensis	1	20-Jul-08	F		7.2	31.9	
M. ussuriensis	1	21-Jul-08	F		7.7	33.2	recapture (23-Jul-07 at Site 1)
M. ussuriensis	1	04-Aug-08	F		4.1	30.5	
M. ussuriensis	1	04-Aug-08	F		3.9	30.4	
M. ussuriensis	1	04-Aug-08	F		4.3	31.2	
M. ussuriensis	1	05-Aug-08	F		4.0	29.8	
M. ussuriensis	1	05-Aug-08	M		4.6	29.5	

Appendix 2. External and cranial measurements of specimens.

Date	Site number	Species	Specimen number	sex	age
20 Oct 2008	25	*M. macrodactylus*	TO1717	F	Y
22 Dec 2005	2	*V. murinus*	KK162	F	Y

Date	Site number	Species	Specimen number	GL	CBL
20 Oct 2008	25	*M. macrodactylus*	TO1717	15.37	14.35
22 Dec 2005	2	*V. murinus*	KK162	15.07	14.98

BW = body weight ; FA = forearm length ; TIB = tibia length ; HFsu = hind foot sine unguis ; HFcu = hind foot cum unguis ; CBL = condylobasal length ; UTL,i-m3 = length of upper tooth row from the incisor to the third molar ; UTL,c-m3 = length UMoW = width across upper molars ; BCW = width of brain case ; BCH = height of brain case ; InOrlW = inter-orbital width ;

Appendix 1. Continued.

Species	Site number	Date	sex	age	BW	FA	Notes
M. ussuriensis	1	05-Aug-08	F		5.2	31.0	
M. ussuriensis	1	05-Aug-08	F		4.0		
M. ussuriensis	1	06-Aug-08	F		4.4		recapture (05-Aug-08 at Site 1)
M. ussuriensis	1	10-Aug-08	M		5.4	30.3	
M. ussuriensis	1	10-Aug-08	F		5.6		recapture (05-Aug-08 at Site 1)
M. ussuriensis	1	10-Aug-08	M		4.6	30.5	
M. ussuriensis	1	10-Aug-08	F		6.8	33.6	recapture (23-Jul-07 at Site 1)
M. ussuriensis	1	10-Aug-08	M		4.5	29.4	
M. ussuriensis	1	10-Aug-08	F		4.8	30.6	
M. ussuriensis	1	10-Aug-08	M		5.7	30.1	
M. ussuriensis	1	10-Aug-08	F		5.1	31.9	
M. ussuriensis	1	11-Aug-08	F	Y	5.1	31.3	
M. ussuriensis	1	21-Aug-08	F		6.2	30.7	
M. ussuriensis	1	21-Aug-08	M		6.5	30.7	
M. ussuriensis	7	21-Aug-08	F	Y	6.2	30.9	
M. ussuriensis	7	21-Aug-08	F	A	6.9	31.3	
M. ussuriensis	7	21-Aug-08	F	Y	6.6	32.1	
M. ussuriensis	7	21-Aug-08	F	Y	6.2	30.9	
M. ussuriensis	7	21-Aug-08	F	A	6.9	31.3	
M. ussuriensis	7	21-Aug-08	F	Y	6.6	32.1	
M. ussuriensis	1	22-Aug-08	M		5.4		recapture (21-Aug-08 at Site 1)
M. ussuriensis	1	25-Aug-08	F		6.2	32.4	
M. ussuriensis	1	26-Aug-08	M		5.4	29.7	
M. ussuriensis	1	26-Aug-08	M		5.3	30.1	
M. ussuriensis	1	30-Aug-08	F		5.6	31.0	recapture (04-Aug-08 at Site 1)
M. ussuriensis	1	30-Aug-08	F		6.0	29.8	
M. ussuriensis	1	31-Aug-08	F	Y	6.2	30.7	
M. ussuriensis	1	31-Aug-08	F	Y	6.1	31.0	
M. ussuriensis	1	31-Aug-08	F	Y	5.6	31.4	
M. ussuriensis	1	31-Aug-08	F	Y	6.2	32.0	
M. ussuriensis	1	31-Aug-08	F	Y	5.8	29.4	
M. ussuriensis	1	30-Sep-08	F		5.8	30.9	

BW (g)	FA	TIB	HFsu	Hfcu	EAR	TRAG	HBL	TA
7.1	38.5	17.0	8.2	9.0	11.5	6.9	48.4	–
11.6	44.8	17.3	8.3	9.3	16.0	4.5	64.7	36.9

UTL,i-m3	UTL,c-m3	RW	ZW	UMoW	BCW	BCH	InOrlW	MdL	LTL
7.99	5.95	4.01	8.89	6.19	7.68	6.97	3.84	10.90	7.20
5.90	5.19	4.96	9.93	6.36	7.85	6.96	4.48	11.59	6.17

EAR = ear length ; TRAG = tragus length ; HBL = head and body length ; TA = tail length ; GL = greatest length of skull ;
of upper tooth row from the canine to the third molar ; RW = rostral width ; ZW = zygomatic width ;
MdL = mandible length ; LTL = length of lower tooth row