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Distribution of Natterer's bat (*Myotis nattereri*) in Finland

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With 2 figures

1 Introduction

Seven bat species hibernate in Finland (SIIVONEN & SULKAVA 1999, SIIVONEN & WERMUNDSEN 2003). These are the Daubenton's bat, *Myotis daubentonii* (Kuhl, 1817), pond bat, *M. dasycneme* (Boie, 1825), Brandt's bat, *M. brandtii* (Eversmann, 1845), wiskered bat, *M. mystacinus* (Kuhl, 1817), Natterer's bat, *M. nattereri* (Kuhl, 1817), northern bat, *Eptesicus nilssonii* (Keyserling & Blasius, 1839), and the brown long-eared bat, *Plecotus auritus* (L., 1758). In Europe, *M. nattereri* is widely distributed up to 63°N in Sweden (MITCHELL-JONES et al. 1999), while in Finland the species occurs below 61°30'N. *M. nattereri* is listed in the Annex IV(a) of the EU Habitats directive, which means that it is a species of Community interest in need of strict protection, and its natural habitats should be maintained or restored (EU Council 1992). Furthermore, *M. nattereri*, is the only bat species in Finland that has been declared threatened species, whose survival in the wild is at risk and which has been placed under a strict protection by a decree (RASSI et al. 2000).

There are only nine records of *M. nattereri* in Finland (KIVIRIKKO 1940, KOTIRANTA et al. 1998, SIIVONEN & WERMUNDSEN 2003), and all of them are from southern Finland. In 1913, the first nursery colony of *M. nattereri* was found in Finland (KIVIRIKKO 1940). Three of the Finnish findings were made in the 19th century, and five in the 20th century (KIVIRIKKO 1940, KOTIRANTA et al. 1998). In the 1980's one hunting *M. nattereri* was identified in the summer by a bat detector in Finland (KOTIRANTA et al. 1998), but in 1990's not a single M. nattereri was reported. The most recent finding of the species was made in 2002, when two *M. nattereri* were found in a transient roost in April in southern Finland (SIIVONEN & WERMUNDSEN 2003).

The aim of this study was to search for *M. nattereri* in southern Finland, both in the summer and in the winter, and to describe and measure the characteristics of their winter roosts. No studies have been published on *M. nattereri* in Finland and, therefore, more knowledge of the distribution and habitat demands of the species is urgently needed.

2 Materials and Methods

2.1 Study area

The study was conducted in southern Finland (south of 62°N). The average annual temperature in southern Finland is 4-6°C and precipitation 600-650 mm. The temperature extremes range from 30°C in the summer to –35°C in the winter. Summer begins in late May and lasts until mid-September. Winter usually begins during November and ends in late April. The coldest month is February (Finnish Meteorological Institute 2006).

2.2 Data collection

We have been searching for hibernating *M. nattereri* in southern Finland throughout the winters of 2002-2006. We have measured the temperature and relative humidity of the hibernation places of *M. nattereri* with VAISALA HM34 portable humidity and temperature meter. Its measurement range for humidity is 0-100 % (0-90 % ±2 %, 90-100 % ±3 %) and for temperature it is –20-60°C (±0.3°C). Me-

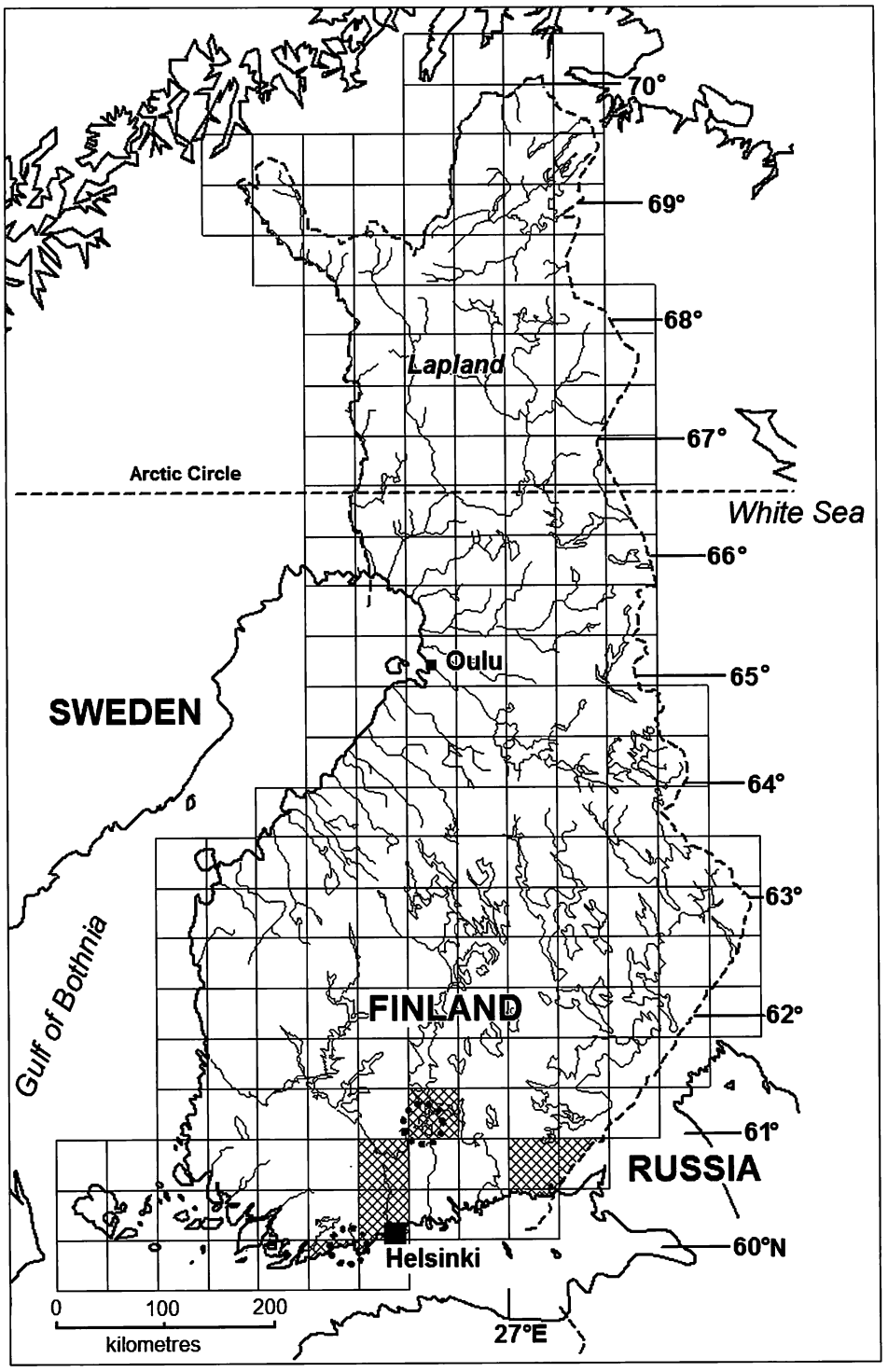

Figure 1. Distribution of *Myotis nattereri* in Finland. The results of the study are presented in a grid based EUREF – FIN coordinate frame, which is based on European Terrestrial Reference System (ETRS89; National Land Survey of Finland 2007). One square of the grid corresponds to 48 x 48 km. The former distribution of the species is marked with dotted line on the map (Mitchell-Jones et al. 1999, Siivonen & Sulkava 1999, Siivonen & Wermundsen 2003).

ans are presented with standard errors (±SE). We recorded facts such as whether the bat hibernated solitarily or clustered. In cases where the bat hibernated in a cluster, we recorded the size and species composition of the cluster. Furthermore, we recorded if the bat was hibernating inside a crevice or on the wall/ceiling of the underground site.

During the summers of 2001-2006 we have been searching randomly for *M. nattereri* in southern Finland. The mapping started after sunset and continued until sunrise. The observations of bats were made visually and by using the Pettersson D240x, D200 and D100 detectors as well as BatSound Pro 3.31 (Pettersson Elektronik Ab 2004) with the DAQ-Card-6062E of the National Instruments that enabled us to see the real time sonograms in the field. The signal stored in the time expansion memory of the D240x can be replayed at its original rate through the heterodyne system, which enables a careful examination of the signal's main frequency with the heterodyne system in the field. In unclear cases, we recorded the time expansion sounds with SONY TCD-D100 DAT recorder and analysed them with the BatSound Pro 3.31 (Pettersson Elektronik Ab 2004). Summer nights are light in Finland, which makes it possible to see bats clearly.

3 Results

During the winters of 2001-2006 we made 20 observations of *M. nattereri* in Finland (Tab. 1, Fig. 1). Only transient roosts (underground sites) were found. Out of all the observations 17 were made in October, two in April, and one in May. No *M. nattereri* was found in these underground sites before or after these months.

M. nattereri was always found roosting in crevices. The majority of *M. nattereri*, 14 individuals, were alone. In two occasions *M. nattereri* was clustered with *E. nilssonii* and once with *P. auritus*. In the late autumn of 2005, we found a cluster of three *M. nattereri* (Tab. 1).

Usually we found only one *M. nattereri* per an underground site, but in the autumn of

Table 1. Characteristics of transient roosts of *M. nattereri*

Date	Underground site	Substrate	Number of bats					
			En	Mb/m	Md	Pa	Mn	total
27.10.2005	Man-made	Natural stone	0	36	3	1	1	41
27.10.2005	Man-made	Natural stone	1	1	1	0	1	4
27.10.2005	Man-made	Natural stone	1	1	1	1	1	5
28.10.2005	Natural	Natural stone	0	0	0	0	5	5
29.10.2004	Man-made	Natural stone	1	9	4	0	1	15
29.10.2004	Man-made	Natural stone	1	5	1	0	2	9
29.10.2004	Man-made	Natural stone	0	37	1	1	1	40
30.10.2004	Man-made	Natural stone	2	62	1	0	1	66
31.10.2004	Man-made	Natural stone	0	0	0	0	1	1
01.05.2004	Man-made	Natural stone	0	45	0	0	1	46
26.10.2003	Man-made	Natural stone	2	4	4	1	1	12
26.10.2003	Man-made	Natural stone	5	38	5	1	1	50
26.10.2003	Man-made	Natural stone	3	2	1	0	1	7
13.04.2002	Man-made	Natural stone	2	34	2	0	2	40*

* SIIVONEN & WERMUNDSEN (2003)
En - *Eptesicus nilssonii*, Mb/m - *Myotis brandtii/mystacinus*, Md - *Myotis dasycneme*, Md - *Myotis daubentonii*, Pa - *Plecotus auritus*, Mn - *Myotis nattereri*

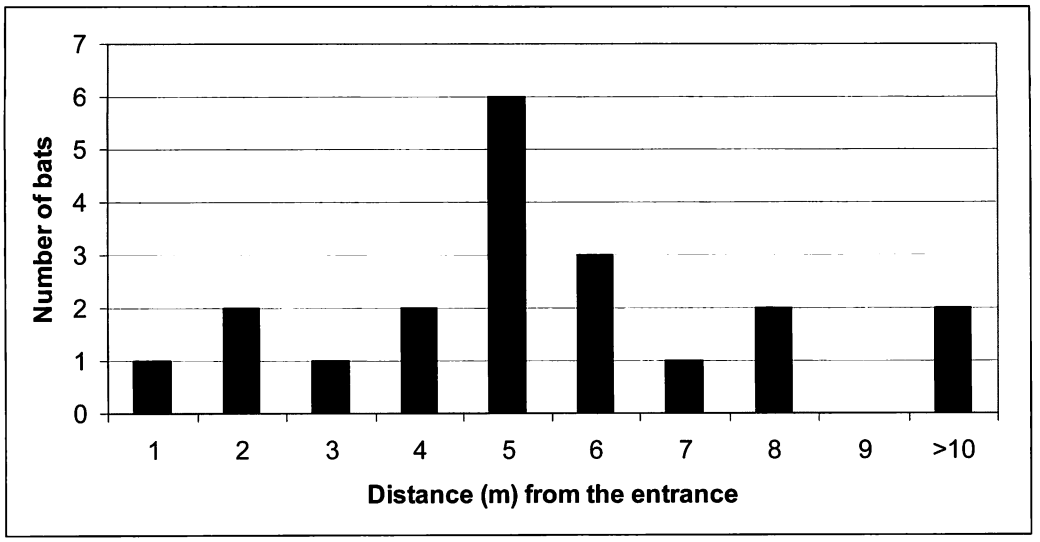

Figure 2. The locations of roosting *Myotis nattereri* from the entrance of the underground sites.

2004, as well as in the spring of 2002, two *M. nattereri* were found using the same underground site as a transient roost. We counted the maximum number of *M. nattereri* in the same underground site in the autumn of 2005, when we found five *M. nattereri* in a small natural cave. *M. nattereri* was mainly an entrance-dwelling species, since 90 % (18 individuals) were found at a distance less than 10 m from the cave entrance (mean 7.2±1.8 m; Fig. 2).

The temperature of the locations where *M. nattereri* were roosting ranged from -1.8 to 11.6°C. The mean temperature of these locations was 6.4±0.9°C. The relative humidity of these locations ranged from 58 to 95 %. The mean relative humidity was 84±2 %. All the roosting sites were crevices in natural rock (Tab. 1).

During the summers of 2001-2006 we found seven *M. nattereri* in southern Finland. In 2001, we found one specimen of *M. nattereri* in Janakkala and Kirkkonummi. In 2002, we found one specimen of *M. nattereri* in Janakkala, Järvenpää and Inkoo, and in 2004, we found one specimen of *M. nattereri* in Kirkkonummi and Laitila (Fig. 1). All the observations were made in edge habitats (deciduous forest and meadow/field) and near (10-300 m) a body of water (river, basin, lake, sea). Four observations were made in parks of mansions, two in agricultural area, and one near ruins of a sawmill.

4 Discussion

In summer, *M. nattereri* was found in woodland edges and parkland in Finland likewise elsewhere in Europe (MITCHELL-JONES et al. 1999). In Finland, *M. nattereri* was observed in underground sites only in the autumn and spring, i.e. in transient roosts. Elsewhere in Europe they are usually observed in the autumn and spring, but also during the whole hibernation season (e. g. DORGELO & PUNT 1969, BAAGOE 2001). *M. nattereri* is rare also in Estonia, but hibernating individuals can be found throughout the winter (MASING 1979, 1984, 2005). In Finland, most of these observations were made at the end of October. In Germany, *M. nattereri* appears in bat boxes during March-April as well as in October-November (OHLENDORF 2002), and in Estonia the best time to find the species is in late October and early November (MASING 1984).

In transient roosts in Finland *M. nattereri* was found mainly in solitary units and always wedged in tight cracks, as elsewhere in Europe (SCHOBER & GRIMMBERGER 1997). It was an

entrance-dwelling species like elsewhere in Europe (DORGELO & PUNT 1969). To be near the entrance of an underground site is risky, because great tits, *Parus major* (L., 1758), and blue tits, *Parus caeruleus* (L., 1758), enter the underground sites up to 10 meters from the entrance (where they can see), and prey upon roosting/hibernating bats, including bats in crevices (RADZICKI et al. 1999). Bats hibernate near the entrances of underground sites for two reasons. They wait for good weather to hunt for insects, or they prefer to hibernate in the condensation zone (DORGELO & PUNT 1969). In Finland, *M. nattereri* was found only in their transient roosts in the autumn and spring, suggesting that they placed themselves near the entrances of the underground sites waiting for good weather in order to move e.g. to their hibernation areas.

According to EUROBATS (1998) counts to monitor the status of the bat populations should be carried out in January-February. In Finland, not a single individual of *M. nattereri* was found in those months and, consequently, we suggest that the most appropriate time to monitor the status of *M. nattereri* population in northern Europe would be at the end of October. Furthermore, according to EUROBATS (1998) in the northern part of the species' ranges, bats remain in hibernation sites for longer periods. Southern Finland is one of the northernmost parts where *M. nattereri* occurs (MITCHELL-JONES et al. 1999). Contrary to the findings of EUROBATS (1998), *M. nattereri* has at least three different hibernation sites during one hibernation season: the species was found in the autumn and spring while in the middle of the winter it was not found anywhere.

In Finland, the mean temperature of the transient roosts was 6.4±0.9. According to WEBB et al. (1996) *M. nattereri* hibernates in temperatures from –3.0 to 8.1°C, but no studies have been made on microclimate conditions of their transient roosts. Elsewhere in Europe (SCHOBER & GRIMMBERGER 1997) *M. nattereri* is occasionally found in small clusters in underground sites similar to this study. However, *M. nattereri* formed mixed clusters with E. nilssonii and *P. auritus* in Finland, while elsewhere in Europe it typically forms clusters with *M. daubentonii* (SCHOBER & GRIMMBERGER 1997). In this study, the biggest aggregation of M. nattereri was found in a natural cave suggesting that in Finland the species hibernates in crevices of natural rocks, though further research is needed to confirm this theory.

Abstract

We have been searching for Natterer's bat (*Myotis nattereri*) in southern Finland (south of 62°N) during the years 2001-2006. During the summers of 2001-2006 we found only seven *M. nattereri* in Finland, but during the hibernation seasons in 2001-2006 we found 20 *M. nattereri* in transient roosts. Almost all the observations were made in late October, suggesting that counts to monitor the status of *M. nattereri* populations in Finland should be carried out at the end of October. All transient roosts were crevices in natural rock. In transient roosts *M. nattereri* was always wedged into tight cracks and usually in solitary units. Biggest aggregations of *M. nattereri* were found in a natural cave suggesting that in Finland the species hibernates in crevices of natural rocks.

Zusammenfassung

Zur Verbreitung der Fransenfledermaus (*Myotis nattereri*) in Finnland

Wir haben in Süd-Finnland (südlich von 62°N) während der Jahre 2001-2006 intensiv nach der Fransenfledermaus (*Myotis nattereri*) gesucht. Während der Sommer 2001-2006 fanden wir von *M. nattereri* in Finnland nur 7 Ex., während wir in der Überwinterungsperiode der gleichen Jahre in Übergangs- bzw. Zwischenquartieren immerhin 20 Tiere antrafen. Die Mehrzahl der Beobachtungen gelang im späten Oktober, naheliegend daß Zählungen zum Monitoringstatus der Fransenfledermaus-Population in Finnland am Ende des Monats Oktober stattfinden sollten. In Übergangsquartieren hatte sich *M. nattereri* immer in enge Spalten eingeschoben und hielt sich darin gewöhnlich einzeln auf. Die größten Ansammlungen wurden in natürlichen Höhlen gefunden und zeigten damit an, daß die Art in Finnland in Spalten von natürlichen Felshöhlen überwintert.

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