

# The parti-coloured bat *Vespertilio murinus* in Rīga (Latvia) during autumn and winter

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## Abstract

The parti-coloured bat is a migratory species for which long-distance movements have been documented from North-eastern to Central Europe. Records in autumn and winter suggest that some populations in northern Europe may be sedentary. During the mating period, male parti-coloured bats can be observed in cities, emitting loud and audible advertisement calls near high buildings. The aim of this study was to determine whether parti-coloured bats currently mate and hibernate in Rīga, the capital of Latvia. High buildings in 13 districts were visited to locate displaying males. Display activity was studied at one site by means of acoustic recording. Displaying males were observed in two districts from late September until early November. Records of parti-coloured bats in December and April confirm that this species hibernates in Rīga. The parti-coloured bats most likely arrive from distant locations, since this species is considered to be rare in Rīga during the breeding period.

**Key words:** display activity, parti-coloured bat, Rīga, *Vespertilio murinus*.

## Introduction

The distribution range of parti-coloured bat *Vespertilio murinus* is situated in central Europe and Asia between 35 and 61°N. Resident populations are rare or absent in most of western and southern Europe, but numerous vagrants have been recorded outside the normal distribution range as far as the British and Faroe isles and northern Scandinavia (Rydell, Baagøe 1994; Baagøe 1999). Banding recoveries have indicated long-distance seasonal movements (Strelkov 1969; Masing 1989; Markovets et al. 2004), suggesting that populations in Eastern and Northern Europe avoid unfavorable weather conditions in winter by migration. This species hibernates in over-ground roosts and several individuals have been found hibernating in ventilation shafts of buildings (Rydell, Baagøe 1994; Baagøe 1999).

Parti-coloured bats are found in almost all landscapes, including agricultural and urban areas (Rydell 1992; Rydell, Baagøe 1994). This species is observed in Scandinavian and Eastern European cities during autumn (Heise 1991; Rydell, Baagøe 1994; Ciechanowski 2001; Lesiński et al. 2001). In the mating period, male parti-coloured bats emit loud and audible advertisement calls during the display flight near high buildings (Rydell, Baagøe 1994; Ahlén, Baagøe 1999).

In Latvia, migrating parti-coloured bats have been observed during the autumn migration at the coast of the Baltic Sea (Celmiņš et al. 1986; Pētersons, Vintulis 1998). Several records of parti-coloured bats after the autumn migration period suggest that this species may hibernate

in the capital city Rīga. No data on parti-coloured bats in Latvia during autumn and winter have been published yet, nor have the display activity of male parti-coloured bats been analysed in previous studies.

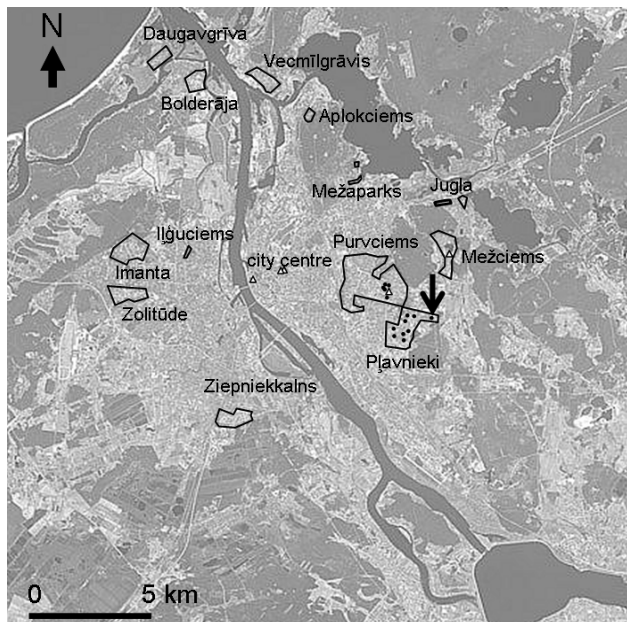
The goals of this study were (i) to summarise all known records of parti-coloured bats in Rīga, (ii) to locate displaying males near high buildings in order to find potential mating territories and (iii) to investigate the display activity by means of acoustic recording.

## Materials and methods

The area of Rīga city (56°56'51"N 24°06'23"E) covers 307.2 km<sup>2</sup>, including residential areas 67.0 km<sup>2</sup> (21.8%), industrial areas 52.5 km<sup>2</sup> (17.0%), streets and roads 24.6 km<sup>2</sup> (8.0%) parks 57.5 km<sup>2</sup> (19.0%) and water bodies 48.5 km<sup>2</sup> (15.8%) (www.riga.lv). Observations of parti-coloured bats in Rīga have been reported to scientists since 2000.

To locate displaying male parti-coloured bats, high buildings (≥ 30 m) were investigated within 13 districts (Fig. 1). In 2005, Purvciems was visited once in late September, twice in October and once in early November. Pļavnieki, Mežciems and Zolitūde were investigated once each from late October until early November. Other districts were visited in 2006, including Zolitūde, which was visited for the second time. No surveys were conducted in rain and strong wind (> 20 m s<sup>-1</sup>) due to a low expected display activity.

The districts were surveyed by two methods: (a) walking



**Fig. 1.** Localities of surveyed districts and records of parti-coloured bats in Riga. Borders of districts surveyed in 2005 and 2006 are marked by polygons; the study site where display activity was studied in 2007 is indicated by an arrow. White triangles correspond to localities of found parti-coloured bats according to received reports (see Table 1); black circles indicate localities of recorded displaying males in the surveys.

near the buildings or (b) driving by car at a low speed (ca. 5 km h<sup>-1</sup>), while listening for audible advertisement calls. Both methods were considered to provide similar results, since the loud calls could be heard easily within a 200-m range. The mean time spent in every district was 30 min. Ultrasound detectors D 200 or D 240x (Pettersson Elektronik AB, Uppsala, Sweden) were sometimes used to confirm species identification (Ahlén 1981; 1990), although the advertisement calls of parti-coloured bats are unique

among European bats and easy to recognise (Ahlén, Baagøe 1999).

Display activity of male parti-coloured bats was studied at one site in Pļavnieki from 15 October until 20 November 2007. An automatic recording system ('the autobox', Ahlén et al. 2007; 2009) was used to verify presence or absence of displaying or echolocating parti-coloured bats. The recording system consisted of an ultrasound detector D 240x set at time-expansion mode and connected to a simple audio-recorder (iAudio U2, Cowon Systems, Inc.). Presence or absence of parti-coloured bats was registered for 15-min periods from sunset until 3:00 to 4:00 AM due to restricted duration of recordings (11 to 12 h). Influence of weather conditions on the display activity was analysed from October 15 until November 11, when the display activity was recorded for the last time. Air temperature and precipitation data were obtained from local weather station (station Rīga, Latvian Environment, Geology and Meteorology Centre) and compared between days when the display activity was and was not recorded. The Mann-Whitney test was used to test for significant differences. Statistical analyses were performed by SPSS for Windows 16.0 (SPSS Inc., Chicago, Illinois).

## Results

Altogether seven records of parti-coloured bats in Riga were made in September, October, November and December from 2000 until 2009 (Table 1). One observation was dated 13 April 2010, before the expected return of migrants from hibernation areas in Central Europe. Most records (n = 4) were made in the city centre; other reports were received from Purvciems (n = 2) and Mežciems (n = 2). Four individuals were males, but sex of other individuals was not recorded.

Displaying male parti-colored bats were found in two of 13 surveyed districts – Purvciems and Pļavnieki

**Table 1.** Records of parti-coloured bats in Rīga from 2000 until 2010

No.	Date	Sex	Place	Details	Observer
1	14.10.2000	male	Purvciems distr.	Advertisement calls heard, observed regularly in other years as well	E. Račinskis
2	25.09.2001	male	city centre	Found with broken wing between windows in the Ministry of Justice	R. Lebuss
3	10.12.2001	unknown	Mežciems distr.	Flew inside a room through an open window on the 9 <sup>th</sup> floor	I. Kolmane, R. Špakovskis
4	19.12.2003	male	Purvciems distr.	A flying bat observed and advertisement calls heard	L. Niedre
5	27.09.2007	unknown	city centre	Found exhausted on a windowsill at A. Upītis' memorial apartment	I. Kaire
6	15.11.2007	unknown	city centre	Caught flying inside the Ministry of Agriculture on the 23 <sup>rd</sup> floor	M. Roze
7	6.11.2009	male	city centre	Found exhausted on the Elizabetes street	T. Tīrmane
8	13.04.2010	unknown	Mežciems distr.	Found with injured wing on a street	K. Onucina

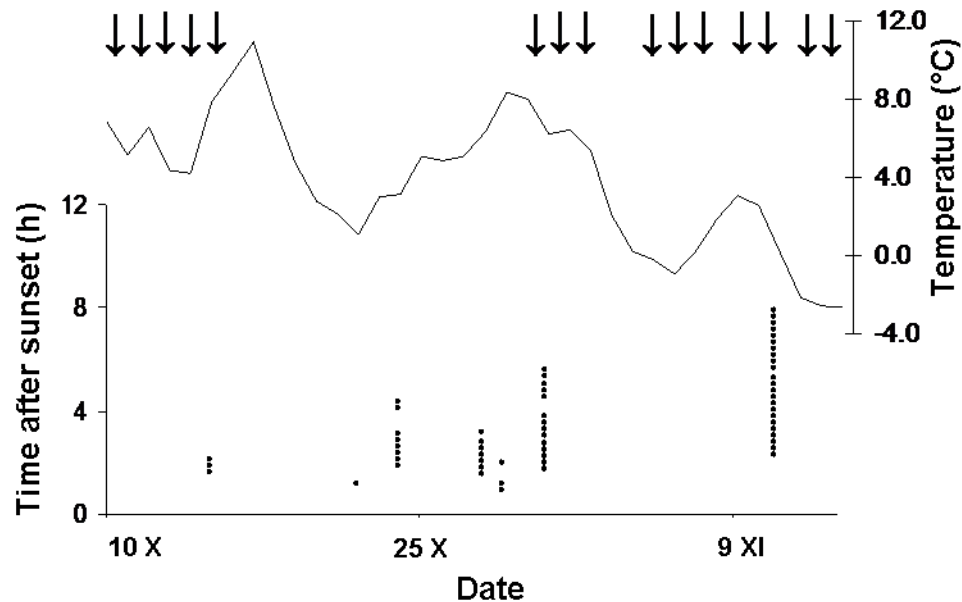


Fig. 2. Display activity of male parti-coloured bats recorded from 15 October until 11 November 2007 at one site in Pļavnieki district (see Fig. 1). Black dots correspond to 15-min periods when advertisement calls were recorded. Changes in mean daily temperature are indicated by a continuous line; rainy nights are marked by arrows.

(Fig. 1). In Purvciems, display activity was observed from late September until October. The maximum number of displaying males in Purvciems and Pļavnieki was five and nine, respectively; their density per surveyed area was ca. 2.6 males km<sup>-2</sup> (area of both districts combined).

In 2007, displaying males were observed on seven days between 15 October and 11 November (Fig. 2). The display started 0.9 to 1.6 h after sunset (mean = 1.61, SD = 0.45). Recorded display duration increased considerably as the season progressed and ranged from 0.5 to 5.6 h (mean = 2.52, SD = 1.91). On days with display activity, daily temperature (range = 0.23 to 8.34 °C, mean = 4.74, SD = 3.26) was slightly higher than on other days (range = -0.90 to 10.91 °C, mean = 4.00, SD = 3.19), but the difference was not statistically significant ( $Z = -0.72$ ,  $p = 0.499$ ). In most cases, the display activity was recorded on days with no or little rain, but difference in mean amount of precipitation comparing to other days was not significant ( $Z = -0.60$ ,  $p = 0.131$ ). When the display activity was recorded, the amount of precipitation ranged from 0.00 to 4.30 (mean = 0.61, SD = 1.63) mm 24 h<sup>-1</sup>. When no activity was recorded, the amount of precipitation ranged from 0.00 to 11.70 (mean = 2.13, SD = 3.68) mm 24 h<sup>-1</sup>.

## Discussion

The displaying male parti-coloured bats were regularly observed in the eastern part of Riga. Past and recent records of exhausted or injured individuals suggest that mating territories may also exist in the city centre and Mežciems, which are situated relatively close (ca. 7 and 2 km, respectively) to the discovered mating territories. No

advertisement calls were heard in the other 11 districts (including Mežciems), where only one survey per year was conducted. One visit per season may not be sufficient to confirm absence of displaying males. On the other hand, in Purvciems and Pļavnieki, the displaying males were found on every visit in late September and October. Mežciems is situated next to Purvciems and Pļavnieki, hence these adjacent districts may belong to a single mating area. For the other districts, no records of parti-coloured bats in autumn and winter are known and repeated surveys are required to determine presence or absence.

The display duration of male parti-coloured bats increased from mid October to early November. For polygynous bat species, a long display duration may be related to maximum potential copulation rate (Lundberg 1989). If the mating territories of parti-coloured bats are located close to their hibernacula, males may achieve more copulations by longer displays when more females arrive to hibernate or gather near the hibernation sites. Hence late autumn and early winter is probably preferred for mating.

In our study, the presence and absence of displaying males could not be explained by weather conditions. When the display was recorded, the mean daily temperature and the amount of precipitation did not differ significantly from other days, when no activity was recorded. Extreme weather conditions, e.g. temperature below 0 °C, strong wind and heavy rain, are expected to suppress the display activity, but such conditions were not observed in our study. The male display can occur even during mild nights in December (Rydell, Baagøe 1994), and reports on such observations were received in our study (see observations No. 3 and 4 in Table 1). Under good weather conditions,

the males may be absent from their mating territories to feed near street lamps, which attract flying insects (Rydell 1992). Hence no display activity may be recorded in good weather as well.

Currently no records of hibernating parti-coloured bats are known in Riga. However, observations in mid December or in mid April provide strong evidence that parti-coloured bats hibernate in Riga. Since this species hibernates in buildings and is not found in underground sites, which are regularly surveyed by scientists, the likelihood of actual finding a hibernating individual is small (Rydell, Baagøe 1994). Records of parti-coloured bats in cities of neighboring countries, e.g. Vilnius (Baranauskas et al. 2006) and St. Petersburg (Bogdarina 2006), indicate that hibernating populations of this species exist in Eastern Europe. Long-distance flights between Eastern and Central Europe are documented as well (Strelkov 1969; Masing 1989; Markovets et al. 2004) and migrating individuals are regularly observed at the south-eastern coast of the Baltic Sea (Celmiņš et al. 1986; Pauza, Pauziene 1998; Markovets et al. 2004). Recent opinion about the migratory behaviour of bats considers the long-distance seasonal movements to be a characteristic of populations rather than species (Fleming, Eby 2003), and for parti-coloured bats the Western European populations are known to be sedentary (Baagøe 1999). The latest findings suggest that in Eastern Europe migratory and sedentary populations of this bat species may co-exist.

This is the first study on parti-coloured bats in Latvia during autumn and winter. No records are known in other cities of Latvia. The origin of individuals found during autumn and winter is unknown (they may be immigrants or belong to resident populations). During the summer period, parti-coloured bats are considered to be rare in Riga (V. Vintulis unpubl. data), and most likely they arrive from distant locations. Origins of migratory organisms can be traced by non-invasive methods, e.g. stable isotope composition analysis (Rubenstein, Hobson 2004). Further research on weather influence on display activity is also needed.

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