

DIVERSITY AND ABUNDANCE OF BATS (CHIROPTERA) FOUND IN BAT BOXES IN EAST LITHUANIA

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Abstract. Bat diversity and abundance was investigated in thirteen areas in east Lithuania in 2009. A total of 504 bat boxes of four models were checked in each area (30–60 bat boxes per area). The bat boxes were checked six times during the warm season of the year: in May, June, July, August, September and October. Six bat species, namely the Nathusius' pipistrelle (*Pipistrellus nathusii*), soprano pipistrelle (*P. pygmaeus*), pond bat (*Myotis dasycneme*), brown long-eared bat (*Plecotus auritus*), noctule (*Nyctalus noctula*) and northern bat (*Eptesicus nilssonii*), were found in bat boxes. The Nathusius' pipistrelle and soprano pipistrelle clearly dominated in the bat assemblage (accordingly, 79.3% and 18.4%). The breeding colonies of Nathusius' pipistrelles and soprano pipistrelles were found in standard and four/five-chamber bat boxes. The breeding colonies of bats were constituted of approximately 30–150 individuals. Multi-chamber bat boxes in Lithuania were erected for the first time.

Key words: bat boxes, *Pipistrellus nathusii*, *Pipistrellus pygmaeus*, *Myotis dasycneme*, *Plecotus auritus*, *Nyctalus noctula*, *Eptesicus nilssonii*, Lithuania

INTRODUCTION

Boxes have turned out to be a valuable means in ecological research on bats (Gerell & Lundberg 1985). Bat boxes are very valuable for bat conservation during the breeding season (Flaquer *et al.* 2006). The use of bat boxes has been one of the most successful conservation schemes throughout Europe, and is particularly useful in providing roosting opportunities where few exist, such as in conifer plantations (Racey 1992).

Bats frequently inhabit both bat and bird boxes (Altringham 1998; Ciechanowski 2005; Gerell 1985; Kasprzyk & Ruczynski 2001; Kiser 2002; Kowalski *et al.* 1994; Lourenço & Palmeirim; Mitchell-Jones 2004; Mitchell-Jones *et al.* 1999; Sachanowicz & Ciechanowski 2005; Schmidt 1994, 1997; Stebbings 1988).

In Lithuania, bats in bat boxes have earlier been investigated by Baranauskas (2007, 2009); Baranauskas *et al.* (2005, 2008); Mickevičienė (2005). Data on bat occupancy of bat and bird boxes in Lithuania can also be found in the works of Juškaitis (1999, 2005), Pauža and Paužienė (1996).

Fourteen bat species are dwelling in Lithuania during the warm season: pond bat (*Myotis dasycneme*), Daubenton's bat (*M. daubentonii*), Brandt's bat (*M. brandtii*), Natterer's bat (*M. nattereri*), Leisler's bat (*Nyctalus leisleri*), noctule (*N. noctula*), brown long-eared bat (*Plecotus auritus*), barbastelle (*Barbastella barbastel-*

lus), northern bat (*Eptesicus nilssonii*), serotine (*Eptesicus serotinus*), parti-coloured (*Vespertilio murinus*), soprano pipistrelle (*P. pygmaeus*), Nathusius' pipistrelle (*P. nathusii*) and common pipistrelle (*P. pipistrellus*). All of them, except for the Daubenton's bat, Nathusius' pipistrelle and soprano pipistrelle, are included into the Red Data Book of Lithuania. The whiskered bat (*Myotis mystacinus*) – a fifteenth bat species – was registered in the country only once.

The purpose of the study was to assess bat diversity and abundance in bat boxes of four models during the warm season of the year in east Lithuania.

MATERIAL AND METHODS

In 2004–2008 standard and flat wooden bat boxes and in 2007–2008 four/five-chamber bat boxes were erected in thirteen areas in east Lithuania (Fig. 1).

The internal dimensions of standard boxes were 25 cm × 15 cm × 10 cm, with an entrance 15 × 2 cm and walls 2.5 cm thick. The roofs of standard bat boxes were convertible. The internal dimensions of flat boxes were 35 cm × 4 cm × 15 cm, with an entrance 15 × 2 cm and walls 2.5 cm thick. The front wall of flat boxes was removable. The internal dimensions of four-chamber bat boxes were 30 cm × 15 cm × 15 cm, with chambers 2 cm wide (Fig. 2).

We erected a number of large bat boxes built according

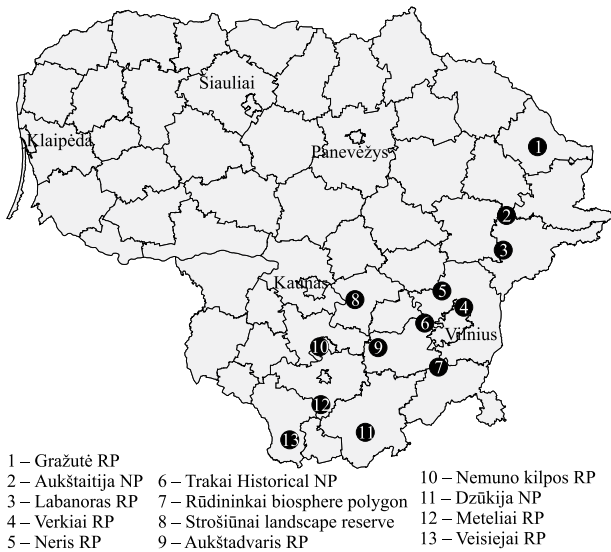


Figure 1. Areas in east Lithuania where the diversity and abundance of bats in bat boxes were investigated.



Figure 2. Breeding colony of *Nathusius' pipistrelles* in four-chamber bat box.



Figure 3. Breeding colony of soprano pipistrelles in five-chamber bat box.

to the Bat Conservation International specifications. Internal dimensions of five-chamber bat boxes were 55 cm × 35 cm × 19.5 cm, with chambers 2 cm wide (Fig. 3).

The roofs of four/five-chamber bat boxes were convertible, too. All multi-chamber bat boxes and part of standard bat boxes were covered by roofing paper. Bat boxes were attached to trees so that their removal was easy. Bat boxes were attached to trees (pine, aspen and oak) growing in open areas surrounded by mixed or pine forests. Boxes facing southeast or southwest were put on separate trees 4–6 m above the ground (Park *et al.* 1998) at a distance of 20–200 m from each other. A total of 504 bat boxes were erected (Table 1).

Boxes were checked for bats on 3–7 May, 7–11 June, 6–10 July, 4–8 August, 8–12 September and 1–5 October. The duration of each check was five days. In order to keep disturbance of bats to a minimum, bats were handled as little as possible.

The abundance of females and their flying young in breeding colonies was determined by counting individuals flying out of boxes to forage in the evening or returning at dawn. Petterson's ultrasound detector D 200 was used to analyse echolocation to determine the species of pipistrelles in the breeding colonies of females (Ahlén 2004; Ahlén & Baagøe 1999; Dietz & von Helversen 2004).

RESULTS

During six checks of bat boxes in east Lithuania in the warm season of 2009, six bat species were found (Table 2). The *Nathusius' pipistrelle* (Fig. 4) and soprano



Figure 4. *Nathusius' pipistrelle* females and their flying young circling around the nursery bat box in the Aukštaitija NP during the night.

Table 1. Number of bat boxes and areas in east Lithuania where the use of bat boxes by bats was investigated.

Area	Standard boxes	Flat boxes	Four chamber bat boxes	Five chamber bat boxes	Total
Aukštadvaris RP	30	10	-	5	45
Aukštaitija NP	15	10	3	5	33
Dzūkija NP	20	10	3	3	36
Gražutė RP	15	10	2	3	30
Labanoras RP	20	20	2	5	47
Nemuno Kilpos RP	20	10	3	5	38
Neris RP	30	10	5	5	50
Meteliai RP	10	20	-	5	35
Rūdininkai biosphere polygon	10	20	-	-	30
Strošiūnai landscape reserve	15	10	5	3	33
Trakai Historical NP	15	8	2	5	30
Verkiai RP	20	10	2	5	37
Veisiejai RP	30	20	-	10	60

Table 2. Diversity and abundance of bats found in bat boxes during six checks in east Lithuania in the warm season of 2009.

Area	Pond bat	Brown long-eared bat	Noctule	Northern bat	Soprano pipistrelle	Nathusius' pipistrelle	Total
Aukštadvaris RP	-	-	3	-	88	124	215
Aukštaitija NP	1	-	-	-	-	211	212
Dzūkija NP	-	-	-	-	-	59	59
Gražutė RP	-	-	4	-	3	29	36
Labanoras RP	-	-	-	-	-	65	65
Nemuno Kilpos RP	-	-	-	-	6	178	184
Neris RP	-	-	-	-	377	265	642
Meteliai RP	-	-	-	-	-	19	19
Rūdininkai biosphere polygon	-	13	-	1	-	14	28
Strošiūnai landscape reserve	-	-	3	-	5	32	40
Trakai Historical NP	-	-	9	-	2	146	157
Verkiai RP	-	29	1	-	45	66	141
Veisiejai RP	-	-	3	-	-	96	99
Total	1	42	23	1	526	1,304	1,897

pipistrelle clearly dominated in the bat assemblage (accordingly, 79.3% and 18.4%). The pond bat, brown long-eared bat, noctule and northern bat together constituted only 2.3%.

In the first days of May, five bat species (pond bat, brown long-eared bat, noctule, soprano pipistrelle and Nathusius' pipistrelle) were found in bat boxes. The Nathusius' pipistrelle constituted 82.5% of all bats and was found in all investigated areas. Nathusius' pipistrelles were found singly dwelling in bat boxes in all areas, and they were also found in social groups of 6–9 individuals in the Aukštaitija NP, Nemuno Kilpos RP and Neris RP. Soprano pipistrelles were found singly in bat boxes, with the exception of the Neris RP where soprano pipistrelles were found both singly and in one social group of six individuals. Pond bats, brown long-eared bats and noctules were found singly in all bat boxes.

On 7–11 June, three bat species (brown long-eared bat, soprano pipistrelle and Nathusius' pipistrelle) were found in bat boxes. Brown long-eared bats were found singly only in the Rūdininkai biosphere polygon and Verkiai RP. Nathusius' pipistrelles and soprano pipistrelles were found singly (probably, territorial males) and in the breeding colonies of females. The breeding colonies of soprano pipistrelles were found to occupy bat boxes in the Aukštadvaris RP, Neris RP and Verkiai RP. The breeding colonies of Nathusius' pipistrelles were found in seven areas. Three breeding colonies of Nathusius' pipistrelles consisting of 30–35 individuals were found in the Trakai Historical NP. Two breeding colonies of Nathusius' pipistrelles consisting of 40–150 individuals were found in each of the Aukštadvaris RP, Aukštaitija NP and Neris RP. One breeding colony of Nathusius' pipistrelles was

found in each of the Nemuno Kilpos RP, Verkiai RP and Veisiejai RP.

On 6–10 July, the same three bat species (brown long-eared bat, soprano pipistrelle and Nathusius' pipistrelle) were found to occupy bat boxes. Again, bat boxes were dominated by Nathusius' pipistrelle, which constituted 75.7% of all bats and was found in all investigated sites. Soprano pipistrelles were found to occupy boxes in five areas, and brown long-eared bat in two sites. As in June, pipistrelles were found in bat boxes singly or in breeding colonies of females. The breeding colonies of pipistrelles disappeared from the Aukštaitija NP and Verkiai RP, but the breeding colonies of Nathusius' pipistrelles and soprano pipistrelles became more abundant in all other areas during the check period in July.

On 4–18 August, during autumn migration of bats, four bat species (brown long-eared bat, noctule, soprano pipistrelle and Nathusius' pipistrelle) were found in bat boxes. All bats were found in social groups (probably harems) consisting of 2–11 individuals or, in rare cases, singly. As in previous months, the Nathusius' pipistrelle was the most abundant bat species. It constituted 95.7% of all bats and was found in all thirteen areas. The abundance of soprano pipistrelles significantly decreased during August and only eight individuals were found (one social group in the Aukštadvaris RP and one individual in the Strošiūnai landscape reserve). The brown long-eared bat, same as the soprano pipistrelle, was found in two areas – one social group in the Verkiai RP (consisting of five individuals) and one individual in the Rūdininkai biosphere polygon.

On 8–12 September, the same four bat species as in August were found in bat boxes. Nathusius' pipistrelles were found in all investigated areas and constituted 72.0% of all bats found in bat boxes. The brown long-eared bat, noctule and soprano pipistrelle constituted, accordingly, 10.7%, 8.0% and 9.3%.

On 1–5 October, at the end of the autumnal bat migration season, bats were found in bat boxes only in seven out of thirteen areas investigated in east Lithuania. Five bat species (Nathusius' pipistrelle, brown long-eared bat, noctule, soprano pipistrelle and northern bat) were found. The brown long-eared bat, which is a short distance migrating species, was found in the greatest numbers. Seven solitary brown long-eared bat individuals were found: three in the Rūdininkai biosphere polygon and four in the Verkiai RP. A social group of five brown long-eared bats was observed staying in the Verkiai RP from July. Nathusius' pipistrelles and soprano pipistrelles were found in bat boxes singly, and noctules were observed in small social groups. In October, the northern bat was found in a bat box for the first time (in the Rūdininkai biosphere polygon).

DISCUSSION

Fourteen bat species are dwelling in Lithuania (Balčiauskas *et al.* 1997, 1999; Pauža & Paužienė 1996). During bat diversity and abundance investigations in east Lithuania, when the 504 bat boxes of four models were checked six times during the warm season of 2009, six bat species (pond bat, brown long-eared bat, noctule, Nathusius' pipistrelle, soprano pipistrelle and northern bat) were found. The Nathusius' pipistrelle constituted 79.3%, and the soprano pipistrelle made 18.4% of the total number of bats found in bat boxes. The pond bat, brown long-eared bat, noctule and northern bat all together constituted 2.3%. Bats of genus *Myotis* were avoiding bat boxes. The Daubenton's bat, Natterer's bat, Brandt's bat are not rare in hibernation sites of the country (Balčiauskas *et al.* 1997, 1999; Baranauskas 2007; Masing *et al.* 2009; Pauža & Paužienė 1996), but we never found them in bat boxes during 7–8 years of investigations (Baranauskas 2007, 2009; Baranauskas *et al.* 2005, 2008). The Daubenton's bat and Natterer's bat are tree-dwelling bat species preferring ashes for roosts (Kanuch 2005). According to Gerell (1985), the Daubenton's bat is selecting boxes with a hole or a slit in the front of a box. We have also checked a lot of bird boxes (unpublished data) in the area of investigations, but all our efforts to find Daubenton's bats, Natterer's bats or Brandt's bats were in vain. In literature there are data that one Brandt's bat individual was found in a bat box in July 1991 (Pauža & Paužienė 1996). In our investigations, only the pond bat, the species of genus *Myotis*, was found in bat boxes for several times, although the species is considered rare in the country.

In central Poland, four bat species (greater mouse-eared bat, noctule, Nathusius' pipistrelle, brown long-eared bat) were found in Stratman boxes in 2005–2008 (Lesinski *et al.* 2009).

The biggest number of bats (3.8–12.8 individuals per bat box) was found in six areas where Nathusius' pipistrelles and soprano pipistrelles established breeding colonies of females (with the exception of the Veisiejai RP where 1.6 individuals per bat box were found). In other six areas, only social groups of non-breeding individuals or solitary bats were found during the investigation. Very small numbers of bats were found in bat boxes in the Meteliai RP and Rūdininkai biosphere polygon (accordingly, 0.6 and 0.9 individuals per bat box). In both areas bat boxes were erected only in 2008.

The breeding colonies of Nathusius' pipistrelles and soprano pipistrelles were found in standard and four/five-chamber bat boxes. From three to about 40 females with new-born juveniles were found in standard bat boxes. The mean number of bats found in breeding colonies in four/five-

chamber bat boxes was about 150. Solitary or social groups of non-breeding bats were found in bat boxes of all four models. We want to stress that though breeding colonies of bats were not found in flat bat boxes such boxes were the only model where all six bat species were found.

CONCLUSIONS

Based on the results that Nathusius' pipistrelle and soprano pipistrelle were using standard and particular multi-chamber bat boxes for roosting, mating and breeding, we can conclude, that such boxes are a very good instrument to increase the population of these bat species in forested areas. A four/five-chamber bat box can contain to about 150–200 breeding females. The Nathusius' pipistrelle was found to be a very common and abundant bat species in the country. During the warm season of the year, the species was found in all thirteen sites of investigations and clearly dominated in the bat assemblage (79.3% of the total of records). The soprano pipistrelle was also abundant and formed breeding colonies in forested areas if the species could find safe places for roosting there. Both pipistrelle species were most abundant in bat boxes during the breeding period, in June and July. The brown long-eared bat used bat boxes permanently during the whole warm season of the year. The noctule used bat boxes only during spring and autumn migrations. The pond bat and northern bat used bat boxes only accidentally and could be found only in standard and flat bat boxes.

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ŠIKŠNOSPARNIŲ ĮVAIROVĖ IR GAUSUMAS INKILUOSE RYTŲ LIETUVOJE

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SANTRAUKA

2009 m. buvo tiriama šikšnosparnių įvairovė ir gausumas trylikoje Rytų Lietuvos teritorijų. Kiekvienoje vietovėje buvo stebima po 30–60 inkilų. Iš viso buvo stebimi 504 keturių modelių inkilai, kurie buvo tikrinami gegužės, birželio, liepos, rugpjūčio, rugsėjo ir spalio mėnesiais. Inkilais naudojosi Natuzijaus šikšniukai (*Pipistrellus nathusii*), šikšniukai mažyliai (*P. pygmaeus*), kūdriniai pelėausiai (*Myotis dasycneme*), rudieji ausyliai (*Plecotus auritus*), rudieji nakvišos (*Nyctalus noctula*) ir šiauriniai šikšniai (*Eptesicus nilssonii*). Šikšnosparnių bendrijoje dominavo Natuzijaus šikšniukai (79,3%) ir šikšniukai mažyliai (18,4%). Standartiniuose ir keturių–penkių kamerų inkiluose aptikta Natuzijaus šikšniukų ir šikšniukų mažylių veisimosi kolonijų, kurias sudarė apytikriai po 30–150 individų. Daugiakameriniai inkilai šikšnosparniams šalyje buvo iškelti pirmą kartą.

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