Bat-detectoring in different types of forests of the Czech Republic

Monitoring of bats was performed during 30 campaigns from May 2005 to August 2005 in 3 periods selected according to reproduction cycle of bats, i.e., pregnancy (15.5. – 14.6.), lactation (25.6. - 14.7.) and post-lactation (25.7. – 14.8.). We used the point counting method of automatic bat-detectoring (PCM) and we acquired 180 recordings (ca. 90 GB) in 3 microhabitats (cluttered, semi-cluttered and open) of 10 different forest types situated in the area of Moravia (eastern part of the Czech Republic), i. e., floodplain forest (1), pine forest (2), thermophilous oak forest (3), lowland beech forest (4), lowland spruce plantation (5), oak-hornbeam forest (6), ravine forest (7), mountain beech forest (8), bog spruce forest (9), and mountain spruce forest (10) (Fig.1). The sites of point bat monitoring were selected to be at least 100 m mutually distant. In addition, the method of line transects (LTM) was used to assess species diversity of bat communities.

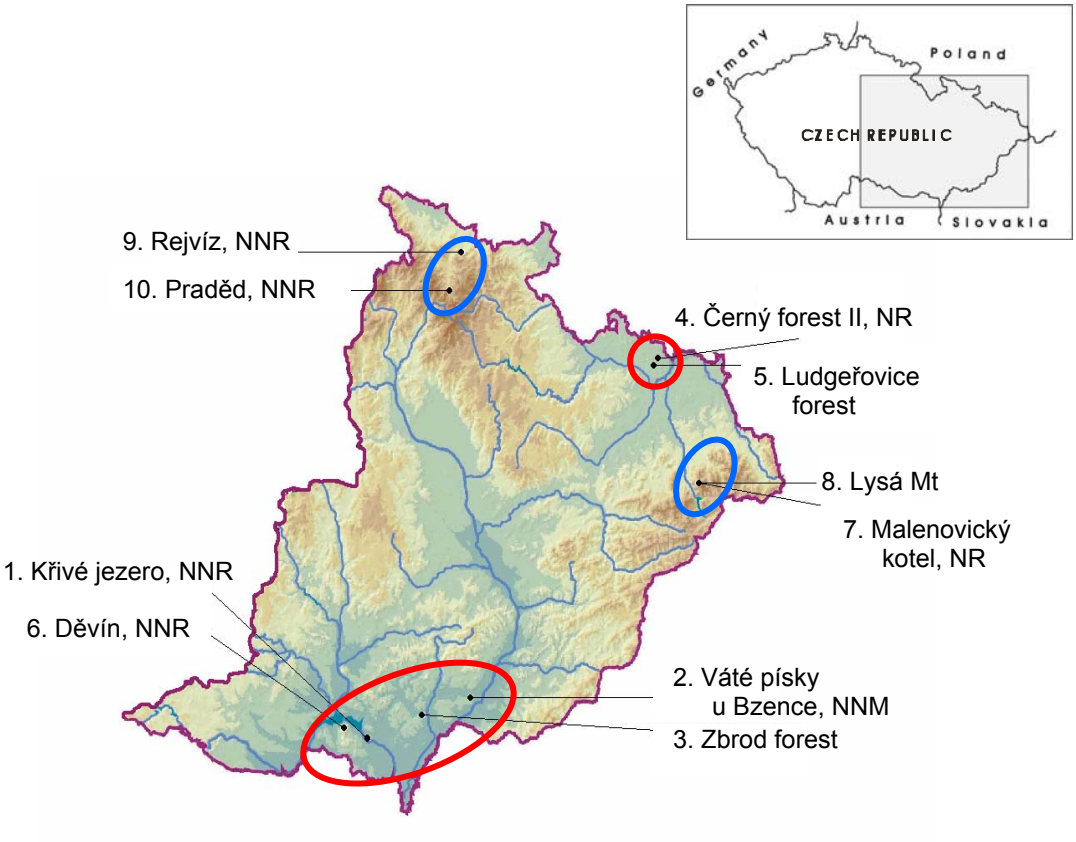

Fig. 1. The map of Moravia with the sites under study.
Lowland forests (1-6), mountain forests (7-10); NNR - National Nature Reserve, NR - Nature Reserve, NNM National Nature Monument.

The set of detectoring equipments (PCM) consisted of the bat-detector (Pettersson D230) and the portable minidisc recorder (SONY MZ-NH1 or NH900) connected by the stereo cable. Assembled in a plastic box the set was fixed on a stand at the height of 1.20 m above ground. Each recording lasted 45 minutes. Two recordings were performed in each detectoring point during a night. The first recording started 30 minutes after the sunset and the second one ended always before midnight. The interval between the end of the first recording

and the beginning of the second one was 45 minutes at least and differed in course of the season due to changes in the night duration. To line transect monitoring (LTM) we used detectors Pettersson D240x or D980 and recorders SONY DAT TCD-D8 or TDM WM-D6C. Bat-detectoring on line transects was performed simultaneously with point counting detectoring and lasted approximately 20 minutes in each of the microhabitats.

All recordings were analysed on the PC using BatSound Pro 3.3.1b software.The level of flight activity of bats was calculated as the number of minutes when bat calls were listened (recorded, min+) of total number of minutes of recording (in per cent, %), or per 1 hour of recording (min+/h). In total, the bats were recorded in 2710 minutes (min+) of 8100 minutes of all recordings using point counting method (33.5 %) and in 797 min+ of 2296 minutes during 109 evaluated line transects (35 %), respectively.

Results revealed by the point counting method

The values of the total flight activity of bats in particular forest types amounted to 50 min+/h (floodplain forest, 160 m a.s.l), 35.9 min+/h (oak-horbeam forest, 290 m a.s.l.), 34.7 min+/h (thermophilous oak forest, 170 m a.s.l.), 29.6 min+/h (lowland pine forest, 200 m a.s.l), 22.4 min+/h (lowland beech forest, 240 m a.s.l.), 19.6 (lowland spruce plantation, 250 m a.s.l.), 3.7 min+/h (peat bog spruce forest, 720 m a.s.l.), 2.4 min+/h (mountain ravine forest, 890-930 m a.s.l.), 1.7 min+/h (mountain beech forest, 940-970 m a.s.l.), 0.7 min+/h (mountain klimax spruce forest, 1120-1200 m a.s.l.). Fig. 2 shows the variancy of absolute values of flight activity (min+) in particular forest types (1-10).

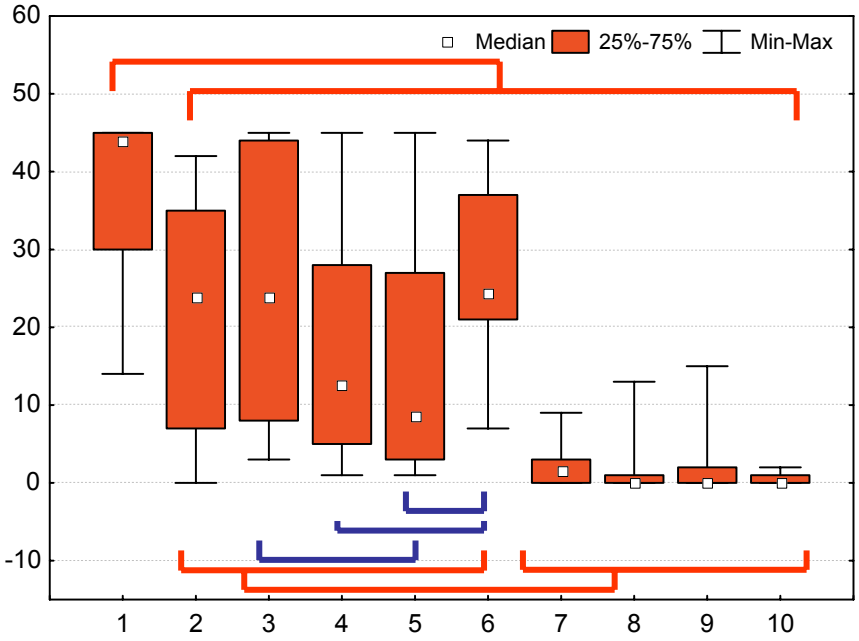

Fig. 2. Variancy of the flight activity (min+) in particular forests (1-10).
Red and blue lines – significant differences, y axis – number of min+ (min. 0, max. 45).

The studied floodplain forest significantly differed from other forest habitats by the highest level of bat activity while bat activity was very low, similar and significantly different in mountain forests compared to all lowland forests under study.

To evaluate temporal differences in bat activity, forest habitats were lumped in two groups, e.g. lowland (6) and mountain (4) forests. In the group of lowland forests the bat activity was significantly highest in the pregnancy period and it gradually decreased towards

the end of the season (Fig. 3). On the contrary, bat activity in mountain forests was well-balanced throughout the season with the lowest value in the pregnancy period.

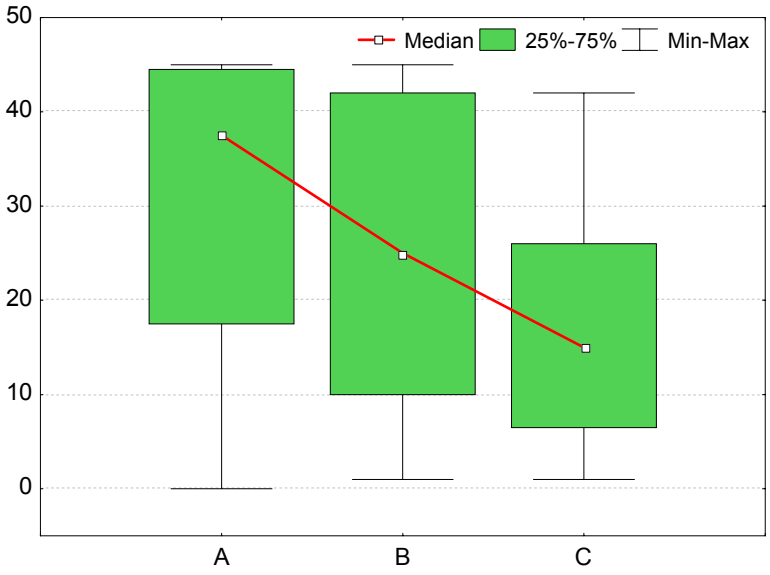

Fig. 3. Variancy of the flight activity (min+) in particular periods in lowland forests (1-6).
A – pregnancy, B – lactation, C – post-lactation, y axis – number of min+ (min. 0, max. 45).

In all forest habitats, bat activity was higher at the beginning of a night (1st quarter of the night) compared to the period before midnight (2nd quarter of the night), but not significantly (Fig. 4).

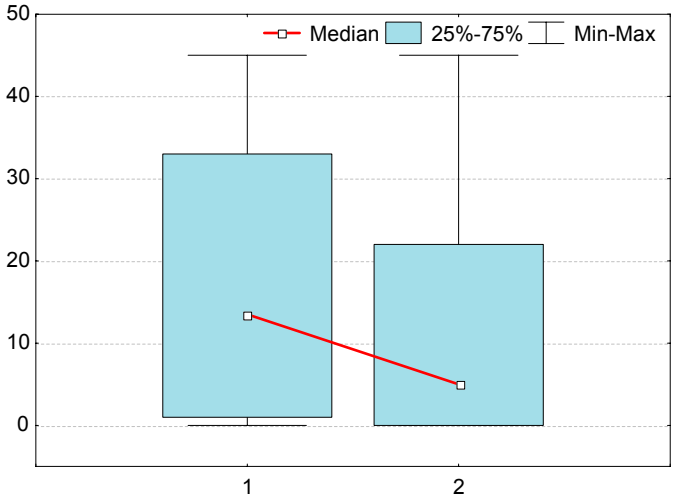

Fig. 4. Variancy of the flight activity (min+) during a night in all forests (1-10 lumped).
1 - 1st quarter of the night, 2 - 2nd quarter of the night, y axis – number of min+ (min. 0, max. 45).

Results revealed by the line transect method

Species structure of bat assemblages obtained by line transect recordings is shown in Tab. 1. In total, 13 bat spacies and 2 pairs of species (undisquished by their echolocation calls in the field) were identified. Occurrence of another two species is unclear. The highest number

of bat species (14 at least and except of *Eptesicus nilssonii*) was recorded in the floodplain forest. On the contrary, only species was found in the mountain spruce forest.

Tab.1. The list of bat species recorded and their presence in particular forest types (1-10). Mmys/bra – *Myotis mystacinus* seu *M. brandtii*, Mema – *M. emarginatus*, Mnat – *M. nattereri*, Mbec – *M. bechsteinii*, Mmyo – *M. myotis*, Mdau – *M. daubentonii*, Enil – *Eptesicus nilssonii*, Eser – *E. serotinus*, Nnoc – *Nyctalus noctula*, Nlei – *N. leisleri*, Ppip – *Pipistrellus pipistrellus*, Ppyg – *P. pygmaeus*, Pnat – *P. nathusii*, Bbar – *Barbastella barbastellus*, Paur/aus – *Plecotus auritus* seu *P. austriacus*, Hsav – *Hypsugo savii*, Nlas – *N. lasiopterus*; + - presence, +? – unclear presence, S – number of species, Order – order of the site, Ar – relative abundance (activity) in per cent, site – number of sites, order – order of the species.

	1	2	3	4	5	6	7	8	9	10	site	order
Mmys/bra	+	+	+	+	+	+	+	+	+		9	1
Mema	+					+					2	15
Mnat	+			+			+		+		4	12-13
Mbec	+	+	+	+	+	+	+		+		8	2-4
Mmyo	+	+	+	+	+	+		+			7	5-7
Mdau	+	+	+	+	+	+	+		+		8	2-4
Enil				+?			+	+		+	3 (4)	14
Eser	+	+	+	+	+	+					6	8-11
Nnoc	+	+	+	+	+	+		+	+		8	2-4
Nlei	+	+	+	+	+				+		6	8-11
Ppip	+		+	+	+	+	+	+			7	5-7
Ppyg	+	+	+			+					4	12-13
Pnat	+		+	+	+	+		+			6	8-11
Bbar	+	+	+	+	+	+					6	8-11
Paur/aus	+	+	+	+	+	+	+				7	5-7
Hsav	+?										(1)	
Nlas	+?										(1)	
S	14-18	10-12	12-14	12-15	11-13	12-14	7-9	6-7	6-7	1		
Order	1	6	2-4	2-4	5	2-4	7	8-9	8-9	10		
Ar (in %)	97,8	53,3	53,3	27,8	18,9	54,4	3,3	0	0	0		
Order	1	3-4	3-4	5	6	2	7	8-10	8-10	8-10		
CELKEM	1	5	3	4	6	2	7	8-9	8-9	10		

Only *Pipistrellus pygmaeus* seems to be typical lowland bat species recorded at four localities. On the other hand, *Eptesicus nilssonii* can be considered typical mountain species. It was obtained only at 3 mountain localities, i. e., in the peat bog spruce forest within the Rejvíz NNR, in the klimax spruce forest below the peak of Praděd Mt. located within NNR of the same name (both sites are situated in the Jeseníky Protected Landscape Area), and in the mountain beech forest in the massif of the Lysá hora Mt. (Beskydy PLA).

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Doc. RNDr. Zdeněk Řehák, Ph.D., Mgr. Tomáš Bartonička, Ph.D., Mgr. Jan Zukal, Dr.,
Bc. Petra Simprová and Bc. Žaneta Džingozovová

Department of Botany and Zoology, Faculty of Science, Masaryk University in Brno (Czech Republic) and Czech Bat Conservation Trust (Prague, Czech Republic)