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Monitoring of church-dwelling bats in the territory of Zemplén Mts (Hungary) between 1989 and 1998

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Abstract. The paper summarises a nine-year bat monitoring project carried out in Zemplén Mountains in northern Hungary. 62 church lofts were investigated in 1989, 1994 and 1998. In the lofts, 9 bat species were discovered. The colonies of the species changed in different ways throughout the years. *Myotis dasycneme* disappeared from the area, and there was also a significant decrease in the number of *Rhinolophus ferrumequinum*. Slight increases in the numbers of *Rhinolophus hipposideros*, *Plecotus austriacus*, *Myotis myotis* and *M. blythii* could were detected, but they cannot be considered significant. A steady significant increase was observed in case of *Myotis emarginatus* and *Eptesicus serotinus*, whilst *Pipistrellus pipistrellus* was found to appear in buildings.

Chiroptera, house-dwelling bats, monitoring, roost

Introduction

Several species and habitat conservation programmes were commenced in Hungary as a consequence of the decrease in the numbers of bats (Dombi 1995, Fehér 1995, Závoczky 1995). The monitoring programmes provide indispensable information for the protection, since it is essential to be aware of the trends in changes of bat numbers.

In Hungary, only a few bat monitoring programmes were carried out. Monitoring of buildings was accomplished by Boldogh & Gombkötő (1996) in the territory of Aggtelek National Park (northern Hungary). They studied the changes in church-dwelling bat colonies for five years.

In Hungary there are approximately 6000 churches. These offer the most important or exclusive summer roosts for many bat species. It can be ascertained that 7 species are strongly linked with churches in the summer (*Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Myotis myotis*, *Myotis blythii*, *Myotis emarginatus*, *Eptesicus serotinus*, *Plecotus austriacus*). The lack of large lofts and open entrances can be limiting factors to the occurrence of these species.

The changes in the number of bats in Hungary are unknown to us, because we do not possess relevant data even on a short-term basis. It was the aim of our research to find the answer to this question. Therefore, we decided to examine the changes in number of bat species and individuals living in churches in the chosen territory over a period of nine years.

Material and methods

Study area and sampling

The research was carried out in Zemplén Mountains and their surroundings in northern Hungary. This area was chosen because of its heterogenous habitats which may imply the greater diversity of species. It borders on Slovakia and the rivers Hernád and Bodrog and lie between 230 and 720 metres above sea level.

There are 84 churches in the area. We have chasen 62 of them, only those accesible in each of the above years. We thoroughly examined their towers and lofts in the summer of 1989, 1994 and 1998. A data sheet was prepared for each church showing the number and species of bats detected there.

Data analyses

In order to assess the results, the SPSS program was used. The significance of changes in the size of colonies between the beginning and the end of the monitoring period was estimated by a Wilcoxon 2-related rank test. The χ-square test was used to analyse the significance of differences in the number of inhabited churches.

Results

The presence of 9 species was detected in the churches. These are the following in order of frequency: *Myotis myotis*, *M. blythii*, *Plecotus austriacus*, *Eptesicus serotinus*, *Rhinolophus ferrumequinum*, *Myotis emarginatus*, *Rhinolophus hipposideros*, *Myotis dasycneme*, *Pipistrellus pipistrellus*.

Some changes could be observed during the 9 years. While bats were found only in 56.4% of the churches in 1989, this decreased to 50% in 1994 and grew to 69.3% in 1998. The increase between 1989 and 1998, however, is not considered significant (G=2.220, df=1, p=0.136). 12.9% of the churches remained uninhabited by bats in each year (Fig. 1).

Myotis myotis and *M. blythii*

A joint discussion of these two species is justified by the fact that it is sometimes difficult to distinguish the each other because they hang very high and also because they often form a mixed colony.

These species were detected at 15 sites in each year of examination. The total number of individuals was 646 in 1989. This number increased more than twofold (1457) during the 5 years and remained nearly at the same level until 1998 (1578). Breeding colonies of more than 100 individuals are illustrative of these species. The territory is also inhabited by another large colony of 800–1000 bats.

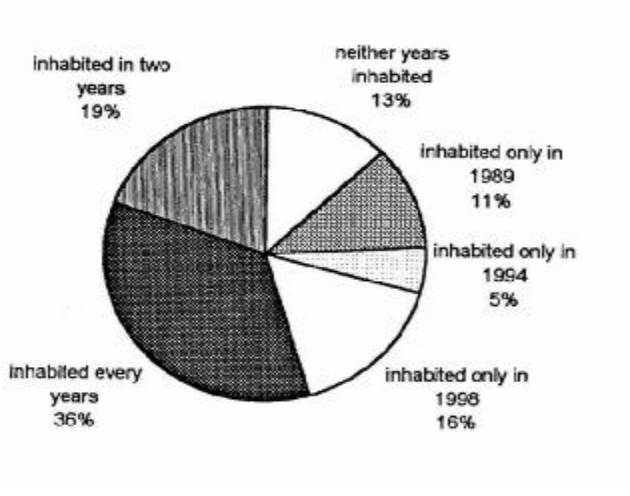

Fig. 1. The proportion of churches inhabited by bats.

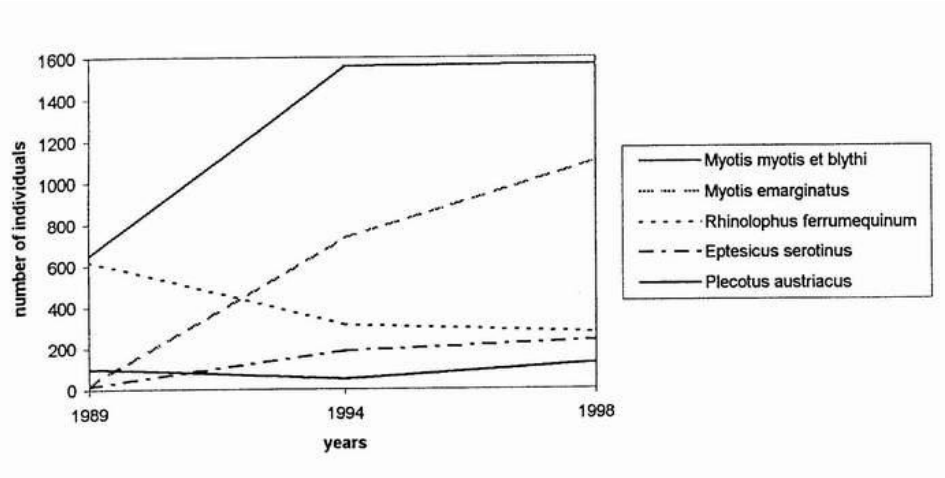

Fig. 2. Changes in numbers of different bat species between 1989 and 1998.

Besides the increasing number of individuals at 12 sites, a decreasing numbers at 10 sites were recorded. There were no significant changes in the numbers of these two *Myotis* species during the nine-year period (n=22, T_+=122, p=0.884).

Plecotus austriacus
The number of Grey long-eared bats varied inconsistently during these years. While 100 individuals were found at 12 sites in the first year, it decreased by 50% in 1994 and they completely disappeared from 5 roosts. Colonies with a stable size of 10–20 individuals decreased from 5 to 2. At that time it indicated a serious threat to this species. In 1994, several dead animals were found. Once we found 15 dead individuals in a church loft. However, a rapid growth took place in 1998. 125 individuals in 5 larger colonies were found at 14 sites. Therefore it seemed that the decrease was only temporary and the long-term 25% increase is promising with regard to the future of the species. The changes, however, were not significant during the examined period (n=21, T_-=90.5, p=0.382).

Eptesicus serotinus
In 1989, Serotine was regarded as a rare species. Altogether 14 individuals were found at four sites. In 1994, a dynamic growth was observed: 186 individuals were found at 9 roosts. In 1998, there were even more – 235 individuals at 16 sites. It becames a species which often occurs in lofts in Zemplén Mountains. They usually use a small opening as an entrance. Therefore they are not endangered by closing windows to prevent the acces of pigeons . The number of these bats significantly increased during the nine-year period (n=18, T_-=5, p< 0.0001).

Rhinolophus ferrumequinum
Two large Greater horseshoe bat colonies were found in the area. Their total number cold be hardly influenced by some other (one or two) solitary individuals living in other churches. There was a decrease at each colony during the examined period. The total number of this species was 619 bats in 1989, but it decreased to 273 by 1998. This species is seriously endangered. Fortuna-

tely, these two colonies live in a safe roost. Explanation for the decline has not been found yet. A decrease in the number of individuals in the nine-year period was significant (n=11, T_+=3, p= 0.019)

Myotis emarginatus
Geoffroy's bat is one of the strictly protected bat species in Hungary. They established two colonies at the same roosts as the Greater horseshoe bat colonies live. While the latter's number decreased, there was a strong increase in the case of Geoffroy's bat. Exactly, 20 individuals were found in 1989 and 1100 in 1998. This is a 55-fold increase. This species is sensitive to any disturbance. Therefore, this abrupt growth in the examined churches might be explained by other colonies' movement to the area.

Myotis dasycneme
Pond bat is a very rare, strictly protected species in Hungary. Only one colony was detected in 1989 in the area. This breeding colony consisted of 150 individuals disappeared despite the fact that it was not disturbed in their summer roost. In 1998, there was no Pond bat found in the Zemplén Mountains.

Pipistrellus pipistrellus
Pipistrelle bat very rarely occurs in lofts. Only one colony of 30 bats appeared in a bell-tower in 1994, which was still there in 1998.

Rhinolophus hipposideros
In some areas of Hungary Lesser horseshoe bats often live in lofts. However, this is not true in the Zemplén Mountains, where only one church was found inhabited by this species. In 1989, only four bats lived there, five in 1994 and ten in 1998. This shows that the numbers of lesser horseshoe bats are stable at least at this site.

We also investigated whether different species occur in the same church. This rarely happened in this area. It seems that the following bat species can co-occur:
Eptesicus serotinus – *Plecotus austriacus*
Eptesicus serotinus – *Myotis myotis* and *M. blythii*
Myotis emarginatus – *Rhinolophus ferrumequinum*

Serotine bat was detected 29 times in the three examination years. It was found six times with Grey long-eared bats, six times with *Myotis* sp. and once with Pipistrelle bats. It means that syntopic occurrence with other species makes nearly half of its records. The reason might be that Serotine bat hides into narrow crevices, therefore it does not appear as a competitor for free-hanging species.

Greater horseshoe bat and Geoffroy's bat form large, separated colonies in the same churches. This joint occurrence could be often seen also in other parts of Hungary.

Discussion

Nine species were found in the church lofts in the study area. Strong significant increase was detected in the case of *M. emarginatus* and *E. serotinus* (Fig. 2).

In the case of *M. emarginatus* an opposite trend could be seen in the Aggtelek National Park (40 km from the study area) (Boldogh & Gombkötő 1996). They found that the number of individuals counted in 1994 decreased fourfold in 1995. The extreme decrease detected there and in

Bükk Mountains (40 km from the study area) suggests that they possibly moved from there into Zemplén Mountains.

Boldogh & Gombkötő (1996) also found some increase in the case of Serotine bat until 1995. In south Hungary, this trend was found by Závoczky (1997) between 1991 and 1995. However, this species tends to hide, particularly between the wall and beams and between the beams and roof. This might result in the underestimation of their numbers.

During the nine-year long monitoring an increase occurred in the numbers of *M. myotis* and *M. blythii* and *P. austriacus*, but it was not significant. Boldogh & Gombkötő (1996) observed the stable number of the *Myotis* species. They reported a drastic decline of *P. austriacus* between 1994 and 1995 as we did. In southern Hungary Závoczky (1997) found an increase in the number of *Myotis myotis* and *M. blythii* between 1991 and 1995.

Our investigation shows that *M. dasycneme* and *R. ferrumequinum* are the most endangered species in northern part of Hungary as is the case in most of Europe.

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Souhrn

Výsledky monitorování kostely využívajících druhů netopýrů na území Zemplínských vrchů (Maďarsko) mezi lety 1989 a 1998. Příspěvek shrnuje devítiletý monitorovací projekt netopýrů, který proběhl v Zemplínských vrších v severním Maďarsku. V letech 1989, 1994 a 1998 bylo opakovaně prověřeno 62 půd kostelů, na kterých bylo nalezeno 9 druhů netopýrů. Během desíti let se změnily osádky a kolonie netopýrů různým způsobem: *Myotis dasycneme* z území vymizel; významný pokles počtů ukázal také *Rhinolophus ferrumequinum*; mírně, nikoliv však významně vzrostly počty netopýrů druhů *Rhinolophus hipposideros*, *Plecotus austriacus*, *Myotis myotis* a *M. blythii*; velmi významný růst počtů byl pozorován v případě druhů *Myotis emarginatus* a *Eptesicus serotinus*; zatímco druh *Pipistrellus pipistrellus* byl na zkoumaném území v budově kostela objeven kostela poprvé.

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