

SURVEY OF BUILDING-DWELLING BAT SPECIES IN THE SURROUNDINGS OF THE TUR RIVER PROTECTED AREAS

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Rezumat. Inventarierea faunei de lilieci din habitatele antropice în împrejurimea Ariilor Protejate Râul Tur. În cursul anilor 2011-2012, am vizitat împrejurimile Ariilor Protejate Râul Tur. În timpul vizitelor am verificat 38 de clădiri, în cea mai mare parte biserici. Comparând rezultatele obținute cu literatura deja existentă privind această arie, am reușit să obținem o imagine cuprinzătoare a faunei de lilieci din această zonă. Am identificat opt specii din cele 31 de specii ale faunei de lilieci din România: *Myotis myotis* (Borkhausen 1797), *Myotis oxygnathus* (Monticelli 1885), *Eptesicus serotinus* (Schreber 1774), *Nyctalus noctula* (Schreber 1774), *Plecotus austriacus* (Fischer 1829), *Pipistrellus pipistrellus* (Schreber 1774), *Rhinolophus ferrumequinum* (Schreber 1774), *Rhinolophus hipposideros* (Bechstein 1800). Pe baza rezultatelor „*Myotis mare*” era prezent în zonă în cel mai mare număr de indivizi, iar cea mai frecventă specie era *Plecotus austriacus*. Am observat o scădere a numărului de indivizi în majoritatea coloniilor an după an. Renovările și lucrările de reconstrucție a clădirilor sunt considerate tulburări pentru lilieci, care ar putea explica scăderea mărimii coloniilor. Prezența jderului (*Martes foina*) sau a strigei (*Tyto alba*) scade de asemenea șansa liliecilor de adăpostire. Declinul numărului indivizilor în colonii, uneori urmat de dispariția completă a acestora, ar justifica inițierea unui sistem de monitorizare pe termen lung pentru zonă. Este de asemenea necesar aplicarea unui plan de management specific și bine dezvoltat pentru conservarea liliecilor.

Summary. In the years 2011 and 2012 we visited the surroundings of the Tur River Protected Areas. During our visits we investigated 38 buildings, mostly churches. Comparing our results with the existing literature concerning this area, we managed to get a comprehensive view of the bat fauna from this area. We identified eight species from the 31 species of the Romanian bat fauna: *Myotis myotis* (Borkhausen 1797), *Myotis oxygnathus* (Monticelli 1885), *Eptesicus serotinus* (Schreber 1774), *Nyctalus noctula* (Schreber 1774), *Plecotus austriacus* (Fischer 1829), *Pipistrellus pipistrellus* (Schreber 1774), *Rhinolophus ferrumequinum* (Schreber 1774), *Rhinolophus hipposideros* (Bechstein 1800). Based on our result the greatest number of individuals in the area was observed in case of *large Myotis*, but the most frequented species was *Plecotus austriacus*. We observed a decreasing number of individuals in almost every colony year after year. The ongoing renovations and reconstruction works of the buildings can be considered as disturbance factors for bats, which may explain the decrease of colonies sizes. The presence of marten (*Martes foina*) or barn owl (*Tyto alba*) also decreases the chance bats occupying the buildings. The continuous drop in the number of individuals of the colonies, sometimes followed by complete disappearance, would justify the initiation of a long-term monitoring system for the area. It is also necessary to create a well-developed, specific conservation management plan.

Introduction

The phenomenon of urbanization is constantly increasing among bat species (Endes 1997; Bihari 2003; Bihari 2004). Its main consequence is that a significant number of bat species are beginning to use populated areas as their habitat, as well as buildings as shelter. The primary reason of this phenomenon, observed also in other animal groups, is the decrease of natural habitats and the constant increase of the settlements sizes (Bakos 1999). Because anthropogenic effects (ex. continuous restoration and reconstruction works) these groups are highly endangered (Jére et al. 2005) and in this way it is particularly important to have accurate data about building-dwelling bat populations. Surveys targeting the Tur River Protected Areas bat fauna did not occur until 2011, although during other surveys between 1999 and 2001 some of the buildings located here were verified. The current study presents a data set collected in 2011-2012, comparing it with existing literature concerning the

areas bat fauna (Szodoray-Parádi F. & Szodoray-Parádi A. 2000; Szodoray-Parádi et al. 2005; Szodoray-Parádi A. & Szodoray-Parádi F. 2008).

Materials and methods

The study was conducted in the surrounding localities of the Tur River Protected Areas, which is situated in the north-western part of Romania, in Satu Mare county (Figure 1.), between 100-350 m a.s.l. With a total area of 209 km², it has a wide variety of habitats, composed of deciduous forests, wetlands and settlements. These settlements are located outside of the borders of the protected areas, yet their administrative regions are within its boundaries.

We investigated 38 buildings in 20 settlements of the area, of which 35 buildings in the 2011-2012 period. In case of 13 buildings there have been other surveys in the past (Szodoray-Parádi et al. 2005) and of these buildings we were able to investigate ten.



Figure 1. The localization of the study area (Source: www.tur-info.ro)

. In the case of the remaining three we used data from the existing literature. Some of the buildings were visited more than once: five buildings were checked three times, while twelve buildings only twice. Thirty-six of the surveyed buildings were towers and attics of churches; one was a mansion, and one was a barn (Annex, Table 1.).

Site visits were done in June, in this way we could observe the presence of maternity colonies. During our visits we tried to reduce to a minimum the disturbance of bats, only spending the necessary time for the survey in the building. The size of colonies was determined by direct counting, in some cases by estimation. For species identification we used the identification key of Jéré et al. (2010). The two large sized *Myotis* species, *M. myotis* and *M. oxygnathus*, were grouped as 'large *Myotis*', therefore in the rest of the study they will be discussed as such. We observed and noted several parameters in every case:

- number of individual bats
- number of dead specimens
- presence and amount of guano
- number, quality and size of roosts entrances used by bats
- surroundings of the buildings
- natural and anthropogenic disturbances
- type of the roofing material

The number and size of roost entrances on the buildings was considered great, and adequate, respectively, in cases where their number was more than five and their size reached 20×10 cm. In turn, they were considered to be scarce and

inadequately small, when there were less than five openings, with a size smaller than 20×10 centimeter.

Abbreviations used throughout the study are found in the List of abbreviations (Annex, Table 2.).

Results

We identified a total of eight bat species in the study area: *Myotis myotis* (Borkhausen 1797), *Myotis oxygnathus* (Monticelli 1885), *Eptesicus serotinus* (Schreber 1774), *Nyctalus noctula* (Schreber 1774), *Plecotus austriacus* (Fischer 1829), *Pipistrellus pipistrellus* (Schreber 1774), *Rhinolophus ferrumequinum* (Schreber 1774), *Rhinolophus hipposideros* (Bechstein 1800). There were bats or traces of bats (ex. guano) in 24 of the 38 visited building. This represents 55% of all surveyed buildings. In seven buildings (18%) the occurrence of marten (*Martes foina*) and barn owl (*Tyto alba*) excluded presence of bats. Similarly, in eight buildings (21%), where renovations were underway, we did not identify any bats. The number of individuals in the identified colonies varies between two, and 300 individuals (Figure 2.).

Four bat species (*N. noctula*, *P. pipistrellus*, *R. ferrumequinum*, *R. hipposideros*) were only identified in one building. In case of these four species combined, this represents 10.6% of the controlled buildings. Large *Myotis* species were identified in four buildings (10.6%), *E. serotinus* was present in 6 structures (15.7%), while *P. austriacus* was found in 13 buildings (34.2%).

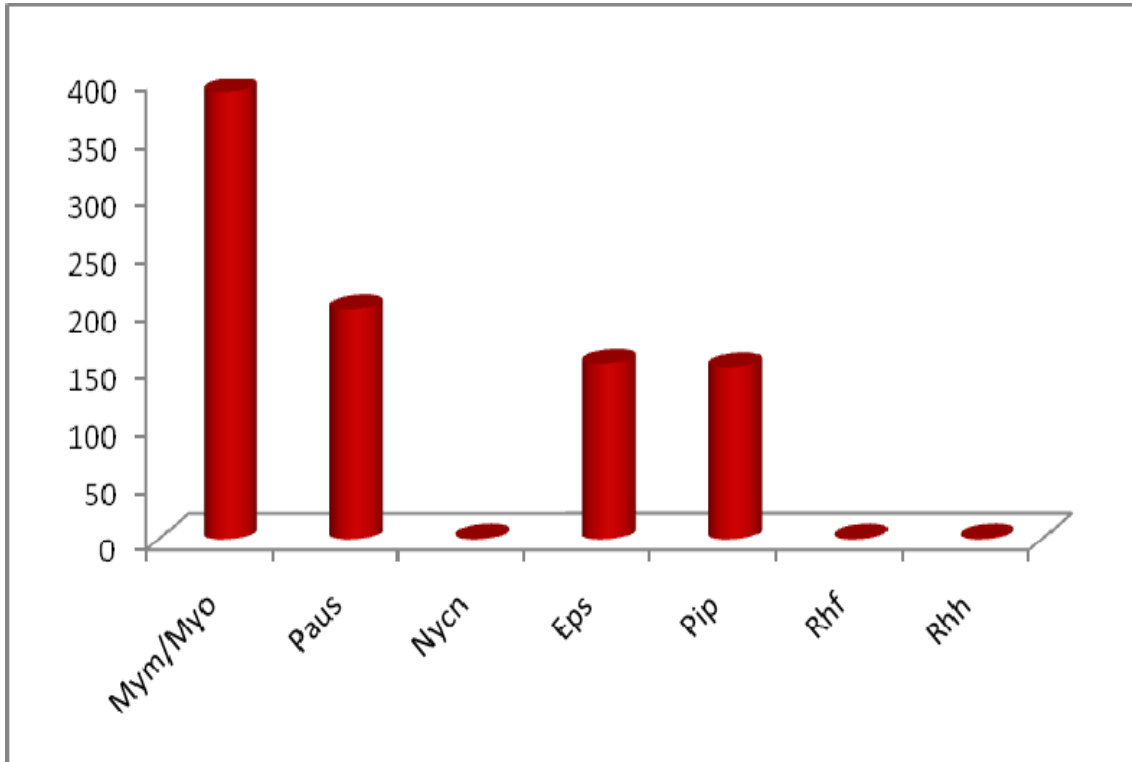


Figure 2. Number of individuals from all bat species observed during the study. Species abbreviations are given in Annex, Table 2.

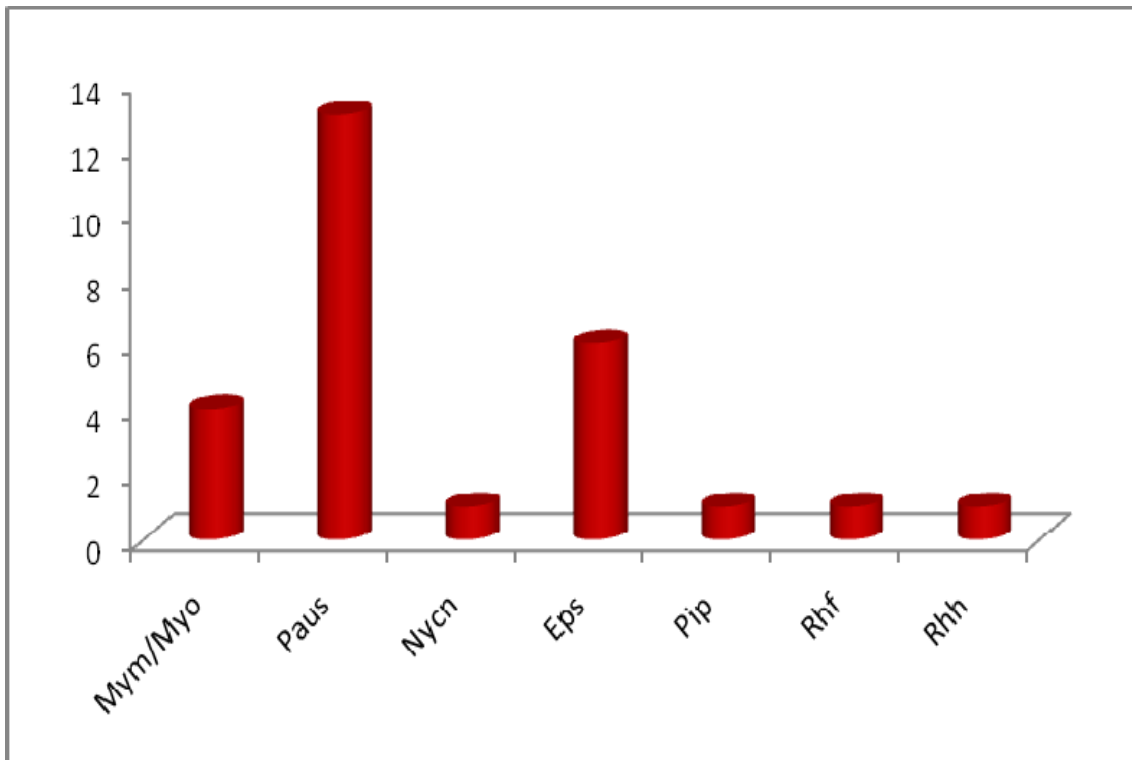


Figure 3. Bat species and the number of buildings in which they were identified. Species abbreviations are given in Annex, Table 2.

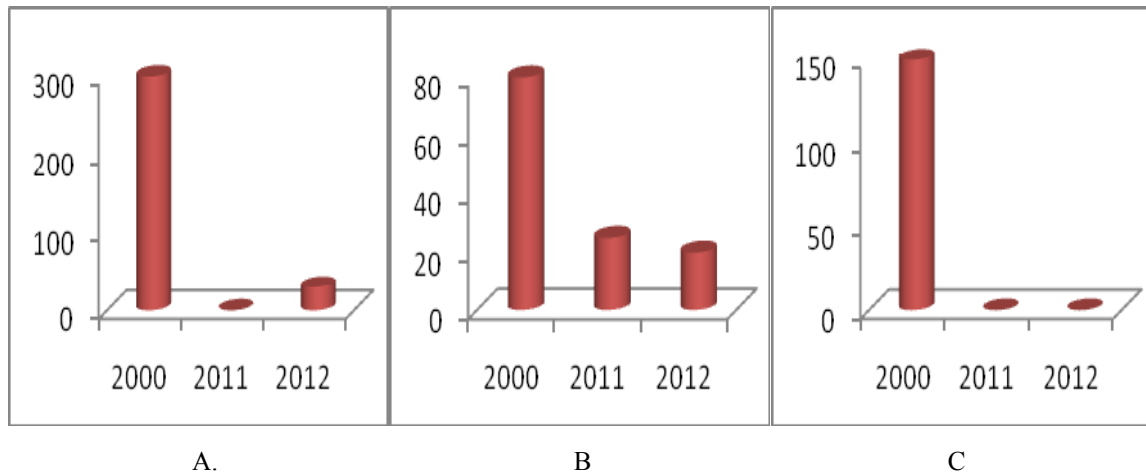


Figure 4. Changes in the number of individuals throughout the years of the study: the large *Myotis* colony from the Reformed Church of Bercu (A), the *E. serotinus* colony of the Catholic Church in Lazuri (B), and the *P. pipistrellus* colony in the Catholic church of Micula (C).

Figure 3 shows the number of buildings in which the indicated bat species was observed.

In three cases repeated site visits allowed to track the changes of colony sizes (Figure 4.).

Large *Myotis*

The largest colony of these species was found in the tower of the Reformed Church in Bercu, numbering approx. 300 individuals. The tower is covered with tin-plate roof, the number of roost entrances is great, having also adequate sizes for bats. In the immediate surrounding of the church deciduous vegetation can be found. Due to renovation works in 2011, we were unable to find the colony in the building. However, in the attic of a nearby church we identified 70 individuals, probably part of the original colony. The renovation of this building in 2012 resulted the disappearance of this smaller colony, however 30 individuals were found in the primarily

used shelter (Figure 4.A.), in the tower of the Reformed Church. The species were identified only in two other buildings of the area: one individual in the tower of the Reformed Church of Nisipeni, and eight individuals in the attic of the Greek-Catholic Church of Turulung (Szodoray-Parádi et al. 2005). During the 2011-2012 survey period these bats were not observed in the mentioned roosts.

Eptesicus serotinus

We identified the species in six roosts. The size of its colonies altered between two and 80 individuals. The colonies were always found in attics, on beams or inside the holes of the brick wall. In all cases, the number of roost entrances was great and of adequate size, formed in general through the lack of lateral roof isolation. In some cases, these openings were formed because of the aging process of the roof structure. We observed only one case of regular use of a building throughout the study

in the Catholic Church of Lazuri, but we noticed a decrease in the number of individual over the years (Figure 4.B.). In the other five cases the use of buildings by individuals of this species was occasional.

Plecotus austriacus

The presence of the species in the study area can be considered general, being observed in 13 roosts during the survey. The size of the colonies varies between two and 70 individuals. The colonies were situated between the tin roof and wooden beams, occasionally in the walls, in the places of lacking bricks. In four of the controlled building they were present together with other species (see Annex, Table 1.). In the cases when they were the sole inhabitants of the building, the roost entrances seemed to be scarce and inadequately small, while the surroundings were dominated by tall, deciduous vegetation (linden, chestnut).

Other bat species

From the existing literature, we had prior knowledge of a *P. pipistrellus* colony in the Catholic Church of Micula (Szodoray-Parádi et al. 2005), which due to building renovation had disappeared (Figure 4.C.). Since then we could not identify the colony in other buildings from the vicinity. *N. noctula* was identified in two cases, through a living and a dead individual. Only one individual of *R. feruumequinum* was identified in the attic of the Reformed Church of Turulung (Szodoray-Parádi et al. 2005), although during the surveys with ultrasound bat-detectors we regularly observed the presence of this

species (unpublished data). The situation is the same for *R. hipposideros*, with a single specimen observed in the area, in the attic of the Reformed Church of Turulung (Szodoray-Parádi et al. 2005). During the current survey of the 2011-2012 period we could not identify the species.

Discussion and conclusion

The renovation of buildings in the study area is becoming a general phenomenon. These works usually take several years, depending on the extent in which the building is renewed. These reconstruction works maintain a constant disturbance, which can lead to the complete disappearance of large colonies. This happened to the large *Myotis* colony of Bercu and the *P. pipistrellus* colony of Micula. In case of the disintegration of these large colonies, we are unable to trace individual bats, and there is no telling whether they remain in the area or not. The continuous sighting of large *Myotis* species in the churches of Bercu is definitely a positive sign for the future. In this case, it is a significantly beneficial that after the renovation process of the Reformed Church, the roost entrances used by bats remained intact, leaving the attic accessible. This may prove helpful in case of re-colonization. Other negative factors in case of the other potential shelters of bats, is that after restoration these buildings completely lose their function, due to modern isolation techniques. These buildings are becoming empty over the years, and because of the

method of restoration, they are probably going to stay empty regarding bats. In our experience, there was only one case, in the Greek-Catholic Church of Bercu, in which the renovation works did not affect the presence of *E. serotinus* (Závoczky 1999). The presence of this colony and the number of its individuals is dynamically changing each year. This phenomenon is presumably due to the fact, that the species is using a series of buildings during summer period. The frequent observation of *P. austriacus* can be explained by the fact, that the species uses more buildings than other bats, due to the small sizes of roost entrances. The high number of potentially good shelters may explain the small individual number of the colonies, which in some cases are formed only by 2-3 individuals. The rare status of *N. noctula* might be explained with the existence of old forests in the area, and that the species does not prefer churches as potential shelters. In the case of *R. ferrumequinum* and *R. hipposideros* we are unable to draw any relevant conclusion, because of the small amount of data. Our results would justify the adaptation of a long-term monitoring system in the area, as well as the development of a closely related conservation management for the future.

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ANNEXES

Table 1. Names of the localities investigated in the current study. Names of controlled buildings, survey periods, as well as bat species, individual numbers and colonies are indicated. Data concerning the presence of guano, marten and barn owl is also included. Empty cells indicate the periods when the site in question was not visited. The 1999-2001 column contains data from the existing literature concerning the area, which was discussed in the study combined with the results of our survey period.

Community	Building	1999-2001	2011	2012
Adrian	Reformed Church	-	-	Empty
Agriș	Reformed Church	Paus/8, Nycn/1	Guano	Guano
Agriș	Greek-Catholic Church	-	Empty	Empty
Bercu	Reformed Church	Mym/Myo/300	Guano	Mym/Myo /30
Bercu	Greek-Catholic Church	-	Mym/Myo /50	Eser/75
Bercu Nou	Barn	-	-	Empty
Bercu Nou	Eastern Orthodox Church	-	Empty	-
Ciuperceni	Reformed Church	-	-	Empty/renovation
Gheța Mică	Eastern Orthodox Church	Paus/1	-	Empty/renovation
Halmeu	Reformed Church	-	-	Paus/2
Halmeu	Catholic Church	-	-	Empty
Iojib	Catholic Church	Eser/5	-	-
Iojib	Reformed Church	Paus/8	-	-
Lazuri	Catholic Church	Eser/80, Paus/5	Eser/25	Eser/20
Lazuri	Reformed Church	Paus/1	-	Barn owl
Lazuri	Greek-Catholic Church	-	Empty/renovation	-
Livada	Reformed Church	-	-	Empty/renovation
Livada	Catholic Church	Paus/8	-	Barn owl
Livada	Greek-Catholic Church	-	-	Paus/70
Medieș vii	Reformed Church	-	-	Marten
Medieș vii	Eastern Orthodox Church	-	-	Marten
Medieș vii	Eastern Orthodox Church	-	-	Empty/renovation
Micula	Reformed Church	-	Empty	Eser/1, Nycn/1-dead, renovation
Micula	Catholic Church	Ppip/150	Empty/renovation	Empty/renovation
Micula	Eastern Orthodox Church	-	Empty/renovation	Empty/renovation
Nisipeni	Catholic Church	-	Empty	Empty
Nisipeni	Mansion	-	Marten	Marten
Nisipeni	Reformed Church	Paus/6, Mym/Myo /1	Guano	Guano
Noroieni	Greek-Catholic Church	Eser/2	Empty	-
Orașu Nou	Reformed Church	-	-	Marten
Pelișor	Reformed Church	-	Empty	Guano
Porumbești	Greek-Catholic Church	-	-	Marten

Porumbești	Catholic Church	-	-	Empty
Prilog vii	Eastern Orthodox Church	-	-	Paus/30
Remetea Oașului	Reformed Church	-	-	Paus/35
Turulung	Catholic Church	-	-	Paus/25
Turulung	Reformed Church	Rfe/1, Rhh/1	-	Empty/renovation
Turulung	Greek-Catholic Church	Eser/20, Mym/Myo /8	Paus/2,	-

Table 2. List of abbreviations used throughout the figures and the text of the current paper.

Abbreviations	Explication of abbreviations
Mym/Myo, M. myotis, M. oxygnathus	<i>Myotis myotis/Myotis oxygnathus, large Myotis</i>
Paus	<i>Plecotus austriacus</i>
Nycn	<i>Nyctalus noctula</i>
Eps	<i>Eptesicus serotinus</i>
Pip	<i>Pipistrellus pipistrellus</i>
Rhf, R. ferrumequinum	<i>Rhinolophus ferrumequinum</i>
Rhh, R. hipposideros	<i>Rhinolophus hipposideros</i>
E. serotinus	<i>Eptesicus serotinus</i>
N. noctula	<i>Nyctalus noctula</i>
P. pipistrellus	<i>Pipistrellus pipistrellus</i>
P. austriacus	<i>Plecotus austriacus</i>