The Amphibia, Insectivora and Rodentia fauna along some inflows of Lake Balaton

By
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Abstract. The aim of the present study was the compilation of species lists and the description of demographic parameters of Amphibia, Insectivora and Rodentia species along some inflows of Lake Balaton. Migration opportunities between stream and lake populations were also to be investigated. Surveys were carried out along five streams. Seven amphibian taxa, nine rodent and three insectivora species were found. Besides water quality requirements, the highest possible diversity of the neighbouring areas is also an important factor in maintaining species rich communities.

While the fauna of Lake Balaton is extensively studied, only scarce information is available on the animal communities of its inflowing streams and their floodplains. They are situated in the contact zone of three zoogeographical regions, Eupannonicum, Praeillyricum and Pilisicum. The Department of Systematic Zoology and Ecology of the Loránd Eötvös University has launched a complex research programme to fill this information gap. One aspect of the study is the investigation of vertebrate groups. Amphibians and small mammals were selected to study. Amphibians are sensitive bioindicators, their decline can be proved worldwide (WADE, 1991). Still, their present distribution has not been thoroughly studied not even in Europe, which is the best known continent from this viewpoint (CRESPO, E. G. et al., 1995). Small mammals are not only important elements of the food chain but their gradation can lead to the complete degradation of certain areas.

The aim of the present study was the compilation of species lists and the description of demographic parameters of Amphibia, Insectivora and Rodentia species. Migration opportunities between stream and lake amphibian populations were also to be investigate

Sampling sites and method

Figure 1 shows the five surveyed inflows of Lake Balaton (Lovasi Stream, Örvényesi Stream, Endrédi Stream, Kétöles Stream, Tetves Stream). The first three streams are described according to the small mammal sampling sites.

I. Lovasi Stream:

Three localities were monitored along the stream, where not only current velocity and water discharge but the vegation was also different.

I/1. Source: ruderal area with some trees at Felsőörs.

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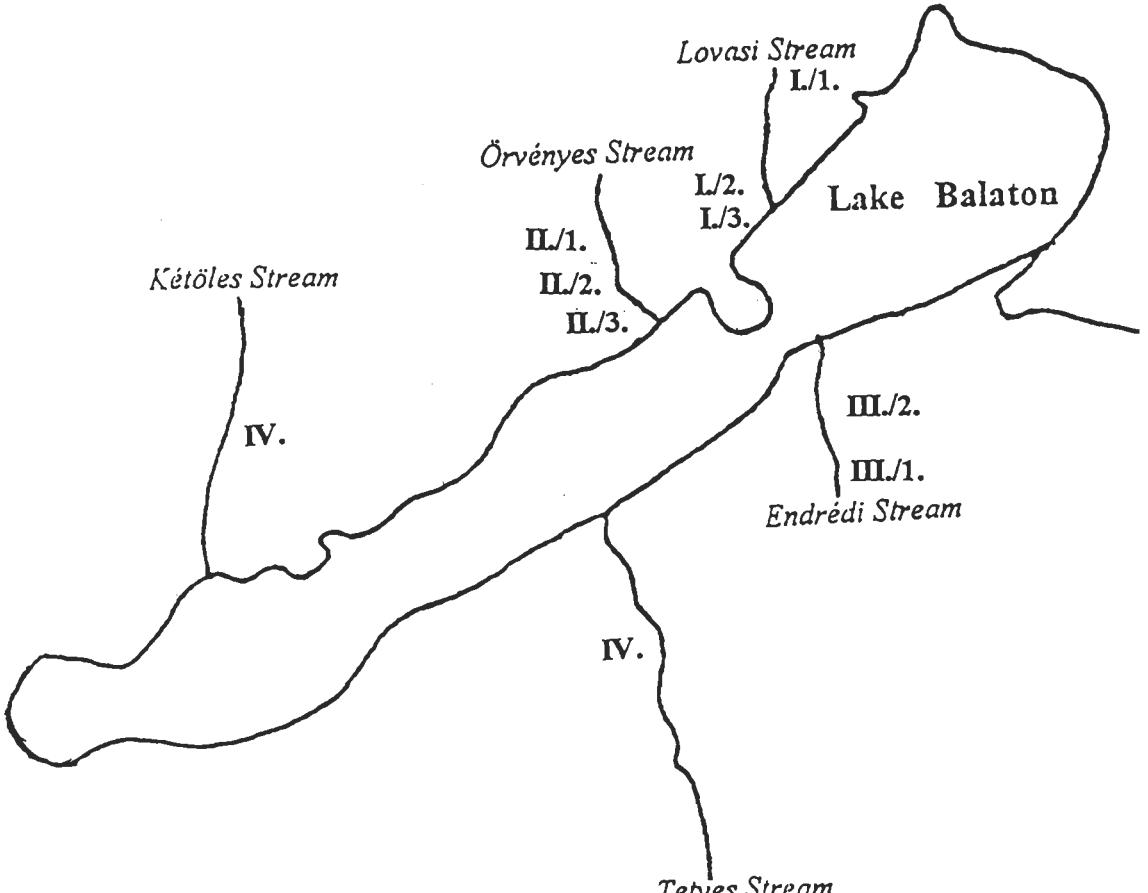
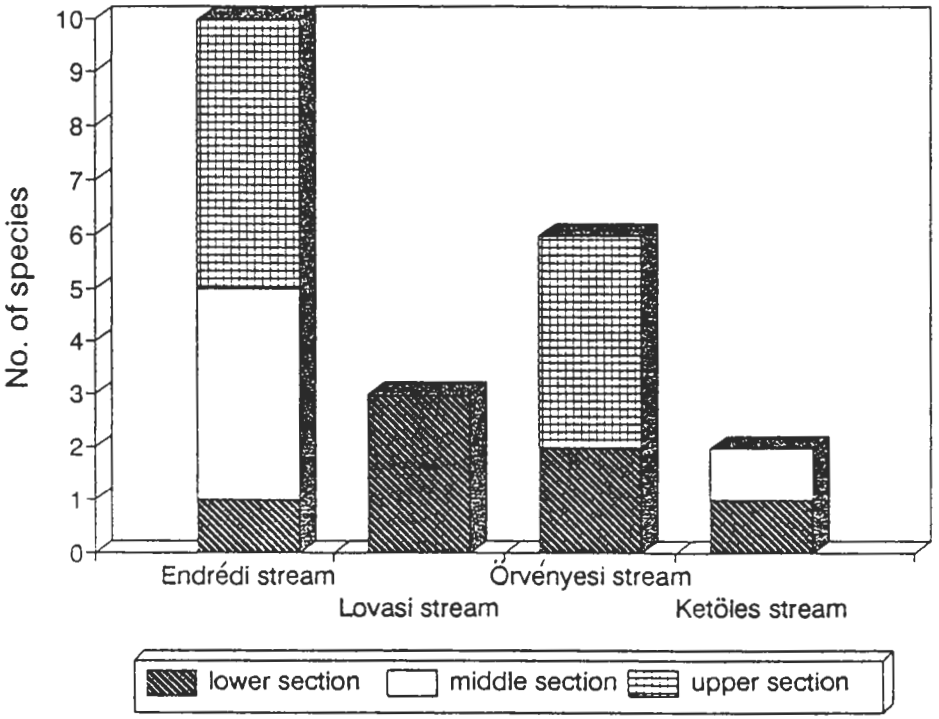

Lovasi Stream
I./1.
Örvényes Stream
I./2.
I./3.
Lake Balaton
II./1.
II./2.
II./3.
Kétöles Stream
IV.
III./2.
III./1.
Endrédi Stream
IV.
Tetves Stream

Fig. 1.


No. of species
10
9
8
7
6
5
4
3
2
1
0
Endrédi stream
Lovasi stream
Örvényesi stream
Ketöles stream
lower section
middle section
upper section

I/2. Damned Stream section at Lovas: lake with an extensive reed belt.

I/3. Section between the railway lines and Lake Balaton: reed and sedge dominated area with a fluctuating water cover.

II. Örvényesi Stream:

The Örvényesi Stream is permanent running water connecting areas with different vegetation types. Three areas were selected for investigation.

II/1. Section above the mill: dense bush and wood.

II/2. Section at the railway: concrete stream channel surrounded with an open meadow.

II/3. Mouth area: reed-covered wetland directly at Lake Balaton.

III. Balatonendréd:

The Endrédi Stream is damned above Balatonendréd near the source creating a siltated pond. The water flows through a meadow before reaching the village. Upstream the village two artificial ponds are in the floodplain near the stream. The stream bed has been deepened downstream the village resulting in a canal like appearance of the stream. Reservoirs were created in the mid-section of the stream surrounded by arable fields.

III/1. Source area: meadow with two ponds.

III/2. Canal-like section downstream the village: ruderal, open area.

IV. Other areas:

Besides the above described streams amphibians were also monitored at Kétöles and Tetves streams, too. The former is a northern inflow with a highly canalised lower section, the latter flows into Lake Balaton from the south, and is in connection with a sophisticated fish pond system.

The amphibian fauna of the sampling sites were investigated in all developmental stages (eggs, tadpoles, adults). During the breeding period egg clutches and adults were counted. In late spring tadpoles and adults were determined according to DELY (1967), ARNOLD & BURTON (1980) and NÖLLERT & NÖLLERT (1992). Green frogs (*Rana esculenta, Rana ridibunda, Rana lessonae*) were regarded as a species group here. One species (*Bombina bombina*) was also put in the species list on the basis of its mating call. At the upper section of Endrédi Stream, where there are two additional water bodies in the floodplain (wired pond, fenced pond), the metapopulation structure of *Rana dalmatina, Bufo bufo* and *Pelobates fuscus* was also studied (EDENHAMN, 1993).

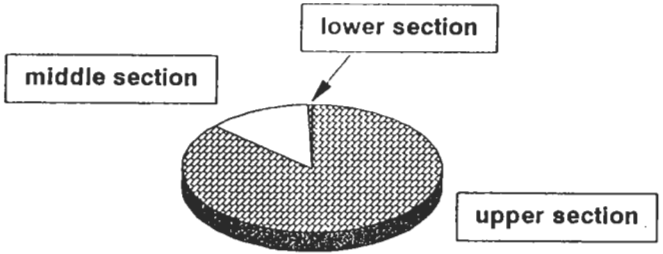
The live-trap method was applied to catch small mammals. 15 traps were arranged into 3 rows parallel with the streams. The traps were suitable to catch both smaller insectivores and larger rodents. The bait was a small piece of toast spiced with onion. Sunflower seeds were put into the trap to reduce the mortality. Trapped animals were narcotized by diethil-ether during the treatment. Several parameters of animals, for example length of body, legs and tail length, weight, state of sex etc were recorded. Animals were marked by cut fingers and the Capture-Mark-Recapture Method was applied. Seen animals were also used in the compilation of the species list.

Results and discussion

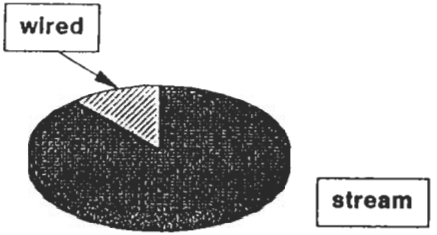
Considerable differences were recorded both in species and individual number among the sampling localities at both animal groups (Table 1 and 2).

Altogether, seven amphibian taxa, half of the Hungarian fauna were found. The amphibian faunal composition of the northern inflows of Lake Balaton was similar to communities in the Bakony Mountains (MARIÁN, 1988). The presence of *Bombina bombina* at three streams, *Hyla arborea* at Tetves Stream and *Pelobates fuscus* at Endrédi Stream was of interest. *Rana esculenta* complex was the commonest at all streams, *Bufo bufo* and *Rana dalmatina* was also quite common. The latter had a highly oppurtunistic breeding strategy,

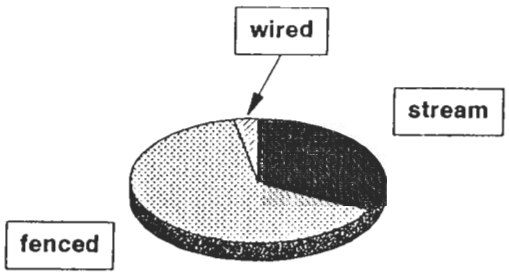
Total individual number of amphibians at different sections of Endredi stream



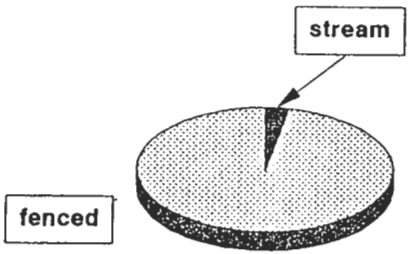
Relative individual number of *Bufo bufo*



Relative egg clutch number of *Rana dalmatina*

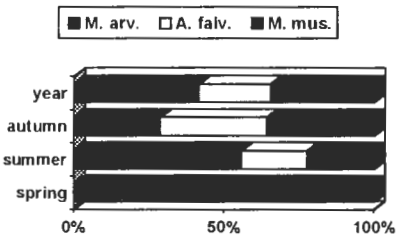


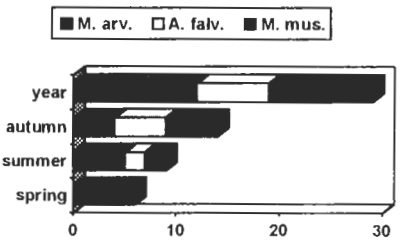
Relative individual number of *Pelobates fuscus*



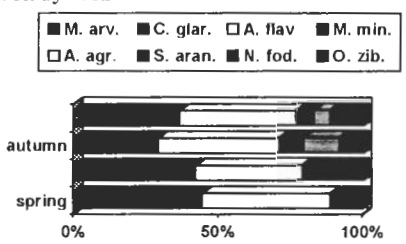
Number of small mammal individuals and rate of the species in different study areas

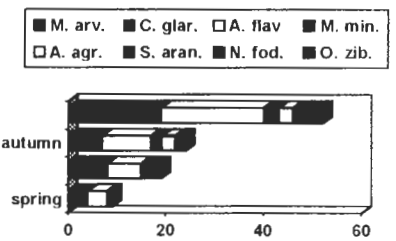
I./1. study area



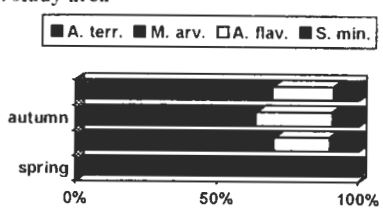


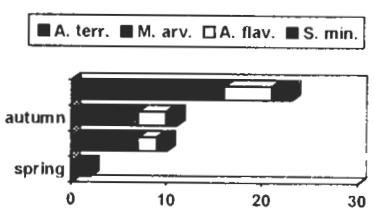
I./2. study area



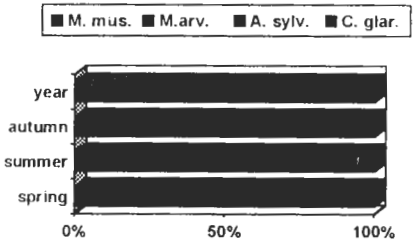


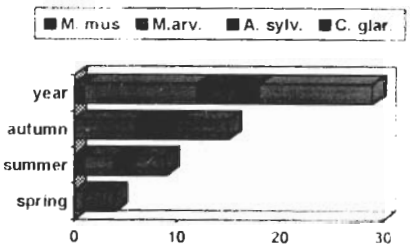
I./3. study area



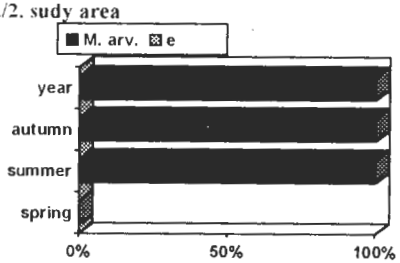


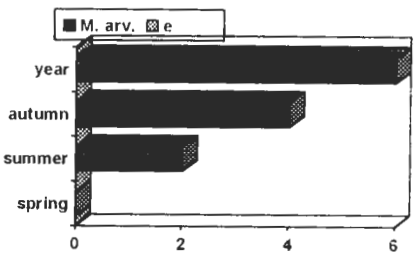
II./1. study area



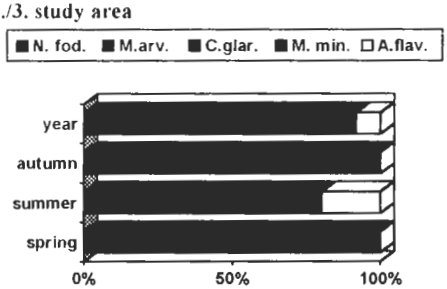


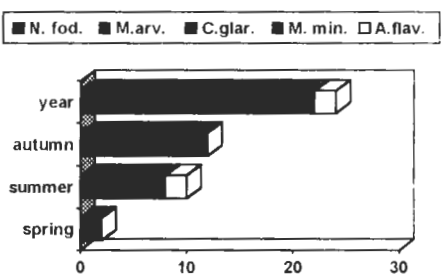
II./2. sudy area





II./3. study area





at one locality along the northern shore (the mouth of Örvényesi Stream) it also fixed egg clumps on reed tussocks in Lake Balaton.

Table 1. Amphibian fauna of five inflows of Lake Balaton

	Triturus vulgaris	Bombina bombina	Bufo bufo	Hyla arborea	Pelobates fuscus	Rana dalmatina	Rana esculenta complex
Endrédi Stream	×		×		×	×	×
Lovasi Stream		×	×			×	×
Örvényesi Stream		×	×	×		×	×
Kétöles Stream						×	×
Tetves Stream		×	×	×		×	×

No correlation between amphibian species composition and stream sections (upper, middle, lower) could be found in a comparison of four streams (Figure 2). The presence of amphibians rather depended on the intensity of different human activities (stream bed modification, agriculture, etc.). Bottleneck areas, where there seems to be barriers for at least some of the species because of inadequate terrestrial or aquatic habitats, were present along all studied streams.

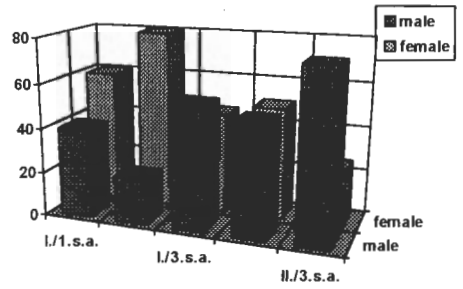
Different breeding habitat preferences of the three predominant species were recognised at the uppper section of Endrédi Stream, which was the most species-rich area (see the top left diagram in Figure 3). The investigation of three separate water bodies (Endrédi Stream, fenced pond, wired pond), with a functional relationship provided an opportunity for metapopulation studies. The other three diagrams (Figure 3) show the distribution of the three commonest amphibians among the water bodies. Surprisingly, the stream was the most important breeding site for *Bufo bufo*. In general, this species selects its breeding sites conservatively. The stream might be a good breeding site due to a moderate current velocity and a stable oxygen supply. There was no special area of *Bufo bufo* reproduction, egg strings were distributed quite equally along a 350 m stretch of the stream upstream the village. Only male common toads were found within the village.

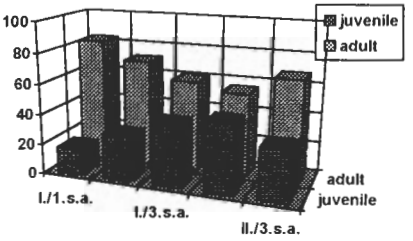
The fenced pond was the most important breeding site for the two other species, *Rana dalmatina* and *Pelobates fuscus*. The third separate water body seemed to be the least important breeding site, still, it is the only remaining breeding locality for common toads in the area in case the stream dries out temporarily or it is polluted.

During the breeding season several *Pelobates fuscus* males died in the stream with no obvious reason. The unknown factor is suspected to be originated from a non-point source, but no evidence could be detected for this hypothesis. No female corpses were found, which is probably because of the general phenomenon of females staying less time in the water than males. No harm was observed on *Bufo bufo* and *Rana dalmatina*, which might be due to their higher tolerance and earlier breeding season, respectively.

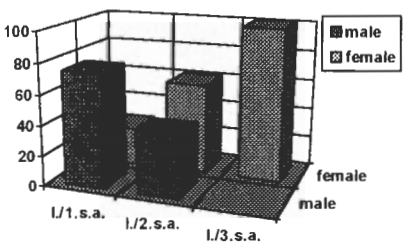
Nine rodents and three insectivorous species were trapped in the investigated areas. Most of them lived in very low numbers in these areas, these animals were probably migrant individuals. This concept is supported by the fact that the rate of juveniles and males were higher at less favourable sites (e.g. study areas II./2 and I./1) than in more complex areas (e.g. study areas I./3 and II./3). Degree of diversity was the highest in areas with limited human impact, though most species were reported from an artificial habitat (I./2 study area). The explanation of this fact may be the complexity of this study area.

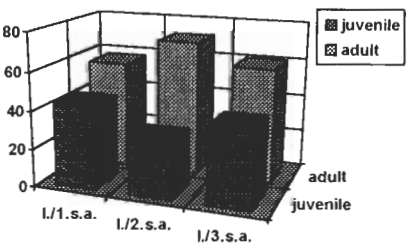
Microtus arvalis



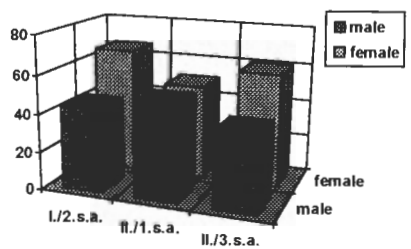


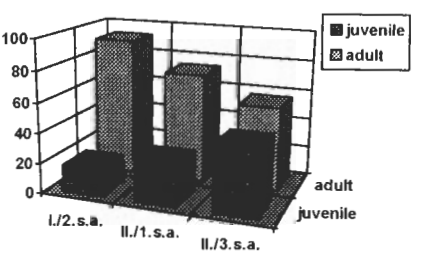
Apodemus flavicollis





Clethrionomys glareolus





Study area I./2 was surrounded by a lot of different habitats which serve as refuge for small mammals during unfavourable conditions.

Table 2. Rodentia and Insectivora fauna in the sudy areas

Species	Number of individuals			
	spring	summer	autumn	total
I/1. study area: 28 trapped individuals				
Microtus arvalis	3	5	4	12
Apodemus flavicollis	-	2	5	7
Mus musculus	2	2	5	9
I/2. study area: 50 trapped individuals				
Microtus arvalis	2	3	3	8
Clethrionomys glareolus	2	5	4	11
Apodemus flavicollis	4	7	10	21
Micromys minutus	-	1	2	3
Apodemus agrarius	-	-	3	3
Sorex araneus	1	-	1	2
Neomys fodiens	-	2	-	2
Ondatra zibethicus	-	detected	detected	-
I/3. study area: 23 trapped individuals				
Arvicola terrestris	-	1	-	1
Microtus arvalis	2	6	7	15
Apodemus flavicollis	-	2	3	5
Sorex minutus	-	1	1	2
II/1. study area: 29 trapped individuals				
Clethrionomys glareolus	3	3	5	11
Microtus arvalis	1	3	6	11
Apodemus sylvaticus	-	2	4	6
Mus musculus	-	1	-	1
II/2. study area: 6 trapped individuals				
Microtus arvalis	-	2	4	6
II/3. study area: 24 trapped individuals				
Neomys fodiens	-	2	1	3
Microtus arvalis	1	2	3	6
Clethrionomys glareolus	1	3	5	9
Micromys minutus	-	1	3	4
Apodemus flavicollis	-	2	-	2

It is interesting that house mouse lived along the section of the stream which flows through the village if the circumstances were favourable for them.

Summary

While the fauna of Lake Balaton is extensively studied, only scarce information is available on its inflowing streams. The aim of the present study was the compilation of species lists and the description of demographic parameters of Amphibia, Insectivora and Rodentia species. Migration opportunities between stream and lake populations were also to be investigated.

Surveys were carried out along five streams. All developmental stages of amphibians were investigated. Mating calls were also considered when the species lists were summarised. Rodents and insectivores were trapped alive. They were marked, and the parameters of the population were estimated by the capture - recapture method.

Altogether, seven amphibian taxa were found. The presence of *Bombina bombina* at three streams, *Hyla arborea* at Tetves Stream and *Pelobates fuscus* at Endrédi Stream was of interest. Different breeding habitat preferences of the three predominant species were recognised at Endrédi Stream, where several *Pelobates fuscus* males died due to an unknown factor probably non-point pollution.

Nine rodent and three insectivore species were trapped along the streams. They seemed to serve as migration corridors as few individuals were trapped from most species and mainly males and juveniles occurred at less favourable sites.

Besides water quality requirements, the highest possible diversity of the neighbouring areas is also an important factor in maintaining species rich communities. Semi-natural sections, wide riparian zones and certain man-made changes can help the migration and spatial distribution of the investigated species and the development of their stable populations.

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