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EFFECT OF URBANIZATION ON THE HERPETOFAUNA OF A SETTLEMENT AT THE TISZA (SZEGED)

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Abstract

The author, on the basis of his investigations performed in Szeged and his immediate vicinity in 1972, 1973, and 1975, is trying to get an answer to the question, what an influence was exerted by the increasing urbanization of the settlement upon the herpetofauna of the town.

From the area of Szeged, there may be demonstrated 10 amphibious species and one variety, as well as 5 reptile species and two varieties altogether. As a result of the investigation it is to be established that the herpetofauna of Szeged underwent a change in the course of decades. After the decrease in the individual number of species, as a result of the different injuries peculiar to civilized communities, there took place even a qualitative change. The less-resistant species, tolerating the standing harassment but with difficulty, began being forced back and later disappeared *(Emys orbicularis, Lacerta viridis)*. The cause of the fast decrease in the species- and individual numbers of the herpetofauna is that, there is less and less area for the safe breeding and development of the brood of the amphibious and reptilian species. The waters of the area became polluted and thus as biotopes they begin to get unsuitable for the herpetofauna. Urbanization has an effect upon the behaviour of animals, as well.

The herpetofauna may also be considered as an indicator of urbanization. Its change in the composition of its species- and individual numbers calls our attention to the necessity of prompt measures.

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In the nature, there are induced considerable changes, as a result of the harmful environmental effects originating as by-products from civilization and the technological development. The overwhelming majority of harmful effects can be observed in the vicinity of the industrial establishments organized in towns and in their neighbourhood. "The town, together with the biotopes in her, is meaning an absolutely new ecosystem" (KERTAI 1973).

The town environment is meaning changed essential conditions, developing new customs and behavioural forms not only for men but it has an effect on the animal kingdom, as well, and within that on Amphibia and Reptilia, too.

On the basis of my investigations in Szeged and her immediate vicinity in 1972, 1973, and 1975, as well as on that of the literature connected with this subject, I should like to describe the herpetological picture of the town, as well as the transformation of the herpetofauna as a result of the increasing urbanization of the settlement.

Characterization of the area investigated

Szeged lies in the southern part of the Great Hungarian Plain, on both riversides of the Tisza, at the mouth of the Maros. The whole area is essentially to be regarded as the flood-plain of both rivers. The region belongs in its entirety to the domain of the warm, dry climate with hot Summers, and even it is the most typical representative of that.

Szeged is today already a great city, having more than 120,000 inhabitants and a well-developed industry. As a lowland town, in her peripheral parts she has preserved her rural character. But after building new housing estates, the quarters of rural character begin to be driven back. As a result of the oil and natural gas mining, organized in the recent past, the pace of the development of the town has accelerated. The number of the industrial establishments exceeds 200.

Biotopes of the herpetofauna

From the point of view of the herpetofauna the character of biotopes is of decisive importance.

The area of Szeged may be called rich in waters. There are to be distinguished the following water biotopes.

(I) Constant water biotopes:

The open water surface does not disappear in any period of the year. From the point of view of the origin, there are four groups to be distinguished. These are: the dead-arms, the natural and artificial standing waters, and the river waters.

Most typical representative of the *river waters* is the Tisza. Its herpetologica. conditions are reported on in details by M. MARIÁN in his paper published in 19631 The canals of the town belong to the river waters, as well. The water of these is polluted. At their watersides only the Rana ridibunda can survive. The quite unicoloured green, markingless individuals of it can be observed in them. (Main Canal for Inland-Water Regulation.)

From the *dead-arms,* the Dead-Tisza at Hattyastelep and the Dead-Maros can be found in the area of Szeged. The water of both dead-arms are polluted, mainly owing to the industrial waste-waters and the sewage-waters conducted into it. The oilpollution is also considerable. These dead-arms are the biotopes of Rana ridibunda, as well as of a small number of Bombina bombina, and Natrix natrix.

Most typical representative of the *natural standing waters* is Lake Fehértó at Szeged. From the *artificial standing waters* the ponds round the brick-works are largest.

It is equally characteristic of the lakes in Szeged that, without almost any exception, they are all overpolluted. The unique exceptions to this are, at most, only the small artificial pond in the Botanical Gardens, the lake at Baktó, and Lake Vöröskereszt (Red Cross). Most of the lakes and ponds are filled in with town garbage and other, mainly industrial wastage. In this way, the shallow reedy marshes, the flat banks, that were so important from the point of view of the herpetofauna, disappear: the open water alone may serve as a biotope to these (Sancerponds, Téglagyári (Brick-work/-pond). Háromszög- (Triangle-) and Kátai-ponds are filled up almost completely. Accordingly, the herpetofauna is also driven back in these placesf In pond Háromszög-tó, the common snake (JÁ), was still living at the end o.

the sixties. In 1973, however, it disappeared from this place already completely. From the overpolluted waters, after *Natrix natrix* generally disappears Bombina, later on *Rana ridibunda,* as well. The herpetofauna may be regarded as completely extinct in the large lakes in the vicinity of the Zsámbok-meadow row, as well as in the ponds beside the Bakay Nándor street. Oil-pollution is considerable in both cases, and the garbage unloading of various origins is also considerable.

(II) Periodical water biotopes

After thawing of the snow in Spring, or after major rainfalls, the areas of deeper site (reedy part in Móraváros), the ditches by the roadside are being filled with water, but in the middle of Summer they become, as a rule, already completely dry. The periodical water biotopes are suitable to let the youngs of frog-species grow up in them. As a result of introducing public amenities in the streets, the various building operations, construction of highways, embankments, the number of this biotope-type decrease more and more.

(III) Wet biotopes

There are belonging here those biotopes where the open water surface is missing in largest part of the year, but the area — owing to its different peculiarities — remains wet during the whole year. In these places it is made possible by the microclimate that the members of the herpetofauna survive the summer aridity. A wet biotope can mainly develop in places covered with reeds (Kiskundorozsma) and in meadows where the water-table is high or which is permanently inundated by some kind of "spring" (water-tap, canal-water). Such places can be found *e.g.* in the vicinity of Lake Ballagi-tó and the Cserepes row. The Amphibia and Reptilia retreat in the middle of Summer from the periodical water biotopes into the wet biotope, striving to survive there through the dry period. There is given shelter by this biotype, apart from Triturus cristatus, Bombina bombina, Rana ridibunda and to Natrix natris, as well. Owing to the causes mentioned above, the area of the wet biotopes is also decreasing more and more.

(IV) Dry biotopes

The decrease in wet biotopes takes place in favour of dry biotopes. But the areas, developed by filling in, do not mean the formation of new biotopes for frogs and lizards, enabling them to continue a dryland life. The cause of this is pollution and the lack in plants and food.

In the parks of the town centre Lacerta agilis still occurs sometimes. In the meadows that are in the vicinity of the inhabited areas, besides the sand-lizard *(L. a. agilis)* lives *Lacerta taurica,* as well. In the gardens of houses *Bufo viridis* takes shelter. The green toads *(B. viridis)* which go out hunting in the evening, often fall a victim unfortunately to the motor traffic or to passers-by.

Characterization of the herpetofauna

At composing the herpetofaunic picture of Szeged I have taken into consideration, apart from the literature dealing with this subject and my own observations, also the collections of the Ferenc Móra Museum, Szeged (MM) and of the Department of Zoology, Gyula Juhász Teachers' Training College, Szeged (JÁ).

Triturus cristatus LAUR.: It occurs both in quite clean, transparent waters (Gedó) and in those rich in vegetable detritus. But it avoids waters containing much industrial and town garbage. In Szeged there are mainly such kinds of water, there are therefore but few habitats here. In the biotopes where it can be found, it is represented but with a small individual number, being not present in large masses like the common newt. Its habitat closest to the town centre was the Gedó (Tölgyes street) where it enjoyed a comparative calm. In 1975, however, a considerable part of this area was filled in with road materials. It is not probable, therefore, that it might still occur in this place.

Habitats: Kiskundorozsma, reeds 1973, Gedó 1973, mouth of the Maros 1958 (MM), Lake Fehér-tó 1966 (MM). (The exact data on habitat will only be published in case of rarely occurring species).

The essential conditions for the newt species are given less and less by the waters in the vicinity of Szeged. Its stock is retreating. Its habitats agree by and large with those of T. cristatus which is regarded to be comparatively rarer. The former is present, in fact, in a much larger individual number.

Its habitat that is closest to the town centre of Szeged, is the reeds at Kiskundorozsma (1973).

Bombina bombina L.: If in Summer, owing to a great drought, the waters are shrunken, a very large number of bombinators may assemble even in a small quantity of water. On September 3, 1973 in Kiskundorozsma, in a water of 4 sq.m surface, I counted 78+6 bombinators, on September 22, 1973 in the Ballagi-tó row in a water of 1 sq.m surface 66+3 bombinators (prototype+green-back variety). They took therefore shelter, even in late September, rather in waters of small surface than to switch over to the dryland way of life. October 10, 1973 was the earliest date when I found the species in dryland, too.

In the environs of Szeged, the bombinators *(B. bombina* L.) are typical individuals, they aren't hybrids. I could not observe any hybridization with bellied toads. I. SZABÓ (1959), in his paper on the distribution of bellied toads in this country, was also referring to the occurrence of *B. variegata* in the vicinity of Szeged. This individual found in Szeged may have been brought by the water of the Maros from the Carpathians. The distribution of the species in the Great Plain does not seem to be probable. I could not find any other data proving its occurrence.

After the marsh-frog *(R. r. ridibunda),* the bombinator is the most wide-spread frog species in Szeged. Both species live often beside each other in the same biotope, but within the biotope, their individuals keep separate locally from one another. The shallower, more protected parts are taken mainly by bombinators.

They tolerate well enough the sewage-water Lake Kátai-tó, but try to avoid possibly the too polluted points of the biotope (Lake Háromszög-tó).

Bombina bombina L. var. *viridis* MARIÁN: It lives in the same biotope as the bombinator. Its way of life, environmental conditions agree with those of the prototype. The green-back variety of B. bombina lives about in such ratio beside the typical form as Lacerta agilis var. rubra lives beside its prototype (MARIÁN 1959). According to my two numerical estimates (cf.: above): on one occasion 7,14 per cent, on the other occasion 2,9 per cent of all the toads investigated belonged to the green-back variety.

Pelobates fuscus LAUR.: Because of its concealed way of life, it gets but rarely

before our eyes. The sand-soils in the environs of Szeged meet the demands of this frog.

Its habitats are: Lake Fehér-tó 1954 (MM), Újszeged, Dead-Maros 1962 (MM), Tápé, Malajdok 1971 (MM).

Bufo bufo L.: Its presence in Szeged is very rare. Some individuals proving its occurrence have only been found in the flood-plain of the Maros so far. Its presence, however, in the Tisza reaches at Szeged is mentioned in a few observations (AVASI 1973), as well.

Bufo viridis LAUR.: It is common everywhere in our country. It is present primarily in gardens and in the neighbourhood of flats. It is wide-spread in the town centre of Szeged, too. In Spring, it lays its eggs into the periodical waters running together in the vicinity of living -houses or canals of shallow water. Its eggs are metamorphosed at about the middle of August (DELY 1967). According to my observations, this date is much earlier in the environs of Szeged. On July 1, 1972, a great many young individuals scattered from the canal of the Szentmihálytelki street towards the gardens around. In late July, early August the priodical waters dry up. Were no change before the complete desiccation, then the larvae would perish.

Hyla arborea L.: It is the common foliage-dwelling frog of the Great Plain. Demanding constantly a humid, wet environment, it does not recede too far from the water biotope. In the collection of the Teachers' Training College nine Hylae arboreae can be found, collected on the side of dam in the Cserepes row, on June 24, 1965.

Rana arvalis woltersorffi FEJÉRVÁRY: It is a flatland animal. In the vicinity of Szeged it may be taken for rare.

Habitats: Algyő, flood-plain of the Tisza (MM), Tápé 1964 (MM).

Rana dalmatina BONAPARTE: Its occurrence in Szeged is proved with more data than that of the previous species. Nevertheless, the agile frog is also to be regarded as rare in the area investigated.

Habitats: Porgány 1957 (MM), Tápé (MM), Boszorkánysziget 1958 (MM), the mouth of the Maros 1966 (MM), Újszeged (JÁ).

Rana ridibunda PALL.: The dominant frog species of the waters in Szeged. In most biotopes it is the sole representative of the herpetofauna. It is the unique wide-spread Amphibion species of the "living" Tisza. Its general dispersion is helped by the fact that it tolerates water pollution comparatively well. It tolerates, to a lesser extent, even the oil-polluted water. In the overpolluted, plantless waters the larvae cannot develop in lack of oxygen and food but the older, more developed individuals are able to survive in these, too. Their distribution is not influenced by the hydrogen-ion concentration of the water, either. Their hiding place is found in garbage heaps as well as in other cases among the waterside plants (Lakes Sancer, Lake Háromszögtó). In the vicinity of industrial units (Lake Rókus at the brick-works, Lake Kátaitó) it is driven back, primarily because of the lack of water area that would be suitable for raising its their young.

In Sándorfalva, on September 24, 1972, after the rainy weather of the days before, far from any water biotope, in the open meadow, I found a "stray" Rana ridibunda. The straying individuals like this have a great part in restocking the young biotopes (basin of borings for oil, roadside canals, etc.) very fast, preceding any other species.

Emys orbicularis L.: It used to be common everywhere in the Great Plain. But owing to the drainage of wet areas, the unreasonable devastation, the pollution of waters, its occurrence has become very rare today. It is a cautious animal that prefers the quiet, undisturbed environment. But in Szeged, places like that are hardly to be found any more. In the collection of the Ferenc Móra Museum there are a number of emydids collected in the town centre of Szeged in 1961. But at present, its name could even be erased from the register of the herpetofauna in Szeged.

Habitats: Town centre 1961 (MM), Lake Fehér-tó 1961 (MM), Dead-Maros 1961 (MM), Újszeged, canal 1961 (MM).

Lacerta agilis L.: It is the most frequent reptile species of the meadows in the vicinity of Szeged. Opposite to the sand-lizard, it prefers the rather wet soil. At the town side of the dam, on the confines of Móraváros, the sand-lizard lives, while at the wetter side, sloping to the brick-works ponds, the agile lizard lives.

On October 26, 1972, in the courtyard bricked of a house (58 Tolbuchin avenue) I caught an agile lizard as it marched towards a gap in the wall. From that the conclusion can be drawn that it may retreat into the houses, as well, for living there through the winter. From the reptiles, this species could mostly accomodate itself to the town environment.

Lacerta agilis L. var. *rubra* LAUR.: In respect of way of life it agrees with the prototype. It lives in the environment of the outer pond at the brick-works, in the same area as the fragile-lizard and sand-lizard.

Lacerta viridis LAUR.: It is written on *L. viridis* by M. VASVÁRY: "I can mention it, from memory, in the vicinity of Szeged, on the confines of Kiskundorozsma... It lives, as anywhere, in the Great Plain, too, in places with trees and bushes. In this respect, the cemeteries are also very suitable for it." According to this communication from 1926, at about the turn of the century the green-lizard could not have been rare in Szeged. It is proved by the specimen found in the Ferenc Móra Museum that in the late fifties this species still lived in the area of the town (1958). Today we are looking for it in vain, it cannot be found any more.

Lacerta taurica PALL.: From the reptiles in our country it is the most thermophilous which avoids the wet areas. It got to this country from SE-Europe, at the end of the last century, and since then it is spreading (MÉHELY 1902, DELY-KOVÁCS 1961). Its distribution in the flood-plain of the Tisza is reported on by MARIÁN 1963). For its fast and considerable spreading it has to thank only itself, as a result (of its excellent adaptability. It is not rare in the meadows in the environs of Szeged, either.

Natrix natrix L.: It is the only snake species it the environment of Szeged. It lives in the biotopes the water of which is comparatively clean and where the waterside is flanked with reed or other vegetation. It avoids the polluted lakes and canals, going there at most only for food from the nearby wet meadows (Ballagi-pond row).

Natrix natrix L. var. *persa* PALL.: Its ecology, way of life agree with those of the prototype (MUHY—PÁLFI 1957).

In the outskirts of Szeged a canal is cut across by the Csongrádi avenue. On September 29, 1975, in the dust of the avenue an individual of it lay trampled down by a vehicle. It may have climed up on the avenue supposedly from the canal.

The herpetofauna of Szeged organically belongs to the animal kingdom of our Great Plain. Both species of it are hill- and flatland types, *i.e.*, eurytopic species that are characteristic of the Great Plain.

The species-number of Amphibia are rich, all the six amphibian families of this country are represented with ten species and one variety. In the reptile species, however, Szeged is poorer. From the reptile species in this country, five species and two varieties are present, while ten species are missing. The occurrence of these in the area investigated does not seem to be probable. In respect of the individual number the dominant species are: *Bombina bombina, Rana ridibunda* resp. *Lacerta agilis.*

The effect of urbanization on the herpetofauna

Summing up the facts above, it is to be established that the herpetofauna of Szeged underwent a change in the course of decades. After solving the regulation of inland waters, in line with a decrease in the water biotopes, there was also a decrease in the individual number of the herpetofauna. As a result of the civilization injuries (industrial pollution, filling in of lakes, etc.), however, there followed a qualitative change, as well. The less resisting species which tolerated the constant harassment with difficulty, began to be driven back and then disappeared *(Emys orbicularis, Lacerta viridis)*. The cause of the fast decrease in the species- and individual numbers of the herpetofauna is that there is less and less area where the youngs of the amphibian and reptile species could be brought up safely. In the vicinity of lakes and ponds there is no untroubled point where, *e.g.*, the common snake or pond tortoise could lay its eggs and the young developing from those would be safe. The waters are polluted as a result of some materials (oil, various pesticides, detergents, and other waste matters) getting into them. In some places the water of lakes and ponds has achieved the pollution level that is preventing the eggs, after a possible egg-laying, from developing. Even if some eggs were reaching the larval phase, they would perish in lack of food, owing to the dissolved production-biological equilibrium. The waters of Szeged begin to become unsuitable not only for bringing up the young but, as a result of the poorer insectfauna, they can provide for fewer Amphibia, as well.

The urbanization has an effect upon the behavior of animals, too. As a result of the changed microclimate, the Amphibia come out earlier from their winter hiding-places and thus a great many Amphibia fall a victim to the night frosts which are still frequent in Spring. On December 15, 1958 (!), a green toad jumped about in a street of Szeged (MARIÁN 1963). The interruption of hibernation can be attributed, apart from the unexpected rise in the winter temperature, also to the influence of the town environment.

A great many Amphibia and Reptilia fall a victim to the motor traffic and unreasonable human devastation, as well (trampling down, kill).

Finally, it may be asked if it is a regular and unavoidable process that, as a result of the increasing urbanization of a settlement, the herpetofauna (together with the other groups of the fauna), during a comparatively short time, should undergo so considerable changes. The spreading of civilization is followed, unfortunately, by the cessation, transformation of more and more biotopes. It is not regular at all that a "ring of garbage" should develop around the towns that becomes from the beginning, a check of any form of life. This devastation tendency may be retarded by reasonable and efficient measures and it is preventible. (Cf.: Act on the protection of the environment).

In Szeged, the situation is not catastrophic, as yet. By putting in action the planned reduction works, the number of the more and more exuberant laystalls

around the town will — as a hope — be decreased and even eliminated. In the near future, Szeged will spend on the protection of the environment a quarter of a thousand million Forint. This amount shall surely provide for the possibility that in a town-planning programme, thought over carefully, the smaller standing waters should not be condemned to death but — after their cultivated environment being organized — they should belong to the cityscape of a modern town that is in an evolution of rapid space. In this way, if we act still in due time, the herpetofauna that is more and more driven back at present, may regain its living basis in Szeged being in the state of urbanization.

The herpetofauna may also be regarded as an indicator of urbanization. The changes in the composition of its species- and individual numbers draw our attention to the importance of taking the necessary measures.

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