

## EFFECT OF FLOODS ON THE AMPHIBIA-REPTILIA FAUNA LIVING IN THE FLOOD-PLAIN OF THE TISZA AND THEIR REGENERATION

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### Abstract

The author is investigating the effect of the annually returning floods upon the herpetofauna living at the fringe of the river Tisza with a regularized bed and in its flood-plain. He establishes that one of the main regulators of the amphibian and reptilian population living here is the flood. He is investigating the possibility of the single species to survive floods. He is reporting on his observations in respect of the regeneration of species-populations.

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The annually returning floods belong to the main regulators of the essential possibilities of animal organisms living in the flood-plains of rivers.

A considerable part of the herpetofauna of the Great Hungarian Plain, containing the larger part of the territory of our country, with a rather arid climate, live in the flood-plains of a comparatively humid climate of our rivers. Owing to the more and more rapid advance of the technological civilization, we must reckon with that in a not very far away future, apart from our few lakes preserved in a natural state, our herpetofauna will only be sustained by our rivers.

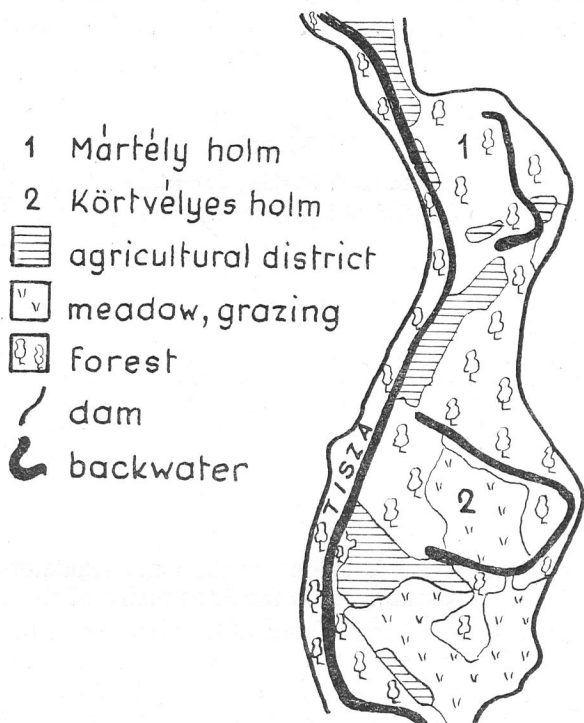
It seems justified to deal with the ecological conditions of the amphibian and reptilian species connected to this important living-space, from this point of view. The investigations of this direction are indicated by the Hungarian programme of the biosphere-research, as well as by the fact, too, that in the zoological literature in this country, as far as I know, there has no publication been issued on this subject, so far.

With my paper I should like to clear one or two false conceptions, to be still found in the literature in connection with the survival of floods in respect of some groups of Vertebrata.

The establishments below refer to the Middle- and Lower-Tisza Regions (to the Tisza reaches from Tokaj down to Titel). It is known that in this area the river has a rather slow water-course, that in the flood-plains limited by dams several dead-arms can be found and the flood-plains may be here and there several km broad. As a rule, it is covered with willow and poplar forests, bushes, meadows. In time of flood, the flood-plain is covered with water from dam to dam. In this way, here

and there a 5 to 6 km broad water surface comes about, and the bed of dead-arms unites with the water of the river, as well. (Sketch-map).

I have got my data from my observations for about a decade and a half, among these my notices on the floods in 1970 (the highest one in the course of our history) and in 1974 (lasting approximately half a year long, owing to three flood-waves connected to one another).



In the times before the Tisza regularization, huge areas were inundated by flood waves flattening out in the Great Plain. In some places where the water never receded from a permanent water-world developed, where Amphibia and Reptilia lived in enormous populations. In our days, after the Tisza regularization, the conditions of flood develop under the general influence of natural water-course and hydrotechnique. These exert a negative or positive influence on the not too populous herpetofauna living in the flood-plain.

The life-rhythm of Amphibia and Reptilia is mostly influenced by the so-called "late-winter" — spring flood (March—April) and the so-called "green flood" or "spring-flood" (May—June). The Autumn (leafy) flood appears but rarely with a major flood-wave and is only dangerous for the reptilia retiring to their winter-sleep in a cavity (*Lacertae* and *Natrix natrix*).

The flood-waves, pressed between dams, move with a large water-mass, faster and, therefore, their mechanical force is considerable. This is, owing to the drifting effect, unfavourable to the Reptilia living in the flood-plain.

In the "living" Tisza, drifting is thoroughly efficient. At time of the flood-wave there are no Amphibia or Reptilia in the area of the permanent bed.

In the flood-plain interrupted by forests, in the area of the dead-arms bordered with grove-woods, the danger of being drifted appears only moderately. Here the current is lower. A large number of Amphibia (*Bombina bombina*, *Rana esculenta*, and *Rana ridibunda*), as well as a few reptilian species (*Emys orbicularis*, *Natrix natrix*) continue their living there under the conditions changed, too.

The drifting, flooding-out effect of the flood-wave considerably depends upon the vertical localization of the dwelling-place of species. It exerts an immediate effect on the species living on the bottom of borrowing pits, seasonal puddles (*Triturus cristatus*, *Triturus vulgaris*), but a species living on smaller bulges, emergency-dams (*Rana dalmatina*) is only affected by higher water, and a species of arboricolous way of life, *Hyla arborea*, is hardly disturbed.

By the higher water-level, stronger motion and, in connection with these, the lower temperature of a too long-drawn-out spring flood or of the early beginning summer flood, the oviposition and later on the ripening of the eggs virtually of all the *Rana* species are hindered, resp. made impossible. In this case, the development of frog-spawns is undisturbed so to say only in the narrow riverside stripe running at the foot of dams.

The time of floods often coincides with the egg-laying period of the reptilian species and overflowing the suitable places or destroying the eggs, they endanger particularly the populations of *Emys orbicularis* and *Lacerta agilis*.

But there is exerted by floods a positive effect, as well, on the amphibian-reptilian world of the flood-plain.

The comparatively quickly receding floods of normal course leave behind, after their recession, several splashes of shallow water, ensuring in this way the optimum possibility for the multiplication of Reptilia. In the water of these inundations that are rich in mineral nutriment, the phytoplankton grows in profusion, furnishing plenty of food to the young newt and frog larvae and promoting by this the survival of the amphibian population.

The higher vapour content of the flood-plain is ensured by the evaporation of the inundations left behind and this considerably contributes to the multiplication of the insect stock. This means, on the other hand, to supply with good food the Amphibia that changed over to the dry-land way of life.

The several amphibian larvae and young lunged shapes that developed in this way in the flood-plains have an important part in the further, ascending branch of the food-chain, as well. Apart from the small fish, the rich food consisting of young amphibians enables a whole range of water-fowl species (Anseriformes, Charadriiformes species) to settle down along the dead-arms, inundations.

Let us investigate, further on, what kind of possibilities the species of the herpetofauna have to survive floods, resp. how the amphibian-reptilian population of the flood-plains regenerate.

A part of Amphibia having a tail (Caudata), as mentioned, preserve themselves in the riverside zone. From here will be populated first of all the zone lying in the vicinity of dams, the borrowing pits and plashes by *Triturus cristatus* and *Triturus vulgaris* species.

In case of frogs (*Salientia*), the possibilities are divided according to the way of life of species.

A large part of the individuals of species (*Bombina bombina*, *Rana esculenta*, *Rana ridibunda*), depending constantly on water, stay at the areas of the flood-plain with rather still water, among the large quantity of the floated material at the sur-

face of the water, or they take hold of the branches of trees, bushes standing out of water. In spite of high water, they live comparatively undisturbedly.

In early Summer, 1974, when the flood already lasted for months, bombinators and marsh-frogs could be observed in hundreds in the more km broad flood-plain at Körtvélyes, in an area similar to that described above. At the surface of the about 3 m deep water, among the several floated pieces of wood, they were active in a way, as if they had lived in a water of only a few cm depth. In a windless, sunny weather, the soft, melodious sound of several frogs could be heard from everywhere, at the extended water-surface.

The populations of these species do, therefore, not suffer much from floods, and they overtake their losses. It is to be attributed to this, as well, that in respect of numerical proportion they are predominating in the flood-plain over the other frog species.

A fragment of the population of species with a terrestrial way of life (*Bufo bufo*, *Bufo viridis*, *Rana arvalis wolterstorffi*, *Rana dalmatina*) preserve themselves in the riverside zone of the flood-plain. The regeneration of the populations is insignificant. This takes primarily place by the immigration of those living at the external dam-sides. All the four species live but in small numbers in the flood-plain.

Spade foot (*Pelobates fuscus*), which leads a similar way of life, occurs but rarely in the flood-plain. That some individuals of them survive even the long-lasting floods, I could observe in the Summer of 1974, at Körtvélyes. After the flood had receded, immediately at the riverside of the living Tisza in clay-earth, I found a living individual. (First proof of its occurrence in the Southern Great Plain, along the Tisza).

The arboricolous way of life of *Hyla arborea*, which is rather independent of floods, was already mentioned above. The only species representing turtles (*Testudines*) is the pond tortoise (*Emys orbicularis*). A small population of it are living in some dead-arms of the Tisza. As I have observed it survives floods. In the Tisza dead-arm at Körtvélyes it was found after the great flood in 1970 similarly as after the long-lasting triple-blood-wave of 1974. It lives in the leafy crown of trees in the forest under the water of the dead-arm, catching on the floated tree-trunks and among the branches during the flood. They are protected from being washed away and can get satisfying food, as well. Their youngs are, however, frequently destroyed by the flood.

The regeneration of the species can only take place from the areas beyond the dams. But the pond tortoise lives but in few places of the Great Plain, any more. Its population are decreasing more and more. In this area, they are near to dying out.

Lizards (*Sauria*) are generally only represented by three species in the flood-plain: *Lacerta taurica*, *Lacerta agilis*, and *Lacerta viridis*. The latter two species occur but rarely in the generally inundated biotopes which are not fully convenient for them. Their settlement takes place from outside, from the protected areas. Smaller or larger populations of the sand-lizard (*L. a. agilis*) live in the dam-sides, less disturbed by floods. By the floods, rather their eggs are destroyed, if they were laid in the lower regions of the dam-side. The dam-repairing works in connection with flood-prevention cause larger damage to their population.

From snakes (*Serpentes*) only *Natrix natrix* lives — sporadically in large numbers — in the flood-plain. The population of this agile and vigorous species are hardly disturbed by floods, at most their youngs will be thinned by these, as seen above. Their numbers are completed with the individuals immigrated through the dams of flood control.

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