

THREATENED AND RARE FISHES FROM UPPER TISA VALLEY AND ITS ROMANIAN LEFT SHORE TRIBUTARIES (NORTH-WESTERN ROMANIA)

A TISZA FELSŐ SZAKASZÁNAK ÉS BAL OLDALI MELLÉKFOLYÓINAK VESZÉLYEZTETETT ÉS RITKA HALAI ROMÁNIÁBAN

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Abstract

The fish fauna of the Upper Tisa river and Romanian tributaries is numbering approximately 54 native fish species and 10 exotic. During the last decades, the human pressure on aquatic fauna was affected the fish populations, especially the rheophilic species from the headwaters. The rare species confront the population decline. Some of the former large spread species are becoming threatened and rare pursuant to the villages extension near the rivers and other human aggressions. Four rheophilic species representatives of Perch family have undergoing a numerical decline in most of the Romanian tributaries of Tisa river. There are five species of Cyprinid fishes which increased their populations and habitat range in detriment of other former abundant species.

Kivonat

A Tisza felső szakaszán és a romániai mellékfolyóiban mintegy 54 őshonos és 10 egzotikus halfaj él. Az utóbbi évtizedekben az emberi tevékenység következtében jelentős változások történtek a folyók halfaunájában. Ez a legerősebben a reofil fajokat érintette (a számuk húszra tehető), amelyek környezete elsősorban a duzasztók, a sóderkitermeles és a vízszennyezés hatására változott meg. A reofil *Zingel zingel*, *Z. streber*, *Gymnocephalus schraetser* és *Gymnocephalus baloni* fajok veszélyeztetett státuszukból fokozottan veszélyeztetett minősítésűvé váltak. A nagy mobilitással rendelkező reofil fajok (*Chondrostoma nasus*, *Vimba vimba*, *Aspius aspius*) létszámcsökkenéséhez a vízi környezet konnektivitásának megszakítása is hozzájárul. Ugyanakkor azonban a Tisza mellékfolyóinak középső szakaszán a Cyprinidae és Cobitidae családnak mintegy 5 faja előnybe került.

Introduction

An increasing number of the rivers in the Tisa watershed are affected by numerous human activities which lead to the fish species numerical decline. Spite of the national befriending programs which are managed a national network of Nature Parks and Natura 2000 sites, including several watersheds from upper Tisa river system, the decline of population of some fish species is still continuing. In order to estimate the actual status of the river's fishfauna some comparisons on species distribution and abundance are needed starting with the historical data. For the majority of the species from Romanian stretches of Tisa tributaries, the only reliable recordings are pertaining to Bănărescu (Bănărescu 1953, 1954, 1964, Bănărescu et al. 1960, 1963). In many cases, the data on fish species are outdated, very poor, or too vague. The Romanian program on Tisa tributaries surveys was started after the '90 decade and researches were initially focused on general fishfauna surveys in order to complete the data gaps (Nalbant 1995, Bănărescu et al. 1997, 1999). Whereupon was not available previous reliable data on fish species assemblage and their ranging along the rivers, thus a comprehensive estimation on fish threatening was not possible. The threatening factors as river levees and damming upon fishfauna were studied along the Crișuri rivers system (Telcean 1997). The fishfauna changes downstream of the localities owe by spilling of sewage waters are studied on tributaries Someș and Crișul repede (Telcean 2002).

The modifications of fishfauna in the upper Tisa River and tributaries in Maramureș are presented according to the occurrence of sensitive fishes along the rivers affected by mining industry (Telcean & Györe 2000, Harka et al. 2002, Telcean & Bănărescu 2002). The studies on threatening of fishes from Crișuri system (Crișul Repede, Crișul Negru and Crișul Alb)

are revealing that the number of human aggressions upon the rivers is increasing. A comprehensive presentation on each threatening factor and the affected fish species on the rivers were recent published (Telcean et al. 2006).

A just appreciation of fish species status must be done considering the ecological requirements of it. Thus, the abundance data obtained on field investigations upon a fish species in a less characteristic habitat is not enough to characterize that species because in a specific habitat, in the same river, the number of specimens collected can be increased. The numerous cases of misunderstandings of relationships habitat requirements - fish specimens' abundance lead to a wrong interpretations on fish samples. The majority of human influences on river habitats prevailing in biotope changes and this are why the appropriate characterization of the ecological requirements of fishes is needed.

A lot of vulnerable fish species became endangered during the last decade. A special remark on some of these species and their threatening in the rivers of Tisa basin will be presented here.

Material and Methods

The data on this study refers to a long term field investigations (1991-2011). The material consisting in a large number of fish specimens was studied in the main Romanian tributaries of Tisa river as follows:

1. Vișeu and Iza rivers and their tributaries from Maramureș county (Northern Romania);
2. Someș river refers to its components Someșul Mare and Someșul Mic and united Someș,
3. Crișuri river system refers to three components: Crișul Repede, Crișul Negru, Crișul Alb,
4. Mureș river - the southernmost tributary of Tisa from Romanian territory.

The fish samples were obtained using electro-narcosis and fishing nets. In most of cases the combined method of fishing was successful. A special attention was paid to the observations on the biotope type in order to ascertain the status of targeted species. The species occurrence was noted only in the specific biotopes, and for the atypical biotopes it was recorded separately.

Regarding to the sampling procedures there was examined a calibrated sampling units along the river channel. It was established as a river section which has a length corresponding to a minimal three time of the river width.

The deeper river sections were sampled using boats and the fishing procedure was repeated in order to catch those of the solitaire specimens of predatory fishes.

All the examined specimens were released alive at the sampling sites.

Results

From a total number of 54 fish species identified as living in the upper Tisa and its Romanian tributaries, 30 native fish are becoming affected by river changes and habitats alteration. These species must consider as vulnerable or endangered in several rivers of the upper Tisa system. Just a little number of native species can be considered as favored in the new habitats transformed by levees, damming and organic pollution of water (*Table 1.*). The majority of the vulnerable and endangered fishes are rheophilic (18 species) and a less number prefers slow running and standing waters (7 species). The endemic thermal species *Scardinius racovitzai* from lowland Crișul Repede river (tributary Peța, close to Oradea) has becoming critical endangered by reduction of temperature in the thermal lake due to the overexploitations of thermal sources.

Ecological requirements of fish species and their threatening in rivers

According to species ecological preferences the vulnerability degree is quite different relating to the biotope changes. The human aggression upon the river habitats is generating a wide range of transformation since the water pollution and continuing with major riverbed

arrangements (river arms shortenings, levees, river damming). A new menace for the headwaters fishfauna is represented by small hydropower plants and losses of mountain forests closer to the river channel. These cause large fluctuations in water level with prevailing of long periods with less volume especially in the summer time.

The above mentioned species (*Table 1*) needs some remarks regarding to their status and vulnerability in the main tributaries of Tisa on the Romanian territory:

Table 1. Fishes which are underwent significant changes in populations' size
1. táblázat. A populációméret szignifikáns változását mutató hafajok

| Fish species | Rivers | | | | | | Remarks |
|---|--------|---|---|----|----|---|--|
| | T | V | I | S | Cr | M | |
| <i>Acipenser ruthenus</i> | - | - | - | ? | - | ? | no reliable data |
| <i>Hucho hucho</i> | v | v | - | - | - | - | - |
| <i>Thymallus thymallus</i> | + | v | v | v | v | v | - |
| <i>Umbra krameri</i> | - | - | - | - | cE | - | in small pools |
| <i>Esox lucius</i> | + | - | - | v | v | + | in lowland channels |
| <i>Telestes souffia</i> | + | v | + | - | - | - | restricted in upper Tisa river system |
| <i>Leuciscus leuciscus</i> | v | v | v | ? | v | ? | |
| <i>Leuciscus idus</i> | - | - | - | v | v | v | in lowland channels |
| <i>Scardinius racovitzai</i> | - | - | - | - | | | cE Only in Peța rivulet, Crișul Repede tributary |
| <i>Vimba vimba</i> | - | - | - | v | v | v | - |
| <i>Rhodeus sericeus</i> | + | - | + | v | v | v | - |
| <i>Gobio uranoscopus</i> | + | v | v | v | v | v | - |
| <i>G. kessleri</i> | + | v | v | + | + | + | - |
| <i>Tinca tinca</i> | + | - | - | - | v | v | in lowland channels |
| <i>Cyprinus carpio</i> | + | - | - | v | v | v | in lowland channels |
| <i>Carassius carassius</i> | + | - | - | - | v | v | in lowland ponds |
| <i>Misgurnus fossilis</i> | + | - | - | + | + | + | in lowland rivulets |
| <i>Sabanejewia aurata</i> | + | v | + | v | + | v | - |
| <i>Lota lota</i> | + | v | + | ? | v | + | - |
| <i>Gymnocephalus schraetser</i> | v | - | v | v | v | v | - |
| <i>G. baloni</i> | - | - | - | - | v | ? | - |
| <i>Zingel zingel</i> | + | - | - | - | v | v | - |
| <i>Z. streber</i> | + | - | ? | cE | v | v | - |
| <i>Cottus gobio</i> | + | v | v | v | v | v | - |
| <i>C. poecilopus</i> | + | v | v | - | - | - | restricted in upper Tisa river system |
| Favored species with increasing populations | | | | | | | |
| <i>Alburnus alburnus</i> | + | + | + | + | + | + | - |
| <i>Squalius cephalus</i> | + | + | + | + | + | + | - |
| <i>Rutilus rutilus</i> | + | - | - | + | + | + | in lowland channels |
| <i>Gobio gobio</i> | + | + | + | + | + | + | - |
| <i>Orthrias barbatulus</i> | + | + | + | + | + | + | - |

+: present and unaffected; -: absent; ?: uncertain; V: vulnerable; cE: critical endangered;

Acipenser ruthenus is one of the sturgeon representatives which have no recent reliable data referring to its distribution and status in the upper Tisa tributaries. During the last decades this species was sporadic registered by anglers from Somes river at gorges of Țicău

– Benesat in the middle sector of this river (Bănărescu et al. 1999). The recent data referring to its occurrence in Mureş river are scarce and not reliable.

Hucho hucho was recent recorded by the authors from Vişeu river close to Bistra locality (the entrance on the river gorges, close to the river mouth at the Tisa confluence). However this fact confirms the scarce presence of this species in the upper Tisa valley. Their vulnerability is amplified by permanent wastage of polluted waters from the abandoned mines from the upper Vişeu river and the large quantities of sterile ores deposited close to the riverbed.

Thymallus thymallus on spite of the intense human pressure on the Vişeu river basin is still have a large population in the tributary Ruscova river. Numerous specimens spread in Vişeu river at the confluence of this tributary. The vulnerability is represented by the same factors as previous species. It needs to be noted that this population represents a relict of the formerly probably the largest population of this species in the upper Tisa basin.

Umbra krameri represents the only representative of fishfauna which is not related strictly to the rivers in a certain sense. This is recorded from small ponds with shallow water, often rich in vegetation. The major menace on this small fish is represented by accentuated dried seasons which are prevailing in the last years. In the lowland Ier river a tributary of Crişuri system, the arid summers causes permanently a drying of small ponds which represents the habitats of *Umbra krameri*. The human pressure on this species is inconsequential since the agriculture and river regulation is not of interest in this area. Unfortunately, there are no solutions to stop the decline of these biotopes.

Esox lucius has registered a numerical decline in the main channel of Someş and Crişuri. The species is retaining its former abundance only in the adjacent ponds and river arms specific from the lowland rivers. It is vulnerable to the overfishing and organic pollution of water. A new threatening factor is the strong fragmentations of its habitats which are affecting during the time the pike populations.

Telestes souffia is vulnerable to the village extension along the riverbed, especially the population from the tributary Iza. In the tributary Vişeu the vulnerability consists in wastage of toxic waters from the abandoned mines. This species endemic in the upper Tisa rivers is representing a peculiar case of rare species which has a restricted area but establish in there large populations. We identified a quite abundant population of this species in the rivers Mara and Cosău (subtributaries of Iza river in Maramureş county) and the provisory data confirm a possible isolation of this population in these rivers. However, the morphological analyses of its representatives is needed in order to confirm or infirm its membership to *agassizii* infraspecific taxa.

Leuciscus leuciscus represents a species with formerly wide range of distribution. It seems that its populations were not numerous as those of the former congener *Leuciscus cephalus* (nowadays *Squalius cephalus*). The numerical decline of this species seems to be determined by water pollution and organic sediments accumulated on the riverbed. The total extinction of this species was recorded in Someşul Mic downstream of city of Cluj-Napoca (tributary component of Someş river system). Specimens from this population are preserved in the collection of the Institute of Biology of the Romanian Academy (Bănărescu 2001).

The populations from the upper Tisa and lowland Crişul Repede are retaining their range, not also the formerly abundance.

Leuciscus idus is a less distributed fish which is confined only in lowland rivers and channels. Its vulnerability consists in rivers regularization and river arm shortenings. The diminishing of water flow in the channels from the lowland Crişuri system is succeeded by invasion of vegetation which are an important inconvenient for this species. In lowland sector of Mureş river the large riverbed offers numerous refuges for this species on the lateral arms of rivers.

Scardinius racovitzai was discussed above in the context of general status of threatened species in the upper Tisa valley.

Vimba vimba until the decade of '70 this species was considered a recent intruder from Tisa in the Romanian tributary Crișul Repede (Bănărescu 1953). At that time the species was considered expansive nearby the species *Chondrostoma nasus*. The upstream expansion of these species was associated with increasing of water temperature consecutively with riverbanks deforestation and slight increases of organic sediments as results of village development. The upstream expansion phenomena has affected at that time also the upper Mureș river there where *Chondrostoma nasus* was, for a short time, a dominant species, a veritable intruder in the grayling zone. *Vimba vimba* has registered a numerical decline in the last decade from all the tributaries of Tisa. In fact, the initial populations were isolated and some of it was affected by extinction. The vulnerability of this species is not quite known, but it is presumable that the concurrence with others cyprinid fishes like *Chondrostoma nasus* and *Squalius cephalus* to be in part responsible for it.

Rhodeus sericeus is the only fish that spawns in the presence of bivalve mollusks. Its vulnerability consists in disappearing of the mollusks populations as a result of water pollution. All the polluted rivers have lost their bivalve population and thereafter populations of *Rhodeus sericeus* become extinct. In all the Romanian tributaries of Tisa excepting the river Iza from Maramureș the species *Rhodeus sericeus* is considered as vulnerable. The large utilization of laundry detergents in the small riverside villages without any system of purification of waste waters causes also the decline of bivalves and finally affects this species.

Gobio uranoscopus and *G. kessleri* are the two cyprinid species which is considered good indicators for ecological conditions in the rivers (Bănărescu 2000). This species has not the same degree of vulnerability which is according to their ecological requirements. *Gobio uranoscopus* is the most vulnerable to the riverbed modification and to the changes in water velocity. This fish prefers the sectors of the fast flowing rivers (70-115 cm/sec.). The other gudgeon species, *G. kessleri* inhabits sandy stretches of the rivers and the water velocity ranged on 45-65 cm/sec. (Bănărescu 2000). Its vulnerability consists in changes in riverbed texture, especially caused by mud and silt sedimentation. Our observations relating to the river substrate and water velocity, in the lowland sector of Someș river (locality Someș Odorhei) the alternation of gravel and sandy bottoms with the stony bottoms and silt is generating an alternation on gudgeon species *Gobio kessleri* and *G. gobio* (the common gudgeon).

The species which inhabits standing and slow running waters *Tinca tinca*, *Cyprinus carpio*, *Carassius carassius* and *Misgurnus fossilis* are vulnerable to the water eutrophication phenomena. The above species excepting *Carassius carassius* are well represented also in lateral arms from the lowland rivers and channels from Crișuri and Mureș rivers. *Cyprinus carpio* has undergoing a numerical decline in lowland Crișuri and Mureș rivers. However, this species was not abundant in these rivers, comparing to the others cyprinids similar ecologic *Abramis brama*, *A. ballerus* and *Blicca bjoerkna*.

Sabanejewia aurata is a species confined only in large rivers with sand and stony bottoms and moderately fast flowing waters. It is no occurred in the small rivulets like the congener *Sabanejewia romanica*, but it is present even in standing waters with silt bottom from the large river meanders. The vulnerability of *Sabanejewia aurata* derives from the inabilities to survive in organic polluted rivers. The most vulnerable are the populations from the rivers Iza, Crișuri system and Mureș. However, the numerical decline of this species is not uniform for entire the rivers, it is affecting only the local populations located downstream to villages.

Lota lota is another "rare" species which is confined along the entire large rivers in the Tisa basin. Due to its peculiar ecology, and predominant nocturne activity, this species

remains as a little known fish, spite of its large range of distribution. During the last decade this fish was recorded frequent from the lowland Mureş river in those areas in which it was not occurred or was considered extinct. There is a possible explanation on this phenomenon which can be related with specimen migration upstream on Mureş from Tisa. In the last decades, the level of water pollution in Mureş river was diminished due to the economical reasons. Thus, the majority of the lowland species manifest a tendency of restore their formerly distribution along the river.

Gymnocephalus schraetser and *G. baloni* are two of the rheophilic species of perch family. These species has undergoing a numerical decline due to the organic pollution of rivers and the exploitation of sand and gravels directly from the riverbed. *Gymnocephalus schraetser* is the most widely distributed representative of the genus in the hilly and lowland rivers. In Someş river it occurs downstream to Ulmeni locality and became rare upstream to Satu Mare village. Its vulnerability is represented by intolerance to the organic pollution of rivers and increasing of water turbidity downstream to the exploitations of mineral aggregates. Such of exploitations are affecting mainly the lowland rivers Someş and Mureş.

Zingel zingel and *Z. streber* are two of the perch family representatives with well defined ecological requirements. These inhabit the moderate fast flowing rivers with stony and gravel bottoms. In those rivers in which both the species occurs (for instance Crişul Negru and lowland Mureş) they live in different habitats. *Zingel streber* prefers the shallow water with increased velocity and predominant stony bottoms, while the second species *Zingel zingel* occurs predominantly in moderately deep waters with sand and gravels on bottom. In the lowland Crişul Negru river, this species manifests affinities for the biotopes in which the aquatic vegetation are well developed. In the Crişul Alb river live only the species *Zingel streber*. It is confined only in the hilly area of this river in which its ecological requirements are satisfied. The other species of the genus is not occurred in this river, probably because of the peculiarity of the riverbed in the lowland area.

Regarding to the degree of vulnerability, it can be stated that these species are sensitive to organic pollution; especially that it is generating a thickness of bacteria colony with *Sphaerotillus* spp. The background of its vulnerability is represented by intolerance to the reduction of dissolved oxygen. Another menace on these species is represented by exploitations of mineral aggregates directly from the riverbed as seen in lowland Mureş river.

Cottus gobio and *C. poecilopus* represents the most exigent rheophilic species from the Tsa basin. There are only few rivers in which these species cohabit and in that case the species *Cottus poecilopus* occupy the uppermost area of mountainous brooks than the other *C. gobio* can distribute relatively far downstream of it (seen in the upper Tisa in Ukraine). A distinctive distribution of cottid fishes is shown in the tributary Iza there in, the species *Cottus poecilopus* lives only in the spring area, while *Cottus gobio* is occupying only the sub-tributary named Valea Albă. In each of these habitats the two species are not overlaps. Spite of apparent less affected habitat of the two cottid species, these confront a strong vulnerability due to the decreasing of water amount and water warming process. The woodcutting is the responsible for these phenomena. Along the riversides are deposited large quantities of sawdust which was generated by local industry of wood processing. At the present-day there remain very few brooks and rivulets in which the species of genus *Cottus* can be considered as "safe".

Discussions

During the last time, a priority in the field of fish species protection is represented by ascertaining of the status of some species that are considered rare (as natural status). It needs differentiate by those species which are becoming rare as a result of human pressure.

The recommended term “rare” used in IUCN normative is quite ambiguous since it refers to both categories of species: ones widely distributed but represented by rare specimens and others which has restricted ranges but are quite abundant in their range. It is the case of two vulnerable species in the Upper Tisa and tributaries: the above mentioned species *Zingel zingel* which has a widely range on the middle stretches of larger tributaries of Tisa (Crişul Negru, Crişul Repede, Mureş) and has rare specimens on their populations, and the species *Telestes souffia* which has a restricted range in the upper Tisa and tributaries Vişeu and Iza there where their populations are quite numerous. The distinction in these two situations needs to be done in order to take the correct measures for species management and protection.

Regarding to the vulnerability and endangered degree of the species we confront our findings with the Maitland list of threatened freshwater fish in Europe (Maitland 1991). From the total of 54 native species confined in the Upper Tisa basin, a number of 18 species are mentioned as vulnerable or distinctively threatened in the Maitland list. It is necessary to mention here that five of the species from Tisa basin (*Cyprinus carpio*, *Rhodeus sericeus*, *Esox lucius*, *Misgurnus fossilis* and *Sabanejewia aurata*) which was not vulnerable or endangered in the '91 years are underwent vulnerable also in the upper Tisa at the present. This is a measure of river's habitats deterioration which is extending in the Danube basin progressive to the easternmost tributaries, Tisa being the most important of them.

Beside the water pollution, the river regularizations is responsible for the aquatic biodiversity losses, especially in fish species. The river damming and meander shortening has a decisive role in the fragmentation of aquatic biotopes. The missing of the aquatic habitats connectivity affecting most of rheophilic fishes, especially the diadrome species which needs to spawns in headwaters and is sedentary in the middle and lowland rivers. The populations of *Chondrostoma nasus*, *Vimba vimba* and *Barbus barbus* was strong affected in the last decades by losing of habitats connectivity. The recent data shows that the piscivorous species from the lowland large rivers (*Esox lucius*, *Silurus glanis*, and *Stizostedion lucioperca*) underwent also a numerical decline due to the habitats fragmentation.

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