

FISHFAUNA FROM THE LOWLAND MUREŞ RIVER (ROMANIA) AND THE FLOODPLAIN NATURAL PARK AREA (WESTERN ROMANIA)

Ilie Cătălin TELCEAN*, Diana CUPŞA*

*University of Oradea, Faculty of Science, Department of Biology, Oradea, Romania

Corresponding author: Ilie Cătălin Telcean, University of Oradea, Faculty of Science, Department of Biology, 1 Universitatii Str., 410087 Oradea, Romania, tel.: 0040259408161, fax: 0040259408461, e-mail: itelcean@uoradea.ro

Abstract. The lowland Mureş river has approximately 120 km in length, thereof more than 80 kilometers are comprised on the Mureş Floodplain Natural Park that was established since the year 2007. This river stretch has different biotopes with lotic or lentic semblances with very characteristic and diverse fish fauna. Along the lowland main stream a system of canals, marshes and pools are connected. The results of repeated ichtiological surveys carried out during the years 1998 – 2001 and 2004 reveals that 48 fish species live in this river sector and other 2 species has uncertain presence. Most of the species from the river mainstream has maintain their former abundance (24 species) while other 16 fish species has increased their abundance. The burbot *Lota lota* and *Zingel zingel* becomes frequent in the lowland Mureş, probably as consequence of their population renewal. The number of fish species that having undergone regression is less (4 species) and the exotic species present here are limited to 8 species. The major threatening factors in the lowland Mureş represents the mineral aggregate extractions directly from the riverbed and the waste waters spill. Subsequent, the meanders and backwaters shortening or cutting down has a negative impact on the fish populations.

Keywords: Fishfauna, Mureş Floodplain Natural Park, changes in species range, Romania

INTRODUCTION

First records on the Mureş river fishfauna were provided by Rotarides [20] Jaszalusi [17] and Băcescu [1]. These papers are devoted to the generally fishfauna from the Transylvanian rivers and mention the Mureş river. More comprehensive data are furnished by Bănărescu [4, 5] in the two monograph works dedicated to the systematic of bony fishes and to the lampreys. The data concerning the Mureş fishfauna are the subject for successive papers [3, 4, 6, 7, 8, 9]. The data mentions the species distributions along the main Romanian rivers including also the river Mureş. A special contribution concerning the species distribution in the Mureş river system is published in 1957 [6] and later by Nalbant [19] who completed the species list with ecological observations. The last paper represents the only recent published data concerning the Mureş fishfauna. It was mentioned more than 50 fish species along the entire river. The fishfauna changes that is ascertain in the last decade are to motivate a new survey on this river.

The subjects concerning the endemic fishes that live in different rivers from the Mureş drainage system are discussed in recent papers [10, 11, 19]. Morphological variation observed on the representatives of *Sabanejewia* genus from different river stretch of Mureş river was explained in several papers [6, 7, 10, 19]. The Mureş river is the only that have no intergrades population between the two loaches species *Sabanejewia balcanica* and *S. bulgarica*. In the other northwestern Romanian rivers in which the two loaches are distributed (Timiş, Somes, Crisuri system), the lowland stretch has an intergrades zone.

There are only four exotic fishes which are mentioned in the lower Mureş [19]. The recent investigations are proved that another 4 exotic fishes are distributed on the lowland river both on Romanian and Hungarian stretches [14, 15]. The presence of the black bullhead *Ictalurus melas* on the small canals and pools was first mentioned from Crisuri rivers system [18]. According to recent data it seems that the exotic

fishes have a large distribution in all of western Romanian rivers [22, 23, 24].

Due to the water pollution on the decades of 70' and 80' a number of species have become rare or extremely rare [19]. Some fishes such as *Acipenser ruthenus*, *Abramis brama*, *Carassius carassius*, *Cyprinus carpio* and *Stizostedion lucioperca* was practically extinct species. Some moderate rheophilic species from lower Mureş river such as *Vimba vimba*, *Abramis ballerus* and *Gobio alpinus* reached the upper stretches of the river [19]. Water pollution has a major influence on the river's fishfauna [18, 21, 22, 27, 29]. The human impact on the fishfauna is now more diverse. Nearby the waste spill and the riverbed modifications, the fisheries activities can modify the fishfauna in the lowland rivers and canals [24]. During the last decade the negative impact of water pollution were diminished in the lower section of Mureş. Thus some of the fish species has restored their former abundance.

MATERIALS AND METHODS

The fish species were identified during repeatedly collecting trips which were conduct both on the river mainstream and the adjoined canals, marshes and ponds. The study was performed in two steps: 1998-2001 the investigations upon the fishfauna from the entire river and in the year 2004 investigations limited to the fish species which live in the lowland river. The ichtiological surveys were focused on the general fishfauna diversity and the species distribution. Thus we can observe the changes in species distribution along the river and the species abundance.

The present paper is referring to the results of the ichtiological surveys upon the lowland river fishfauna. The samples on the Mureş Floodplain Natural Park were located as follows: Bodrog, Pecica, Prundu Mare, Şeitin, Nădlac and Cenad. The upstream stretch was investigated in two sites: near the Zam defile and near the locality Mândruloc.

The collecting methods were combined using both the fishing nets (mesh size 5mm) and electro-narcosis

device (type IUP 12V, 4-10 A, 360W). The electric fishing procedure was according to the CEN directive [30] using pulsed direct current (PDC). The applied methods combine the boat fishing and fishing directly from the riverbanks. The stop nets were not necessary

because of the habitats without swift streams. The fish specimens were identified and recorded at the sampling sites and then released. In some cases additional information from local competent people and anglers associations was used.

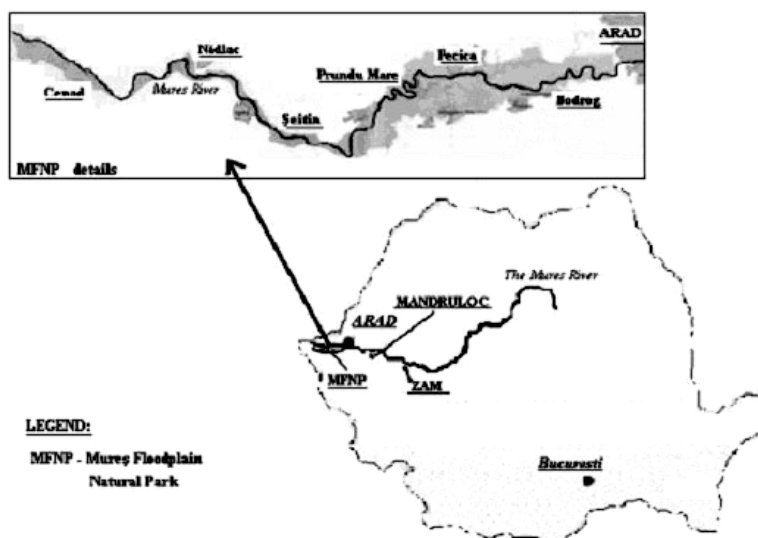


Fig. 1. The sampling in the lowland Mureș River

RESULTS

A total number of 48 fish species were identified in the lower sector of the Mureș and neighboring canals and ponds (Table 1). Approximately a number of 29 of these species are widely distributed downstream to defile from the locality Zam until the locality Mândruloc (Figure 1). Others 19 fish species are distributed predominantly on still waters and canals from a limited sector in the lowland river.

Species identified on the mainstream river between localities Zam and Mândruloc

This river sector has characteristic a non homogenous flowing velocity and alternant pebbly and gravels bottoms.

We identified here a total number of 26 fish species. The majority belongs to Cyprinidae family (13 are natives and 3 exotic). The others species are representatives of the Cobitidae family (2 species), Siluridae, Esocidae and Gadidae (each with a single species), Percidae (3 species); Centrarchidae (one species).

Native cyprinids: *Rutilus rutilus*, *Leuciscus cephalus*, *Scardinius erythrophthalmus*, *Aspius aspius*, *Alburnus alburnus*, *Alburnoides bipunctatus*, *Abramis ballerus*, *Vimba vimba*, *Chondrostoma nasus*, *Rhodeus sericeus*, *Gobio gobio*, *G. kessleri*, *Barbus barbus*. Exotic cyprinids: *Carassius gibelio*, *Pseudorasbora parva* and *Hypophthalmichthys molitrix*. Cobitidae: *Cobitis elongatoides*, *Sabanejewia balcanica*; Siluridae: *Silurus glanis*; Esocidae: *Esox lucius*; Gadidae (Lotidae): *Lota lota*; Percidae: *Perca fluviatilis*, *Gymnocephalus schraetser*, *Zingel zingel*, *Z. streber*; Centrarchidae *Lepomis gibbosus*.

The most frequent species were *Chondrostoma nasus*, *Leuciscus cephalus*, *Barbus barbus*, *Alburnus*

alburnus, *Aspius aspius*, *Gobio kessleri* and *Rhodeus sericeus*.

Species identified on the mainstream river between localities Pecica and Cenad

The river biotope is characterized here by the tendency of homogeneity on flowing velocity and the predominance of sandy riverbed. The slopes especially those with vegetation such as *Potamogeton* and *Trapa* are densely populated by early stages of different species. The crevices from the arduous shores are best hiding places for many species.

On the mainstream of this river stretch were identified 44 fish species which belongs to the following taxa: Acipenseridae (one species), Cyprinidae (22 native and 5 exotic species); Cobitidae (4 species), Siluridae (one species); Ictaluridae (2 species); Esocidae and Gadidae (each with a single species), Percidae (7 species) Centrarchidae (one species).

Acipenseridae:: *Acipenser ruthenus*; Native cyprinids: *Rutilus rutilus*, *Leuciscus cephalus*, *Leuciscus idus*, *Scardinius erythrophthalmus*, *Aspius aspius*, *Alburnus alburnus*, *Blicca bjoerkna*, *Abramis brama*, *A. ballerus*, *A. sapa*, *Vimba vimba*, *Pelecus cultratus*, *Chondrostoma nasus*, *Leucaspius delineatus*, *Rhodeus sericeus*, *Gobio gobio*, *G. albipinnatus*, *Barbus barbus*. *Cyprinus carpio*, *Tinca tinca*; Exotic cyprinids: *Carassius gibelio*, *Pseudorasbora parva* *Hypophthalmichthys molitrix*, *H. nobilis* and *Ctenopharyngodon idella*; Cobitidae: *Misgurnus fossilis*, *Cobitis elongatoides*, *Sabanejewia balcanica*, *S. bulgarica*; Siluridae: *Silurus glanis*; Ictaluridae: *Ictalurus nebulosus*, *I. melas*; Esocidae: *Esox lucius*; Gadidae (Lotidae): *Lota lota*; Percidae: *Perca fluviatilis*, *Gymnocephalus schraetser*, *G. baloni*, *G. cernuus*, *Zingel zingel*, *Z. streber*, *Stizostedion (Sander) lucioperca*; Centrarchidae *Lepomis gibbosus*.

There are two rare species: *Stizostedion volgense* (Volga's pike perch) which are recorded from the Hungarian sector of the river, close to the locality Cenad and the tubenose - *Protherorhinus marmoratus* (species with marine origin that extend its area far away on the Black Sea tributaries). The last species is also frequent in Tisa and other rivers and ponds from Hungary.

Species identified on the canals and neighboring ponds

The slow flowing and the standing waters are represent a characteristic biotope from the lowland Mureş. The canals system connected to the river are natural hideaway for many fishes. The well vegetated canals and ponds from the territory of the natural park are favorable biotope for crucian carp - *Carassius carassius* and *Tinca tinca*. The both species are rare and their populations were drastically reduced in the last decades. The ponds near Bezdin monastery are such of habitats for *Carassius carassius*.

In the canals near locality Cenad and neighboring ponds are occurred 22 fish species. There are 11 native Cyprinid species: *Rutilus rutilus*, *Leuciscus idus*, *Scardinius erythrophthalmus*, *Blicca bjoerkna*, *Abramis brama*, *Abramis sapa*, *Leucaspis delineatus*, *Rhodeus sericeus*, *Cyprinus carpio*, *Carassius carassius*, *Tinca tinca* ; 3 exotic Cyprinid species: *Carassius gibelio*, *Pseudorasbora parva*, *Ctenopharyngodon idella*. There are two Ictaluridae species *Ictalurus nebulosus* and *I. melas*. The last one is less distributed on the canals. The families Esocidae and Centrarchidae are represented here as well by a single species (*Esox lucius* and *Lepomis gibbosus*). The Percid fishes are represented here by 4 species: *Perca fluviatilis*, *Gymnocephalus baloni*, *G. cernuus* and *Stizostedion lucioperca*. The marshes from lowland Mureş is the optimal habitat for another rare species *Misgurnus fossilis*.

DISCUSSIONS

The Acipenseridae family representative species *Acipenser ruthenus* occurs in the lower river and probably in the middle river from the locality Aiud until Zam. Former records of this species [19] from the Mureş river is not based on captured specimens. However this species are captured periodically by fishermen downstream to Prundu Mare isles on the Mureş Floodplain Natural Park.

A special remark is need upon the two *Leuciscus* species: *L. leuciscus* is a rare species in the lowland Mureş and has undergone numerical decline in the majority of Romanian rivers. This species is maintaining former abundance in Tisa river and Crisul Repede. The other representative of this genus, *Leuciscus boristhenicus* (*Petroleuciscus boristhenicus*) was recorded by a single specimen from a canal near the fishery of Nădlac [19]. The presence of this species on this area cannot be explained by natural migrations or other possibilities. However this species was not found again. This species occurs in the Danube Delta and Comana ponds near Bucuresti.

The most rheophilic representatives of Percidae fish family lives almost exclusive in the river mainstream (*Stizostedion lucioperca*, *Gymnocephalus schraetser*, *Zingel zingel*, *Zingel streber*). They are also widely distributed in the lowland Mureş. The Percidae species which lives predominantly in the canals system and ponds are *Perca fluviatilis*, *Gymnocephalus baloni*, *G. cernuus*. There is occurring as well the exotic species *Lepomis gibbosus* representative for the Centrarchidae family. There are no recent reliable data on the presence of *Stizostedion volgense* on the lower Mureş. It is recorded frequent from the Hungarian stretch of the river and surely it is present also on the Romanian sector.

The burbot *Lota lota* is became more frequent on the lowest river sector corresponding to the Mureş Floodplain Natural Park. Previous data [19] mention this species only from the upper river (between locality Senetea and Gorneşti). Is possible that the specimens from lower Mureş are originated from lowermost river from Hungary and Tisa river. This species prefers cold waters and in some years reach the tributaries. Another quasi-migratory fish species are *Pelecus cultratus* which is occurred predominantly in Tisa river and Danube. This species migrates occasionally on the tributary from the left side of Tisa river but has not being a permanent dweller in these rivers.

The small sized fish species which are large distributed on the river mainstream are the loaches *Sabanejewia balcanica* and *Sabanejewia bulgarica*. The first are characteristic in the middle and lowland Mureş river and the second (*S. bulgarica*) became more frequent only in the lowland river beginning to Periam Port locality (near Pecica) until the Tisa river confluence. Both species *S. balcanica* and *S. bulgarica* has no intergrades in lowland Mureş [19]. Others rivers from north-western Romania has such of intergrades on the contact area of these species.

The gudgeon species *Gobio gobio*, *G. kessleri* and *G. albipinnatus* are gregarious fishes and have no homogenous distribution. It is distributed according to the riverbed texture. The majority of *Gobio kessleri* specimens is finding on the pebbly bottoms and moderated swift waters. The other *Gobio albipinnatus* is forming large agglomerates groups on the still waters with sandy bottoms. This species reach frequent the canals mouths in the lowland river. The white gudgeon *G. albipinnatus* together with loach *Sabanejewia balcanica* are representative species in fish communities established on lowland Mureş river.

Species that are maintain their abundance in the lowland river;

There are 23 species which were not significant affected by human activities in the last decade (Table 1). Majority of these are rheophilic species: *Alburnoides bipunctatus*, *Gobio kessleri*, *Abramis ballerus*, *Vimba vimba*, *Pelecus cultratus*, *Gobio kessleri*, *Barbus barbus*. Others are moderate rheophilic species: *Leucaspis delineatus*, *Abramis brama*, *Abramis sapa*, and *Cyprinus carpio*. The rheophilic Percidae *Zingel streber*, *Zingel zingel*, *Gymnocephalus schraetser*, *Stizostedion* (Sander) *volgense* needs a special remark. These species are

vulnerable to the water pollution. Thus their population renewal coincides with the reduction of amount of waste waters spill along the upstream Mureș river and tributaries. This phenomenon is registered recently on this river.

The others fishes are ubiquitous *Perca fluviatilis*, *Silurus glanis*, *Gymnocephalus baloni*, and *Esox lucius*. Their distribution covers both the lowland river and the canals system that adjoined the mainstream.

Table 1. Fish species from the lowland Mureș river

Current No.	Fish species	Occurrence	
		River mainstream	Channels and ponds
1	<i>Acipenser ruthenus</i>	+	-
2	<i>Rutilus rutilus</i>	++	++
3	<i>Leuciscus cephalus</i>	++	+
4	<i>Leuciscus leuciscus</i>	?	-
5	<i>Leuciscus borysthenticus</i>	-	?
6	<i>Leuciscus idus</i>	?	?
7	<i>Scardinius erythrophthalmus</i>	++	++
8	<i>Aspius aspius</i>	++	-
9	<i>Alburnus alburnus</i>	++	+
10	<i>Alburnoides bipunctatus</i>	+	-
11	<i>Blicca bjoerkna</i>	?	+
12	<i>Abramis brama</i>	+	+
13	<i>Abramis sapa</i>	+	+
14	<i>Abramis ballerus</i>	+	++
15	<i>Vimba vimba</i>	+	+
16	<i>Pelecus cultratus</i>	+	-
17	<i>Chondrostoma nasus</i>	++	-
18	<i>Leucaspisus delineatus</i>	+	++
19	<i>Rhodeus sericeus</i>	++	++
20	<i>Gobio gobio</i>	++	++
21	<i>Gobio kessleri</i>	+	-
22	<i>Gobio albipinnatus</i>	++	-
23	<i>Barbus barbus</i>	+	-
24	<i>Cyprinus carpio</i>	+	+
25	<i>Carassius carassius</i>	-	↓
26	<i>Tinca tinca</i>	↓	↓
27	<i>Carassius gibelio*</i>	++	++
28	<i>Pseudorasbora parva*</i>	++	++
29	<i>Ctenopharyngodon idella*</i>	+	+
30	<i>Hypophthalmichthys molitrix*</i>	++	+
31	<i>Hypophthalmichthys nobilis*</i>	+	+
32	<i>Misgurnus fossilis</i>	↓	↓
33	<i>Cobitis elongatoides</i>	+	+
34	<i>Sabanejewia balcanica</i>	++	-
35	<i>Sabanejewia bulgarica</i>	+	-
36	<i>Silurus glanis</i>	+	+
37	<i>Ictalurus nebulosus*</i>	+	++
38	<i>Ictalurus melas*</i>	-	++
39	<i>Esox lucius</i>	+	+
40	<i>Lota lota</i>	++	-
41	<i>Lepomis gibbosus*</i>	++	++
42	<i>Perca fluviatilis</i>	+	+
43	<i>Gymnocephalus cernuus</i>	-	+
44	<i>Gymnocephalus baloni</i>	+	+
45	<i>Gymnocephalus schraetser</i>	+	-
46	<i>Stizostedion (Sander) lucioperca</i>	↓	↓
47	<i>Stizostedion (Sander) volgense</i>	+	?
48	<i>Zingel zingel</i>	++	-
49	<i>Zingel streber</i>	+	-
50	<i>Potherorhinus marmoratus (P. semilunaris)</i>	-	?

+ = present and stationary effective; ++ = increasing effective; ↓ = numerical regress; ? = uncertain; * = exotic fish

Species that are increasing their effectiveness in the lowland river:

There are 12 species (those are not including the exotic species). The majority of these are favored by human activities. Species *Scardinius erythrophthalmus*, *Alburnus alburnus*, *Leuciscus cephalus*, *Rutilus rutilus*, *Chondrostoma nasus*, *Gobio gobio* and *Sabanejewia balcanica* were favored by the spill of household waste

waters which increases the total amount of organic suspensions and organic detritus. As a consequence the available nutrients increase. The others species are *Aspius aspius*, *Rhodeus sericeus*, *Gobio albipinnatus*, *Zingel zingel* and *Lota lota*. These are indirectly favored by reduction of industrial waste waters that are recently befallen. The ostracophiles fish *Rhodeus sericeus* find more specimens of *Anodonta* and *Unio* bivalve

mollusks in less polluted waters. This offers conditions for the species spawn. The adjacent canals and pools are the suitable biotopes for this species due to the presence of bivalve mollusks.

Fish species having undergone regression

Nowadays these are represented by four species:

Carassius carassius are affected by water pollution and the competition of congener *Carassius gibelio* [10]. The species *Misgurnus fossilis* became rare in the lowland rivers and marshes. In Mureş river it is affected by embankments and meanders shortening; The pike perch *Stizostedion (Sander) lucioperca* and *Tinca tinca* are under numerical regress in standing waters due to the water pollution and eutrophication. The same factors threatened the populations of these species in lowland rivers.

REFERENCES

- [1] Băcescu, M., (1946): Peştii așa cum îi vede țăranul pescar Român, Institutul de Cercetări Piscicole, Monographia, Imprimeria Națională Publishing House, Bucharest, 3: 218.
- [2] Bănărescu, P., (1953): Prezența morunașului (*Vimba vimba*) în bazinul Crișurilor /Occurrence of the vimba –bream (*Vimba vimba*) in the basin of Crisuri rivers/ (in Romanian), Buletinul Institutului de Cercetări Piscicole, XII(4): 73.
- [3] Bănărescu, P., (1954): Contribuții la cunoașterea ihtiofaunei României / Contributions to knowledge of the freshwater fish fauna of the Romanian rivers. (in Romanian), Studii si Cercetari Stiintifice, Cluj, 4(3-4): 153-187.
- [4] Bănărescu, P., (1964): Pisces-Osteichthyes. Fauna R.P.R., Academiei Publishing House, Bucharest, 13: 962.
- [5] Bănărescu, P., (1969) Cyclostomata et Chondrichthyes, - Fauna R.S.R., Academiei Publishing House, Bucharest, vol. 12.
- [6] Bănărescu P., Müller, G., Nalbant, T., (1957): Pestii Ardealului / Fishes of Transylvania / Studii si Cercetări de Biologie, Cluj-Napoca, (2): 335-366.
- [7] Bănărescu, P., Müller, G., Nalbant, T., (1959): Noi contribuții la cunoașterea ihtiofaunei dulcicole a României / New contributions to the study of freshwater fishfauna of Romania (in Romanian), Comunicări de Zoologie, Societatea de Stiințe Nataturale și Geografie, 1: 111-126.
- [8] Bănărescu, P., Müller, G., (1960): Peştii Ardealului și răspândirea lor / Fishes of Transylvania and their distribution. Studii și Cercetări de Biologie, Cluj-Napoca, 10: 335-366.
- [9] Bănărescu, P., Papadopol, M., Müller, G., (1963): Le genre Vimba (*Pises Cyprinidae*) dans le basin du Danube. Travaux de Museum de Historie Naturelle "Gr. Antipa", Bucharest, 4: 381-400.
- [10] Bănărescu, P., (1994): The present-day conservation status of the fresh water fish fauna of Romania, Ocrotirea naturii și a mediului înconjurător, Acad. Române Publishing House, 38(1): 5-20.
- [11] Bănărescu, P., (2002): Species and subspecies of fish and lampreys endemic or almost endemic to the drainage area of the Tisa River, In: Sarkany-Kiss, A & Hamar, J., (eds.), Tisca Monograph Series, Ecological aspects of the Tisa River Basin, Szolnok-Szeged-Tg. Mureş, 6: 167-172.
- [12] Futó, J., (1942): Szeghalom környekenek halfaunaja / The fishfauna of the Sheghalom area, Dissertation Szatmarnemeti Hungary (Satu-Mare, Romania).
- [13] Harka, A., (1990): Zusätzliche Verbreitungsgebiete der Marmorierten Grundel (*Protherorhinus marmoratus* Pallas 1811) in Mitteleuropa.- Österreichs Fischerei, 43: 262-265.
- [14] Harka, A., (1997): Halaink / Our fishes; Term. es Kornyzetvedo Tanarok Egyesulete, Budapest, 175 p.
- [15] Harka, A., Sallai, Z., (2004a): Magyarország halfaunaja, Nimfea Termeszettudományi Egyesület, Szarvas Hungary, pp. 269.
- [16] Harka, A., Szepesi, Zs., (2004b): A tarka geb (*Protherorhinus marmoratus* Pallas 1811) megjelenése és terjedése a Zagyva vízrendszereben. Halaszat, 97/1: 38-40.
- [17] Jásfalusi, L., (1947): Descrierea limnobiologica și piscicola a Mureşului la hotarele comunei Godea și paraiele învecinate / Limnobiological and fishery description of the upper Mureş River, Notatione Bilogicae 5(1-3): 287-323.
- [18] Kohler, H.R., Sandu, C., Scheil, V., Nagy-Petrică, E.M., Segner, H., Telcean, I., Stan, Gh., Triebkorn, R., (2007): Monitoring pollution in river Mureş, Romania, Part III: biochemical effect markers in fish and integrative reflection; Environmental Monitoring and Assessment, Springer publ., 127: 47-57.
- [19] Nalbant, T., (1995): Fish of the Mureş / Maros River: systematics and ecology. In: Hamar, J., & Sarkany-Kiss, A. (eds.), Tisca Monograph Series: The Maros / Mureş River Valley, Szolnok-Szeged - Tg. Mureş, pp. 225-234.
- [20] Rotarides, M. (1944): Adatok erdelyi vizeink halainak elterjedesehez / Contribution to the knowledge of fishes distribution in Transylvania, Ann. Historico-Naturales Musei Nationalis Hungarici, Budapest, 1: 16-38.
- [21] Telcean, I., (2001): Comunități piscicole din sectorul superior al râului Mureş / Fish communities from the upper Mureş River, Analele Științifice ale U.S.M.F. "Nicolae Testemițanu", Chișinău, Vol. I., pp. 104-108.
- [22] Telcean, I., Bănărescu, P., (2002): The fish fauna changes in the upper Tisa and its southward and eastward tributaries. In: Sarkany-Kiss, A & Hamar, J., (eds.), Tisca-Monograph series: Ecological aspects of the Tisa River Basin, Szolnok-Szeged - Tg. Mureş, 6: 179-186.
- [23] Telcean, I., Covaciu-Marcov, S.D., Cupşa, D., (2002): Ihtiofauna sistemului de canale și a bălților învecinate cursului inferior al Crișului Repede și Văii Ierului / The fishfauna that inhabit the canals and neighboring ponds from Crisul Repede and Ier valleys, An. Șt. ale USMF "Nicolae Testemițanu", Chișinău, I: 104-108.
- [24] Telcean, I.C., Cupşa, D., Covaciu-Marcov, S.D., Sas, I. (2005a): The Fishfauna changes in the lower Crișul Repede river as a result of the fisheries activities, An. Univ. of Craiova, X(XLVI): 169-174.
- [25] Telcean, I.C., Cupşa, D., Covaciu-Marcov, S.D., Sas, I., (2005b): Study about the fish fauna changes in the organic polluted stretches of Crișul Repede river (Bihor County, western Romania). Studii și Cercetări Științifice, Univ. of Bacău, Seria Biologie, 10: 83-86.
- [26] Telcean, I., Cupşa, D., (2007): The influence of the habitats upon the fishfauna of the lower sector of Crisuri rivers, Pisces Hungarici., Debreceni Egyetem, Agrartudományi Köylemenzek, Debrecen, Hungary, II: 31-40.
- [27] Triebkorn, R., Telcean, I., Casper, H., Farkas, A., Sandu, C., Stan, G., Colărescu, O., Tiberiu, D., Köhler, H.R., (2008): Monitoring Pollution in River Mureş, Romania, Part II: Metal accumulation and histopathology in fish, Environmental Monitoring and Assessment, Springer publ. 141: 177-188.
- [28] Wilhelm, A., (1998a): Black bullhead (*Ictalurus melas* Rafinesque, 1820) (Pisces, Ostariophysi: Bagridae) a new species of Fish Recently Found in Romanian Waters. Travaux du Museum de Historie Naturelle "Grigore Antipa", Bucharest, XL: 377-381.
- [29] Wilhelm, A., Harka, A., Sallai, Z., (2002): The prevailing anthropogenic effects on certain smaller northwestern Romanian Rivers, Tisca monograph series, 6: 187-198.
- [30] ***CEN directive 2003 "Water Analysis – Fishing with Electricity" (EN 14011; CEN, 2003); ***FAME CONSORTIUM (2004): Manual for the application of the European Fish Index