NATURA 2000 A PANACEA? NATURA 2000 SITE OLTUL MIJLOCIU-CIBIN-HÂRTIBACIU (ROSCI0132) – A LOCAL EXTINCTION OF A NATIVE FISH SPECIES AND A NEW ALIEN FISH ARRIVAL CASE STUDY

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DOI: 10.2478/trser-2023-0007

KEYWORDS: Natura 2000, Transylvania, Romania, native and alien fish species.

ABSTRACT

The Romanian Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site of community importance (SCI) was designated for the purpose of protecting biodiversity and maintaining the wild flora and fauna in a favourable conservation status, as well as the natural habitats of conservation interest. This research focused on the possible disparition of one protected fish species *Pelecus cultratus* (Linnaeus, 1758) and the appearance of an alien one *Babka gymnotrachelus* (Kessler, 1857), as ecological indicators of the fact that at least this Natura 2000 site is far from being properly protected and a new, more responsible way should be followed and different administrators put in charge of the areas management.

RÉSUMÉ: Natura 2000 une panacée? Site Natura 2000 Oltul Mijlociu-Cibin-Hârtibaciu (ROSCI0132) – Une extinction d'espèces locales de poissons indigènes et un nouveau cas d'étude d'arrivée de poissons exotiques.

Le site roumain Natura 2000 d'importance communautaire (SIC), Oltul Mijlociu-Cibin-Hârtibaciu, a été désigné dans le but de protéger la biodiversité et de maintenir dans un état de conservation favorable la flore spontanée et la faune sauvage, ainsi que les habitats naturels d'intérêt pour la conservation. Cette recherche s'est concentrée sur la possible disparition d'une espèce de poisson protégée, *Pelecus cultratus* (Linnaeus, 1758) et l'apparition d'une espèce exotique, *Babka gymnotrachelus* (Kessler, 1857), comme indicateurs écologiques du fait qu'au moins ce site Natura 2000 est loin d'être être correctement protégé et qu'une nouvelle voie plus responsable devrait être suivie par les différentes administrations en charge de ces activités.

REZUMAT: NATURA 2000 un panaceu? Situl Natura 2000 Oltul Mijlociu-Cibin-Hârtibaciu (ROSCI0132) – studiu de caz referitor la extincția locală a unei specii de pește nativă și sosirea unui pește străin nou.

Situl Natura 2000 de importanță comunitară (SCI) Oltul Mijlociu-Cibin-Hârtibaciu din România a fost desemnat în scopul protejării biodiversității și menținerii într-o stare favorabilă de conservare a florei spontane și a faunei sălbatice, precum și a habitatelor naturale de interes pentru conservare. Această cercetare s-a axat pe posibila dispariție a unei specii protejate de pești *Pelecus cultratus* (Linnaeus, 1758) și apariția unei specii noi, *Babka gymnotrachelus* (Kessler, 1857), ca indicatori ecologici ai faptului că cel puțin acest sit Natura 2000 este departe de a fi protejat în mod corespunzător și o nouă cale mai responsabilă ar trebui să fie urmată de diferite administrații responsabile de aceste activități.

INTRODUCTION AND BACKGROUND

More than four billion species were estimated to have emerged and evolved on our planet in the last 3.5 billion years, more than 99% are extinct (Novacek, 2002). The extinction episodes were and are natural in the evolution of the Earth's biosphere, but generally are counterbalanced by speciation, only five such events were described as "mass extinctions" till present, near the end of the Ordovician, Devonian, Permian, Triassic, and Cretaceous periods (Jablonski, 1994). Present-day there is controversy amongst naturalists of a new, ongoing sixth mass extinction, due to the recent global trends, in which the human impact is more and more present and agressive (Barnosky et al., 2021).

In spite of this phenomenon's appearance, magnitude, and importance, somehow the public opinion and even decision makers are not really aware about it. In these circumstances all the changes in biodiversity, especially any new extictions or alien species arrivals which in one way or an other, change the species structure should to be highlighted by up to date scientific research.

Over a century ago, Europe still included extensive magnificient regions which were relatively natural, but all forms of economy increased and sped up progress and expansion inprinted its negative footprint. Human impact on ecosystems grew faster and faster after the Second World War; in parallel, coordinated efforts were made to conceptualise, design, and put into action programmes of nature protection and conservation, as a recognition of worth and significance for human society (Curtean-Bănăduc and Florescu, 2007). In the context of raising awareness about the global biodiversity related threats, risks, and changes which affect Europe, maybe more than other continents, a succession of politics, strategies, and actions were implemented with the aspiration to protect and conserve ecosystems, their habitats, and their species. One such well known approach is the European Union's admirable initiative, struggle, and large scale efforts with the Natura 2000 network. More than 18% of the EU's terrestrial area and over than 8% of its marine region, Natura 2000 is the largest coordinated network of protected areas on the planet, offering a place of refuge to Europe's most priceless and threatened species and habitats (*), or at least this was the intention.

The European Danube Basin is a historically well-known important area for the richness and diversity of its fish fauna, habitats, and fisheries (Antipa, 1909; Bănărescu, 1964; Polačik et al., 2008; Trichkova et al., 2009; Kalchev et al., 2010; Bănăduc et al., 2014, 2016a,b, 2020a,b; Erős et al., 2017; Snigirova et al., 2021).

In the worldwide context, where there exists a high variability of stressor categories and stressors adversely impacting the freshwater ecosystems (Bănăduc et al., 2022a,b, 2023), all the Danube River basin countries sub-basins' lotic systems, naturaly described by a high level of general biodiversity, were sadly substantially affected by the impacts of human activities mostly in XX and XXI centuries, but not only (Schneider-Binder, 2020; Burga and Landolt, 2020; Cianfaglione and Pedroti, 2020; Čarni and Juvan, 2020, Adámek et al., 2020; Ćaleta et al., 2020; Dekić et al., 2020; Đikanović et al., 2020; Lenhardt et al., 2020; Mišiková and Makovinská, 2020; Maślanko et al., 2020; Afanasyev et al., 2020; Kostov et al., 2020; Kenderv and Trichkova, 2020). In spite of the historical and partially the present major economical and ecological role of fish in the Danube Basin, this taxonomic group habitats and biocoenosis were and still are under continuous and tremendous pressures, threats, and risks due to a high number of negative human impacts like: pollution (persistent organic pollutants, mining pollutants, plastics, pharmaceuticals, viral ARN, bacteria, oversedimentation, etc.), riverine vegetation destruction, habitat fragmentation, deterioration and destruction, climate change, trophic resource dynamics, human induced interbreedings, introduced alien and invasive species, etc. (Curtean-Bănăduc and Bănăduc 2008; Bănăduc 2010, 2016; Bănăduc et

al., 2011, 2020a,b, 2021a,b, 2022a,b; Curtean-Bănăduc et al., 2014, 2020, 2021, 2023; Anastasiu et al., 2017; Popa et al., 2019; Burcea et al., 2020; Boeraş et al., 2021, 2022a,b; Costea et al., 2021).

Based on the Alpine, Continental, Pannonian, Stepic, and Pontic Biogeographical Seminars of Sibiu (Romania) in 2007 (Bănăduc 2010, 2011; Bănăduc et al., 2012; Bănăduc and Curtean-Bănăduc, 2013a,b), Romania started to build its Natura 2000 network, a complex and difficult process in which fish species were one of the core taxonomic groups, and were the basis on which many Natura 2000 sites were designated, of course in relation with other species and habitats too (Curtean-Bănăduc and Florescu, 2007).

In spite of a large number of specific studies dedicated to Natura 2000 protected fish species in special designed sites (i.e. Bănăduc, 2001; 2006, 2007a-e, 2008a-f; 2009, 2010, 2012; Bănăduc et al., 2011, 2015, 2016a,b, 2017a,b; Bănăduc and Curtean-Bănăduc, 2013a,b; Curtean-Bănăduc et al., 2015; Năstase and Oțel, 2016, 2017; Nicolaev et al., 2018) the authors of this case study highlight that at least sometimes the ichthyologists advice for real conservation remain on paper, and the decision makers act as they know better or the so called local and regional economic development should have no connection at all with the sustainable development concept principles, and the ichthyocenoses and their habitats are degrading in spite of their ecosystems theoretical protection status.

Petrographical contrasts, altitudinal range of the relief forms and radiate-divergent shape of the hydrographic net create and developed in Romania the predominance of the streams and rivers and with a rather reduced extent, volume and surface of their watersheds (Velcea and Savu, 1982; Mutihac, 1990). With a length of 699 km, an area of the watershed of 24,010 km^2, the total length of its 564 tributaries of 8,465 km and an average discharge at its end of 164 m^3/s, the Olt River is one of the exceptions (Diaconu and Stănculescu, 1971; Ujvári, 1972; Roşu, 1973; Badea et al., 1983). Consequently, the Olt River basin includes a large diversity of relief forms and climatic types, and varied human impacts.

The variability elements of these habitats induces a relatively high potential for biodiversity variation, especially in the upper and middle Olt River watershed (Bănărescu, 1999; Costea, 1999; Curtean et al., 1999a; Drăgulescu, 1999; Fântână et al., 1999; Gheoca and Popovici, 1999; Gyöngivér et al., 1999; Momeu et al., 1999; Onciu et al., 1999; Rasiga et al., 1999; Sîrbu et al., 1999; Szállássy, 1999; Şerban and Busuioc, 1999; Tatole, 1999; Ujvárosi and Chişu, 1999).

This potential is not reached due to the negative effects of varied extensive and/or intensive human activities such as: industry, agriculture, tourism, hydroenergetic systems, transport, etc. Among all of these, a relatively complex hydrotechnical network induces one of the major negative human impacts on the Olt River basin ecosystems (Curtean et al., 1999b).

The first hydrotechnical work in the Olt River watershed was chronicled in 1240, when the Teutonic knights, who had established in this marshy region, started the first sanitation works in Bârsa County (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000).

These works reside in withdrawal channels of the swamps, dead branches and ponds, in the vicinity of the human settlements. All these on site modifications were done by the local inhabitants, without a strategic master plan, all that was done in reaction to momentary necessities. These ancient works referred only to this type of recuperation of swampy lands; barrages even if needed, were not built due to the fact that they required much more funds, not available then for such objectives. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

The first works implemented in this region based on specific technical records, appeared here since 1895-1898, when the Prejmer-Hărman-Teliu area drainage project was implemented, a project finished between 1900 and 1910 (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989, 1990; Tecuci, 1989; *, 2000).

In general, since 1400, the hydrotechnical projects started to diversify and expand continuously, including drainage, flood protection, and water supply works. For example the Timiş Canal was inaugurated in 1500, a diversion canal from the Timişul Sec River for the Braşov City area water supply was done, and in 1640 the Slatina-Olt canal was realized for irrigation (Brâncoveanu Canal), more works followed, including water supply channels for the city of Sibiu by capturing springs, etc. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

Since 1890, a new usage of water became common in Romania: using water for electricity production. The first hydroelectric plant in Romania was built on the Dambovița River from Grozăveşti-Bucharest in 1892 in another watershed, the second one was built in the Olt-UHE Sadu I river basin in the studied basin, operating since 1896. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

Other works followed, like the regularization of the Cibin River (Olt Basin) in 1909 (0.8 km), and procurement of more water to supply Braşov City (1932), etc. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

In 1924, a new law for water regime management appeared, and after it one for energy production in 1930, laws which produced little effects on water works. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

Since 1950 due to the comunists' neglijent or even lack of care about environment, the impact on river basins water became intesive. (Blidaru, 1962; Constantinescu, 1989; Priscu, 1974; Tecuci, 1989; *, 2000)

Among the first works carried out in this period were the Sadu V Dam and power plant (1950-1955), the hydropower development of the Lotru River (1966-1974), and the launching of hydropower development of the Olt River in 1970. There are tens of hydrotechnical works in operation in present on this watercourse, usually with various uses, and the accumulation lakes with a total of arround one billion m^3. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989; *, 2000)

The human activities continuously carried out in the last 40-50 years in the Olt River watershed are predominantly miscellaneous. As well as the hydropower facilities, another chief concentration by the works is flood defense through the construction of around 900 km of dams and 20 non-permanent accumulation lakes. With these resources, the works can reduce excess moisture over 300,000 ha arranged for irrigation and fishing facilities totalling an area of over 1,000 ha. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989; Tecuci, 1989)

In the Olt River watershed there are rather frequent lakes, both natural and anthropogenic. The natural lakes are mostly glacial lakes and ponds, with the largest being man-made hydroenergetic dam lakes on the Olt River. (Blidaru, 1962; Priscu, 1974; Constantinescu, 1989, *, 2000)

Fish are one of the most defenseless vertebrates on our planet due to their high associated risks to be affected by human impact. Obviously, the expansion of dams, mycrohydropower plants, and weirs interfere with aquatic ecosystems and induce disturbance in longitudinal connectivity, upstream, and downstream fish movement and migration, which leads to segregation, isolation, decline, and major losses to fish populations and species (Bănăduc and Curtean-Bănăduc, 2018). The historical human activities impact on the middle Olt River basin induced significant changes on the lotic ecosystems (Curtean et al., 1999).

All these natural and anthropogenically varied circumstances point out the dimensions of the specific effort required for carrying out unitary, permanent and exhaustive ichthyofauna ecological assessments and monitoring activities for this river and its tributaries.

The Romanian Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site of community importance (SCI) was specially designated to conserve biodiversity and preserve native, valuable flora and fauna species in favourable conservation status, likewise the natural habitats of conservation interest situated in the study site, placed in the southern part of the Transylvanian Water Tower (Curtean-Bănăduc and Bănăduc, 2015), a region of which streams and rivers have been again and again massively negatively impacted by various human activities throughout history (Curtean-Bănăduc et al., 2007, 2018, 2019, 2020, 2021; Popa et al., 2016; Cismaş et al., 2018; Boeraş et al., 2021, 2022a,b; Bănăduc et al., 2021a,b; Costea et al., 2021).

Among other taxa, there are nine fish species based on which this site was designated. Among them is *Pelecus cultratus* (**). This freshwater, brackish, pelagic, anadromous fish species, a good swimmer, spawns in the midstream (Bănărescu, 1964; Bănărescu and Bănăduc, 2007; Oţel, 2007; Cocan and Mireşan, 2018) belong to Teleostei, Cypriniformes, Leuciscidae, and Leuciscinae groups (Bănărescu, 1964; Riede, 2004) and is protected by the Bern Convention (appendix III).

This research analyses and summarizes the decreasing spatial and temporal frequency trend of *Pelecus cultratus* species along the XIXth, XXth and XXIst centuries, and its possible local extinction, together with the appearance and spreading of an alien species *Babka gymnotrachelus* (Kessler, 1857), and in this context, raising awareness about the lack of management eficiency of this Natura 2000 site.

Pelecus cultratus (Linnaeus, 1758) range in Romania was much restrained and fragmented in the last century due to the negative quantitative and qualitative impacts of anthropogenic activities, which is different from one basin/basin sector to another, and even from one protected area to another (Curtean-Bănăduc et al., 2015). It is a fish species of community interest, the subject of an annual monitoring survey along the last quarter of century, since 1998 to 2023.

One of this papers objectives is to reveal the results of this fish monitoring program in terms of spatial and temporal frequency trends.

Babka gymnotrachelus (Kessler, 1857) is a freshwater, brackish, benthopelagic fish species, which ussualy prefers muddy aquatic ecosystems substrata and slow flowing or even stagnant water bodies. It has its Terra typica in the lower Nistru/Dnister River, and has no conservation or economic importance (Bănărescu, 1964; Oţel, 2007; Cocan and Mireşan, 2018). Its distribution in Nistru/Dnister and Danube river basins reveal a continuous quick extension in space and time, and peculiar environmental conditions of the rivers even caused adaptative modifications of morphological features (Bănărescu, 1964; Oţel, 2007).

A second objective of this paper is to reveal the spreading trend of this non native fish species in the studied protected area.

MATERIAL AND METHODS

Study area

The research area is primarily the Olt River and some of its tributaries in the Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site, and some sections in the proximity of the limits of this protected area (Fig. 1) (code ROSCI0132), with the site-centre location 24.316267 longitude and 45.672355 latitude, established in December 2007, with a surface of 29 km^2 (2910.50 ha), placed in Alpine (12.27%) and Continental (87.73%) biogeographical areas, it protects 18 species of the Natura 2000 Directive and two habitat types of the Habitats Directive. (*** https://eunis.eea.europa.eu/sites/ROSCI0132; **** https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=ROSCI0132)

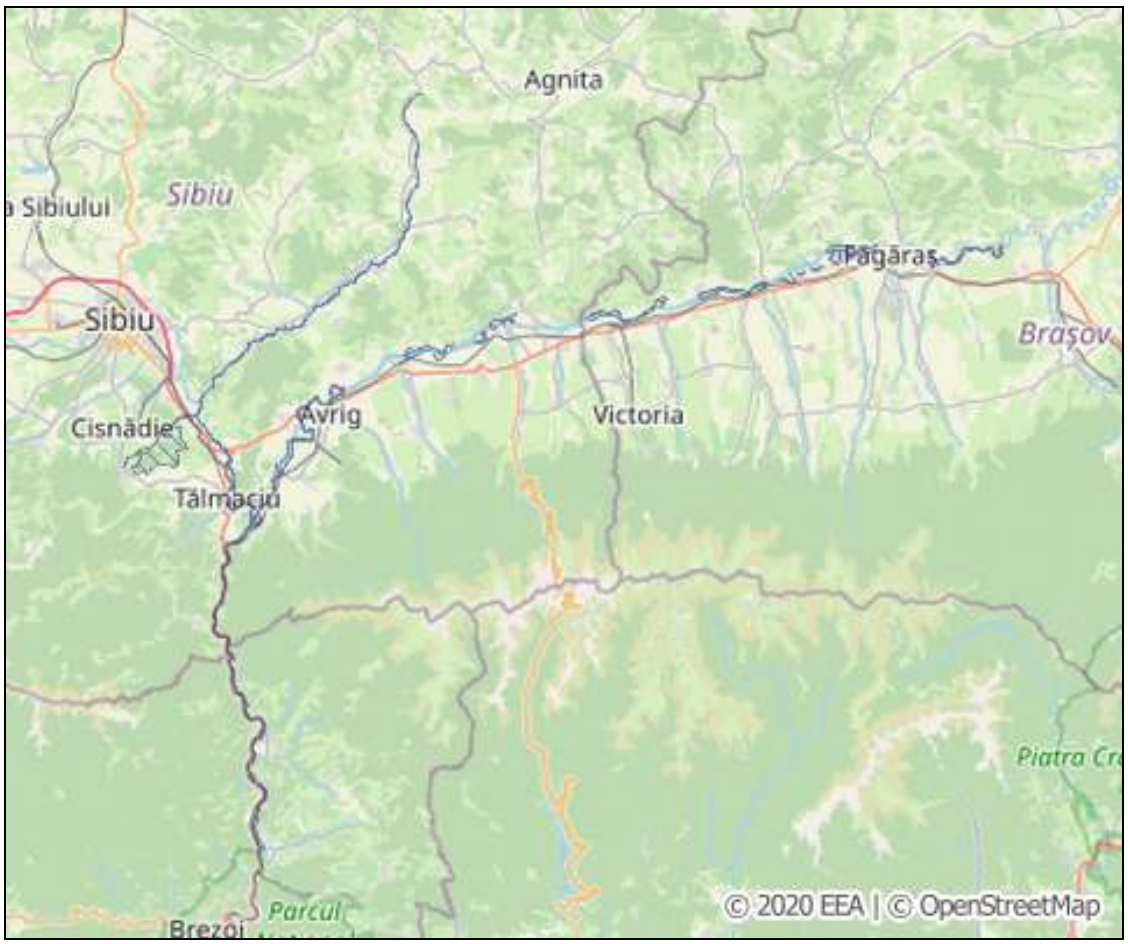

Figure 1: Oltul Mijlociu – Cibin – Hârtibaciu Natura 2000 site area (***).

Collection of samples

25 years monitoring (1998-2023) in 19 sampling points was done based on local fishermen captures, the obtained data and information being analysed and discussed in the context of the historical scientific data, about *Pelecus cultratus* and *Babka gymnotrachelus* fish species in their distribution range, in the researched protected area, and also in some neghbouring lotic sectors (Antipa, 1909, Bănărescu, 1964; Bănăduc, 1999; Curtean-Bănăduc et al., 2015).

RESULTS AND DISCUSSION

The on site monitoring data for the studied *Pelecus cultratus* and *Babka gymnotrachelus* fish species in the research area are presented in table 1.

Table 1: *Pelecus cultratus (Pc)* and *Babka gymnotrachelus (Bg)* presence/absence in Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site area, in 1998-1999 period, approximately one km upstream of 19 localities or neghbouring areas of the studied riverine localities.

Studied sectors / Species/ Years	S1 Hălmeag	S2 Făgăraș	S3 Dridif	S4 Sâmbăta de Jos	S5 Olteț	S6 Vișstea	S7 Arpașu de Jos	S8 Porumbacu de Jos	S9 Avrig	S10 Racovița	S11 Turnu Roșu	S12 Boița	S13 Lazaret	S14 Câineni	S15 Greblești	S16 Robești	S17 Balota	S18 Racovița	S19 Copăceni
1998	–	+	+	+	+	+	+	+	+	–	+	–	–	+	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
1999	–	+	+	+	+	–	+	+	+	–	+	–	–	+	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2000	+	+	–	+	–	+	–	–	+	–	+	–	–	+	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2001	–	+	+	–	–	–	+	+	–	–	+	–	–	+	–	–	–	–	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2002	–	+	–	–	+	–	+	–	–	–	+	–	–	+	–	–	–	–	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2003	–	+	–	+	–	–	+	–	+	–	–	–	–	+	–	+	–	–	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2004	–	–	–	+	–	–	+	–	+	–	+	–	–	+	–	–	–	–	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
Bg																			
2005	–	+	–	+	–	–	+	–	–	+	–	–	–	–	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	+
Bg																			
2006	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	+	–
Bg																			

Table 1 (continued): *Pelecus cultratus (Pc)* and *Babka gymnotrachelus (Bg)* presence/absence in Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site area, in 1998-1999 period, approximately one km upstream 19 localities or neghbouring areas of the studied riverine localities.

Studied sectors / Species/ Years	S1 Hălmeag	S2 Făgăraș	S3 Dridif	S4 Sâmbăta de Jos	S5 Olteț	S6 Vișt ea	S7 Arpașu de Jos	S8 Porumbacu de Jos	S9 Avrig	S10 Racovița	S11 Turnu Roșu	S12 Boița	S13 Lazaret	S 14 Câineni	S15 Grebleș ti	S16 Robeș ti	S17 Balota	S18 Racovița	S19 Copăceni
2007	–	+	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	+	–	–	–	+	–	–	+	–	–
Bg																			
2008	–	–	–	–	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Pc	–	–	–	–	–	–	–	+	–	–	–	–	+	–	–	–	–	–	+
Bg																			
2009	–	–	–	–	+	–	+	–	–	–	–	–	–	+	–	–	–	–	–
Pc	–	–	–	–	–	–	–	–	+	–	–	–	–	+	–	–	–	+	–
Bg																			
2010	–	–	–	–	+	–	–	–	–	–	+	–	–	–	–	–	–	–	–
Pc	–	–	–	+	–	–	–	–	–	–	–	–	–	+	–	–	–	+	–
Bg																			
2011	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pc	–	–	+	–	–	–	–	+	–	–	–	+	–	–	–	–	–	–	–
Bg																			
2012	–	–	–	+	+	–	–	–	–	–	+	–	–	–	–	–	–	–	–
Pc	–	+	–	–	+	–	–	–	+	–	–	–	–	–	–	–	–	–	+
Bg																			
2013	–	–	–	–	+	–	+	–	–	+	–	–	–	–	+	–	–	+	–
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg																			
2014	+	–	–	+	–	–	–	–	+	–	–	–	–	+	–	–	–	–	+
Pc	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
Bg																			
2015	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pc	–	+	–	+	–	–	–	+	–	–	–	+	–	–	–	+	–	–	+
Bg																			
2016	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pc	+	+	–	–	+	–	+	–	–	+	–	–	+	–	–	+	–	+	–
Bg																			
2017	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pc	–	+	+	–	–	+	+	–	+	+	–	+	–	+	–	+	–	–	+
Bg																			

Table 1 (continued): *Pelecus cultratus (Pc)* and *Babka gymnotrachelus (Bg)* presence/absence in Oltul Mijlociu-Cibin-Hârtibaciu Natura 2000 site area, in 1998-1999 period, approximately one km upstream 19 localities or neghbouring areas of the studied riverine localities; + presence, – absence.

Studied sectors / Species/ Years	S1 Hălmeag	S2 Făgăraș	S3 Dridif	S4 Sâmbăta de Jos	S5 Olteț	S6 Vișt ea	S7 Arpașu de Jos	S8 Porumbacu de Jos	S9 Avrig	S10 Racoviț a	S11 Turnu Roșu	S12 Boiț a	S13 Lazaret	S 14 Câineni	S15 Grebleș ti	S16 Robeș ti	S17 Balota	S18 Racoviț a	S19 Copăceni
2018 *Pc*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg	+	–	–	–	+	–	–	+	+	–	–	–	–	+	+	–	+	–	+
2019 *Pc*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–
Bg	+	–	+	+	–	–	+	+	+	+	–	+	–	+	–	–	+	–	+
2020 *Pc*	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg	–	+	–	+	+	+	–	+	+	+	–	+	+	+	–	+	–	–	+
2021 *Pc*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg	+	+	–	+	+	+	+	–	+	+	+	–	+	+	+	–	+	–	–
2022 *Pc*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg	–	–	+	+	+	+	–	+	+	–	+	+	+	+	–	+	+	+	+
2023 *Pc*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Bg	+	+	+	–	+	+	–	+	+	+	+	+	–	+	–	–	+	+	+

There were and still are gaps in the knowledge of fish presence, absence and ecological status in this country, which highly need sustainable, continuous efforts in this respect. This is in part due to an extremely high complexity of Romanian aquatic habitats with low accessibility for some of them, very big areas of assessment and large monitoring studies to be done, a relatively high number of species, and a relatively small number of ichthyologists in spite of the high ecological, economical and social importance of fish, and an internationally recognised Romanian "ichthyology school" with members highly active since the 18th century (i.e. Bielz, 1853; Antipa, 1909; Bănărescu 1964; Giurescu, 1964; Vasiliu and Manea, 1987).

Unfortunatelly for this general context, even the few existent Romanian fish experts have to face incredible and continuous administrative bureaucratic obstacles due to some irrationale national laws, in fulfilling their mission and offer the decision makers real and updated reliable data from the field.

Pelecus cultratus' common presence was well known in all Olt River middle and lower sectors (Bănărescu, 1964). After that, a first study which revealed the presence of this species in the middle Olt River, was done at the end of the XXth century (Bănăduc, 1999). It was reported as an accidental captured species until 2019 (Trifonof, 2019). Based on the obtained results, in the context of a significant human impact presence, the authors of this paper decided that this species need a monitoring programme, which was put in practice for a quarter of century, as a consequence the last year when this species was noted in the local fisherman captures was 2020.

In the past, in Romania *Babka gymnotrachelus* was found only in the waters which flow directly in the Black Sea (Bănărescu, 1964), before 2007 (Oțel, 2007) it was found in the south-east of Romania, and since 2005-2010 it was noted in this study area (Trifonov, 2019), also in this monitoring study in the lower and middle Olt River it was found since 2004. Here it must be added that this fish was already found as an accidental species in the Olt River tributaries lowland aqutic habitats, namely in Cârțișoara and Porumbacu along this monitoring programme, and also in Avrig River by Togor A. in 2021 (personal communication).

After the diminishing of some aggressive industrial pollution from Brașov, Râșnov, Ghimbav, Codlea, Zârnești, Făgăraș, Victoria, etc. (Bănăduc, 1999; Trifonov, 2019), after the 45 years of no care for the environment of the communist Eastern Europe politic administrations, the Olt River suffered less because of polluted waters, and an important increase in fish abundance and species diversity (Bănăduc, 1999). Unfortunately the long chain of hydroelectric dam powerplants (Constantinescu and Pâslaru) continue to significantly negatively influence the ichthyofauna, and in spite of the raising awareness about this subject, not only that the existent dams have not benefited of new efficient fish lathers or passages, but new such environmentally unfriendly big dams continued to be built. If this studied sector of the Olt River belonged to the natural ichthyological nase zone before these contruction works (Bănărescu, 1964, Trifonov, 2019), today it can not fit in any natural ichthyological zone, respresenting a chaotic fish fauna skewed by a mix of different anthropogenically induced activities.

CONCLUSIONS

If this studied sector of the Olt River belonged to the natural ichthyological nase zone before these contruction works (Bănărescu, 1964, Trifonov, 2019), today it can not fit in any natural ichthyological zone, respresenting a chaotic fish fauna skewed by a mix of different anthropogenically induced activities, with disappearing native species and alien newcomers.

Pelecus cultratus (Linnaeus, 1758) fish species is locally extinct or at the brink of extinction in the studied area.

Babka gymnotrachelus (Kessler, 1857) fish species appeared in the last years in the study area and have good chances to establish permanent sustainable populations.

This research reveal mainly the fact that the fish community is changing, native species are impacted and alien species are coming, all of these due to the specific impact of habitat changes induced by the increasing local hydrotechnical constructions, all done in general without any slight concern or mitigation measures in relation to the environment and especially with no regard in this case for the Natura 2000 European network objectives and regulations.

Until the mentality of decision makers changes appropriately, the decreasing trend of this aquatic environment will continue and will accentuate.

ACKNOWLEDGEMENTS

The authors thank the European Union initiatives to protect the environmental values across Europe including the Natura 2000 network initiative, in spite of still some local resistance to these needed innovative conservation measures and changes.

REFERENCES

1. Adámek Z., Jurajdová Z., Janáč M., Zahrádkova S., Němejcová D. and Jurajda P., 2020 – The response of fish assemblages to human impacts along the lower stretch of the rivers Morava and Dyje (Danube river basin, Czech Republic), 135-150, in Human impact on Danube Watersheed biodiversity in theXXI Century, ISBN 978-3-030-37241, 437.
2. Afanasyev S., Lyashenko A., Iarochevitch A., Lietytska O., Zorina-Sakharova E. and Marushevska O., 2020 – Pressures and impacts on ecological status of surface water bodies in Ukrainean part of the Danube River basin, 327-358, in Human impact on Danube Watersheed biodiversity in the XXI Century, ISBN978-3-030-37241, 437.
3. Anastasiu P., Preda C., Bănăduc D. and Cogălniceanu D., 2017 – Alien species of European Union concern in Romania, *Transylvanian Review of Systematical and Ecological Research*, 19.3, The Wetlands Diversity, 93-106, ISSN-L 1841-7051, ISSN 2344-3219.
4. Antipa G., 1909 – Fauna Ihtiologică a României, Institutul de Arte Grafice "Carol Göbl", Bucureşti, Academia Română, Publicaţiile Fondului Adamachi, XVI, 294. (in Romanian)
5. Badea L. (coord.), 1983 – Geografia României I, Geografia Fizică, Edit. Academiei Române, 662. (in Romanian)
6. Barnosky A. D., Matzke N., Tomiya S., Wogan G. O. U., Swartz B., Quental T. B., Marshall C., McGuire J. L., Lindsey E. L., Maguire K. C., Mersey B. and Ferrer A., 2011 – Has the Earth's sixth mass extinction already arrived? *Nature,* 471, 51-57.
7. Bănăduc D., 2001 – Specii de peşti dulcicoli şi migratori în mediul dulcicol, de interes comunitar, prezente în România, în Natura 2000 în România. Conservarea speciilor şi habitatelor acvatice, coordonator Curtean-Bănăduc Angela, Edit. Alma Mater Sibiu, ISBN 973-632-243-2, 72-81. (in Romanian)
8. Bănăduc D., 2006 – Important areas for fish in Romania – Preinventory for a draft list of Natura 2000 sites (SCIs) for five fish species, 62.
9. Bănăduc D., 2007a – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus species (Romania), *Brukenthal Acta Musei*, II.3, 105-108.
10. Bănăduc D., 2007b – Middle Olt River (Transylvania, Romania) – special area for conservation (Natura 2000 site) proposal for Barbus meridionalis Risso, 1827 and associated fish species, *Acta Ichtiologica Romanica*, II, 37-42.
11. Bănăduc D., 2007c – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus Lukasch, 1933 species in the Danube Delta (Romania), *Acta oecologica – Studii şi Comunicări de Ecologie şi Protecţia Mediului*, XIV, 1-2, Edit. Universităţii "Lucian Blaga" din Sibiu, 127-135.
12. Bănăduc D., 2008a – Natura 2000 sites proposal for the European community interest cottidae fish species (Romania), *Transylvanian Review of Systematical and Ecological Research*, 6, Edit. Universităţii "Lucian Blaga" din Sibiu, ISSN 1841-7051, 191-198.
13. Bănăduc D., 2008b – Natura 2000 sites proposals for the Europen Community interest Cyclostomata fish species conservation (Romania), *Acta Oecologica Carpatica*, I, 83-88.
14. Bănăduc D., 2008c – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus Lukasch, 1933 species in the Lower Caraş River (Banat, România), *Acta Oecologica Carpatica*, I, 89-92.
15. Bănăduc D., 2008d – Mureș River Gorge (Transylvania, Romania) – special area for conservation (Natura 2000 Site) proposal for Gobio albipinnatus Lukasch, 1933 species, *Acta Ichtiologica Romanica*, III, 27-32.
16. Bănăduc D., 2008e – Umbra krameri Walbaum, 1792, a Natura 2000 protected fish species, in Romania, *Acta Ichtiologica Romanica*, III, 33-44.
17. Bănăduc D., 2008f – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus Lukasch, 1933 species in the Olt River – Danube River confluence*, Drobeta. Seria Ştiinţele Naturii*, Drobeta Turnu Severin, Edit. Universitaria Craiova, XVIII, 28-32.

18. Bănăduc D., Nagy A. and Bănăduc A., 2008 – New SCIS proposal regarding the ichthyofauna after the Continental Biogeographic Seminar for Romania, Sibiu (Transylvania, Romania) 9-12 June 2008, *Acta Oecologica Carpatica*, 145-162, V. 4.3.24.
19. Bănăduc D., 2009 – Lower Timiş River (Banat, Romania) – Special area for conservation (Natura 2000 site) for Gobio albipinnatus Lukasch, 1933, *Aquaculture, Aquarium, Conservation & Legislation International Journal of the Bioflux Society*, 2, 2, 147-151, ISSN-1844-9166.
20. Bănăduc D., 2010a – New SCIs proposal regarding the ichtiofauna after the Pannonian Biogeographic Seminar for Romania, Sibiu (Transylvania, Romania) 9-12 June 2008, *Acta Oecologica Carpatica*, III, ISSN 1221-5015, 117-122.
21. Bănăduc D., 2010b – New SCIs proposal regarding the ichtiofauna after the Pannonian Biogeographic Seminar for Romania, Sibiu (Transylvania, Romania) 9-12 June 2008*, Acta Oecologica Carpatica*, III, ISSN 1221-5015, 117-122.
22. Bănăduc D., 2010c – Hydrotechnical works impact on Cyclostomata and Cottidae species in the Rodna Mountains and Maramureş Mountains Natura 2000 sites (Eastern Carpathians, Romania), Repede River – A study case*, Transylvanian Review of Systematical and Ecological Research*, 9, Edit. Universităţii "Lucian Blaga" din Sibiu, ISSN 1841-7051, 175-184.
23. Bănăduc D., 2011a – New SCIS proposal regarding the ichtiofauna after the Alpine Biogeographic Seminar for Romania, Sibiu (Transylvania, Romania) 9-12 June 2008, *Acta Oecologica Carpatica*, 175-184, IV, 2011.
24. Bănăduc D., 2012 – Peşti de interes comunitar în Măsuri minime de management pentru menţinerea stării favorabile de conservare a habitatelor și speciilor de interes comunitar din Siturile Natura 2000, in Curtean-Bănăduc A. and Florescu F. (coord.), Edit. Universităţii "Lucian Blaga" din Sibiu, ISBN 978-606-12-0414-4, 230. (in Romanian)
25. Bănăduc D., Oprean L. and Bogdan A., 2011a – Fish species of community interest management issues in Natura 2000 site Sighișoara-Târnava Mare (Transylvania, Romania), *Revista Economică*, 3, 56, econ.ulbsibiu.ro, Crises after crisis inquiries from a national, European and Global perspective, II, 23-27, ISBN 978-606-12-0139-6.
26. Bănăduc D., Oprean L., Bogdan A. and Curtean-Bănăduc A., 2011b – The analyse of the trophic resources utilisation by the congeneric species Barbus barbus (Linnaeus, 1758) and Barbus meridionalis Risso, 1827 in Târnava River Basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 12, The Wetlands Diversity, Edit. Universităţii "Lucian Blaga" din Sibiu, ISSN 1841-7051, 101-118.
27. Bănăduc D., Nagy A. and Bănăduc A., 2012 – New SCIS proposal regarding the ichthyofauna after the Continental Biogeographic Seminar for Romania, Sibiu (Transylvania, Romania) 9-12 June 2008, *Acta Oecologica Carpatica*, 145-162, V.
28. Bănăduc D. and Curtean-Bănăduc A., 2013a – New SCIs proposal regarding the ichtiofauna for the Stepic Biogeographic area in Romania, 137-148, *Acta Oecologica Carpatica,* VI.
29. Bănăduc D. and Curtean-Bănăduc A., 2013b – Barbus meridionalis Risso 1827 (Syn. Barbus balcanicus): proposal for monitoring elements for Croatia, in the context of Natura 2000, *Transylvanian Review of Systematical and Ecological Research*, 15.1, Edit. Universităţii "Lucian Blaga" din Sibiu, ISSN 1841-7051, 163-182.
30. Bănăduc D., Bănăduc A., Lenhardt M. and Gutti G., 2014 – The "Porţile de Fier/Iron Gates" Nature Park (Romania) some Danube northern tributaries fish fauna 16, 171-196.
31. Bănăduc D., Cismaş I.-C., Curtean-Bănăduc A., 2015 – Barbus meridionalis Risso 1826 on site decisions support management system – a Transylvanian Natura 2000 Site study case, *Acta Oecologica Carpatica*, VIII, Edit. Universităţii "Lucian Blaga" din Sibiu, 173-188.

32. Bănăduc D., Cismaș I.-C. and Curtean-Bănăduc A., 2016a – Barbus meridionalis Risso, 1827 populations system support for management decisions Sighişoara-Târnava Mare Natura 2000 Site – study case, *Romanian Journal of Biology – Zoology*, Bucharest, 61, 1-2, 91-102.
33. Bănăduc D., Rey S., Trichkova T., Lenhardt M. and Curtean-Bănăduc A., 2016b – The Lower Danube River – Danube Delta – North West Black Sea: A pivotal area of major interest for the past, present and future of its fish fauna – A short review, *Science of the Total Environment*, 545-546, 137-151, DOI: 10.1016/j.scitotenv.2015.12.058, ISSN 0048-9607, eISSN 1879-1026.
34. Bănăduc D., Cismaș C.-I., Pătrulescu A., Voicu R. and Curtean-Bănăduc A., 2017 – Cobitis taenia Linnaeus, 1758 species populations management support system in Natura 2000 Site Sighişoara-Târnava Mare (ROSCI0227), *Acta Oecologica Carpatica*, X.II, 61-72.
35. Bănăduc D., Joy M., Olosutean H., Afanasyev S., Curtean-Bănăduc A., 2020a – Natural and anthropogenic driving forces as key elements in the Lower Danube Basin – South-Eastern Carpathians – North-Western Black Sea coast area lakes: a broken stepping stones for fish in a climatic change scenario? *Environmental Sciences Europe*, 32, 1-14.
36. Bănăduc D., Voicu R. and Curtean-Bănăduc A., 2020b – Sediments as factor in the fate of the threatened endemic fish species Romanichthys valsanicola Dumitrescu, Bănărescu and Stoica, 1957 (Vâlsan River basin, Danube Basin), *Transylvanian Review of Systematical and Ecological Research*, 22.2, 15-30, ISSN-L 1841-7051, ISSN 2344-3219.
37. Bănăduc D., Sas A., Cianfaglione K., Barinova S. and Curtean-Bănăduc A., 2021 – The role of aquatic refuge habitats for fish, and threats in the context of climate change and human impact, during seasonal hydrological drought in the Saxon Villages area (Transylvania, Romania), *Atmosphere*, 12, 9, 1209, https://doi.org/10.3390/atmos12091209, 2021.
38. Bănăduc D., Curtean-Bănăduc A., Cianfaglione K., Akeroyd J.R. and Cioca L.-I., 2021a – Proposed environmental risk management elements in a Carpathian valley basin, within the Roşia Montană European historical mining area, *International Journal of Environmental Research and Public Health*, 18, 9, 4565, 10.3390/ijerph18094565.
39. Bănăduc D., Voicu R., Voicu L., Baki A. B. M., Serrano I., Barb C. and Curtean-Bănăduc A., 2021b – Coştei hydrographic diversion node, a historical environment quality and biological resources accessibility game changer (Middle Danube Watershed); anthropogenic induced problems and sustainable solutions – an ichthyologic perspective, *Transylvanian Review of Systematical and Ecological Research*, 21.3, 87-114.
40. Bănăduc D., Marić S., Cianfaglione K., Afanasyev S., Somogyi D., Nyeste K., Antal L., Koščo J., Ćaleta M., Wanzenböck J. and Curtean-Bănăduc A., 2022a – Stepping stone wetlands, last sanctuaries for European mudminnow: how can the human impact, climate change, and non-native species drive a fish to the edge of extinction? *Sustainability*, 14, 13493, 1-39, 10.3390/su142013493.
41. Bănăduc D., Simić V., Cianfaglione K., Barinova S., Afanasyev S., Öktener A., McCall G., Simić S. and Curtean-Bănăduc A., 2022b – Freshwater as a sustainable resource and generator of secondary resources in the 21st century: stressors, threats, risks, management and protection strategies, and conservation approaches, *International Journal of Environmental Research and Public Health*, 19, 16570, 1-30, 10.3390/ijerph192416570.
42. Bănăduc D., Barinova S., Cianfaglione K. and Curtean-Bănăduc A. 2023 – Editorial: Multiple freshwater stressors-Key drivers for the future of freshwater environments, *Frontiers in Environmental Science*, 11, 1143706, 1-3, 10.3389/fenvs2023.1143706.
43. Bănărescu P. M. 1964 – Fauna R.P.R. Pisces-Osteichthyes (Peşti Ganoizi şiOsoşi), vol. XIII, Edit. Acad.R.P.R.Bucureşti, 959. (in Romanian)
44. Bănărescu P. M., 1999 – Micro-evolutionary and dispersal problems in fishes involving the Olt River basin (Transylvania, Romania) TRSER 1, 165-168.
45. Bănărescu P. M. and Bănăduc Doru., Habitats Directive (92/43/EEC) fish species (Osteichthyes) on the Romanian territory, Acta Ichtiologica Romanica, Vol. II, pp. 43-78, 2007.

46. Bielz Ernst Alb., 1853 – Übersicht der lebenden Fische Siebenbürgens, Verh Mitth Sieb Verein Naturwiss Hermannstadt 4, 10, 172-185. (in German)
47. Blidaru V., Georgescu I., Gheorghiu I. M. and Vlădescu D., 1962 – Hidroameliorațiile în Republica Populară Română, Monografie, Edit. Agro-Silvică, București.
48. Boeraş I., Burcea A., Coman C., Bănăduc D. and Curtean-Bănăduc A., 2021 – Bacterial microbiomes in the sediments of lotic systems ecologic drivers and role: a case study from the Mureş River, Transylvania, Romania, *Water*, 13, 3518, https://doi.org/10.3390/w13243518.
49. Boeraş I., Curtean-Bănăduc A., Bănăduc D. and Cioca G., 2022a – Anthropogenic sewage water circuit as vector for SARS-CoV-2 viral ARN transport and public health assessment, monitoring and forecasting – Sibiu metropolitan area (Transylvania/Romania) study case, *International Journal of Environmental Research and Public Health*, 19, 11725, 10.3390/ijerph191811725.
50. Boeraş I., Curtean-Bănăduc A., Bănăduc D. and Cioca G., 2022b – Anthropogenic sewage water circuit as vector for SARS-CoV-2 viral ARN transport and public health assessment, monitoring and forecasting – Sibiu metropolitan area (Transylvania/Romania) study case, *International Journal of Environmental Research and Public Health*, 19, 11725, 10.3390/ijerph191811725.
51. Burcea A., Boeraş I., Mihuţ C.-M., Bănăduc D., Matei C. and Curtean-Bănăduc A., 2020 – Adding the Mureş River Basin (Transylvania, Romania) to the list of hotspots with high contamination with pharmaceuticals, *Sustainability*, 12, 23, 10197, doi:10.3390/su122310197, Special Issue Landscape, Water, Ground, and Society Sustainability under Global Change Scenarios, 19.
52. Burga C. A. and Landolt E., 2020 – The Upper Engadine – headwater region of the river Inn. A Swiss hot spot ofplant diversity and premium tourism region, 49-64, In Human impact on Danube Watersheedbiodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
53. Ćaleta M., Musta ć P., Zanella D., Buj I., Marčić Z. and Mrakovčić M., 2020 – Human impacts of the Dobra River (Croatia), 151-168, in Human impact on Danube Watersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
54. Čarni A. and Juvan N., 2020 – Forest vegetation along the Mura River in Slovenia, 119-134, in Human impacton Danube Watersheed biodiversity in the XXI Century, 437.
Constantinescu M. and Pâslaru M. (coord.) – Hidroconstrucția S. A., Hydraulics constructions in Romania, Edit. Arta Grafică, 322.
55. Cianfaglione K. and Pedroti F., 2020 – Italy in the Danube: territory, landscape, environment, vegetation, fauna,culture, human management and outlooks for the future, 87-118, in Human impact on DanubeWatersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
56. Cocan D. and Mireșan V., 2018 – Ihtiologie, I, Sistematica și morfologia peștilor, Edit. Colorama, 559.
57. Costea M., 1999 – Preliminary data concerning the avifauna of Brădeni – Fishponds (Hârtibaci Valley, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 197-202.
58. Costea G., Push M. T., Bănăduc D., Cosmoiu D. and Curtean-Bănăduc A., 2021 – A review of hydropower plants in Romania: distribution, current knowledge, and their effects on fish in headwater streams, *Renewable & Sustainable Energy Reviews*, 54, 111003, ISSN 1364-0321, https://doi.org/10.1016/j.rser.2021.111003.
59. Constantinescu D. T., 1989 – Construcții monumentale, Edit. Științifică și Enciclopedică, București, 494.
60. Curtean A., Morariu A., Făcălău S., Lazăr B. and Buian G., 1999 – Data concerning the benthic communities of the Cibin River; Olt River basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 99-110.
61. Curtean-Bănăduc A. and Florescu F., 2007 – Romanian Natura 2000 NGO Coalition contribution for the SCIs designation, ISBN 978-973-632-402-4, 212.

62. Curtean-Bănăduc A. and Bănăduc D., Bucşa C., 2007 – Watersheds management (Transylvania/Romania): implications, risks, solutions, Strategies to enhance environmental Security in transition countries, NATO Science for Peace and Security Series C-Environmental Security, Springer, 225-238, DOI: 10.1007/978-1-4020-5996-4_17, ISSN 1971-4668, ISBN 978-1-4020-5994-0.
63. Curtean-Bănăduc A. and Bănăduc D., 2008 – Trophic elements regarding the non-indigenous Pseudorasbora parva (Schlegel) 1842 fish species spreading success – Olt River Basin,a case study, *Journal of Bioloy – Zoology*, 52-53, Edit. Academiei Române, 33-52, 2007-2008.
64. Curtean-Bănăduc A., Schneider-Binder E., Bănăduc D., 2014 – The importance of the riverine ligneous vegetation for the Danube Basin lotic ecosystems, in Cianfaglione K. (ed.), L'importanza degli Alberi e del Bosco. Cultura, scienza e coscienza del territorio, Temi Ed., Trento, Italia, ISBN: 978-88-973772-63-9, I-II, 187-210.
65. Curtean-Bănăduc A. and Bănăduc D., 2015 – The Transylvanian Water Tower through history, *Danube News*, 32, 17, 1-4.
66. Curtean-Bănăduc A., Cismaș I.-C. and Bănăduc D., 2015 – Pelecus cultratus (Linnaeus, 1758) on site management decisions support system – a Carpathian Natura 2000 site study case, *Romanian Journal of Biology – Zoology*, Bucharest, 60, 1, 27-37.
67. Curtean-Bănăduc A., Bănăduc D., Burcea A., Berg V., Lyche J. L. and Gheorghe L. M., 2016 – Persistent organic pollutants in Mureș watershed, in The impact of persistent organic pollutants on freshwater ecosystems and human health, editor Curtean-Bănăduc A., Publisher "Lucian Blaga" University of Sibiu, ISBN 978-606-12-1411-2, 117-152, 152.
68. Curtean-Bănăduc A., Didenko A., Guti G. and Bănăduc D., 2018 – Telestes souffia (Risso, 1827) species conservation at the eastern limit of range – Vişeu River basin, Romania, *Applied Ecology and Environmental Research*, 16, 1, 291-303, DOI: http://dx.doi.org/10.15666/aeer/1601_291303.
69. Cismaș C., Bănăduc D. and Curtean-Bănăduc A., 2018 – Diversion of fishing pressure on the economically important species Barbus barbus (Linnaeus, 1758) to protect the community interest congeneric Barbus meridionalis Risso, 1826, based on a decision-support management system, *Transylvanian Review of Systematical and Ecological Research*, 20.2, 63-74, ISSN-L 1841-7051, ISSN 2344-3219.
70. Curtean-Bănăduc A., Marić S., Gabor G., Didenko A., Rey Planellas S. and Bănăduc D., 2019 – Hucho hucho (Linnaeus, 1758): last natural viable population in the Eastern Carpathians – conservation elements, *Turkish Journal of Zoology*, 43, 2, 215-223, 10.3906/zoo-1711-52, 2019, ISSN: 1300-0179, eISSN: 1303-6114.
71. Curtean-Bănăduc A., Burcea A., Mihuț C.-M., Berg V., Lyche J. L. and Bănăduc D., 2020 – Bioaccumulation of persistent organic pollutants in the gonads of Barbus barbus (Linnaeus, 1758), *Ecotoxicology and Environmental Safety*, 201, 110852, 10, https://doi.org/10.1186/s12302-020-00348-z.
72. Curtean-Bănăduc A., Burcea A., Mihuţ C.-M., Berg V., Lyche J. L. and Bănăduc D., 2020 – Bioaccumulation of persistent organic pollutants in the gonads of Barbus barbus (Linnaeus, 1758), *Ecotoxicology and Environmental Safety*, 201, 110852, 10, https://doi.org/10.1186/s12302-020-00348-z.
73. Curtean-Bănăduc A., Burcea A., Mihuţ C.-M. and Bănăduc D., 2021 – The benthic trophic corner stone compartment in POPs transfer from abiotic environment to higher trophic levels – Trichoptera and Ephemeroptera pre-alert indicator role, *Water*, 13, 13, 1778, doi.org/10.3390/w13131778, 57-68.
74. Curtean-Bănăduc A., Mihuț C., Burcea A., McCall G. S., Matei C. and Bănăduc D., 2023 – Screening for Microplastic uptake in an urbanized freshwater ecosystem: Chondrostoma nasus (Linnaeus, 1758) case study, *Water*, 15, 1578.

75. Dekić R., Ivanc A., Ćetković D. and Lolić S., 2020 – Anthropogenic impact and environmental quality ofdifferent tributaries of the river Vrbas (Bosnia and Herzegovina), 169-214, in Human impact on Danube Watersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
76. Diaconu C. and Stănculescu S., 1971 – Rîurile României, Monografie Hidrologică, Institutul de Meteorologie și Hidrologie, 750. (in Romanian)
77. Đikanović V., Nikčević M., Mićković B., Hegediš A., Mrdak D. and Pešić, V., 2020 – Anthropogenic pressures on watercourses of the Danube River basin in Montenegro, 241-256, in Human impact on DanubeWatersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
78. Dippong T., Mihali C., Marian M., Roșca O M. and Resz M.-A., 2023 – Correlations between chemical, hydrological and biotic factors in rivers from the protected area of Tisa Superioară, Romania, *Process Safety and Environmental Protection*, 176, 40-55.
79. Drăgulescu C., 1999 – The hydrophilous and hygrophilous flora and vegetation from the upper and middle Olt River Valley (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 13-30.
80. Erős T., Bammer V., György Á. I., Pehlivanov L., Schabuss M., Zornig H., Weiperth A. and Szalóky Z., 2017 – Typology of a great river using fish assemblages: implications for the bioassessment of the Danube River, *River Research and Applications*, 33, 37-49.
81. Fântână C., Szabó Z., Nagy Z. and Tioc T., 1999 – Data on the avifauna from the Olt and Cibin valleys (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 183-190.
82. Florea L., Strătilă S. D. and Costache M., 2014 – The assessment of community interest fish species from protected area ROSCI0229, *Transylvanian Review of Systematical and Ecological Research*, 16.1, 73-96.
83. Gheoca V. and Popovici P., 1999 – Aspects of the terrestrial malacofauna from the upper and middle region of the Olt River valley (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 123-128.
84. Giurescu C. C., 1964 – Istoria pescuitului și a pisciculturii în România, I. (in Romanian)
85. Gyöngivér M., Ghira I. and Levente F., 1999 – Preliminary report on herpetofauna of the upper and middle Olt River basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 169-182.
86. Jablonski D., 1994 – Extinctions in the fossil record. Philosophical Transactions of the Royal Society of London, B 344, 11-17.
87. Kalchev R., Beshkov V., Bogdanović T., Coman A., Edinger M., Hein T., Ivanov B., Krasic D., Mihaljevic M., Pehlivanov L., Puzovic S., Sandu C., Stojnic N., Vasilev M. and Vujic A., 2010 – Verterbate species distribution in selected wetlands of the Danube River basin, *Transylvanian Review of Systematical and Ecological Research*, 10, 151-168.
88. Kenderv L. and Trichkova T., 2020 – Long-term changes in the ecological conditions of the Iskar River (DanubeRiver basin, Bulgaria), 393-424, in Human impact on Danube Watersheed biodiversity in the XXICentury, ISBN 978-3-030-37241, 437.
89. Kostov V., Slavevska-Stamenkovic V., Ristovska M., Stojov V. and Marić S., 2020 – Characteristics of the Danube drainage area in the Republic of Macedonia, 381-392, in Human impact on DanubeWatersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
90. Lenhardt M., Jarić I., Kolarević S., Vuković-Gačić B., Knezević-Vukčević J., Smederevac-Lalić M. and Gačić V., 2016 – Impact of human activities on the status of the Danube River in Serbia: microbiological and ichthyofaunistic studies, *Acta Oecologica Carpatica* IX, 151-176.
91. Lenhardt M., Smederevac-Lalić M., Hegediš A., Skrić S., Cvijanović G., Višnjić-Jeftić Ž., Djikanović V., Jovičić K., Jaćimović M. and Jarić I., 2020 – Human impacts on fish fauna in the Danube River in Serbia:current status and ecological implications, 257-280, in Human impact on Danube Watersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.

92. Lyashenko A. V., Afanasyev S., Sandu C., Zorina-Sakharova K., Manturova O., et al., 2018 – Hydrobiocenoses of the transboundary sections of the Ukrainean and Romanian parts of the Danube Delta, ISBN: 978-617-7301-58-1.
93. Maślanko W., Ferencz B. and Dawidek J., 2020 – State and changes of natural environment in Polish part ofthe Danube River basin Poland, 301-326, in Human impact on Danube Watersheed biodiversity in theXXI Century, ISBN 978-3-030-37241, 437.
94. Mišiková E. and Makovinská J., 2020 – Assessment of the aquatic ecosystem in the Slovak stretch of the Danube River, in Human impact on Danube Watersheed biodiversity in the XXI Century, 281-300, ISBN 978-3-030-37241, 437.
95. Momeu L., Rasiga A., Péterfi Ș. and Kozma A., 1999 – Algal communities of the Cibin River and of some wetlands situated on the upper and middle course of the Olt River (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 49-66.
96. Momeu L., Battes K. W., Battes K. P., Stoica I., Cîmpean M., Pricope F. and Ureche D., 2009 – Algal, macroinvertebrate and fish communities from the Arieș Catchment area (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 7, 179-180.
97. Mutihac V., 1990 – Structura geologică a teritoriului României, Edit. Tehnică, Bucureşti, ISBN 973-31-0193-8, 418. (in Romanian)
98. Năstase A. and Oțel V., 2016 – Researches on the fish fauna in some SCIs Natura 2000 from Romania, *AACL Bioflux*, 9, 3, 527-540.
99. Năstase A. and Oțel V., 2017 – Fish fauna status of the Natura 2000 sites proposal as new or for extension in the rivers Someș and Mureș (Romania), *Transylvanian Review of Systematical and Ecological Research*, 19, 19.3, 57-74.
100. Nicolaev S., Maximov V., Niță V., Zaharia T. and Nenciu M.-I., 2018 – Marine protected areas management: interaction with commercial fisheries in Natura 2000 sites along the Romanian Black Sea Coast, *Revista Cercetări Marine – Revue Recherches Marines – Marine Research Journal,* 48, 1, DOI: https://doi.org/10.55268/CM.2018.48.5.
101. Nikolić V., Nedić Z., Jurlina D. S., Djikanović V., Kanjuh T., Marić A. and Simonović, 2023 – Status and perspectives of the ichthyofauna of the Labudovo okno Ramsar Site: an analysis of 14 years of data, *Sustainablity*, 15, 9303.
102. Novacek M. J. (ed.), 2002 – The Biodiversity Crisis: Losing What Counts, The New Press.
103. Priscu R., 1974 – Construcții Hidrotehnice, Edit. Didactică, București, 995.
104. Onciu T.-M., Radu A. and Galațchi L.-D., 1999 – Contributions to the knowledge of the zooplankton from the Olt River (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 67-76.
105. Oțel V., 2007 – Atlasul peștilor din Rezervația Biosferei Delta Dunării, Edit. Centrul de Informare Tehnologică Delta Dunării, Tulcea, 481.
106. Polačik M., Trichkova T., Janáč M., Vassilev M. and Jurajda P., 2008 – The ichthyofauna of the shoreline zone in the longitudinal profile of the Danube River, Bulgaria, *Acta Zoologica Bulgarica*, 60, 1, 77-88.
107. Popa G.-O., Curtean-Bănăduc A., Bănăduc D., Florescu I. E., Burcea A., Dudu A., Georgescu S. E. and Costache M., 2016 – Molecular markers reveal reduced genetic diversity in Romanian populations of Brown Trout, Salmo trutta L., 1758 (Salmonidae), *Acta Zoologica Bulgarica*, 68, 3, 399-406, ISSN 0324-0770.
108. Popa G.-O., Dudu A., Bănăduc D., Curtean-Bănăduc A., Burcea A., Ureche D., Nechifor R., Georgescu S. E. and Costache M., 2019 – Genetic analysis of populations of brown trout (Salmo trutta L.) from the Romanian Carpathians, *Aquatic Living Resources*, 32, 23, 10, doi.org/10.1051/alr/2019021.
109. Rasiga A., Momeu L., Péterfi Ș. and Kozma A., 1999 – Biodiversity of algae of the upper and middle course of the Olt River (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 31-48.

110. Riede K., 2004 – Global register of migratory species – from global to regional scales, Final Report of the R&D-Projekt 808 05 081, Federal Agency for Nature Conservation, Bonn, Germany, 329.
111. Roşu A., 1973 − Geografia fizică a României, Edit. Didactică şi Pedagogică, Bucureşti, 435. (in Romanian)
112. Schneider-Binder, E. 2020 – The habitats along the upper Danube in Germany and changes to them inducedby human impacts, 27–49, in Human impact on Danube Watersheed biodiversity in the XXI Century, ISBN 978-3-030-37241, 437.
113. Sîrbu I., Sárkány-Kiss A., Petrescu M., Lazăr B. and Buian G., 1999 – Contributions to the knowledge of the freshwater Mollusks fauna from the upper and middle Olt River basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 111-122.
114. Snigirova A., Bogatova Y. and Barinova S. 2021 – Assessment of river-sea interaction in the Danube nearshore area (Ukraine) by bioindicators and statistical mapping, *Land*, 10, 3, 310, https://doi.org/10.3390/land10030310.
115. Stojkovic Piperac M., Milošević D., Čerba D. and Simić V. M., 2022 – Fish communities over the Danube wetlands in Serbia and Croatia, Small Water Bodies of the Western Balkans, DOI: 10.1007/978-3-030-86478-1-16.
116. Szállássy N., 1999 – Contributions to the knowledge of the mayfly larvae (Insecta: Ephemeroptera) from the Olt River Basin (Transylvania), *Transylvanian Review of Systematical and Ecological Research*, 1, 143-148.
117. Şerban V. and Busuioc C., 1999 – Some aspects concerning the benthal fauna in the upper and middle Olt River basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 91-98.
118. Tatole V., 1999 – Tendecies of the taxonomic dynamics of the aquatic invertebrate fauna from middle Olt River section, *Transylvanian Review of Systematical and Ecological Research*, 1, 77-90.
119. Tecuci I., 1989 – Lucrări de gospodărirea apelor ân R. S. R., baraje, lacuri de acumulare, derivații, aducțiuni și alte amenajări complexe, Monografie, Consiliul Național al Apelor, Litografia I.C.P.G.A., București.
120. Telcean I., Cicort-Lucaciu A.-Ș., Sas-Kovacs I. and Covaciu-Marcov S.-D., 2011 – Romanichthys valsanicola is still fighting! How can we help? *North-Western Journal of Zoology*, 7, 2, 334-338.
121. Trichkova T., Stefanov T., Vassilev M. and Zivkov M., 2009 – Fish species diversity in the rivers of the north-west Bulgaria *Transylvanian Review of Systematical and Ecological Research*, 8, 161-168.
122. Trifonof P., 2019 – Ape, pești și pescuit în Țara Făgărașului, ISBN 978-973-0-28676-2, 146.
123. Ujvári I., 1972 – Hidrografia Republicii Socialiste România, Bucureşti, Edit. Ştiinţifică, 590. (in Romanian)
124. Ujvárosi L. and Chişu S., 1999 – Contributions to the knowledge of the caddis flies (Insecta: Trichoptera) fauna of the Olt River basin (Transylvania, Romania), *Transylvanian Review of Systematical and Ecological Research*, 1, 129-142.
125. Vasiliu G. D. and Manea G. I., 1987 – Istoria ihtiologiei Românești, *Buletinul de Cercetări Piscicole*, Supliment I, Intreprinderea Poligrafică Bucureștii Noi, București, 332. (in Romanian)
130. Velcea V. and Savu A., 1982 – Geografia Carpaţilor şi a Subcarpaţilor Româneşti, Edit. Didactică și Pedagogică, Bucureşti. (in Romanian)
131. Witkowski A., Bajić A., Treer T., Hegedis A., Marić S., Sprem N., Piria M. and Kapusta A., 2013 – Past and present of and perspectives for the Danube huchen, Hucho hucho (L.) in the Danube basin, *Archives of Polish Fisheries*, 21, 3, 129-142.
132. *, https://ec.europa.eu/environment/nature/natura2000/index_en.htm

133. **, https://eunis.eea.europa.eu/sites/ROSCI0132
134. *** https://eunis.eea.europa.eu/sites/ROSCI0132
135. ****, https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=ROSCI0132