ROMANOGOBIO BANATICUS (BĂNĂRESCU, 1960) IN THE NERA RIVER (DANUBE BASIN)

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ABSTRACT

Romanogobio banaticus it is a species of conservation interest with a small distribution range in the south-west of the Romanian Carpathians basin. In spite of the presence of some moderate anthropogenic threats and risks, the Nera River is a sanctuary for this fish. The lower latitude of Nera in comparison with other rivers where this fish is living, explain its presence in an atypical ichthyological zone. This species presence is permanent, the abundance is relatively high, the age structure is well balanced, more than that, in some sectors is a co-dominant species, all of these revealing a favourable conservation status.

RÉSUMÉ: *Romanogobio banaticus* (Bănărescu, 1960) dans la rivière Nera (bassin du Danube).

Romanogobio banaticus est une espèce d'intérêt pour la conservation avec une petite aire de répartition dans le sud-ouest du bassin des Carpates roumaines. Malgré la présence de quelques menaces et risques anthropiques modérés, la rivière Nera est un sanctuaire pour ce poisson. La latitude plus basse de Nera par rapport aux autres rivières où vit ce poisson explique sa présence dans une zone ichtyologique atypique. Cette présence d'espèce est permanente, l'abondance est relativement élevée, la structure d'âge est bien équilibrée, plus que cela dans certains secteurs est une espèce co-dominante, tout cela révélant un état de conservation favorable.

REZUMAT: *Romanogobio banaticus* (Bănărescu, 1960) în râul Nera (bazinul Dunării).

Romanogobio banaticus este o specie de interes conservativ cu o arie de distribuție mică în partea de sud-vest a bazinului Carpaților Românești. În ciuda prezenței unor amenințări și riscuri antropogene, râul Nera este un sanctuar pentru acest pește. Latitudinea mai scăzută a Nerei în comparație cu alte râuri unde acest pește trăiește, explică prezența acestuia într-o zonă ihtiologică atipică. Prezența acestei specii este permanentă, abundența este relativ ridicată, structura pe vârste este echilibrată, și mai mult decât atât în unele sectoare este specie co-dominantă, toate acestea relevând o stare favorabilă de conservare.

INTRODUCTION

The talent, inspiration and dedication of pioneering scientific personalities like Grigore Antipa or Petru Mihai Bănărescu, to mention only the most representative Romanian ichthyologists, as well as the next generations of fish biology and ecology experts, led to the initiation and consolidation in this country at an international scientific level of an ichthyology school with exceptional results. The almost three centuries of ichthyological studies have led to the accumulation of some special qualitative and quantitative data, and new studies can benefit in principle from the previous results obtained in the field, for comparison reasons.

Why in principle? Although the number of existent fish taxa is relatively small and the national territory has been relatively well covered by studies, the increase of direct or indirect human impact on them, create a neccesity for more screenings of them.

Following the bibliographical analysis regarding genus *Gobio* representatives since 1726 on the Romanian territory (Curtean-Bănăduc et al., 2014a,b, 2019; Bănăduc, 2001, 2003a,b, 2004a-c, 2007a-e, 2008a-d, 2009, 2017; Bacalu et al., 1995; Bănărescu, 1947, 1952, 1953, 1954, 1956, 1962, 1964, 1965a,b, 1970, 1992a,b, 1994; Bănărescu and Nalbant, 1973; Antonescu 1934, 1957; Băcescu, 1947; Simionescu, 1923; Antipa, 1909), some elements still require extensive or intensive studies in the Romanian freshwaters. Consequently such a bibliographical analysys reveal the need for update field work based studies related to the *Gobio* genus representatives in terms of distribution and ecological status.

Such a case is addressed in the present study, the authors proposing the identification of the current distribution, threats and risks, and the evaluation of the general ecological status of the species *Romanogobio banaticus* in the Nera River (Danube Basin).

Romanogobio banaticus/Gobio kessleri banaticus (Bănărescu, 1960) (Fig. 1) (Teleostei, Cypriniformes, Gobionidae) it is a freshwater, benthopelagic fish, with a maximum length of 8.5 cm living in the temperate zone, in Europe, Romania, namely with important populations in two medium sized watersheds: Nera and Timiș. This species was found also in Crișul Alb, Crișul Negru, Bega, and Caraș rivers (Bănărescu, 1964; Bănăduc, 2004a).

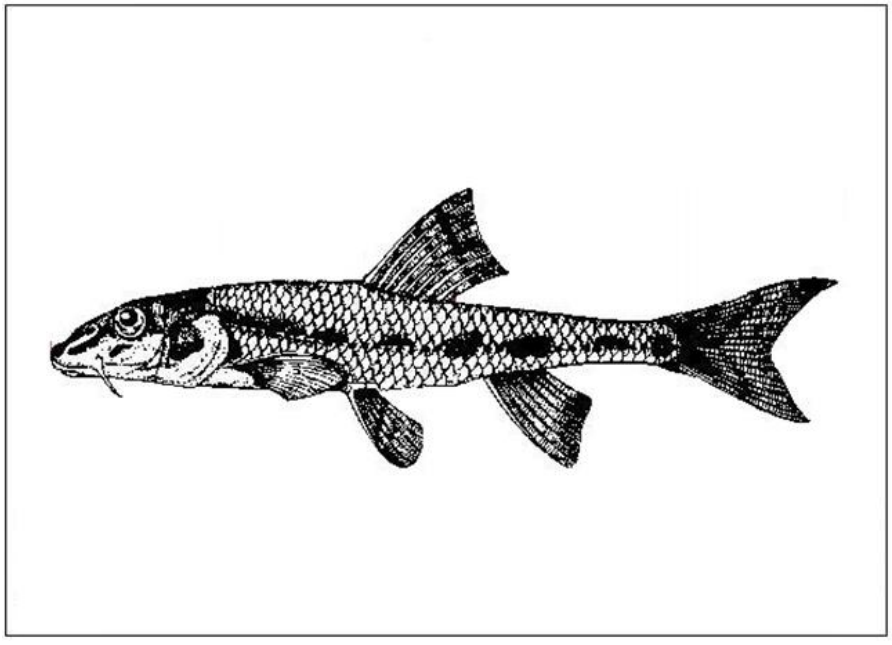

Figure 1: *Romanogobio banaticus/Gobio kessleri banaticus* (Bănărescu, 1964).

Nera and Timiș rivers springs both from the Semenic Mountains and cross a very complex and relatively isolated geographical areas (Diaconu, 1971; Ujvari, 1972; Oancea and Velcea, 1987; Badea and Bugă, 1992).

At least at a first glance the specific local/regional environmental conditions push the evolutionary processes in forming and conserving this fish in the area. With a different general flow direction, another two relatively similar rivers as dimensions of the area, Bârzava and Caraș rivers suffered a more accentuated human impact in the last centuries and this fish was not signalled in them, may be correlated with this significant human impact acting on them. In comparison with the majority of other species of this genus the distribution range of *Romanogobio banaticus* is relatively limited. This area defined from the relief point of view by the Banatului Mountains and its surrounding hills and plains landscape with some interrelated environmental characteristics, probably offer the conditions for this species appearance and survival. Still the relatively small distribution area under a direct and indirect human impact on the characteristic habitats and associated biota including fish, can be a risk factor for this species existence and survival. This induces the need for periodical updates regarding information about distribution range and ecological status of *Romanogobio banaticus*. This was the goal of this study due to the old and incomplete data regarding this species.

The Nera River is located in the south-west part of Romania and has an east-west orientation, with a length of 131 km, springs from the Semenic Mountains, below the Piatra Goznei Peak (1,447 m), and flows into the Danube River; before its discharge, along a length of 15 km, the Nera constitutes the border between Romania and Serbia. The narrow valley carved into the Jurassic rocks constitutes the Nera Gorges. It collects 36 tributaries, the length of the hydrographic network is 574 km, the density is 0.42 km/km^2. The multiannual average runoff has values between 20 l/s x km^2, in the highland area with altitudes of 800-900 m, and below 8 l/s x km^2, in the lower areas, below 400 m altitude. The average flow in the Sasca section is around 1,700 l/s. The area of the basin is 1,240 km^2. The Nera River runs 23 km through the Nera National Park, where it separates the Anina Mountains from the Locvei Mountains. (*; Diaconu, 1971; Ujvari, 1972; Oancea and Velcea, 1987; Badea and Bugă, 1992)

This hydrological basin includes a lotic systems network formed of Nera River and its tributaries: left side tributaries – Cremenița, Ogașul Bogozului, Ogașul Babei, Ogașul Mare, Valea Haimeliug, Ogașul Porcului, Ogașul Ulmu Mic, Ogașul Ulmu Mare, Ogașul Porcarului, Ogașul Rintu, Ogașul Cracu Lung, Şuşara, Valea Fântâna Seacă; and right side tributaries – Valea Miniș, Ogașul Lighidia, Ogașul Agrișul, Ogașul Lăpușnic, Ogașul Moceriș, Valea Ducin, Ogașul Bresnic, Ogașul Țârcovița, Ogașul Alunilor, Ogașul Radovanului, Valea Rea, Valea Padina Seacă, Valea Lindina, Valea Beiului, Pârâul Vicinic, Valea Ilidia, Valea Baca, Valea Ghicin, Valea Ciclova, Valea Oraviței, etc. (*; Diaconu, 1971; Ujvari, 1972; Oancea and Velcea, 1987; Badea and Bugă, 1992; Posea, 2006)

The diversity of habitats and ecosystems in a relatively small geographical area is induced by the complexity of the regional relief. The Semenic Mountains are part of the Banat Mountains. This geographical area has a very complex geology and varied relief, a fact which created the characteristic, extremely variable habitats, biocoenosis, and ecosystems. The main features of the relief include interfluvial ridges, interfluves, and deep river valleys and gorges. (*; Diaconu, 1971; Ujvari, 1972; Oancea and Velcea, 1987; Badea and Bugă, 1992; Posea, 2006)

MATERIAL AND METHODS

The presence/absence of *Romanogobio banaticus* (Figs. 2 and 3) in Nera River was signaled based on electrofishing with a Hans Grassl IG 600TL device, in time (45 minutes)/effort unit, from every two-three km length river sectors, from the river springs to its outflow in the Danube, in a total of 48 sampling sectors of 100 m long. After fast visual indentification, the fish were released in the habitat of origin. In this paper is presented only the river sector where the target species was found, between Pătaș and Zlatița.

Figure 2: Sampled *Romanogobio banaticus*.

Figure 3: Sampled *Romanogobio banaticus*.

RESULTS

The studied species was found in 25 sampling stations on all the Nera River (Tab. 1).

Table 1: Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.. In the table is presented only the river sector where the target species was found, between Pătaș and Zlatița localities.

S.S.	L.	GIS	D.	N.	H.D.	P.F.S.
N1	Pătaș Village, downstream of Borlovenii Vechi	N 44º57.125' E 22º06.140'	07.07.2022	1	Substrate dominated by rocks, gravel and isolated patches of sand and mud. Water width between 10-15 m. Riparian vegetation in favorable condition, consisting of tall trees (*Alnus glutinosa, Salix alba*). High degree of water shading. Submersed aquatic vegetation. Stable banks, without signs of erosion.	*Alburnoides bipunctatus*
N2	Upstream of Pârlipeț Village	N 44º55.866' E22º04.401'	08.07.2022	3	Gravel and boulder substrate, with isolated rocky sections. Water width between 10-15 m. Steep right bank, small slope on the left bank. Moderate water turbidity. Riparian vegetation in favourable condition consisting of tall trees, shrubs and herbaceous vegetation. High degree of water shading. Stable banks, without signs of erosion.	*Alburnoides bipunctatus*
N3	Downstream of Pârlipeț Village	N 44º55.726' E 22º02.887'	08.07.2022	1	Gravel and boulder substrate, with isolated rocky sections. Water width between 10-15 m. Steep right bank, smoother left bank. Moderate water turbidity. Riparian vegetation in favourable condition consisting of tall trees, shrubs and herbaceous vegetation. High degree of water shading. Stable banks, without signs of erosion.	*Alburnoides bipunctatus*
N4	Upstream of Bozovici Commune – at the upstream bridge	N 44º55.04' E 22º01.02'	08.07.2022	1	Substrate consisting of gravel, coarse sand, fine sand, and mud. Water width between 10-15 m. Moderate water turbidity. Riparian vegetation in favourable condition consisting of tall trees, shrubs and herbaceous vegetation. High degree of water shading. Stable banks, without signs of erosion.	*Alburnoides bipunctatus* and *Barbus meridionalis*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N5	Bârz – upstream of Bârz, downstream of Moceriș	N 44.85013º E 21.91517º	19.10.2022	21	Substrate consisting of rocks, gravel, boulders, with patches of sand, and silt. Water width between 10-15 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus*
N6	Bârz – between Bârz and Boinița	N 44.84145º E 21.89474º	19.10.2022	6	Substrate consisting predominantly of mud and sand, with isolated patches of gravel. Water width between 14-15 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Cobitis elongata*
N7	Upstream of the Șopotul Nou Commune	N 44.82892º E 21.88104º	19.10.2022	3	Substrate predominantly consisting of gravel, sand with isolated patches of silt. Water width between 14-17 m. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Alnus glutinosa* and in lower number *Fagus sylvatica* and *Carpinus betulus*), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus* and *Barbus meridionalis*
N8	At the bridge in Șopotu Nou Commune, next to the confluence with the Buceaua River.	N 44.82127º E 21.86562º	20.10.2022	6	Substrate consisting predominantly of sand, gravel and in some areas mud. Water width between 10-20 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus*
N9	Breșnic-Corniș	N 44.83781º E 21.84897º	20.10.2022	10	Substrate consisting predominantly of sand, gravel and in some areas mud. Water width between 10-20 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N10	Downstream of Bozovici Commune	N 44.89908º E 21.98630º	18.10.2022	1	Substrate consisting of gravel, coarse sand, fine sand and mud, isolated patches with boulders. Riparian vegetation in favourable condition, consisting of tall trees (*Salix alba, Alnus glutinosa*), shrubs and herbaceous vegetation. Steep banks, with areas of erosion.	*Alburnoides bipunctatus*
N11	Dablosețț – under the bridge located upstream from Dalbosețț	N 44.87735º E 21.95813º	18.10.2022	2	Substrate consisting of gravel, boulders and sand covered with organic matter. Water width between 12-15 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus, Rhodeus amarus, Squalius cephalus* and *Barbus meridionalis*
N12	Moceriș – at the Moceriș bridge	N 44.86355º E 21.92986º	19.10.2022	5	Substrate consisting of gravel, boulders and sand covered with organic matter. Water width between 12-15 m. Riparian vegetation in favourable condition consisting of tall trees (*Salix alba* predominantly), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus*
N13	3 km upstream of Dracului Lake	N 44.84746 E 21.83561º	20.10.2022	2	Substrate consisting predominantly of sand, with isolated patches of mud. Water width between 10-20 m. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica*, and *Carpinus betulus*), shrubs and herbaceous vegetation. Adequate degree of water shading	*Alburnoides bipunctatus* and *Barbus meridionalis*
N14	At the entrance of the river into the Nera Gorges	N 44.8594 E 21.81687	20.10.2022	14	Substrate consisting predominantly of sand, with isolated patches of mud. Water width between 15-20 m. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Quercus petraea* and *Carpinus betulus*), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Cobitis elongata, Romanogobio kessleri banaticus* and *Squalius cephalus*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N15	In the vicinity of the Dracului Lake	N 44.863432º E 21.813235º	28.10.2022	10	Substrate consisting predominantly of sand, with isolated patches of mud. Water width between 15-20 m. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Quercus petraea* and *Carpinus betulus*), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Squalius cephalus, Alburnoides bipunctatus* and *Barbus meridionalis*
N16	In Nera Gorges, Poiana Alunilor area	N 44.873248º E 21.807432º	28.10.2022	5	Substrate consisting predominantly of boulders, gravel and coarse sand. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur, Quercus petraea* and *Populus alba*), shrubs and herbaceous vegetation. Adequate degree of water shading.	*Barbus meridionalis* and *Alburnoides bipunctatus*
N17	2 km downstream of Poiana Alunilor	N 44.88885º E 21.80057º	29.10.2022	8	Substrate consisting predominantly of boulders, gravel, coarse sand and isolated patches with mud. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur, Quercus petraea* and *Populus alba*), shrubs (*Sambucus nigra* and *Cornus sanguinea*) and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus* and *Cobitis elongata*
N18	In Nera Gorges, at La Cârlige area	N 44.89057º E 21.78882º	29.10.2022	–	Substrate consisting predominantly of boulders, gravel, coarse sand and isolated sections with mud. Stones covered with silt and organic matter. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur* and *Quercus petraea*), shrubs and herbaceous vegetation (*Sambucus nigra* and *Cornus sanguinea*). Adequate degree of water shading.	*Alburnoides bipunctatus* and *Cottus gobio*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N19	In Nera Gorges, Cantonul lui Damian area	N 44.89965º E 21.77771º	04.11.2022	4	Substrate consisting predominantly of boulders, gravel, coarse sand and isolated patches with mud. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur, Quercus petraea* and *Populus alba*), shrubs (*Sambucus nigra* and *Cornus sanguinea*) and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus, Chondrostoma nassus* and *Cobitis elongata*
N20	In Nera Gorges, at Gura Lindinii meadow	N 44.89987º E 21.76553º	05.11.2022	–	Substrate consisting predominantly of gravel, coarse and fine sand, and isolated sections with boulders and mud. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur* and *Quercus petraea*), shrubs and herbaceous vegetation (*Sambucus nigra, Cornus sanguinea* and *Rubus fruticosus*). Adequate degree of water shading.	*Cobitis elongata, Squalius cephalus* and *Sabanejewia balcanica*
N21	In Nera Gorges – Bei Bridge – at the confluence of Nera River with Bei River	N 44.90284º E 21.74546º	05.11.2022	16	Substrate consisting predominantly of boulders, gravel, coarse sand and isolated patches with mud. Riparian vegetation in favourable condition consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Fagus sylvatica, Carpinus betulus, Quercus robur, Quercus petraea* and *Populus alba*), shrubs (*Sambucus nigra* and *Cornus sanguinea*) and herbaceous vegetation. Adequate degree of water shading.	*Alburnoides bipunctatus* and *Romanogobio banaticus*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N22	At the entrance of Nera River in Sasca Română Village	N 44.90055º E 21.72236º	05.11.2022	3	Substrate consisting predominantly of gravel, coarse sand, boulders, and areas with fine sand and mud. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Alnus glutinosa, Populus alba*), shrubs and herbaceous vegetation (predominantly *Rubus fruticosus*). Adequate degree of water shading. Submerged vegetation present.	*Alburnoides bipunctatus*
N23	At the bridge in Sasca Montană, near the Cheile Nerei Beușnița Park Admini-stration	N 44.88572º E 21.70699º	06.11.2022	2	Substrate consisting predominantly of gravel, coarse sand, boulders and areas with fine sand and mud. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Alnus glutinosa* and *Populus alba*), shrubs and herbaceous vegetation (predominantly *Rubus fruticosus*). Adequate degree of water shading. Submerged vegetation present.	*Squalius cephalus*
N24	2 km downstream of Sasca Montană Village	N 44.90039º E 21.68874º	06.11.2022	2	Substrate consisting predominantly of gravel, coarse sand, and boulders. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba* and *Alnus glutinosa*), shrubs and herbaceous vegetation (predominantly *Rubus fruticosus*). Adequate degree of water shading.	*Alburnoides bipunctatus* and *Barbus meridionalis*
N25	Upstream from Bogodinț Village	N 44.90724º E 21.67430º	06.11.2022	8	Substrate consisting predominantly of gravel and boulders, coarse sand and isolated areas with mud. The rocky substrate covered with vegetation. Presence of submerged vegetation. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba* and *Alnus glutinosa*), shrubs and herbaceous vegetation (predominantly *Rubus fruticosus* and *Sambucus nigra*). Adequate degree of water shading.	*Alburnoides bipunctatus* and *Barbus meridionalis*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N26	Downstream from Bogodinț Village	N 44 º53.8486’ E 021º39.0468’	24.03.2023	13	Meadow landscape with pasture. Steep left bank, smooth right bank – meadow. Substrate consisting predominantly of gravel and boulders, coarse sand, and isolated areas with mud. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba* and *Populus alba*), shrubs and herbaceous vegetation. Presence of the rapids with strong water current.	*Alburnoides bipunctatus* and *Barbus meridionalis*
N27	Between Bogodinț and Naidăș villages	N 44.88525333 E 21.63783833	24.03.2023	1	Slightly steep banks with riparian vegetation in favourable condition. Left bank – forest, right bank - meadow surrounded by forest. Substrate consisting predominantly of gravel, boulders, coarse sand, and isolated areas with mud. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba* and *Populus alba*), shrubs and herbaceous vegetation. Presence of the rapids, strong water current.	*Alburnoides bipunctatus*
N28	Between Bogodinț and Petrilova villages	N 44º53.3944’ E 021º37.4752’	24.03.2023	3	Left bank – forest, right bank - meadow surrounded by forest. Gravel covered with organic matter. Presence of submerged vegetation. Riparian vegetation in favourable condition, consisting of tall trees (predominantly *Salix alba, Quercus, Fagus* sp., *Acacia* sp., *Acer* sp., *Alnus* sp.) with shrubs (predominantly *Sambucus nigra*). Smooth flow of water.	*Rhodeus amarus*

Table 1 (continued): Sampling stations in which *Romanogobio banaticus* was sampled and the habitats characteristics: Sampling station – S.S., Location – L., GIS coordinates – GIS, Date of sampling – D., Number of *Romanogobio banticus* individuals – N., Habitat description – H.D., Predominant fish species – P.F.S.

N29	Upstream of Naidăș Village	N 44º52.9534' E 021º36.3409'	25.03.2023	8	The right bank – slightly steep with riparian vegetation in a strip, followed by pasture. Steep, eroded left bank, poorly represented riparian vegetation, pasture area. Substrate consisting predominantly of gravel, boulders, sand, and fine sand with isolated areas of mud. Submerged vegetation present. Presence of rapids, followed by smooth flow of water.	*Romanogobio kessleri banaticus* and *Cobitis elongata*
N30	At Naidăș Village bridge	N 44º53.0731' E 021º35.2272'	25.03.2023	4	Smooth banks, riparian vegetation in inadequate condition. Substrate consisting predominantly of gravel, boulders, sand, and fine sand with isolated areas of mud. Submerged vegetation present.	*Alburnoides bipunctatus* and *Barbus meridionalis*
N31	Downstream of Naidăș – upstream of Lescovița villages	N 44.8768133 E 21.5643683	25.03.2023	-	Low banks, left bank – meadow, right bank – meadow and agricultural land. Substrate consisting predominantly of gravel, boulders, silt, and isolated areas with boulders. Strong water flow. Moderate riparian vegetation, dominated by *Salix alba*.	*Neogobius melanostomus* and *Cobitis elongata*
N32	At Lescovița Village bridge	N 44º52.1892' E 021º32.3322'	25.03.2023	2	Left Bank – slightly steep. Right Bank characterized by meadow and pasture Substrate consisting predominantly of gravel, coarse sand, fine sand, and isolated patches with mud Strong water flow. Moderate riparian vegetation, dominated by *Salix alba*	*Cobitis elongata*
N33	Between Lescovița and Zlatița villages	N 44º52.5772' E 021º31.4735'	26.03.2023	-	Slightly steep right bank with signs of erosion, smooth left bank characterized by a meadow landscape. The predominant substrate consists of gravel, boulders, with submerged vegetation. Portions of sand and silt. Strong water flow. Moderate riparian vegetation, dominated by *Salix alba*.	*Rhodeus amarus*

DISCUSSION

Natural and anthropogenic induced environmental conditions and fish fauna vary both qualitatively and quantitatively in the Carpathian Basin streams and rivers (Simalcsik and Bates, 1973; Curtean-Bănăduc and Bănăduc, 2002, 2008; Bănăduc, 2010; Popa et al., 2013, 2019; Bănăduc et al., 2012, 2013, 2017, 2020a,b, 2021; Didenko, et al, 2014; Curtean-Bănăduc et al., 2014, 2015, 2019; Popescu et al., 2015; Afanasyev et al., 2023) the habitat characteristic variation led to the establishment of fish zonation based on the characteristic indicator fish species. Large and medium size Carpathian rivers which spring in mountain areas, like the Nera, have five such specific fish zones: brown trout zone, grayling and Mediterranean barbel zone, nase zone, barbel zone, and carp zone. (Bănărescu, 1964)

Due to the habitats general characteristics (high river flow, less moderate-accentuated water current, generally devoid of waterfalls, permanently rocky bottom made up by boulders, water saturated in oxygen, oscillations of temperature 12-14°C) and dominance of *Alburnoides bipunctatus* in the majority of the sampling stations where *Romanogobio banaticus* was identified, with the co-dominance of *Barbus balcanicus* and *Cobitis elongata*, it can be stated that the target fish species of this study is located slightly atypically a little upstream on the river in the grayling and Mediterranean barbel zone, in comparison with its presence in the nase zone or even carp zone in other more northern Carpathian rivers (Bănărescu, 1964).

The relatively lower latitude of Nera River with its environmental characteristics in comparison with other rivers where this fish is living can be an explanation for this species presence upstream on the river than in other northern rivers and missing in the lower sectors of the river and their associated ichthyological zones.

It is worth highlighting the fact that this species presence is permanent, the abundance of this species is relatively high, around 5,000 individuals are estimated to be present in the area, the age structure is well balanced. More than that, in three of the sampling stations it is a co-dominant species, all of these revealing a good ecological status of this species populations, and last but not least that the conservation status is favourable.

In spite of the fact that this species populations in the Nera Basin are relatively protected by its natural characteristics and status, and the relatively low human impact presence, there are still some threats and risks from this perspective as following: riverbed mineral exploitation and overexploitation; bridges and viaducts; localities; household wastes; fishing; off-road vehicle driving; pollution; etc.

The riverbed and riverine areas mineral exploitation of the Nera River influence the fish populations through the increasing of the noise and vibrations level, the modification of the downstream sedimentation rate, and the modification of the specific habitat substrate.

The negative impact of bridges and viaducts manifests itself especially during their construction phase, rehabilitation of the bridge legs or when unclogging the riverbed in the near areas. The pressure is represented by the intervention that is carried out with machines in the minor riverbed, affecting the ichthyofauna during construction/rehabilitation by changing the physico-chemical properties of the water (increasing the turbidity of the water, high vibrations, various substances that can reach the water during the pouring of concrete, etc.).

All the localities through which Nera flows exert an impact on the respective lotic sectors. In this sense, household wastes were most often identified thrown into the riverbed or stored on the banks of the water, part of it being carried away by the floods or wind affecting the downstream sectors as well. The micro-plastic released by these wastes represents a significant impact for the ichthyofauna. Ad hoc deposits of construction materials have been identified on the banks, which can affect by releasing various substances and changing the physio-chemical water properties, through runoff during rains or floods. Also, loading with organic matter facilitates the eutrophication process, changing the microbiology of river water,

changing the physio-chemical properties of water, pollution with toxic and corrosive substances from detergents are among the most significant pressures identified, especially in the sectors where the sewage system mouths pours household waste water directly into the river without any filtration or purification system. These pressures have a significant negative impact on both fish and benthic invertebrates' species, which are their main food source. Often in these areas, the number of species is small and the fish can present a danger to the local human population if they are consumed, the toxic substances eliminated in the water being stored in the muscle mass of the fish through bioaccumulation. (Gokul et al., 2023; Curtean-Bănăduc et al., 2023)

The household wastes illegal deposition is another frequent problem. Very often there were identified household wastes in the riverbed or on the river banks, a part of them present there due the wind and water transport action. The intensity of this pressure is related with the presence of the multitude of localities and the abundance of the wastes in some sectors.

Inapropriate and even illegal fishing it is also a problem which create a pressure on fish. This pressure is manifested through the capturing and retaining of the fish of conservation interest, as food for human also as baits for fishing. The majority of the people have no idea about what fish species are protected, they can not identify them, they do not understand their role in nature and for humans, or consider that breaking the laws it is an option.

Off-road driving common practice induces vibrations and noise in water, the water turbidity changings, pollution with oil and gas. The intensity of this pressure is related with the presence of the multitude of localities and by the level of their traffic.

The pollution is present in the rivers sectors where the lotic system pass through or near the localities. The main pollution sources are: household water and wastes, building materials, organic matters, etc.

All these threats and risks should be managed in an integrated way not only in the protected areas but in the whole basin, to create optimum conditions for *Romanogobio banaticus* species of conservation interest protection, the Nera River basin is and still can remain in the future a sanctuary area for *Romanogobio banaticus*.

CONCLUSIONS

Romanogobio banaticus it is a species of conservation interest with a small distribution range in the south-west of the Romanian Carpathians basin. In spite of the presence of some moderate anthropogenic threats and risks, the Nera River is a sanctuary for this fish. The lower latitude of Nera in comparison with other rivers where this fish is living, explain its presence in a rather atypical ichthyological zone. This species presence is permanent, the abundance is relatively high, the age structure is well balanced, more than that, in some sectors it is a co-dominant species, all of these revealing a favourable conservation status. An integrated management plan for the entire Nera Rive rbasin should be enforced to keep this area safe, a response to the extending anthropogenic impact.

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REFERENCES

1. Afanasyev S., Hupalo O., Tymoshenko N., Lietytska O., Roman A., Manturova O. and Bănăduc D., 2023 – Morphological and trophic features of the invasive Babka gymnotrachelus (Gobiidae) in the plain and mountainous ecosystems of the Dniester Basin, spatiotemporal expansion and possible threats to native fishes, Fishes, 8, 427, 2-16, DOI: 10.3390/fishes8090427.
2. Antipa G., 1909 – Fauna ihtiologică a României, Edit. Academiei Române, Publicațiile Fondului V. Adamachi, Bucureşti, 294.
3. Antonescu C. S., 1934 – Peştii apelor interioare din România, Edit. Imprimeriile Monitorului Oficial, București, 80. (in Romanian)
4. Antonescu C. S., 1957 – Peştii din apele Republicii Populare Române, Edit. Agrosilvică, București, 213. (in Romanian)
5. Bacalu P., Găldean N. and Staicu G., 1995 – Age classes, diurnal rhythm of feeding and trophic spectrum inGobio kessleri banaticus Bănărescu, 1953 (Pisces: Cyprinidae: Gobioninae), Travaux du Museum National d'Histoire Naturelle Grigore Antipa, 35, 593-607.
6. Badea L. and Bugă D. (coord.), 1992 – Geografia României IV, Regiunile pericarpatice, Edit. Academiei Române, București, 580. (in Romanian)
7. Băcescu M., 1947 – Peştii aşa cum îi vede ţăranul pescar român, Edit. Publicațiile Institutului de Cercetări Piscicole, România, Monographia, 3. (in Romanian)
8. Bănăduc D., 2001 – Elemente de variabilitate morfologică ale subspeciei Gobio kessleri Dybowski 1862, Analele Universităţii Ovidius din Constanţa, 2001. (in Romanian)
9. Bănăduc D., 2003a – Aspecte privind variabilitatea morfologică a subspeciei Gobio uranoscopus frici Vladykov 1925, Acta oecologica, X, 1, 115-130. (in Romanian)
10. Bănăduc D, 2003b – Contribuții la cunoașterea morfologiei și biologiei speciilor genului Gobio (Gobioninae, Cyprinidae, Pisces) în România, Teză de Doctorat, Academia Română – Institutul de Biologie București, 225. (in Romanian)
11. Bănăduc D., 2004a – Gobio albipinnatus vladykovi 1943, aspecte de variabilitate morfologică, Analele Universității Oradea, Facultatea de Biologie, XI, 33-47. (in Romanian)
12. Bănăduc D. 2004b – Gobio kessleri banaticus Bănărescu 1953, morphological variability aspects, Studii și Cercetări Științifice – Seria Biologie, Universitatea din Bacău, 9, ISSN 122-919-X, 109-115.
13. Bănăduc D., 2004c – Aspecte privind variabilitatea morfologică a speciei Gobio gobio (Linnaeus) 1758, Studia Universitatis Vasile Goldiș Arad, 14, 1, 67-82. (in Romanian)
14. Bănăduc D., 2006 – Speciile şi subspeciile din România ale genului Gobio (Gobioninae, Cyprinidae, Pisces) – analiza stadiului cunoaşterii, Brukenthal Acta Musei, I.3, 125-144. (in Romanian)
15. Bănăduc D., 2007a – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus species (Romania), Brukenthal Acta Musei, II.3, 105-108.
16. Bănăduc D., 2007b – Gobio kessleri in Combroux I., Thiry E. and Toia, T. (eds.), Caiet de habitate şi specii – Fişe pilot, Edit. Balcanic, Timişoara, România, 73-74, ISBN 978-973-85742-6-7. (in Romanian)
17. Bănăduc D., 2007c – Gobio uranoscopus in Combroux I., Thiry E. and Toia T. (eds.), Caiet de habitate şi specii – Fişe pilot, Edit. Balcanic, Timişoara, România, 75-76, ISBN 978-973-85742-6-7. (in Romanian)
18. Bănăduc D., 2007d – 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.

19. Bănăduc D., 2007e – Gobio albipinnatus in Combroux I., Thiry E. and Toia T. (eds.), Caiet de habitate şi specii – Fişe pilot, Edit. Balcanic, Timişoara, România, 71-72, ISBN 978-973-85742-6-7. (in Romanian)
20. Bănăduc D., 2008a – 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.
21. Bănăduc D., 2008b – Morphological variability aspects, of Gobio albipinatus vladykovi, Acta Ichtiologica Romanica, III, 9-26.
22. Bănăduc D., 2008c – Mureş River Gorge (Transylvania, Romania) – special area for conservation (Natura 2000 Site) proposal for Gobio albipinnatus Lukasch, 1933 species, Acta Ichtiologica Romanica, III, 27-32.
23. Bănăduc D., 2008d – Important area for fish – Natura 2000 (SCI) for Gobio albipinnatus Lukasch, 1933 species in the Olt River – Danube River confluence, Drobeta, Seria Ştiinţele Naturii, Edit. Universitaria Craiova, Drobeta Turnu Severin, XVIII, 28-32.
24. 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.
25. Bănăduc D. 2010 – 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, 175-184.
26. Bănăduc D. and Curtean-Bănăduc A., 2002 – A biotic integrity index adaptation for a Carpathian (first – second order) river assesment, Acta oecologica – Studii şi Comunicări de Ecologie şi Protecţia Mediului, IX, 1-2, Edit. Universităţii Lucian Blaga din Sibiu, ISSN 1221-5015, 81-99.
27. Bănăduc D. and Bănărescu P. M., 2006 – Morphological variability aspects, of Gobio kessleri kessleri Dybowski 1862, Acta Ichtiologica Romanica, I, 37-54.
28. Bănăduc D., Oprean L., Bogdan A. and Curtean-Bănăduc A. 2012 – The assessment, monitoring and management of the Carpathian rivers fish diversity, Management of Sustainable Development, 19-27, 4, 1.
29. Bănăduc D., Răchită R., Curtean-Bănăduc A. and Gheorghe L., 2013 – The species Hucho hucho (Linnaeus, 1758), (Salmoniformes, Salmonidae) in Ruscova River (Northern Romanian Carpathians, Acta Oecologica Carpatica, VI, 149-166.
30. Bănăduc D., Cismaş C.-I. and Curtean-Bănăduc A., 2017 – Romanogobio kesslerii (Dybowski, 1862) fish species populations management decisions support system in ROSCI0227 – Sighişoara-Târnava Mare (Romania), Acta Oecologica Carpatica, X.I, 71-84.
31. Bănăduc D., Joy M., Olosutean H., Afanasyev S. and 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 Science Europe, 32, 1, 73, 14, DOI: 10.1186/s12302-020-00348-z.
32. Bănăduc D., Noblet B., Chauveau R., Latrache Y., Touati A. and Curtean-Bănăduc A., 2020b – Mountainous lotic systems dams associated environmental risks – a comparative short review between Carpathians and Alps, Acta Oecologica Carpatica, XIII, 57-68.
33. Bănăduc D., Curtean-Bănăduc A., Cianfaglione K., Akeroyd J. R. and Cioca L.-I., 2021 – 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.
34. Bănărescu P. M., 1947 – Ecologie et distribution géographique des espéce roumaines de Gobio, Dare de seamă asupra şedinţelor cercului zoologic din Cluj pe anul 1947-1948, Institutul de Zoologie, Tip. Cartea Românească, Cluj. (in Romanian)

35. Bănărescu P. M., 1952 – Studiul biometric şi sistematic al ciprinidului Gobio albipinnatusLukas (inclusiv belingi Slast.) din bazinul hidrografic al fluviului Dunărea, Studii și Cercetări Științifice, Cluj, III, 1-2, 246-263. (in Romanian)
36. Bănărescu P. M., 1953 – Zur Kenntnis der Systematik, Verbreitung und Okologie von Gobiouranoscopus (Agassiz) aus Rumanien, Vestn. Ceskoslov. Zool. Spolecn., XVII, 3, 178-198. (in German)
37. Bănărescu P. M., 1954 – Biometrische und systematische Studien an Gobio gobio ausRumänien, Vestn. Ceskoslov. Zool. Spolecn., XVIII, 1, 6-40. (in German)
38. Bănărescu P. M., 1956 – Importanţa speciilor de Gobio ca indicatori de zone biologice în râuri, Buletinul Institutului de Cercetări Piscicole, 15, 3, 53-56. (in Romanian)
39. Bănărescu P. M., 1961 – Weitere systematische Studien über die Gattung Gobio (Pisces, Cyprinidae), insbesondere im Donaubecken, Vestn. Ceskoslov. Zool. Spolecn., XXV, 4, 318-346. (in German)
40. Bănărescu P. M., 1962 – Phyletische Beiziehungen der Arten und Artbildung bei der Gattung Gobio (Pisces, Cyprinidae), Vestn. Československ. Zool. Společn., XXVI, 1, 38-64. (in German)
41. Bănărescu P. M., 1964 – Pisces-Osteichthyes, Fauna Republicii Populare Române, 13, Edit. Academiei R.P.R., Bucureşti, 959.
42. Bănărescu P. M. and Nalbant T., 1965a – Studies on the Systematics of Gobioinae (Pisces, Cyprinidae), Revue Roumaine de Biologie, Serie de Zoologie, Bucharest, 10, 4, 219-229.
43. Bănărescu P. M., Nalbant T., 1965b – Studii asupra sistematicii Gobioninelor (Pisces, Cyprinidae), Studii și Cercetări de Biologie, Seria Zoologie, Bucureşti, 17, 4, 397-407. (in Romanian)
44. Bănărescu P. M., 1970 – Données sur la forme nominale de Gobio uranoscopus (Pisces, Cyprinidae), Bulletin du Muséum National d'Histoire Naturelle, 42, 165-169. (in French)
45. Bănărescu P. M. and Nalbant T., 1973 – Pisces, Teleostei. Cyprinidae (Gobioninae), Das Tierreich, Lief, 93, De Gruyter, Berlin. (in German)
46. Bănărescu P. M., 1992a – A critical updated checklist of gobioninae (Pisces, Cyprinidae), Travaux du Museum National d'Histoire Naturelle Grigore Antipa, Bucureşti, XXXII, 303-330.
47. Bănărescu P. M., 1992b – Probleme ale protecţiei faunei reofile din sudul Banatului, Hidrobiologia, 20. (in Romanian)
48. Bănărescu P. M., 1994 – On the presumed origin of Gobio albipinnatus Lukash, in the upper Danube by simpatric speciation, Senckenbergiana biologica, Frankfurt am Main, 73,1-2, 49-55.
49. Curtean-Bănăduc A. and Bănăduc D., 2008 – The riverine ligneous vegetation importance elements, on some submountain Carpathian lotic systems (macroinvertebrates and fish), Acta Ichtiologica Romanica, III, 53-58.
50. Curtean-Bănăduc A., Cismaş I.-C. and Bănăduc D., 2014a – Romanogobio kesslerii (Dybowski, 1862) fish populations management decisions support system for ROSCI0132 (Transylvania, Romania), Acta Oecologica Carpatica, VII, 95-110.
51. Curtean-Bănăduc A., Bănăduc D., Ursu L. and Răchită R., 2014b – Historical human impact on the alpine Capra Stream macroinvertebrates and fish communities (southern Romanian Carpathians), Acta Oecologica Carpatica, VII, 111-152.
52. 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.
53. Curtean-Bănăduc A. and Bănăduc D., 2017 – The status of Romanogobio uranoscopus (Agassiz, 1828) species, in Maramureș Mountains Nature Park (Romania), Transylvanian Review of Systematical and Ecological Research, 19.1, 71-84, ISSN-L 1841-7051, ISSN 2344-3219.

54. Curtean-Bănăduc A., Cismaş C.-I. and Bănăduc D., 2019a – Gobio genus species integrated management system – Târnava Rivers study case (Transylvania, Romania), Transylvanian Review of Systematical and Ecological Research, 21.1, 83-96, ISSN-L 1841-7051, ISSN 2344-3219.
55. Curtean-Bănăduc A., Marić S., Gabor G., Didenko A., Rey Planellas S. and Bănăduc D., 2019b – Hucho hucho (Linnaeus, 1758): last natural viable population in the Eastern Carpathians – conservation elements, Turkish Journal of Zoology, 43, 2, 215-223, DOI: 10.3906/zoo-1711-52, 2019, ISSN: 1300-0179, eISSN: 1303-6114.
56. Curtean-Bănăduc A., Mihuţ 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, ISSN 2073-4441, Section Biodiversity and Functionality of Aquatic Ecosystems, Special Issue Recent Advances in the Aquatic Biodiversity, 15, 1578, DOI: 10.3390/w15081578.
57. Diaconu C., 1971 – Râurile României, Monografie, Edit. INMH Bucuresti, 494 (in Romanian)
58. Didenko A., Velykopolsky I. and Chuklin A., 2014 – Use of poachers' catches for studying fish fauna in the water bodies of the Transcarpathian region (Ukraine), Transylvanian Review of Systematical and Ecological Research, 16.2, 107-118.
59. Oancea D. and Velcea V. (coord.) 1987 – Geografia Romaniei, III, Carpații și Depresiunea Transilvaniei, Edit. Academiei Române, București, 647. (in Romanian)
60. Popa G.-O., Khalaf M., Dudu A., Curtean-Bănăduc A., Bănăduc Doru, Georgescu S. E. and Costache M., 2013 – Brown trout's populations genetic diversity using mitochondrial markers in relatively similar geographical and ecological conditions – a Carpathian case study, Transylvanian Review of Systematical and Ecological Research, 15.2, ISSN 1841-7051, 125-132.
61. 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: 10.1051/alr/2019021.
62. Popescu C. V., Ureche D. and Nechita E., 2015 – A statistical model for estimation of ichtyofauna quality based on water parameters in Oituz Basin (Carpathians), Transylvanian Review of Systematical and Ecological Research, 17.1, 85-94.
63. Posea G., 2006 – Geografia fizică a României, I, Date generale, Poziție geografică, II, București, Edit. Fundației România de Mâine, ISBN (10) 973-725-711-1, 264.
64. Simalcsik F. and Bates K., 1973 – Date privind nutriţia porcuşorului (Gobio gobio obtusirostris) din Lacul de acumulare Bicaz, Lucrările Staţiunii Stejarul, 1972-1973, 157-163.
65. Simionescu I., 1923 – Peştii apelor noastre, Institutul de Arte Grafice „Luceafărul", București, 179. (in Romanian)
66. Ujvari I, 1972 – Geografia apelor Romaniei, Edit. Științifică, București, 577. (in Romanian)
67. * Plan de management integrat Parcul Național Cheile Nerei-Beușnița (ROSCI 0031 și ROSPA 0020 Cheile Nerei-Beușnița).