NERA RIVER (DANUBE WATERSHED) FISH FAUNA DYNAMIC OVER ONE CENTURY

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ABSTRACT

The ichthyofauna of the Nera River is shaped by the adaptation and evolution of fish fauna to the local highly variable relief of this river watershed. In the last half century, in some aspects, it was moderately influenced by the human activities' impact over time in different degrees, but also by the sectors in a good ecological status, which can be considered as sanctuaries for important ecological and economic fish species. Also, climate change can be added as another driver. This research almost doubled the number of known fish species in this area.

RÉSUMÉ: Rivière Nera (Bassin de la Danube) dynamique des l'ichtyofaune sur un siècle.

L'ichtyofaune actuelle de la rivière Nera est le fruit de l'adaptation et de l'évolution des poissons au relief très varié de son bassin versant. Au cours des cinquante dernières années, elle a été modérément influencée, à des degrés divers, par les activités humaines. Cependant, certains secteurs, en bon état écologique, constituent de véritables sanctuaires pour des espèces de poissons importantes, tant sur les plans écologiques qu'économiques. Le changement climatique joue également un rôle déterminant. Cette étude a presque doublé le nombre d'espèces de poissons recensées dans cette zone.

REZUMAT: Râul Nera (bazinul Dunării) dinamica ihtiofaunei de-a lungul unui secol.

Situația actuală a ihtiofaunei râului Nera este determinată atât de rezultatul adaptării și evoluției faunei piscicole la relieful local cu variații mari în acest bazin hidrografic, iar recent poate fi considerată moderat influențată în unele aspecte în mai bine de jumătate de secol, de impactul activităților umane în diferite grade în timp, dar și de sectoarele aflate într-o stare ecologică bună care pot fi considerate sanctuare, pentru specii de pești importante ecologic și economic, iar aici se poate adăuga ca factor determinant și impactul schimbărilor climatice. Această cercetare aproape că a dublat numărul speciilor de pești cunoscute în această zonă.

INTRODUCTION

The Nera River is situated in the south-west of Romania and has an east to west course, with a 131 km stretch, springs in the Semenic Mountains (near Piatra Goznei Peak, 1,447 m) area, and runs into the Danube. Upstream of this confluence, on 15 km lengthwise, this river forms the Romanian-Serbian border. The relatively narrow river valley deepened into the Jurassic geological foundation, creating the Nera Gorges. The Nera River amasses 36 streams, the length of its hydrographic system is 574 km, and the density is 0.42 km/km^2. The multiannual average runoff is 20 L/s x km^2 in the highland areas with altitudes of 800-900 m, and below eight L/s x km^2, in the lower areas, below 400 m altitude. The average flow in the Sasca locality sector is about 1,700 L/s. The watershed area is 1,240 km^2. The Nera flows 23 km through the Cheile Nerei-Beușnița National Park, where it separates the Anina Mountains from the Locvei Mountains. (Posea, 2006; Badea and Bugă, 1992; Ujvari, 1972; Diaconu, 1971; Oancea and Velcea, 1987)

This hydrological watershed includes lotic systems as the main Nera River collector of the streams: 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, Șușara, 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. (Posea, 2006; Badea and Bugă, 1992; Ujvari, 1972; Diaconu, 1971; Oancea and Velcea, 1987)

The variety of habitats and ecosystems in a rather reduced geographical area is determined by the complexity of this region's relief. The Semenic Mountains belong to the Banat Mountains. This geographical region has a highly complex geology and varied forms of relief, a circumstance that has led to the formation of very diverse and representative habitats, biocoenosis, and ecosystems. The main characteristics of the relief comprise of interfluves, interfluvial ridges, river valleys, and deep river gorges. (Posea, 2006; Badea and Bugă, 1992; Ujvari, 1972; Diaconu, 1971; Oancea and Velcea, 1987)

The specific natural features of this region push the evolutionary processes in founding and preserving valuable fish species communities in this zone (Bănăduc et al., 2023a).

The talent, dedication, and determination of pioneering prominent experts like Grigore Antipa and Petru Mihai Bănărescu, to name simply only the most famous Romanian ichthyologists, as well as the following generations of biologists and ecologists specialists in fish, led to the emergence in Romania of a noteworthy ichthyology school with excellent scientific outcomes. Just about three centuries of wide-ranging fish-related field work and research have led to the amassing of very useful data in this respect, and new studies can take the comparative benefits from the earlier outcomes acquired in diverse sampling campaigns.

The geographically isolated watersheds of the Carpathian Mountains are generally well-studied and are known to contain numerous fish species of both conservation and economic value. (Curtean-Bănăduc et al., 2019a,b; Koščo et al., 2014; Bănăduc et al., 2013) except in the more and more frequent cases when human activities' negative impact are major drivers there (Bănăduc et al., 2023b, 2021, 2020a,b; Bănăduc 2010; Popa et al., 2019; Curtean-Bănăduc et al., 2014).

This study aim is to update and bridge the gap between the past and present knowledge, specifically between the relatively far away in time ichthyological data (Antipa, 1909; Bănărescu, 1964), and the present, in this geographicaly relatively remote and isolated basin, regarding fish fauna spatial and temporal structure dynamics in the Nera River.

MATERIAL AND METHODS

This Nera River research was done in a total of four years, namely an initial assessment conducted between 2022-2023, followed by some monitoring activities in 2024-2025, with the the initial assessment preponderently a part of the scientific research project "Îmbunătăţirea stării de conservare a speciilor şi habitatelor de interes conservativ din Parcul Naţional Cheile Nerei-Beuşniţa şi ariile naturale de interes comunitar şi naţional suprapuse prin revizuirea planului de management integrat" POIM Cheile Nerei-Beușnița/"Improving the conservation status of species and habitats of conservation interest in the Cheile Nerei-Beușnița National Park and the overlapping natural areas of European Community and national interest by revising the integrated management plan" POIM Cheile Nerei-Beușnița.

The presence/absence of fish species in the Nera River were determined and documented using scientific electrofishing sampling (with a Hans Grassl IG 600 TL device), in time/effort (45 minutes) unit. Information regarding fish captures onsite from local fishermen was incorporated into the results only if it included a species that was not identified/captured by the research team's sampling.

The biological material sampling was conducted in a total of 46 lotic sampling sections (Fig. 1; Tab. 1). Each section was 100 m in length and was established every two to four kilometers, covering the entire river stretch from the Nera's mountainous headwaters to this river delta formed at the confluence with the Danube River. After a quick visual check of the sampled fish individuals, all of them were released unharmed in the river, in their characteristic ecosystem. No deaths have been recorded as a result of the electrofishing process.

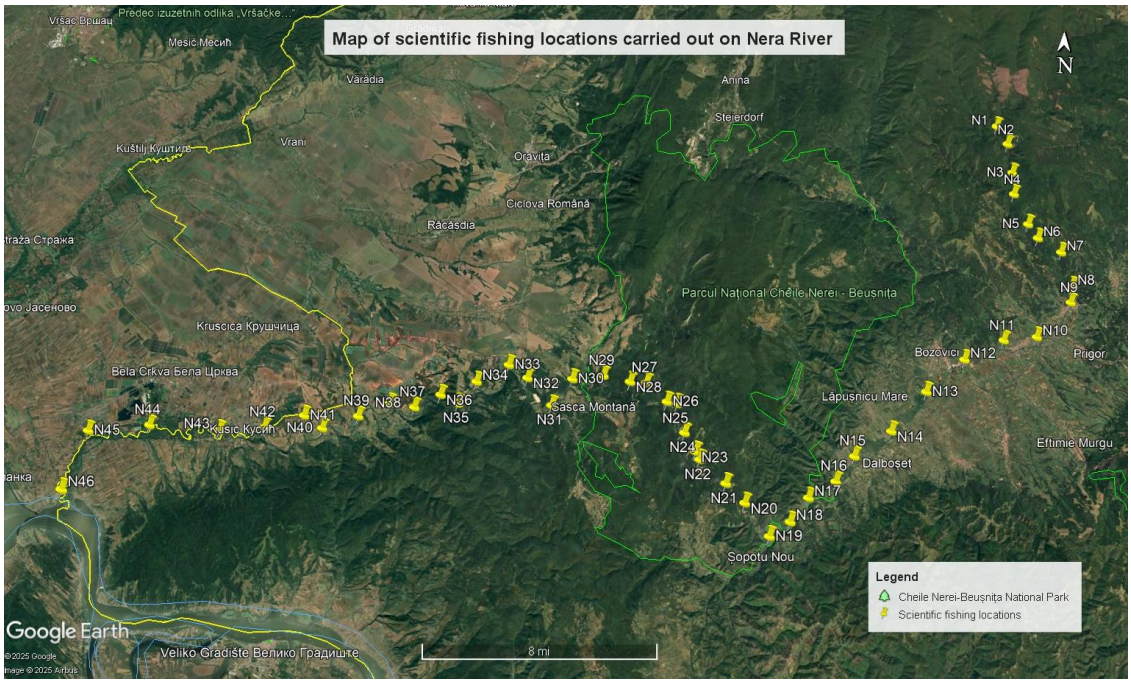

Figure 1: Sampling stations
along the Nera River.

RESULTS

Table 1: (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N1	Botul Calului Canton (Nera springs area) N 45º03.3628' E 22º03.5663' 638 m altitude	Substrate dominated by boulders, rocks, gravel and coarse sand. Water width between 5-10 m. High water velocity, well oxygenated. Riparian vegetation in good condition. High water shading. Submerged aquatic vegetation. Stable banks, without erosion. No human impact.	*Salmo trutta* A –, B +, C +
N2	Two km downstream Botul Calului Canton (Nera springs area), N 45º02.6884' E 22º03.9784', 575 m altitude	Substrate dominated by boulders, rocks, gravel, and sand. Water width between 5-10 m. High water velocity, well oxygenated. Riparian vegetation in favorable condition. High water shading. Bioderm present on the substrate and submerged aquatic vegetation. Stable banks with no erosion. No human impact.	*Salmo trutta* A –, B +, C +
N3	Four km downstream Botul Calului Canton (Nera springs area), N 45º01.5643' E 22º04.0519', 496 m altitude	Substrate dominated by boulders, rocks, gravel and sand. Water width between 5-10 m. High water velocity, well oxygenated. Riparian vegetation in favorable condition, formed by large trees. High water shading. Bioderm present on the substrate and submerged vegetation. Stable banks, without signs of erosion. No human impact was observed.	*Salmo trutta* A –, B +, C +
N4	Six km downstream Botul Calului Canton (Nera springs area), N 45º00.7985' E 22º03.9791', 453 m altitude	Substrate dominated by boulders, gravel and sand. Water width 8-12 m. High water velocity, well oxygenated. Good riparian vegetation, formed by large trees. High degree of water shading. Bioderm present on the substrate and submerged vegetation. Human impact: logging, oil leaks from machinery, increased water turbidity in the area of runoff from the slopes where trees are carried out.	*Salmo trutta* A –, B +, C + *Alburnoides bipunctatus* A –, B –, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N5	Six km upstream Borlovenii Vechi, N 45º01.795' E 21º51.681', 390 m altitude	Substrate dominated by boulders, gravel, rocks and coarse sand. Water width between 8-12 m. High water velocity, well oxygenated. Sector with many small waterfalls. Riparious vegetation in favorable condition, formed by large trees. High degree of water shading. Bioderm present on the substrate. Stable banks, without signs of erosion. No human impact was observed.	*Salmo trutta* A –, B +, C + *Alburnoides bipunctatus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Lota lota* A –, B –, C +
N6	Four km upstream Borlovenii Vechi, N 45º01.612' E 21º53.152', 367 m altitude	Substrate of boulders, gravel, rocks and coarse sand. Water width 8-12 m. High water speed, well oxygenated. Sector with many small waterfalls. Riparious vegetation in favourable condition, formed by large trees. High degree of water shading. Bioderm present on the substrate. Stable banks, no sign of erosion. No anthropogenic impact.	*Salmo trutta* A –, B +, C + *Alburnoides bipunctatus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Barbatula barbatula* A –, B –, C + *Cottus gobio* A –, B +, C +
N7	Two km upstream Borlovenii Vechi, N 45º01.125' E 21º54.264', 328 m altitude	Substrate dominated by boulders, gravel, rocks and coarse sand. Water width between 8-12 m. High water speed with many small waterfalls. Riparous vegetation in favourable condition, consisting of large trees. High degree of water shading. Bioderm present on the substrate. Stable banks, without erosion. No human impact.	*Salmo trutta* A –, B +, C + *Squalius cephalus* A –, B –, C + *Alburnoides bipunctatus* A –, B –, C + *Gobio obtusirostris* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Cottus gobio* A –, B +, C +
N8	Upstream Borlovenii Vechi –, N 44º57.6275' E 22º06.2896', 310 m altitude	Substrate dominated by boulders and gravel. Water width 12-15 m. Riparous vegetation in good condition, with large trees and shrubs. High water shading degree. Submerged aquatic vegetation. Stable banks. No anthropogenic impact.	*Alburnoides bipunctatus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Barbatula barbatula* A –, B –, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N9	Pătaș Locality, N 44º57.073' E 22º06.145', 302 m altitude	Substrate dominated by boulders and gravel, isolated sandy and silty areas. Water width between 12-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. High degree of water shading. Stable banks, no sign of erosion. Anthropogenic impact: household waste thrown on the banks.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B –, C + *Phoxinus phoxinus* A –, B +, C + *Alburnoides bipunctatus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Lota lota* A –, B –, C + *Cottus gobio* A –, B +, C +
N10	Upstream Pârlipeț locality, N 44º55.866' E 22º04.401', 268 m altitude	Substrate formed by gravel and boulders, isolated rocky. Water width between 10-12 m. Steep right bank. Moderate water turbidity. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. High degree of water shading. Stable banks, without signs of erosion. No human impact.	*Squalius cephalus* A –, B –, C + *Alburnoides bipunctatus* A –, B –, C + *Romanogobio banaticus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Barbatula barbatula* A –, B –, C +
N11	Downstream Pârlipeț locality, N 44º55.726' E 22º02.887', 262 m altitude	Substrate of gravel and boulders, isolated rocky. Water width 10-15 m. Steep right bank, smoother left bank. Moderate turbidity. Riparian vegetation in good condition, consisting of large trees, shrubs, and grass. High degree of water shading. Stable banks, no signs of erosion. Anthropogenic impact: road crossing the minor riverbed.	*Squalius cephalus* A –, B –, C + *Alburnoides bipunctatus* A –, B –, C + *Barbus balcanicus* A –, B –, C + *Cobitis elongata* A –, B –, C + *Sabanejewia balcanica* A –, B –, C +
N12	Bridge upstream Bozovici locality, N 44º55.04' E 22º01.02', 244 m altitude	Substrate consisting of gravel, coarse sand, fine sand, and silt. Water width 10-15 m. Riparian vegetation in good condition, consisting of large trees, shrubs, and herbaceous vegetation. High degree of water shading. Stable banks, without erosion. Anthropogenic impact: pollution from the Bozovici urbanized area.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B –, C + *Rhodeus sericeus* A –, B –, C + *Barbus balcanicus* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N13	Downstream Bozovici locality, N 44.89908º E 21.98630º, 250 m altitude	Substrate consisting of gravel, coarse sand, fine sand, and silt, isolated boulders. Water width between 10-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. Steep banks, with erosion areas. Anthropogenic impact: pollution from the upstream Bozovici locality.	*Squalius cephalus* A –, B +, C + *Alburnus alburnus* A –, B –, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B –, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C +
N14	Bridge upstream Dabloșeț locality, N 44.87735º E 21.95813º, 218 m altitude	Substrate consisting of gravel, boulders covered with bioderma, and sand. Water width between 12-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs and grassy vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion.	*Leuciscus aspius* A –, B –, C + *Alburnus alburnus* A –, B –, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B –, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B +, C + *Sabanejewia balcanica* A –, B –, C + *Cottus gobio* A –, B +, C +
N15	Bridge in Moceriș locality, N 44.86355º E 21.92986º, 280 m altitude	Substrate consisting of sand, gravel and boulders covered with bioderma, in some places mud. Water width between 12-16 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion. No human impact was identified.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcánica* A –, B +, C + *Cottus gobio* A –, B +, C +
N16	Upstream Bârz locality, N 44.85013º E 21.91517º, 201 m altitude	Substrate consisting of sand, gravel, and boulders covered with bioderma, in some places mud. Water width between 12-16 m. Riparian vegetation in favourable condition, consisting of large trees, shrubs, and grassy vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion. No anthropogenic impact found.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B –, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N17	Between Bârz and Boinița localities, N 44.84145º E 21.89474º, 205 m altitude	Substrate predominantly silty, isolated sandy areas. Water width between 14-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion. No anthropogenic impact was observed.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B –, C +
N18	Șopotu Nou locality, N 44.82892º E 21.88104º, 203 m altitude	Substrate predominantly of gravel, sand, and isolated silt. Water width between 14-17 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs and grassy vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion. Anthropogenic impact: road passage through the riverbed.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus A –, B +, C +* *Rhodeus sericeus A –, B +, C +* *Romanogobio banaticus A –, B +, C +* *Barbus balcanicus A –, B +, C +* *Sabanejewia balcanica A –, B +, C +* *Cottus gobio A –, B +, C +*
N19	Șopotul Nou bridge – confluence with Buceaua River, N 44.82127º E 21.86562º, 196 m altitude	Substrate predominantly of sand, gravel, and in some areas mud. Water width between 10-20 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. Appropriate degree of water shading. Stable banks, no signs of erosion. Anthropogenic impact: minor road passage through the riverbed.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcánica* A –, B +, C + *Cottus gobio* A –, B +, C +
N20	Breșnic-Corniș, N 44.82892º E 21.88104º, 189 m altitude	Substrate predominantly sand, gravel, and in some areas mud. Water width between 15-20 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia romanica* A –, B –, C + *Sabanejewia balcanica* A –, B –, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N21	Upstream Dracului Lake, N 44.84746º E 21.83561º, 190 m altitude	Substrate predominantly gravel, boulders, and sand with isolated portions of mud. Water width between 10-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs and herbaceous vegetation. Good degree of water shading. Stable banks, without signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B –, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N22	Nera River entrance in Nera Gorges, N 44.8594 E 21.81687, 186 m altitude	Substrate predominantly gravel, boulders, and sand with isolated portions of mud. Water width between 10-15 m. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Good degree of water shading. Stable banks, without erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N23	Dracului Lake area, N 44.863432º E 21.813235º, 185 m altitude	Substrate predominantly gravel, boulders, and sand with isolated portions of mud. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and grassy vegetation. Appropriate degree of water shading. Stable, steep, rocky banks without signs of erosion.	*Eudontomyzon danfordi* A –, B –, C + *Squalius cephalus* A –, B +, C + *Alburnus alburnus* A –, B –, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Romanogobio uranoscopus* A–, B+, C+ *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N24	Poiana Alunilor, N 44.873248º E 21.80600º, 180 m altitude	Substrate predominantly boulders, gravel, and coarse sand. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion. Steep right bank, and flat right bank – glade.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Romanogobio uranoscopus* A–, B+, C+ *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Cobitis elongatoides* A –, B –, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location	Sampling stations habitat characteristics	Fish species
N25	Two km downstream of Poaiana Alunilor, N 44.88885º E 21.80057º, 175 m altitude	Substrate predominantly boulders, gravel, coarse sand, and isolated areas with silt. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Stable banks, no signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N26	La Cârlige, N 44°53'22" E 21°47'35", 170 m altitude	Substrate mainly of boulders, gravel, and sand, and isolated silty areas. Riparian vegetation in good condition, of large trees, shrubs, and herbaceous vegetation. Good degree of water shading. Stable banks, without signs of erosion.	*Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N27	Cantonul lui Damian, N 44.89965º E 21.77771º, 168 m altitude	Substrate predominantly of boulders, gravel, coarse sand, and isolated portions with silt. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Stable banks, without signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C +
N28	Poiana Gura Lindinii, N 44.89987º E 21.76553º, 165 m altitude	Boulders, gravel, coarse sand, and small mudy areas. Riparian vegetation in good state, residing of big trees, shrubs, herbaceous vegetation. Good degree of shading. The left bank steep with slight signs of erosion, right bank flat. Floods debris on banks.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N29	Bei bridge – Nera River with Bei River confluence, N 44.90284º E 21.74546º, 161 m altitude	Substrate predominantly of boulders, gravel, coarse sand, portions of fine sand, and silt. Riparian vegetation in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Steep, rocky banks, without signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcanica* A –, B –, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N30	Upstream Sasca Română – Nera River out of Nera Gorges, N 44.90055º E 21.72236º, 153 m altitude	Substrate predominantly of gravel, coarse sand, boulders, portions with fine sand, and silt. Riparian vegetation in good state, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Submerged vegetation present. Stable banks, without erosion. Sources of human impact: household waste deposited in the major riverbed, waste also present on the banks plus roads crossing the minor riverbed.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B +, C + *Sabanejewia balcanica* A –, B +, C + *Cottus gobio* A –, B +, C +
N31	Sasca Montană locality Nera – Cheile Beușniței National Park Headquarter, N 44.88572º E 21.70699º, 148 m altitude	Substrate predominantly of gravel, coarse sand, boulders, portions of fine sand, and silt. Rocks covered with bioderma. Presence of submerged vegetation. Riparian vegetation in favorable condition, consisting of large trees, shrubs and herbaceous vegetation. Appropriate degree of water shading. Confluence with the Șușara Stream. Stable banks, no signs of erosion.	*Salmo trutta* A –, B +, C + *Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio uranoscopu* A–, B+, C+ *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Sabanejewia balcánica* A –, B –, C + *Zingel streber* A –, B +, C + *Cottus gobio* A –, B +, C +
N32	Two km downstream Sasca Montană locality, N 44.90039º E 21.68874º, 150 m altitude	Substrate predominantly formed of gravel, coarse sand, and boulders. The riparian vegetation is in favorable condition, consisting of large trees, shrubs, and herbaceous vegetation. Appropriate degree of water shading. Stable banks, without signs of soil erosion. Sources of anthropogenic impact: road crossing the minor riverbed of Nera River.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio uranoscopus* A–, B+, C+ *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B +, C + *Cottus gobio* A –, B +, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N33	Upstream Bogodinț locality, N 44.90724º E 21.67430º, 145 m altitude	Substrate mainly of gravel, boulders, coarse sand, and isolated areas of silt. Hard substrate covered with vegetation. Submerged vegetation. Riparian vegetation in good condition, of large trees, shrubs and herbaceous vegetation. Appropriate degree of water shading. Submerged vegetation present. Stable banks, with slight signs of erosion.	*Squalius cephalus* A –, B +, C + *Alburnus alburnus* A –, B +, C + *Alburnoides bipunctatus A –, B +, C +* *Chondrostoma nasus A –, B +, C +* *Rhodeus sericeus A –, B +, C +* *Gobio obtusirostris A –, B +, C +* *Romanogobio banaticus A –, B +, C +* *Barbus barbus A –, B +, C +* *Barbus balcanicus A –, B +, C +* *Neogobius melanostomus A –, B –, C +* *Cottus gobio A –, B +, C +*
N34	Downstream Bogodinț locality, N44°53.84860' E21°39.04680' 131 m altitude	Meadow landscape. Steep left bank, smooth right bank. Substrate mainly of gravel, boulders, coarse sand, and isolated silty areas. Riparian vegetation in good state, of large trees, shrubs and herbaceous vegetation. Rapids with strong current. Stable banks, with erosion. Sources of impact: road through the minor riverbed, and wastes on banks.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cottus gobio* A –, B +, C +
N35	Between Bogodinț and Petrilova localities, N44.88525333 E21.63783833 130 m altitude	Slightly steep banks with compact good riparian vegetation. Forrested left bank, meadow surrounded by forest on the right bank. Predominant substrate of gravel, boulders, coarse sand, and silty isolated areas. Presence of rapids. Strong current, deep water, fishing was done in challenging environmental conditions. Anthropogenic impact: household waste brought by floods.	*Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B –, C + *Sabanejewia balcanica* A –, B +, C + *Neogabius melanostomus* A –, B –, C + *Neogobius fluviatilis* A –, B –, C + *Cottus gobio* A –, B +, C +
N36	Between Bogodinț and Naidăș localities, N 44º53.3944' E 21º37.4752', 128 m altitude	Steep left forested bank. Straight bank smooth-meadow surrounded by forest. Predominant substrate of gravel, sand, and mud. Gravel coated with bioderma. Submerged vegetation present. Riparian vegetation in good condition, consisting of large trees. Smooth water flow.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus A –, B +, C +* *Chondrostoma nasus A –, B +, C +* *Rhodeus sericeus A –, B +, C +* *Romanogobio banaticus A –, B +, C +* *Barbus balcanicus A –, B +, C +* *Zingel streber A –, B +, C +* *Neogobius melanostomus A –, B –, C +* *Neogobius fluviatilis A –, B –, C +* *Cobitis elongata A –, B –, C +* *Cobitis elongatoides A –, B –, C +*

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N37	Upstream Naidăș locality, N 44º52.9534' E 21º36.3409', 123 m altitude	Steep banks with signs of erosion. Predominant substrate of gravel, sand, and mud. Gravel covered with bioderma. Submerged vegetation present. The density of riparian vegetation decreases, due to sheep and cattle grazing.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B –, C + *Cobitis elongata* A –, B –, C + *Cobitis elongatoides* A –, B –, C + *Sabanejewia balcanica* A –, B –, C + *Zingel streber* A –, B +, C + *Neogobius melanostomus* A –, B –, C + *Cottus gobio* A –, B +, C +
N38	Bridge in Naidăș locality, N 44º53.0731' E 21º35.2273', 120 m altitude	Smooth river banks, moderately represented riparian vegetation. Predominant substrate of gravel, boulders, sand, and fine sand, with isolated sectors of mud. Submerged vegetation present. Anthropogenic impact: cutting of riparian vegetation and also pollution with solid waste from Naidăș.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B –, C + *Cobitis elongatoides* A –, B –, C + *Sabanejewia balcanica* A –, B –, C + *Neogobius melanostomus* A –, B –, C +
N39	Upstream Lescovița locality, N 44.8768133 E 21.5643683, 108 m altitude	Smooth river banks, left bank – meadow, right bank – meadow and agricultural land. Substrate predominantly gravel, boulders, mud, isolated areas with boulders. Strong current. Moderate riparian vegetation. Anthropogenic impact: household waste brought by floods.	*Squalius cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio uransocopus* A–, B–, C+ *Barbus barbus* A –, B +, C + *Cobitis elongata* A –, B –, C + *Cobitis elongatoides* A –, B –, C + *Neogobius melanostomus* A –, B –, C + *Neogobius fluviatilis* A –, B –, C +
N40	The bridge of Lescovița locality, N 44º52.1892' E 21º32.3322', 106 m altitude	Left bank – slightly steep, right bank – smooth, meadow and pasture. Predominant substrate of gravel, coarse sand, and isolated portions with mud. Strong current. Fragmented riparian vegetation. Anthropogenic impact – household waste and construction materials deposited on the banks.	*Alburnoides bipunctatus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio banaticus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B –, C + *Cobitis elongata* A –, B –, C + *Cobitis elongatoides* A –, B –, C + *Sabanejewia balcanica* A –, B –, C + *Zingel streber* A –, B +, C + *Neogobius melanostomus* A –, B –, C + *Neogobius fluviatilis* A –, B –, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N41	Between the localities Lescovița and Zlatița, N 44º52.5772' E 21º31.4735', 105 m altitude	Slightly steep right bank with signs of erosion, smooth left bank characterized by meadow landscape. Predominantly substrate of gravel, boulders with submerged vegetation. Portions of sand and mud. Strong current. Moderate state of riparian vegetation.	*Squalis cephalus* A –, B +, C + *Alburnoides bipunctatus A –, B +, C +* *Rhodeus sericeus A –, B +, C +* *Gobio obtusirostris A –, B +, C +* *Barbus balcanicus A –, B +, C +* *Cobitis elongata A –, B –, C +* *Cobitis elongatoides A –, B –, C +* *Sabanejewia balcanica A –, B –, C +* *Neogobius melanostomus A –, B –, C +* *Neogobius fluviatilis A –, B –, C +*
N42	Upstream Zlatița locality, N 44.89987º E 21.76553º, 99 m altitude	Smooth banks, the landscape is characteristic for the meadows area. Substrate predominantly of gravel, boulders, with portions of sand and silt. Strong current. Riparian vegetation in good condition.	*Squalis cephalus* A –, B +, C + *Alburnus alburnus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Barbatula barbatula* A –, B –, C + *Cobitis elongata* A –, B –, C + *Cobitis elongatoides* A –, B –, C + *Neogobius melanostomus* A –, B –, C + *Neogobius fluviatilis* A –, B –, C +
N43	Downstream Zlatița locality, N 44º52.0285 E 21º27.8096', 88 m altitude	Eroded and steep banks. Strong current. Abundant riparian vegetation in favorable condition. Pastures present on the Serbian bank of the Nera River. Anthropogenic impact: household waste accumulated following floods.	*Squalis cephalus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio uranoscopus* A–, B–, C+ *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cobitis elongata* A –, B –, C + *Sabanejewia balcanica* A –, B –, C + *Neogobius fluviatilis* A –, B –, C +
N44	Câmpia locality, N 44º52.0795' E 21º24.7250', 84 m altitude	Steep left bank, heavily eroded. Smooth right bank. Strong current, deep water. Abundant riparian vegetation in favorable condition. Shrubs.	*Alburnoides bipunctatus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Perca fluviatilis* A –, B –, C +
N45	Socol locality, N 44º51.8404' E 21º22.0435', 65 m altitude	Slightly steep banks, with signs of erosion. Strong current, deep water. Abundant riparian vegetation in favorable condition. Shrubs.	*Eudontomyzon danfordi* A –, B –, C + *Squalis cephalus* A –, B +, C + *Leuciscus aspius* A –, B –, C + *Alburnus alburnus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Romanogobio uranoscopus* A–, B–, C+ *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Carassius gibelio* A –, B –, C + *Cobitis elongata* A –, B –, C + *Perca fluviatilis* A –, B –, C + *Neogobius melanostomus* A –, B –, C +

Table 1 (continued): (A) fish species reported by Antipa (1909) in the study area at the end of the 19th century (+); (B) fish species reported by Bănărescu (1964, 1969) in the study area in the first half of the 20th century (+); (C) fish species sampled and identified by the authors in the period 2022-2025 (+). No historical data/no fish sampled (–).

Sampling stations	Location, coordinates and altitude	Sampling stations habitat characteristics	Fish species
N46	Downstream Socol locality, at the confluence with Danube River, in the Nera Delta area	A delta like hidrogeomorphology characteristics sector, and rich riverine vegetation.	*Eudontomyzon danfordi* A –, B –, C + *Esox lucius* A –, B +, C + *Rutilus rutilus* A –, B +, C + *Squalis cephalus* A –, B +, C + *Leuciscus idus* A –, B +, C + *Tinca tinca* A –, B –, C + *Scardinius erythrophthalmus* A–,B–,C+ *Leuciscus aspius* A –, B –, C + *Alburnus alburnus* A –, B +, C + *Alburnoides bipunctatus* A –, B +, C + *Blicca bjoerkna* A –, B –, C + *Abramis brama* A –, B –, C + *Ballerus sapa* A –, B –, C + *Ballerus ballerus* A –, B –, C + *Vimba vimba* A –, B –, C + *Pelecus cultratus* A –, B –, C + *Chondrostoma nasus* A –, B +, C + *Rhodeus sericeus* A –, B +, C + *Gobio obtusirostris* A –, B +, C + *Romanogobio albipinnatus* A–, B+, C+ *Pseudorasbora parva* A –, B –, C + *Barbus barbus* A –, B +, C + *Barbus balcanicus* A –, B +, C + *Cyprinus carpio* A –, B +, C + *Carassius gibelio* A –, B –, C + *Hypophthalmichthys molitrix* A–,B–,C+ *Hypophthalmichthys nobilis* A–,B–,C+ *Ctenopharyngodon idella* A –, B –, C + *Misgurnus fossilis* A –, B –, C + *Cobitis taenia* A –, B –, C + *Cobitis elongata* A –, B –, C + *Sabanejewia bulgarica* A –, B –, C + *Silurus ganis* A –, B +, C + *Ameiurus nebulosus* A –, B –, C + *Lota lota* A –, B +, C + *Syngnathus abaster* A –, B –, C + *Lepomis gibosus* A –, B –, C + *Perca fluviatilis* A –, B –, C + *Gymnocephalus cernua* A –, B –, C + *Gymnocephalus schraetser* A–, B–, C+ *Gymnocephalus baloni* A –, B –, C + *Sander lucioperca* A –, B –, C + *Sander volgensis* A –, B –, C + *Neogobius melanostomus* A –, B –, C + *Neogobius fluviatilis* A –, B –, C + *Ponticola kessleri* A –, B –, C + *Babka gymnotrachelus* A –, B –, C + *Benthophilus stellatus* A –, B –, C + *Percottus glenii* A –, B –, C +

DISCUSSION

Natural, semi-natural and anthropogenical induced aquatic ecosystems structure, processes, and last but not least their fish fauna features vary significantly from the spatio-temporal points of views in the Carpathians' Basin hydrographical net (Haubrock et al., 2025; Rusu et al., 2025; Burlacu et al., 2024; Czeglédi et al., 2024; Hämmerling et al. 2024; Mruk et al., 2024; Stavrescu-Bedivan, 2024; Uiuiu et al., 2024; Afanasyev et al., 2023, 2013; Marić et al., 2022; Costea et al, 2021; Bănăduc et al., 2021, 2020, 2017, 2013, 2012, 2010, Cismaș et al., 2018; Voicu et al., 2018; Florea, 2017; Telcean et al., 2017: Crăciun et al., 2015; Didenko et al., 2014; Popa et al., 2019, 2015, 2013; Popescu et al., 2015; Moldoveanu et al., 2013; Davideanu et al., 2010; Momeu et al., 2009; Staicu et al., 1998; Simalcsik and Bates, 1973) the different environmental features determine the establishing, perpetuation, changes or sometimes disapearence of fish zonation grounded on the indicator species (Bănărescu, 1964).

The Carpathian Mountains' lotic systems springing in alpine areas, like Nera River, have five such particular fish zones, namely: brown trout zone, grayling and Mediterranean barbell zone, nase zone, barbel zone, and carp zone (Bănărescu, 1964). Some deviances from these natural fish zones were found in this research and were pointed out in this paper.

Natural and semi-natural environmental conditions vary greatly along the Nera River, these together with the diversity and intensity of human activities have induced changes in the different ichthyological zones (Bănărescu, 1964) and sectors (N1-46) of the river.

In total 59 fish species were identified, 10 of them have the same known (past-present) number of stations (=) and range as they had in the past, 49 have an increased number of known (past-present) stations (+) and range, and no species have a decreased number of known (past-present) stations (–) range: *Eudontomyzon danfordi* Regan, 1911 (+ 8); *Salmo trutta fario* Linnaeus, 1758 (= 8); *Esox lucius* Linnaeus, 1758 (= 1); *Rutilus rutilus* (Linnaeus, 1758) (= 1); *Squalius cephalus* (Linnaeus, 1758) (= 25, + 4); *Leuciscus idus* (Linnaeus, 1758) (= 1); *Phoxinus phoxinus* (Linnaeus, 1758) (= 1); *Tinca tinca* (Linnaeus, 1758) (+ 1); *Scardinius erythrophthalmus* (Linnaeus, 1758) (+ 1); *Leuciscus aspius* (Linnaeus, 1758) (+ 3); *Alburnus alburnus* (Linnaeus, 1758) (= 4, + 3); *Alburnoides bipunctatus* (Bloch, 1782) (= 35, + 8); *Blicca bjoerkna* (Linnaeus, 1758) (+ 1); *Abramis brama* (Linnaeus, 1758) (+ 1); *Ballerus sapa* (Pallas, 1814) (+ 1); *Ballerus ballerus* (Linnaeus, 1758) (+ 1); *Vimba vimba* (Linnaeus, 1758) (+ 1); *Pelecus cultratus* (Linnaeus, 1758) (+ 1); *Chondrostoma nassus* (Linnaeus, 1758) (= 20, + 3); *Rhodeus sericeus* (Bloch, 1782) (= 32, + 1); *Gobio obtusirostris* Valenciennes, 1842 (= 20, + 1); *Romanogobio uranoscopus* (Agassiz, 1828) (= 3, + 2); *Romanogobio albipinnatus* (Lukasch, 1933) (= 1); *Romanogobio banaticus* (Bănărescu, 1960) (= 24, + 1); *Pseudorasbora parva* (Temminck and Schlegel, 1846) (+ 1); *Barbus barbus* (Linnaeus, 1758) (= 14); *Barbus balcanicus* Kotlík, Tsigenopoulos, Ráb and Berrebi, 2002 (= 32, +7); *Cyprinus carpio* Linnaeus, 1758 (= 1); *Carassius gibelio* (Bloch, 1782) (+ 2); *Hypophthalmichthys molitrix* (Valencienes, 1844) (+ 1); *Hypophthalmichthys nobilis* (Richardson, 1845) (+ 1); *Ctenopharyngodon idella* (Valencienes, 1844) (+ 1); *Barbatula barbatula* (Linnaeus, 1758) (= 2, + 7); *Misgurnus fossilis* (Linnaeus, 1758) (+ 1); *Cobitis taenia* Linnaeus, 1758 (+ 1); *Cobitis elongata* Heckel and Kner, 1858 (= 16, + 11); *Cobitis elongatoides* Băcescu and Mayer, 1969 (+ 8); *Sabanejewia romanica* (Băcescu, 1943) (+ 1); *Sabanejewia balcanica* (Karaman, 1922) (= 9, + 12); *Sabanejewia bulgarica* (Drensky, 1928) (+ 1); *Silurus glanis* Linnaeus, 1758 (= 1); *Ameiurus nebulosus* (Lesueur, 1819) (+ 1); *Lota lota* (Linnaeus, 1758) (= 1, + 2); *Syngnathus abaster* Risso, 1827 (+ 1); *Lepomis gibbosus* (Linnaeus, 1758) (+ 1); *Perca fluviatilis* (Linnaeus, 1758) (+ 3); *Gymnocephalus cernua* (Linnaeus, 1758) (+ 1); *Gymnocephalus schraetser* (Linnaeus, 1758) (+ 1); *Gymnocephalus baloni* Holcík and Hensel, 1974 (+ 1); *Sander lucioperca* (Linnaeus, 1758) (+ 1); *Sander volgensis* (Gmelin, 1789) (+ 1);

Zingel streber (Siebold, 1863) (+ 13); *Neogobius melanostomus* (Pallas, 1814) (+ 11); *Neogobius fluviatilis* (Pallas, 1814) (+ 8); *Ponticola kessleri* (Günther, 1861) (+ 1); *Babka gymnotrachelus* (Kesslr, 1857) (+ 1); *Benthophilus stellatu*s (Sauvage, 1874) (+ 1); *Percottus glenii* Dybowski, 1877 (+ 1); and *Cottus gobio* Linnaeus, 1758 (= 26).

This ichthiofauna structure revealed situation, including significant changes regarding new species presence or ranges modifications can be explain simply by the appearance of new species in the studied area and by the extension of the range of the majority of the species (38 of 59) counted here, and/or finnaly by the diferent quality of results of old studies approached here and this new study. In any circumstances, the quality of the results is expected to increase due to modern fishing methods and more focused present fishing efforts. Important to be highlighted here is the fact that no single species disappeared in this river from the middle of the 20th century till today, relatively close to the middle of the 21st century. The reader of this paper has to assess the obtained results in terms of species in the context of different synonyms used in the past and in the present, and even in some new species proposal names.

The Nera River mountainous **upper trout zone** (N1-N3 sampling stations sector; 638-496 m. altitude) was the least affected by human impact, and no changes in the fish communities' structure in comparison with the old data appeared, namely only the flagship fish species *Salmo trutta fario* is present here. The **lower trout zone** (N4-6; 453-367 m. alt.) had and still has a naturally increased number of characteristic species trout zone, like *Salmo trutta fario* and *Cottus gobio* with a new appearance from downstream sectors namely *Alburnoides bipunctatus*. The lower sampling stations, bring a mixture of species near the well known in the past characteristic *Salmo trutta fario*, the new ones appeared lately like *Alburnoides bipunctatus, Barbus balcanicus,* and *Barbatula barbatula,* still characteristic for the lower trout zone; the totally unexpected *Lota lota* presence characteristic only for three downstream ichthyological zones (Mediterranean barbell zone), reveal the fact that some important expansion pressure from the downstream fish communities appear, and the local conditions allow this uncharacteristic species to appear and remain (N9).

The submountainous **grayling-mediterranean barbel zone** (N7-11; 328-262 m. alt.), include in spite of the natural missing of its flagship species, appearance in the proximity of the first rural localities with a change in the human activities, a context which bring a mixture of species near the well known in the past characteristic *Salmo trutta fario, Cottus gobio,* the new ones appeared lately like *Eudontomyzon danfordi, Alburnoides bipunctatus, Phoxinus phoxinus, Barbus balcanicus, Barbatula barbatula, Gobio obtusirostris,* and *Squalius cephalus* still characteristic for the lower trout zone; again the unexpected *Lota lota* presence characteristic only for three downstream ichthyological zones (barbell zone), reveal the fact that some important expansion pressure from the downstream fish communities appear, and the local conditions allow this uncharacteristic species to appear and remain. Other downstream common nase zone characteristic species start to appear namely: *Romanogobio banaticus, Cobitis elongate,* and *Sabanejewia balcanica*.

The flat land **common nase zone** (N12-22; 244-186 m. alt.) with its fish flag species *Chondrostoma nasus* appear in the proximity of the first and single large locality proximity area, Bozovici large commune, with the appearance of water pollution, and a mixture of characteristic for this fish zone species *Squalius cephalus, Alburnoides bipunctatus, Gobio obtusirostris, Gobio uranoscopus, Barbatula barbatula, Cobitis elongata, Sabanejewia romanica, Sabanejewia balcanica, Zingel streber*, with upstream species *Cottus gobio, Barbus balcanicus, Eudontomyzon danfordi,* and downstream species *Leuciscus aspius, Alburnus alburnus, Rhodeus sericeus,* and *Romanogobio banaticus*.

The **barbell zone** (N23-44; 185-84 m. alt.) with its fish flag species *Barbus barbus* appear in Nera River Gorges till upstream the proximity with the confluence with the Danube, together with a mixture of characteristic for this fish zone species *Squalius cephalus, Alburnus alburnus, Alburnoides bipunctatus, Romanogobio banaticus, Gobio obtusirostris, Zingel streber, Cobitis elongatoides,* with upstream species *Salmo trutta, Cottus gobio, Eudontomyzon danfordi, Barbus balcanicus, Sabanejevia balcanica, Cobitis elongate, Gobio uranoscopus, Chondrostoma nasus, Barbatula barbatula, Neogobius fluviatilis,* and downstream species: *Rhodeus sericeus, Neogobius melanostomus,* and *Perca fluviatilis.*

The **carp zone**, (N45-46; 65-60 m. alt.) with its fish flag species *Cyprinus carpio* appear in the proximity of the Nera and Danube rivers proximity, together with a mixture of characteristic for this fish zone species *Perca fluviatilis, Cobitis elongata, Squalius cephalus, Alburnus alburnus, Rhodeus sericeus, Leuciscus aspius, Neogobius melanostomus, Carassius gibelio, Cobitis taenia, Neogobius fluviatilis, Esox lucius, Rutilus rutilus, Leuciscus idus, Tinca tinca, Scardinius erythrophthalmus, Blicca bjoerkna, Abramis brama, Ballerus sapa, Ballerus ballerus, Vimba vimba, Pelecus cultratus, Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Ctenopharyngodon idella, Romanogobio albipinnatus, Pseudorasbora parva, Misgurnus fossilis, Sabanejewia bulgarica, Silurus ganis, Ameiurus nebulosus, Syngnathus abaster, Lepomis gibosus, Gymnocephalus cernua, Gymnocephalus schraetser, Gymnocephalus baloni, Sander lucioperca, Sander volgensis, Benthophilus stellatus, Ponticola kessleri, Babka gymnotrachelus, Percottus glenii,* with upstream species *Alburnoides bipunctatus, Lota lota, Gobio obtusirostris, Eudontomyzon danfordi, Barbus balcanicus, Barbus barbus, Gobio uranoscopus,* and *Chondrostoma nasus.*

We highlight below the new found fish for the Nera River, few species of conservative interest, many of direct/indirect economic interest, and some invasive species, in general the most of them appeared in the Nera River delta, at the contact with the Danube River.

Eudontomyzon danfordi (Petromyzonti, Petromyzontiformes, Petromizontidae, Lampetrinae) it is a freshwater demersal, potamodromous fish and of Least Concern in IUCN Red List; *Tinca tinca* (Teleostei, Cypriniformes, Tincidae) it is a freshwater, brackish, demersal, potamodromous fish and of Least Concern in IUCN Red List; *Scardinius erythrophthalmus* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic fish and of Least Concern in IUCN Red List; *Leuciscus aspius* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern in IUCN Red List; *Blicca bjoerkna* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, demersal, potamodromous fish and of Least Concern in IUCN Red List; *Abramis brama* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern in IUCN Red List; *Ballerus sapa* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic fish and of Least Concern in IUCN Red List; *Ballerus ballerus* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern in IUCN Red List; *Vimba vimba* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, benthopelagic, anadromous fish and of Least Concern in IUCN Red List; *Pelecus cultratus* (Teleostei, Cypriniformes, Leuciscidae, Leuciscinae) is a freshwater, brackish, pelagic, anadromous fish and of Least Concern in IUCN Red List; *Pseudorasbora parva* (Teleostei, Cypriniformes, Gobionidae) is a freshwater, brackish, benthopelagic fish and of Least Concern in IUCN Red List; *Carassius gibelio* (Teleostei, Cypriniformes, Cyprinidae, Cyprininae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern in IUCN Red List; *Hypophthalmichthys molitrix* (Teleostei, Cypriniformes, Xenocyprididae) is a freshwater,

brackish, benthopelagic, potamodromous fish and a Near Threatened species in IUCN Red List; *Hypophthalmichthys nobilis* (Teleostei, Cypriniformes, Xenocyprididae) is a freshwater, brackish, benthopelagic, potamodromous fish and a data deficient species in IUCN Red List; *Ctenopharyngodon idella* (Teleostei, Cypriniformes, Xenocyprididae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern species in IUCN Red List; *Misgurnus fossilis* (Teleostei, Cypriniformes, Cobitidae) is a freshwater, brackish, demersal, potamodromous fish and of Least Concern species in IUCN Red List; *Cobitis taenia* (Teleostei, Cypriniformes, Cobitidae) is a freshwater, benthopelagic, potamodromous fish and of Least Concern species in IUCN Red List; *Cobitis elongatoides* (Teleostei, Cypriniformes, Cobitidae) is a freshwater, benthopelagic fish, and of Least Concern species in IUCN Red List; *Sabanejewia romanica* (Teleostei, Cypriniformes, Cobitidae) is a freshwater, demersal fish and a Vulnerable species in IUCN Red List; *Sabanejewia bulgarica* (Teleostei, Cypriniformes, Cobitidae) is a freshwater, demersal fish and of Least Concern species in IUCN Red List; *Ameiurus nebulosus* (Teleostei, Siluriformes, Ictaluridae) is a freshwater, demersal fish and of Least Concern species in IUCN Red; *Syngnathus abaster* (Teleostei, Syngnathiformes, Syngnathidae, Syngnathinae) is a marine, freshwater, brackish, demersal fish and of Least Concern species in IUCN Red List; *Lepomis gibbosus* (Teleostei, Centrarchiformes, Centrarchidae) is a freshwater, brackish, benthopelagic potamodromous fish) and of Least Concern species in IUCN Red List; *Perca fluviatilis* (Teleostei, Perciformes/Percoidei, Percidae, Percinae) is a freshwater, demersal, anadromous fish and of Least Concern species in IUCN Red List; *Gymnocephalus cernua* (Teleostei, Perciformes/Percoidei, Percidae, Percinae) is a freshwater, brackish, benthopelagic, potamodromous fish and of Least Concern species in IUCN Red List; *Gymnocephalus schraetser* (Teleostei, Perciformes/Percoidei, Percidae, Percinae) is a freshwater, demersal fish and of Least Concern species in IUCN Red List; *Gymnocephalus baloni* (Teleostei, Perciformes/Percoidei, Percidae, Percinae) is a freshwater, benthopelagic fish and of Least Concern species in IUCN Red List; *Sander lucioperca* (Teleostei, Perciformes/Percoidei, Percidae, Luciopercinae) is a freshwater, brackish, pelagic, potamodromous fish and of Least Concern species in IUCN Red List; *Sander volgensis* (Teleostei, Perciformes/Percoidei, Percidae, Luciopercinae) is a freshwater, brackish, demersal fish and of Least Concern species in IUCN Red List; *Zingel streber* (Teleostei, Perciformes/Percoidei, Percidae, Luciopercinae) is a freshwater, demersal fish and of Least Concern species in IUCN Red List; *Neogobius melanostomus* (Teleostei, Gobiiformes, Gobiidae, Gobiinae) is a marine, brackish, demersal, amphidromous fish and of Least Concern species in IUCN Red List; *Neogobius fluviatilis* (Teleostei, Gobiiformes, Gobiidae, Gobiinae) is a freshwater, brackish, benthopelagic fish and of Least Concern species in IUCN Red List; *Ponticola kessleri* (Teleostei, Gobiiformes, Gobiidae, Gobiinae) is a freshwater, brackish, benthopelagic fish and of Least Concern species in IUCN Red List; *Babka gymnotrachelus* (Teleostei, Gobiiformes, Gobiidae, Gobiinae) is a freshwater, brackish, benthopelagic fish and of Least Concern species in IUCN Red List; *Benthophilus stellatu*s (Teleostei, Gobiiformes, Gobiidae, Gobiinae) is a freshwater, brackish, demersal fish and of Least Concern species in IUCN Red List; *Percottus glenii* (Teleostei, Gobiiformes, Odontobutidae) is a freshwater, brackish, demersal fish and of Least Concern species in IUCN Red List. (IUCN, 2025; Riede, 2004; Gerstmeier and Romig, 1998; Baensch and Riehl, 1997; Scott and Crossman, 1973).

CONCLUSIONS

Antipa (1909) provided a general overview of the ichthyofauna of Romania since the beginning of the 19th century but did not specifically cover the Nera River. Detailed documentation for the Nera began in the mid-20th century with Bănărescu (1964). This current research almost doubled the number of fish species recorded as present in Nera River.

The Nera River ichthyofauna present state is induced by the adaptation and evolution of fish fauna to the local high variable relief of this river watershed. Over the last half-century, this river has been moderately influenced by the varying degrees of human activities. Nevertheless, several sectors remain in a good ecological status and can be considered sanctuaries for valuable fish species of both ecological and economic importance. Also here the climate change impact can be added as a significant driving force. Given the area's relatively low impact from human activities and the conservative efforts made there by the local protected areas managers create conditions for the this river to beecome a relatively resilient cornerstone hydro-bio-ecological system capable of successfully facing the negative consequences of human impacts. It should be noted that the climate change process could also be responsible for the identified fish fauna changes, an issue that must remain a subject of permanent future concern. The highest number of newly identified fish species was recorded in the Nera River delta. This finding highlights the impact of the nearby Danube River as a potential pool for fish species expanding their ranges upstream into the Nera Basin.

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