THE STATUS OF *ROMANOGOBIO URANOSCOPUS* (AGASSIZ, 1828) SPECIES, IN MARAMUREŞ MOUNTAINS NATURE PARK (ROMANIA)

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KEYWORDS: Danubian longbarbel gudgeon, habitats, human impact, assessment.

ABSTRACT

The condition of aquatic habitats typically occupied by *Romanogobio uranoscopus* within the Maramureş Mountains Natural Park fluctuates, in the best cases, between reduced to average. Good or excellent conservation status is now absent for populations of this species in the researched area. The identified human impact types (poaching, minor riverbeds morphodynamic changes, solid and liquid natural flow changes, destruction of the riparian vegetation and bush vegetation, habitat fragmentation/isolation of population, organic and mining pollution and displaced fish that are washed away during the periodic flooding in the lotic sectors uniformized by humans) are contributing to the diminished ecological state of *Romanogobio uranoscopus* habitats and for that reason populations. *Romanogobio uranoscopus* is now considered a rare species in the studied basin but where this species was specified as missing, it has been registered with a restorative potential.

RESUMEN: El estado de *Romanogobio uranoscopus* (Agassiz, 1828) en el Parque Natural Montañas Maramureş (Rumania).

La condición de los hábitats acuáticos que típicamente ocupa *Romanogobio uranoscopus* dentro del Parque Natyural Montañas Maramures fluctúa, en el mejor de los casos, entre degradado y promedio. Los estados excelente o bueno no existen para las poblaciones de esta especie en el área de estudio. Se categorizaron distintos tipos de impacto humano (pesca ilegal, cambios morfodinámicos menores en los ríos, cambios en el flujo natural de líquidos y sólidos, destrucción de vegetación arbustiva y de árboles riparios, aislamiento/fragmentación del hábitat de la población, contaminación orgánica y de minería y desplazamiento de peces que son arrastrados en los periodos de inundación hacia sectores lóticos homogeneizados por el humano) que contribuyen a empeorar el estado ecológico de los hábitats de *Romanogobio uranoscopus* y, por consiguiente, de sus poblaciones. *Romanogobio uranoscopus* puede ser considerada actualmente como una especie rara en el cuenca estudiada, que si bien ha desaparecido de algunos sectores, aún existe potencial de restauración.

REZUMAT: Starea de conservare a speciei *Romanogobio uranoscopus* (Agassiz, 1828), în Parcul Natural Munţii Maramureşului (România).

Calitatea habitatelor acvatice ocupate de regulă de *Romanogobio uranoscopus* în Parcul Natural Munții Maramureșului variază între scăzută și medie, în cele mai bune cazuri. Starea de conservare a populațiilor acestei specii în zona investigată variază între moderată și slabă. Categoriile de impact antropic identificate (braconaj, modificări în morfodinamica albiilor minore, modificări de debit natural solid și lichid, distrugerea arboretelor ripariene și a vegetației arbustive, fragmentarea habitatelor/izolarea populațiilor, poluare organică și minieră) contribuie la deteriorarea stării ecologice a habitatelor speciei *Romanogobio uranoscopus* și la declinul populațiilor sale. Specia poate fi considerată în prezent ca specie rară în bazinul studiat, dar există potențial restaurativ pentru mai multe sectoare de râu.

INTRODUCTION

The condition of the highland water natural sources are generally influenced by low anthropic activities (Curtean-Bănăduc and Bănăduc, 2012; Romanescu, 2016), which should be evaluated in a specific area background.

The lotic systems of the Maramureș Mountains Nature Park area consist mostly of the Vișeu Basin (Fig. 1) and a few little streams, of the Bistrița Aurie Basin, in the northern side of the Romanian national territory. This basin is neighboured by the Maramureș Mountains in the northeast, the Rodna Mountains in the south, and the Maramureș Hills in the west and southwest. The lowest sector of the studied watershed is at 303 m above sea level at the junction of the Vișeu and Tisa rivers. The highest sector is at 2,303 m altitude in the Pietrosul Rodnei Peak in the Rodna Mountains. Due to the geological and the relief variety within this watershed (glacial relief forms, karst, exokarst, and so forth), the studied basin is various in scenery, with a great diversification of biotopes, biocoenosis, including ichthyocoenosis. (Curtean-Bănăduc et al., 2008; Bănăduc et al., 2011)

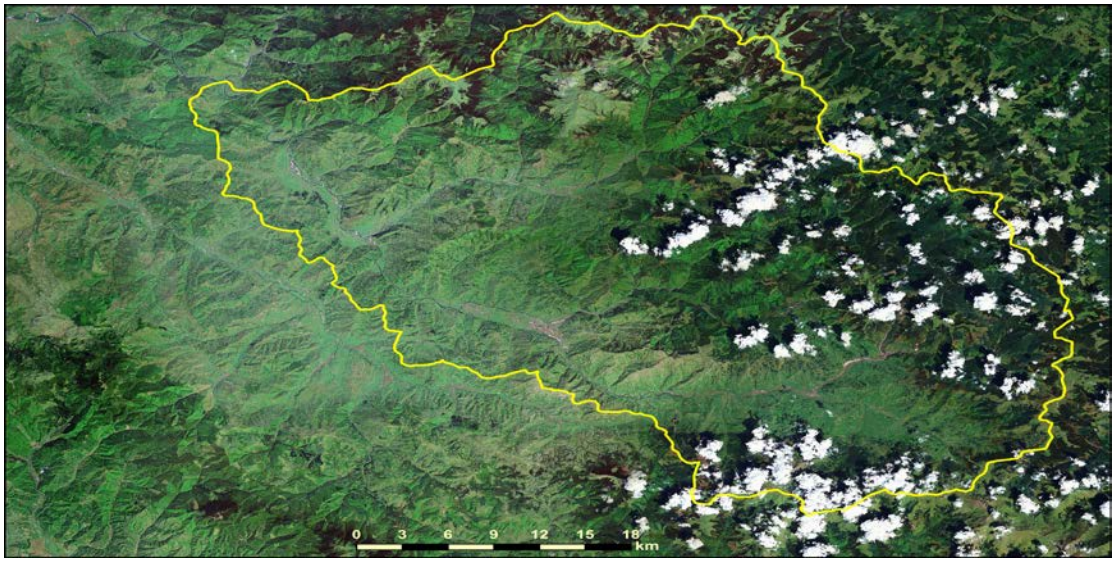

Figure 1: Vișeu River basin; GIS support Danci O.

The Vişeu River is one of the main tributary of the Danube River, entering into the much larger Tisa River. It is over 80 km long and has a multiannual average discharge of 30.7 m^3/s at its lower sector near the junction with the Tisa River. The springs are situated in the Prislop Pass (1,416 m) area and it flows into the Tisa River, in the proximity of Valea Vișeului locality, the watershed covers 1,606 km^2. In its higher area, from its springs to the Moisei locality, the Vișeu River has a considerable declination (20-50 m/km) having as a name Vișeuț or Borșa. The Vișeu River at Moisei locality drains into the Maramureș Depression where its valley is wider, in spite of the presence of few narrow gorge-like corridors: Rădeasa Gorges between Moisei and Vișeu de Sus, Oblaz Gorges between Vișeu de Jos and Leordina, and Vișeu Gorges between Bistra and Vișeului Valley. The hydrography of Vișeu River is of Eastern-Carpathian-Moldavian type in the upper part and of Eastern-Carpathian-Transylvanian type in its lower sector. Its flow is important in the spring (39.4% of the annual flow), later diminishing in the summer (27% of the annual flow), further diminishing during the autumn (18.6% of the annual flow), with its minimum period during winter (15% of the annual flow). (Curtean-Bănăduc et al., 2008; Bănăduc et al., 2011)

Because the Vișeu Watershed is located, for the largest part, in mountainous areas (67%) there is also an important density of the hydrographic network (0.7-1 km/km^2) and one of the highest specific flows in the Eastern Carpathians, as a consequence of rain and snow of over 1,100 mm/year. In the Vişeu River upper part, its tributaries start in the glacial Rodna Mountains, with a flow of around five m^3/s. The most important Rodna-originating tributaries of Vişeu are the following: Fântânilor Valley (seven km in length), Negoiasa Valley (six km), Repedea Valley (10 km), Pietroasa Valley (seven km), Vremeșu Valley, Hotarului Stream, Dragoș's Valley (11 km) and Izvorul Negru (seven km). The most important Maramureș Mountains right side tributaries are: Hășmașul Mic, Cercănel (11 km), Țâșla (20 km), Vaser (52 km in length and catchment area of 422 km^2, with an average flow of nine m^3/s contributing 27% to the total flow of Vișeu), Novăț (16 km, 88 km^2 tributary of the Vaser), Ruscova (39 km in length and 435 km^2 catchment area, average discharge of 11.3 m^3/s), Socolău (13 km in length and 72 km^2 catchment area, tributary of the Ruscova), Repedea (19 km in length and 87 km^2 catchment area, tributary of the Ruscova), Bardi (11 km in length and 32 km^2 catchment area, tributary of the Ruscova), Covașnița (11 km in length and 34 km^2 catchment area, tributary of the Ruscova), Frumușeaua (14 km in length) and Bistra (nine km in length). The left-side tributaries spring from the Maramureș Hills area, which are relatively small with low water input: Drăguiasa, Cocicoi, Spinului, Plăiuț, Neagră and Luhei. (Curtean-Bănăduc et al., 2008; Bănăduc et al., 2011)

In the Vişeu River basin, the water characteristics are influenced in some areas by the presence of mineral springs (approximately five in Maramureş Hills; approximately six in Rodnei Mountains, and 150 in Maramureş Mountains) with appreciably various composition (bicarbonate, ferrous, sulphurous and saline) (Curtean-Bănăduc et al., 2008).

In the Rodnei and Maramureş Mountains the lotic systems are sometimes "blocked" by sizable waterfalls and series of rapids, we note such large waterfalls from the Rodnei Mountains: Cailor, Cimpoioasa, Repedea and Izvorul Verde; and from the Maramureş Mountains: Criva, Tomnatic and Bardău. Stagnant water systems also materialize. Glacial lakes from Rodnei Mountains are situated at an altitude over 1,900-1,950 m and were formed at the heels of some deposits like the following: Gropi Lake, Iezer Lake, Rebra Lake, Buhăiescu Lake, Cimpoieş Lake and Negoiescu Lake. The wetlands (marshes) of the studied area are eutrophic and oligotrophic: Tăul Obcioarei, Strungi, Jneapănul Hânchii, Tăul Ihoasa, Tăul Băiţii, Pietrosul Barcăului, Vârtopul Mare, Preluca Meşghii, Tăul cu Muşchi and Bedreasca. The lakes in the Maramureş Mountains area are Bârsănescu, Lutoasa, Budescul Mare, Vinderel and Măgurii. Near Petrova locality in the Vişeu Valley, there are a few small bodies of water (ponds). (Curtean-Bănăduc et al., 2008; Bănăduc et al., 2011)

The mixture of aquatic and semi-aquatic habitats and their related endangered, rare and endemic species from Vişeu Basin are diversified and very precious under conservation perspective. The fish species of the studied area are not exceptions in these circumstances, as noted by many ichthyologists for over a century in particular studies (Bănărescu, 1964; Staicu et al., 1998; Curtean-Bănăduc et al., 2008). Over 50% of the local fish species are of important conservation value.

Romanogobio uranoscopus (Assiz, 1828) is one of these fish species of conservation value (Bănăduc, 2007), populations within the Vişeu River basin have significantly diminished. Actual distribution and abundances of these valuable taxa are not completely known and specific targeted data for an optimum management is highly necessary.

MATERIAL AND METHODS

Study on populations of *Romanogobio uranoscopus* within the Maramureş Mountains Natural Park was done in 2007-2015, consisting of 370 sampling sectors (Fig. 2; Tab. 1). This study included population mapping, assessment of the actual conservation status, and description of the elements culpable for the actual diminishing of populations.

The study starts from the working hypothesis (a) and null hypothesis (b): 1a. Aquatic habits with reduced conditions will have smaller populations of *R. uranoscopus*; 1b. There will be no difference in *R. uranoscopus* populations between habitats of reduced or average condition; 2a. The population of R. uranoscopus has declined over the period 2007-2015; the population of *R. uranoscopus* has not declined over the period 2007-2015.

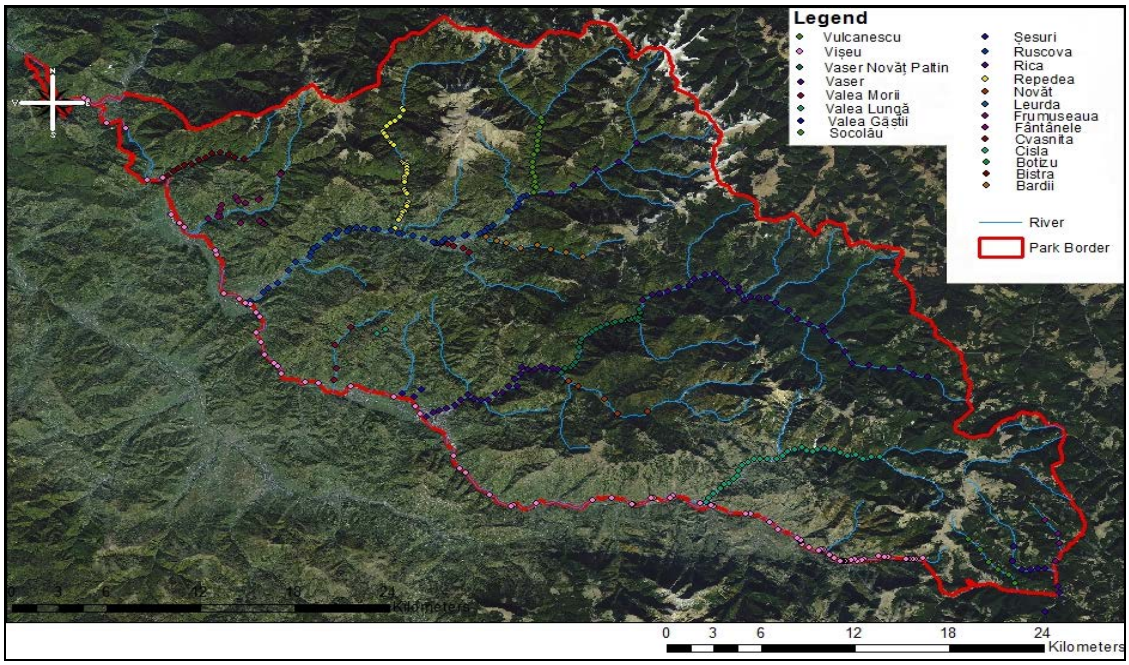

Figure 2: Locations of the 370 sampling stations; GIS support Danci O.

To assess the status and population of *Romanogobio uranoscopus* within the Maramureşului Mountains Nature Park, quantitative samples were collected from sampling stations within a range of three kilometres between two successive sectors on all habitats with proper conditions for this fish species. The positions of the sampling stations allow the assessment of the consequence of anthropic impact on the studied fish populations, containing the biotope state change, presence of riverbed exploitation, hydrotechnical works, pollution sources, uncontrolled sport fishing and heavy poaching.

Ichthyofauna quantitative sampling was realized by the electronarcosis, per unit of time and effort per each section (two hours on Vişeu River, one hour on Ruscova River, 30 minutes on the other rivers of the studied zone), on five longitudinal sectors of 100 m length. After the fish species identification, all fish were right away released in their habitat.

The number of fish sampled in the time/effort unit can be transformed by correlation in classes: (C) – common fish species, (R) – rare fish species, or (V) – very rare fish species, alike the guidelines for Natura 2000 standard data form filling, “In mammals, amphibians, reptiles and fishes, no numeric information can be indicative and then the size/density of the population is evaluated as (C) – common species, (R) – rare species, or (V) – very rare species”.

The criteria used to assess the population status are: population size, balanced distribution of individuals by age classes, areal size and the percent of fish individuals of the species of interest in the structure of fish communities.

Similar to the Natura 2000 guidance, standard data form filling the following criteria "The conservation degree of specific habitats" contain subcriteria: i) the degree of conservation of the habitat features which are important for the species; ii) possibilities for recovery.

The criterion i) needs a complete evaluation of the characteristics of the habitat regarding the necessities of the species of interest. "The best expertise" is used to rank these criteria in the following way: I. elements in excellent condition, II. well preserved elements, III. elements in average or partially degraded condition.

In the circumstances in which the subclass I is granted "I: elements in excellent condition" or "II: well preserved elements," the criteria B (b) should be grouped as "A: excellent conservation" or "B: good conservation", unconcerned of the other sub-criteria.

In the case of this sub-criterion ii) which is taken into account only if the items are moderately or fractionally deteriorated, an assessment of the viability of the studied population is needed. The acquired classification system is: I. easy recovery; II. restoration possible with moderate effort; III. restoration problematic or impossible.

The combined practice for categorization relies on two sub-criteria: A – excellent conservation = elements in excellent condition, regardless of classification of recovery possibility; B – good conservation = elements in average or partially degraded condition and easy to restore; C – average or reduced conservation = all other combinations.

In all sampled areas, the following were assessed: condition, pressures/threats of habitats and populations of interested fish species.

The sampling sections to assess fish population and the conservation status of *Romanogobio uranoscopus* in the studied area appeared in sectors where these populations are stable, with a favoring conservation status and well maintained typical habitats, as well as lotic sectors placed at the boundary of the distribution area for this fish species, which contain sectors under human activities impact that can put in jeopardy the studied populations status – the Representativity Criteria.

We based on the economical criterion for selecting the monitoring sectors; as well an average number was set to offer the data for the management instruments which should assure the conservation of a favourable status for the studied fish species in the researched area.

Romanogobio uranoscopus (Agassiz, 1828), Actinopterygii – Cypriniformes – Cyprinidae – Gobioninae (Fig. 4), was sampled in the studied area in the last century (Bănărescu, 1964; Staicu et al., 1998; Telcean and Bănărescu, 2002; Homei, 1963).

This fish body and the caudal peduncule are thick and cylindrical. At the lips, points unite in a posteriour extension which is like a second pair of whiskers. The anus is closer to the anal fin than the ventral fins. The chest is coated with scales. In Romania lives *Romanogobio uranoscopus* (Agassiz, 1828). The dorsal contour is slightly convex, the ventral is horizontal. The snout is approximately sharp. The eyes look upward. The fish ventral fins are inserted under the dorsal fin insertion or slightly backward. The caudal fin is profoundly holed; the lobes are rounded and equal or almost equal (the inferior lobe a little longer). The outline of the dorsal fin is slightly holed. The dorsal side is greyish-greenish or brown-reddish. The back scales have black margins. Behind the dorsal fin are two-three big dark marks. There are seven-ten big rounded marks on the flanks. The ventral side is white-yellowish. There are two white marks at the caudal fin base. There are two rows of black marks on the dorsal and caudal fins. It can reach a total of 13 cm length. (Bănărescu, 1964; Bănărescu and Bănăduc, 2007)

RESULTS

The river sectors where *Romanogobio uranoscopus* (Fig. 3) was sampled during the study are presented in table 1 (Fig. 4), for all such sectors the catch index values were presented (individual numbers per time and effort unit).

Figure 3: *Romanogobio uranoscopus* (Agassiz, 1828).

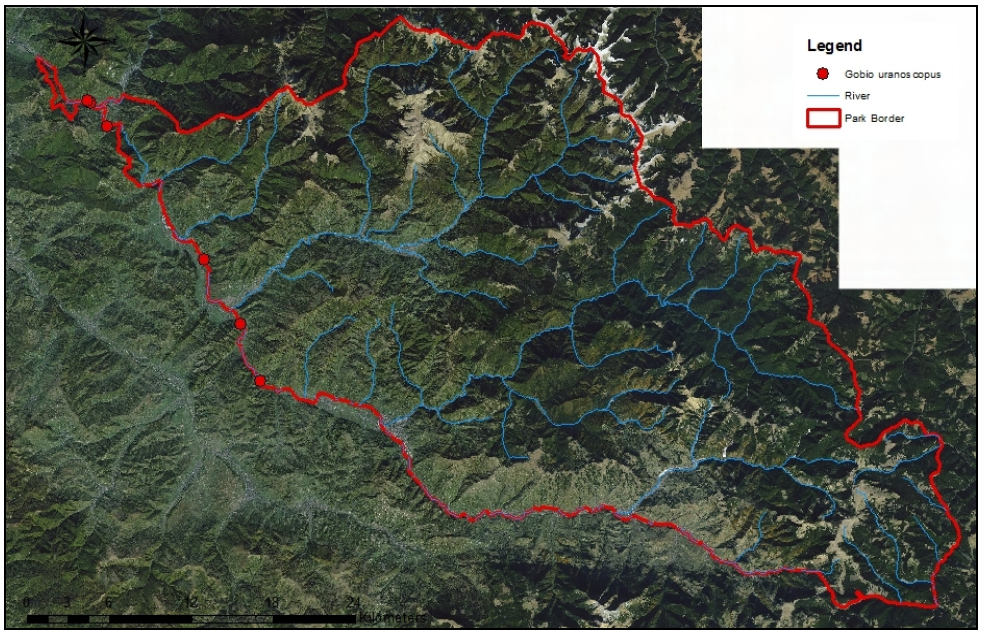

Figure 4: *Romanogobio uranoscopus* sampling stations location; GIS support Danci O.

Table 1: *Romanogobio uranoscopus* sampling points in the study area.

No. crt.	Lotic system	Station code	Lat. (N')	Long. (E')	Catch index no. ind./100 m × 30 min	Characteristic habitat state
1.	Vișeu River	57	47 44 17.0	24 18 12.0	1	reduced
2.	Vișeu River	63	47 46 29.5	24 17 03.1	1	reduced
3.	Vișeu River	690	47 48 54.3	24 14 49.6	1	reduced
4.	Vișeu River	77	47 53 59.9	24 09 07.1	7	average
5.	Vișeu River	78	47 54 52.5	24 08 07.8	18	average
6.	Vișeu River	79	47 54 58.3	24 07 56.5	1	average

DISCUSSION

Based on the outcome of this study, consistent with *Romanogobio uranoscopus* fish species biological and ecological needs, there were identified some risk elements (pressures and threats): poaching, minor riverbed morphodynamic changes, liquid and solid natural flow disruption, habitats/fish populations fragmentation, pollution.

Poaching. During the study period poaching was noticed with electricity from different rechargeable gears. Poachers were found during their illegal fishing activities including using different substances to collect fish of any size. By asking many people who live in study area, poaching is a relatively uninterrupted activity around the year. The failure to control this local habit may reduce the number of *Romanogobio uranoscopus* individuals and diminish its distribution in the Vișeu Basin.

Minor riverbed morphodynamic changings. Typical diversified microhabitat and habitat needs of this fish species, in consonance with its life cycle phases, it contains natural riverbed morphodynamics variability. Dams, dikes, sills, roads in riverbeds, modified riverbeds, riverbed mineral exploitation (Fig. 5), influence the dynamics of liquids and solids flow, etc., all influencing through changing the natural morphodynamics of the riverbed. These modifications changed the habitats needed for different life cycle phases of the *Romanogobio uranoscopus*, which could push to decline the abundance of this fish species population.

Watercourse obstacles, water resource development activities growth on the studied area (dikes, dams, high sills, microhydropowerplants, water extractions, modifications in the riverbeds, riverbed mineral overexploitations, etc.) should not be allowed by the Park Administration without explicit ichthyologic applied studies for this valuable fish species.

Figure 5: Overexploitation of minerals in the banks and terraces of the lower Vișeu River.

Solid and liquid and natural flow changings. The modifications of natural liquid and solid flow and riverine morphology change the generation of particular microhabitats, habitats, and other environmental elements important for the presence of *Romanogobio uranoscopus*. These modifications to the riverbed natural morphodynamics may induce the decreasing of the studied species population size. Unnatural artificially episodes (Fig. 6), where water turbidity is raised due to bad forestry activities near the riverbeds, there are cases of activities inducing negative effects on the natural regime of the river solid and liquid flow.

The natural discharge can be avoided if the riverbed mineral exploitations and/or forestry practices do not disturb considerably the basin limits of self-sustainable function. This can be realised by harmonizing the human activities within the seasons of the year when the natural conditions are relatively similar to those to be produced (e.g. high water turbidity). Potential planned in-channel constructions and changes, such as dams, thresholds, water extractions, bank modifications and roads in the waterbed (Fig. 7), crossings, embankments, thalweg changes by exploitations of construction materials from the riverbed, etc., should be not admitted by the protected site administrator without the consent of experts with a proper expertise for this fish species, based on the identified local stress elements and the ecological and biological needs of the fish species of conservation interest. In this distinct case, no riverbed overpass should be higher than 5-10 cm in the shallow water lotic sectors and in dry season. The authors suggested also the monitoring the banning of dragging and storage lumber through/in the streams and rivers. The authors suggest the control of the development works for lumber storage and exploitation terraces, (Fig. 8) and the imperative requirement of fast reforestation. In this case, the rotation of forest exploitations in the sub-basins of the Vișeu Basin is more than advantageous.

Figure 6: Forestry activities induce unnatural turbidity (Vişeu and Sârca tributary confluence).

Figure 7: Frumuşeaua River concrete riverbank/completely modified and road in the riverbed.

Figure 8: Logs transported on the Vaser River banks and in the riverbed.

Figure 9: Destroyed riparian vegetation on the Ruscova River bank.

Habitat fragmentation/isolation of populations very often push to genetic isolation, decline of gene variability and, to species inbreeding and sometimes local or regional extinction. Dams disconnect rivers into sections, which limit Danubian longbarbel gudgeon access to old spawning habitats, are one of the most serious causes of habitat degradation resulting in the decreased abundance and disappearance of this species (Bănărescu, 1964). Dams can also put not direct pressures on the Danubian longbarbel gudgeon populations by inducing modifications in water thermal regimes, blocking the transport of the organic and inorganic materials, altering water flow and by sediment accumulation.

The free upstream and downstream displacement, including the various sub-drainage basins of the Vișeu catchment area, is a highly important element for the studied fish species protection and conservation.

We propose the study of the potential future economic investments located near and/or on the water courses very laboriously, as far as some of them could decrease or completely cut the longitudinal connectivity of the rivers and/or streams of the studied basin, not only by constructing diverse traverse barriers in the riverbed, but also by lowering the water level or, sometimes, preventing water from accessing some lotic sectors.

Pollution caused by mining activities. The very old documented pollution, occurring from heavy metals mining activity in the Țâșla Basin, is affecting negatively not only the Țâșla River, but also the upstream part of Vișeu River (Staicu et al., 1998). The impact of the rainfall and snowfall washing waters of the non-isolated mines and greened refuse heaps is considered as major on the Țâșla River and significant on the upstream Vișeu.

The impact of rainfall and snowfall water washing the non-isolated mines and rehabilitated refuse heaps can be significantly reduced by isolating/filling the old mine galleries and by isolating (not only greening) the refused heaps from the water courses in the Țâșla River basin.

Obviously, the synergism among the identified human impact put pressure on numerous lotic sectors in the researched area (Figs. 10 and 11) and the evaluation score for the reserached fish species is not at the natural potential.

Organic pollution caused by sewages, agriculture and fish farms, resulted in disappearance of Danubian longbarbel gudgeon from some historic spawning habitats. It is a significant problem related to sewage and wastewater treatment as well as to the farms, in the large majority of the Vișeu Basin, mainly on the Vișeu River, this is a continuous impact source for the studied fish species.

Exhaustive sewage systems must be realised first in the Vișeu River basin and lately on its tributaries basins, also the wastewaters of the localities alongside the main tributaries must be cleaned.

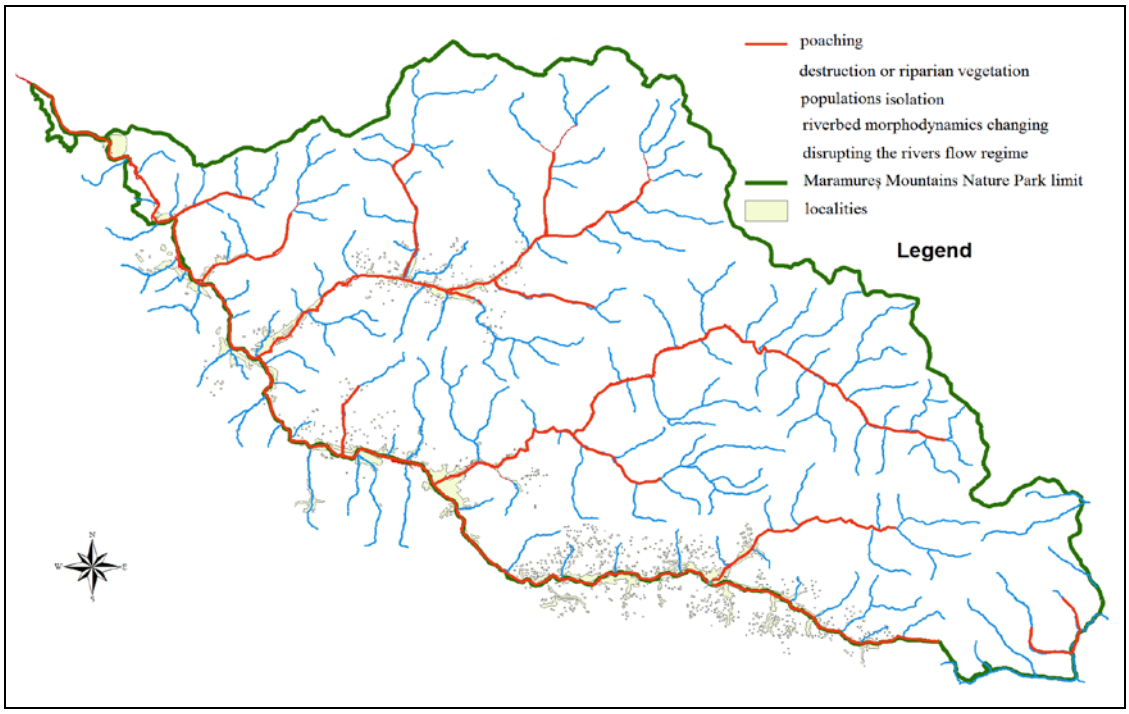

Figure 10: Diagnosed combined pressures and threats
for *Romanogobio uranoscopus* in the studied area; GIS support Danci O.

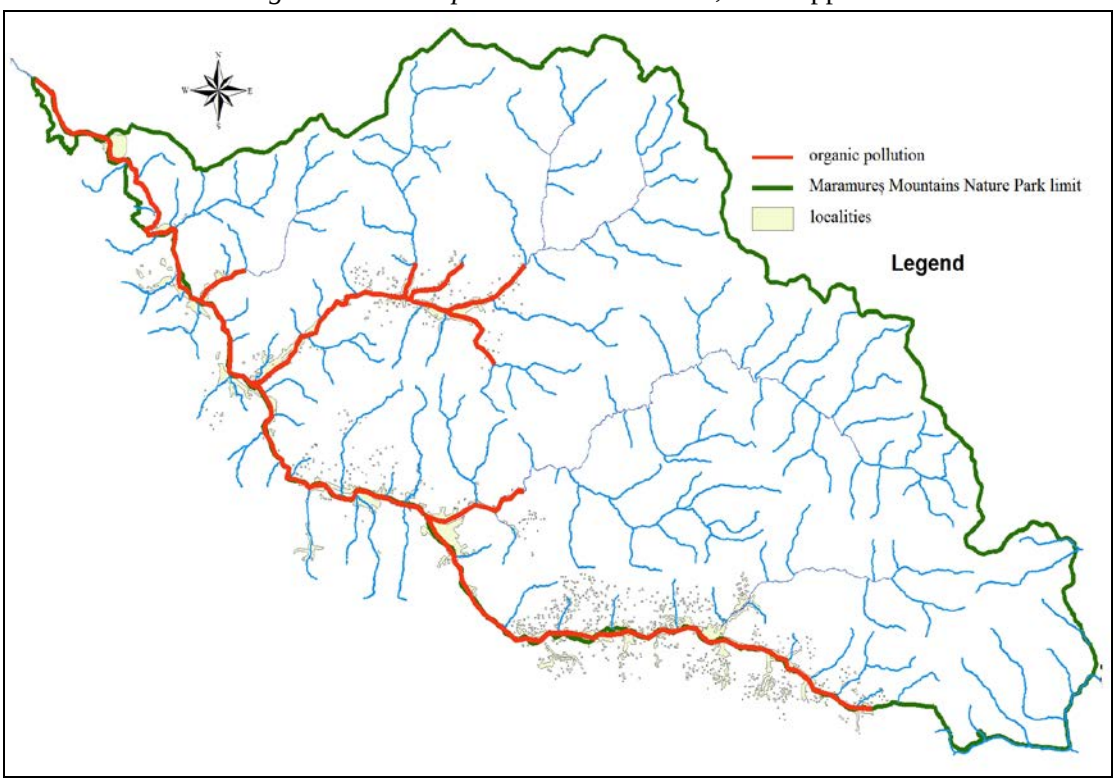

Figure 11: Lotic sectors influenced by organic pollution; GIS support Danci O.

CONCLUSIONS

Romanogobio uranoscopus (Agassiz, 1828) is one of the fish species of important conservation concern within the Vişeu River basin, one of the remote areas of northern Romania. The condition of aquatic habitats typically occupied by *Romanogobio uranoscopus* within the Maramureş Mountains Nature Park fluctuates in the best cases between reduced (half of the lotic sectors where the species was identified) to average (half of the lotic sectors where the species was identified). Good or excellent conservation status is now missing for populations of this species in the studied area.

The determined human impact types (poaching, minor riverbeds morphodynamic changings, solid and liquid natural flow changes, destruction of riparian trees and bush vegetation, habitat fragmentation/isolation of population, organic and mining pollution, and displaced fish that are washed away during flood periods in the lotic sectors uniformized by humans) are inducing the decreasing ecologic state of *Romanogobio uranoscopus* species habitats and as a result the populations in the researched area in comparison with its natural potential are significantly below the potential in natural conditions.

Romanogobio uranoscopus has constant populations in the researched area, but their natural potential in comparison with historical data due to human impact is not realised in terms of aquatic habitat and abundance of individuals, in the Vișeu – middle and lower sectors. The preferred habitat for this species is big enough within this area to conserve the present reduced to average ecological state of the Danubian longbarbel gudgeon researched populations.

Romanogobio uranoscopus can be considered today as a rather rare species in the studied basin but there, where a specific absence of this species was registered, exists a restorative potential (middle and upper Vișeu River and at least Ruscova and Vaser lower sectors).

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