



Ichthyofauna of Torysa River in stream profiles of planned small hydroelectric power plants

A Torysa (Tarca) folyó halfaunája két tervezett kis vízerőmű szelvényében

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Keywords: fish fauna, dominance, ecological characteristics

Kulcsszavak: halfauna, dominancia, ökológiai jellemzők

Abstract

An ichthyological survey was conducted in September 2011 at two stream profiles of planned construction of small hydroelectric power plants on the Torysa River – Vyšná Hutka and Zdoba. Our main objective was to investigate the species composition of ichthyofauna prior to the planned construction of hydropower plants and determine the potential impacts on fish assemblages. In Vyšná Hutka 11 species and in Zdoba 14 species were recorded. At the first site (Vyšná Hutka) bleak (*Alburnoides bipunctatus*) and chub (*Squalius cephalus*) were dominant species. At the second site (Zdoba), common dace (*Leuciscus leuciscus*), gudgeon (*Gobio gobio*) and bitterling (*Rhodeus amarus*) were dominant.

Kivonat

2011. szeptember folyamán a Torysa (Tarca) folyó két szakaszán, melyeken kis vízerőművek építését tervezik – Vyšná Hutka és Zdoba térségében – mértük fel a halállományt. A mintavételeknek az volt a célja, hogy vizsgáljuk a halfauna fajok szerinti összetételét és állapotát a tervezett kis vízerőművek megépítése előtt, valamint hogy meghatározzuk azok potenciális hatását a folyó érintett szakaszain jelenleg élő halközösségekre. Összesen 11 halfajt jegyeztük fel az első (Vyšná Hutka) mintaterületen és 14 halfajt a második (Zdoba) mintaterületen. Az első mintaterületen a sujtásos küsz (*Alburnoides bipunctatus*) és a fejes domolykó (*Squalius cephalus*) voltak domináns fajok. A második mintaterületen a nyúldomolykó (*Leuciscus leuciscus*), a fenékjáró küllő (*Gobio gobio*) és a szivárványos ökle (*Rhodeus amarus*) voltak domináns fajok.

Introduction

Appearance of Torysa River basin has changed a lot over the last few years. Realization of construction and melioration flow adjustment, as well as the planned construction of a small hydroelectric power plant, may differently affect the original aquatic communities, and the fish communities as well. Exploitation of hydropower from hydroelectric power plants is encountered with different responses in Slovakia. Adverse interventions often lead to changes in aquatic communities and trigger a shift from clear to turbid water state. The so-called barrier effect denotes the restricted migration of aquatic animals due to hydropower plants or dams, and it may cause increased fish mortality or decay of macrophyte beds. Such interventions often lead to an imbalance in ichthyocenosis, the extinction of some species from their habitats and to the deterioration of the qualitative and quantitative composition of ecologically important species (Kirka et al. 1981). Our ichthyological exploration on the lower flow of Torysa River assesses the current state of ichthyocenosis before the planned construction of the dam. This study is partly based on the results of previous surveys carried out in the River Torysa (Koščo et al. 1988, Manko & Koščo 2004; Koščo 2007). The first studies on the ichthyofauna of Torysa River were performed by Vutskits (1904), Hykeš (1921), Žitňan (1960), Žitňan and Kaščák (1960),

Hradil (1960), Kux and Weisz (1964), Kirka et al. (1981), Dorko (1983). The aim of the ichthyological survey was to determine the species composition of the ichthyofauna.

Description of the Torysa catchment

The catchment area of the Torysa River is located in the north-eastern part of Slovakia. Torysa River flows into the Hornád River, which is connected to the Bodrog River and finally flows into the Tisa River on the Hungarian territory (Fendekova 2011). Torysa River springs in Levočské Hills, northern of Levoča and an altitude of 1100 m. a. s. l. Torysa River is located in the submontane zone, which is characterized by slightly cold climate with winter temperatures of -3.5 to 6 ° C and mid-summer temperatures of 16.0 - 17.0 ° C. The average precipitation in this region is 600–850 mm (Mazur et al. 1980).

Materials and Methods

Our ichthyological survey was carried out in September 2011 at two localities (Zdoba and Vyšná Hutka), close to the spots of the planned hydroelectric power plants on the lower flows of the Torysa River (Fig. 1). Altogether, 388 fish specimens were found by aggregate ichthyological investigation on localities in the main stream of Torysa River. Lengths of river sections were 100 m. Fish species were identified after catching, the standard body length was measured, then fish were released back to the river. Quantitative and structural characteristics were determined according to Losos et al. 1985, the classification of species into ecological groups was according to Holčík (1998) and ecological status of fish was determined based on the Red List of lampreys and fishes of Slovakia (Koščo & Holčík 2008).



Fig. 1. Map of study area and sampling locations

Results and Discussion

In our research, 224 individuals we recorded in Zdoba (Table 2), belonging to 14 species. Common dace (*Leuciscus leuciscus*), gudgeon (*Gobio gobio*), bitterling (*Rhodeus amarus*) and Balkan loach (*Sabanejewia balcanica*) were dominant species.

In Vyšná Hutka, 164 specimens of 11 species were recorded; Chub (*Squalius cephalus*), riffle minnow (*Alburnoides bipunctatus*) and Balkan loach (*Sabanejewia balcanica*) were dominant species. By threat aspect, most species from both sites belonged to the category LC - Least Concern. During the survey, we found 5 species of fish belonging to the list of Natura 2000 (Table 2). Both sites records show that most fish had standard body length (SL) up to 49 mm. Species similarity of the sites was 66.6 %. Diversity and equitability index was very similar for both localities.

Several studies were dedicated to the ichthyofauna of Torysa River, which evaluated the species composition of the Torysa flow (Table 3). Early studies from the last century (Vutskits 1904, Hyeš 1921) mentioned only a few species. Detailed knowledge about ichthyofauna of Torysa River (near village Nižná Hutka) was discussed in works of Hradil (1960), who recorded about 20 species. Kux and Weisz (1964) divided Torysa River into the two sections, upper zone characterized by trout and lower one, which is characteristic as barbel zone, which starts around Prešov and where water is significantly contaminated. *Barbus barbus*, *Squalius cephalus*, *Chondrostoma nasus*, *Gobio gobio*, *Alburnoides bipunctatus* were included.

Table 2. Ecological groups and conservation status of fish on the localities Zdoba and Vyšná Hutka

Family Species	Localities		Ecological group				Conservation status	
	Hutka	Zdoba	Food	Repro- duction	Relation to current	Migration	RL-2008 Koščo & Holčík	NATURA
Cyprinidae								
<i>Alburnoides bipunctatus</i>	+	+	Ca.1	A.1.3	Re	SD	LC	
<i>Barbus barbus</i>	+	+	Ca.2	A.1.3	Re	SD	LC	
<i>Barbus carpathicus</i>	+	+	Eu	A.1.3	Re	SD	LC	+
<i>Carassius gibelio</i>		+	Eu	A.1.5	Li	NM		
<i>Gobio gobio</i>	+	+	Ca.1	A.1.6	Et	NM	LC	
<i>Leuciscus leuciscus</i>		+	Ca.1	A.1.3	Re	SD	NT	
<i>Pseudorasbora parva</i>		+	Eu	B.2.2	Et	NM		
<i>Rhodeus amarus</i>	+	+	Eu	A.2.5	Et	NM	LC	+
<i>Romanogobio vladykovi</i>	+	+	Ca.1	A.1.6	Et	NM	NT	+
<i>Rutilus rutilus</i>		+	Eu	A.1.4	Et	SD	LC	
<i>Squalius cephalus</i>	+	+	Eu	A.1.3	Re	SD	LC	
Cobitidae								
<i>Cobitis elongatoides</i>	+	+	Eu	A.1.5	Re	NM	LC	+
<i>Sabanejewia balcanica</i>	+	+	Ca.1	A.1.5	Re	NM	NT	+
Balitoridae								
<i>Barbatula barbatula</i>	+	+	Ca.1	A.1.6	Re	NM	LC	
Lotidae								
<i>Lota lota</i>	+		Ca.1	A.1.2	Et	SD	LC	

Ca.1 – nonspecific carnivorous; Ca.2 – specific carnivorous; Eu – omnivorous; A.1.2 – lithopelagophils; A.1.3 – lithophilous; A.1.4 – phytolithophils; A.1.5 – phytophils; A.1.6 – psammophils; B.2.2 – polyphilous sp.;

Re – reophils; Li – limnophils; Et – eurytopic;

SD – migration to 100 km; NM – non migration; LC – Least Concern; NT – Near Threatened

On the other hand, at this zone decreased incidence of *Barbus carpathicus* and *Chondrostoma nasus* was found. New species were also found – *Zingel streber* and *Romanogobio vladykovi*. We did not find species *Romanogobio kesslerii*, *Chondrostoma nasus*, *Zingel streber* during our research. Manko and Koščo (2004) recorded occurrence of *Cobitis elongatoides*, *Sabanejewia balcanica*, *Alburnus alburnus*, *Rhodeus amarus*, *Romanogobio vladykovi* and *Romanogobio uranoscopus* on the main flow near Prešov (Ploské site, Byster a confluence of Hornád), but we did not find these species here. Summary of ichthyological research since 1988 were performed by Koščo (2007), who recorded 21 species in the Torysa and in its five tributaries. However, there is presence of preserved, endangered species like *Romanogobio kesslerii* and *Zingel streber*, and economically important species like *Anguilla anguilla* (European eel), *Aspius aspius* (asp), *Cyprinus caprio* (common carp), which were mentioned by other authors (Table 3.).

Critically endangered *Romanogobio uranoscopus* was reported in very small numbers and only at a small area near Košice. For the ichthyofauna of Torysa River, high geographic integrity index is characteristic (0.91), which highly exceeds the value of the index given to the entire area of Slovakia (0.76). This is due to the low number of fish farms, which often cause the introduction of some adventive species. Also, fragmentation of Hornád River, into which Torysa River flows, and temperature conditions in Hornád and Torysa Rivers prevent the immigration of these alien species. Most of the adventive species can not maintain self-keeping populations (Koščo 2007).

Table 3. Comparison of ichthyological surveys in the TORYSA basin

Family Species	Author(s)											
	1	2	3	4	5	6	7	8	9	10	11	12
I. Anguillidae												
1. <i>Anguilla anguilla</i>	-	-		-	-	-	+	-	-	-	-	-
II. Cyprinidae												
2. <i>Barbus barbatus</i>	-	-	-	-	+	+	+	+	+	+	+	+
3. <i>Barbus carpathicus</i>	-	-	-	-	+	+	+	+	+	+	+	+
4. <i>Carassius gibelio</i>	-	-	-	-	-	-	-	-	-	-	-	+
5. <i>Carassius carassius</i>	-	-	-	-	-	-	-	-	+	-	-	-
6. <i>Cyprinus carpio</i>	-	-	-	-	+	-	-	+	-	-	-	-
7. <i>Gobio gobio</i>	+	+	-	-	+	+	+	+	+	+	+	+
8. <i>Gobio uranoscopus</i>	-	-	-	-	-	-	+	+	-	-	-	+
9. <i>Romanogobio vladykovi</i>	-	-	-	-	-	-	+	-	-	-	-	+
10. <i>Romanogobio kesslerii</i>	-	-	-	-	-	-	+	-	+	-	-	-
11. <i>Rhodeus amarus</i>	-	-	-	-	-	-	-	-	-	-	-	+
12. <i>Aspius aspius</i>	-	-	+	-	+	-	-	-	-	-	-	-
13. <i>Chondrostoma nasus</i>	-	-	-	-	+	+	+	+	+	+	+	+
14. <i>Squalius cephalus</i>	+	+	+	+	+	+	+	+	+	+	+	+
15. <i>Leuciscus leuciscus</i>	-	-	-	-	+	+	+	+	+	-	-	+
16. <i>Phoxinus phoxinus</i>	-	-	-	-	+	+	+	+	+	+	+	+
17. <i>Rutilus rutilus</i>	-	-	-	-	-	-	-	-	+	-	-	-
18. <i>Scardinius erythrophthalmus</i>	-	-	-	-	-	-	-	+	-	-	-	-
19. <i>Vimba vimba</i>	-	-	-	-	+	+	-	-	-	-	-	-
20. <i>Alburnoides bipunctatus</i>	-	-	-	-	+	+	+	+	+	+	+	+
21. <i>Alburnus alburnus</i>	-	-	-	-	+	-	-	-	+	-	-	+
III. Cobitidae												
22. <i>Cobitis elongatoides</i>	-	-	-	-	+	-	+	-	-	-	-	+
23. <i>Sabanejewia balcanica</i>	-	-	-	-	+	-	-	-	-	-	-	+
IV. Balitoridae												
24. <i>Barbatula barbatula</i>	+	+	-	-	+	+	+	+	+	+	+	+
V. Esocidae												
25. <i>Esox lucius</i>	-	-	+	+	+	-	+	-	+	-	-	-
VI. Salmonidae												
26. <i>Oncorhynchus mykiss</i>	-	-	-	-	+	-	-	+	+	+	-	+
27. <i>Salmo trutta m. fario</i>	-	-	-	-	+	+	+	+	+	+	+	+
28. <i>Salvelinus fontinalis</i>	-	-	-	-	+	-	-	+	-	-	-	-
VII. Thymallidae – lipňovitě												
29. <i>Thymallus thymallus</i>	-	+	-	-	-	-	-	+	-	-	+	+
VIII. Cottidae												
30. <i>Cottus poecilopus</i>	-	-	-	-	-	-	+	+	-	-	-	+
IX. Percidae												
31. <i>Perca fluviatilis</i>	-	-	-	-	+	-	-	-	-	-	-	+
32. <i>Zingel streber</i>	-	-	-	-	-	-	+	-	-	-	-	-
Number of species	3	4	3	2	20	11	18	17	16	10	10	21

Legend: 1 - Vutskits, 1904; 2 - Hykeš, 1921; 3 - Žitňan, 1960; 4 - Žitňan, Kašćák, 1960; 5 - Hradil, 1960; 6 - Olejár, 1962; 7 - Kux, Weisz, 1960; 8 - Kirka et al., 1981; 9 - Dorko, 1983; 10 - Košćo et al., 1988; 11 - Košćo et al., 1991; 12 - Košćo, 2007

+ present, - absent

In the case of construction of small hydroelectric power plants, negative changes on the stream may occur. Rising of water level above the weir creates adverse conditions for reophilous species, which are prevailing in this section and part of which is protected. This causes the fragmentation of fish populations above and below the weir, moreover, the dammed water creates favourable conditions for the occurrence of non-native and eurytopic fish species, as it was observed after the construction small hydropower plants on similar sectors of streams.

Acknowledgements

The study was supported by the Slovak Grant Agency VEGA – project No. 1/0847/13 and by project APVV-SK-PL-0077-12.

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