

Long-term changes of fish fauna in the Hungarian section of the Ipel River

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1 Introduction

Rivers have long been affected by several types of human influences that have a negative impact on their integrity. Nowadays, improvement of ecological status of a river system is an increasing demand of the society but the delineation of the environmental objectives for rehabilitation is often restricted by a lack of knowledge of pristine conditions. The possibilities of direct investigation of undisturbed rivers are very limited; therefore, historical information from the pre-regulation period can be used for describing the original state. Due to their complex habitat requirements fish are sensitive indicators for the ecological integrity of a river (Karr 1991) and long-term changes of fish fauna can be reconstructed from old catch records, data of early publications and habitat descriptions from archive maps (Carrel 2002, Wolter et al. 2005, Winter et al. 2008).

The Ipel is a medium size regulated river along the border of Hungary and Slovakia. Its source is at 1020 m above sea level in Slovakia and its tributary is at Szob at rkm 1708 of the Danube. The length of the river is 257.4 km, its catchment area is 5108 km² and its mean discharge is 20.6 m³ s⁻¹. Its flow regime fluctuates between 1.7 m³ s⁻¹ and 660 m³ s⁻¹. The first efforts of river regulation are known from the 17th and 18th century. Some meanders were cut off and several small tributaries were regulated in the 19th century. In the 1980s, six dams were constructed between Ipolytölgyes and Sahy (Mike 1991, Kabay 2007). The interventions resulted in channel incision and a decrease of mean and low water levels. The lower section of the river belongs to the Danube-Ipel National Park and an increasing effort is made to restore its ecosystem in the recent years. Our study was aimed to assess the deviation of the present fish fauna from its original reference state in the Hungarian section of the river. Analysis of ichthyologic literature and history of river regulation provided information for the judgement of former fish fauna.

2 Methods

The long-term changes of the fish fauna and occurrence of species were evaluated by literature data. Acceptable reports are available from the end of the 19th century (Herman 1887, Vutskits 1918, Vásárhelyi 1961, Kux & Weisz 1964, Botta et al. 1984, Botta 1993, Keresztessy 1993, Györe et al. 2001, Tóth et al. 2005). The description of the recent fish fauna was completed by the results of our fish surveys undertaken by electrofishing in the vicinity of Ipolytölgyes (rkm 18) and Szob (rkm 2) between July and October 2009.

3 Results

Our fish surveys detected 38 fish species and three of them (*Ameiurus melas*, *Neogobius melanostomus*, *Neogobius gymnotrachelus*) were new for the Ipel. According to results of literature analysis and data of our fish surveys the occurrence of 56 fish species has been proved in the Hungarian section of the river (sequence according to Table 1):

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- Bream (*Abramis brama* Linnaeus, 1758): Common species, indicated in all fauna lists from the 1960s.
- Sterlet (*Acipenser ruthenus* Linnaeus, 1758): It is an occasional migratory species from the Danube. All of the early publications (Herman 1887, Vutskits 1918, Vásárhelyi 1961) indicated its occurrence, but it has not been mentioned since the middle of the 1960s.
- Spirin (*Alburnoides bipunctatus* Bloch, 1782): Common species mentioned by all authors.
- Bleak (*Alburnus alburnus* Linnaeus, 1758): Abundant species, indicated in almost all fauna lists.
- Asp (*Aspius aspius* Linnaeus, 1758): Common species, listed in most of the publications.
- Zopel (*Ballerus ballerus* Linnaeus, 1758): Its occurrence was mainly indicated in the early publications (Herman 1887, Vutskits 1918, Vásárhelyi 1961). It occasionally migrates from the Danube to the lower section of the river (Botta 1993).
- Blue bream (*Ballerus sapa* Pallas, 1814): Rare species, recorded in the lower section (Botta 1993, Györe et al. 2001). It was detected by our surveys, too.
- Stone loach (*Barbatula barbatula* Linnaeus, 1758): Common species. It is listed in most of the fauna studies.
- Barbel (*Barbus barbus* Linnaeus, 1758): Abundant species listed in all publications.
- Carpathian barbel (*Barbus carpathicus* Kotlík et al. 2002): Common species, particularly in the tributaries and the upper section of the river. It is listed in almost all publications from the 1960s.
- Silver bream (*Blicca bjoerkna* Linnaeus, 1758): Rare species, listed in almost all publications from the 1960s.
- Crucian carp (*Carassius carassius* Linnaeus, 1758): Rare species in the disconnected oxbows (Herman 1887, Vutskits 1918, Vásárhelyi 1961, Botta 1993).
- Nase (*Chondrostoma nasus* Linnaeus, 1758): Common species, listed in all publications.
- Spined loach (*Cobitis elongatoides* Bačescu & Maier, 1969): Common species listed in almost all publications.
- Sculpin (*Cottus gobio* Linnaeus, 1758): Sporadic species drifted from the upper section of the river. One occurrence was only recorded at Hont in 1996 (Györe et al. 2001).
- Carp (*Cyprinus carpio* Linnaeus, 1758): Common species mentioned in all fauna studies. Its population was recently increased by stocking.
- Pike (*Esox lucius* Linnaeus, 1758): Common species indicated in almost all fauna lists.
- Gudgeon (*Gobio gobio* Linnaeus, 1758): Common species. It is mentioned in most of the fauna studies from the 1980s.
- Ruffe (*Gymnocephalus cernuus* Linnaeus, 1758): Common species mentioned in most of the publications from the 1980s.
- Danube ruffe (*Gymnocephalus baloni* Holčík & Hensel, 1974): Common species indicated by most of the authors from the 1990s.
- Yellow pope (*Gymnocephalus schraetzer* Linnaeus, 1758): Rare species. It was found at some locations (Kux & Weisz 1964, Botta 1993, Györe et al. 2001).
- Sun bleak (*Leucaspis delineatus* Heckel, 1873): Rare species in the disconnected oxbows, its occurrence was proved in the last decade (Györe et al. 2001, Tóth et al. 2005).
- Dace (*Leuciscus leuciscus* Linnaeus, 1758): A rare fauna element in the Hungarian section of the river and its tributaries. Its first occurrence was recorded by Botta et al. (1984), since then it has been listed in most fauna descriptions.
- Ide (*Leuciscus idus* Linnaeus, 1758): Common species, but its first record was only published in the 1990s (Botta 1993) and ever since then its occurrence has been verified by all authors.
- Burbot (*Lota lota* Linnaeus, 1758): Common species mentioned by all authors.
- Weatherfish (*Misgurnus fossilis* Linnaeus, 1758): Rare species in the disconnected oxbows (Herman 1887, Botta et al. 1984, Botta 1993, Keresztessy 1993, Györe et al. 2001).

Table 1. The original and recent fish fauna of the Hungarian section of the Ipel River. Authors: **1** Herman 1887, **2** Vutskits 1918, **3** Vásárhelyi 1961, **4** Kux & Weisz 1964, **5** Botta et al. 1984, **6** Botta, 1993, **7** Keresztessy 1993, **8** Györe et al. 2001, **9** Tóth et al. 2005, **10** our data 2009. **Orig.** = original fish fauna (blue), **Nnat.** = non-native species (orange), **Rec.** = recent fish fauna (green), purple = atypical native species.

	authors	1	2	3	4	5	6	7	8	9	10	Orig.	Nnat.	Rec.
1	<i>Abramis brama</i>													
2	<i>Acipenser ruthenus</i>													
3	<i>Alburnoides bipunctatus</i>													
4	<i>Alburnus alburnus</i>													
5	<i>Aspius aspius</i>													
6	<i>Ballerus ballerus</i>													
7	<i>Ballerus sapa</i>													
8	<i>Barbatula barbatula</i>													
9	<i>Barbus barbus</i>													
10	<i>Barbus carpathicus</i>													
11	<i>Blicca bjoerkna</i>													
12	<i>Carassius carassius</i>													
13	<i>Chondrostoma nasus</i>													
14	<i>Cobitis elongatoides</i>													
15	<i>Cottus gobio</i>													
16	<i>Cyprinus carpio</i>													
17	<i>Esox lucius</i>													
18	<i>Gobio gobio</i>													
19	<i>Gymnocephalus baloni</i>													
20	<i>Gymnocephalus cernuus</i>													
21	<i>Gymnocephalus schraetzer</i>													
22	<i>Leucaspius delineatus</i>													
23	<i>Leuciscus idus</i>													
24	<i>Leuciscus leuciscus</i>													
25	<i>Lota lota</i>													
26	<i>Misgurnus fossilis</i>													
27	<i>Pelecus cultratus</i>													
28	<i>Perca fluviatilis</i>													
29	<i>Phoxinus phoxinus</i>													
30	<i>Rhodeus sericeus</i>													
31	<i>Romanogobio albipinnatus</i>													
32	<i>Romanogobio kessleri</i>													
33	<i>Rutilus pigus</i>													
34	<i>Rutilus rutilus</i>													
35	<i>Sabanejewia balcanica</i>													
36	<i>Salmo trutta</i>													
37	<i>Sander lucioperca</i>													
38	<i>Sander volgensis</i>													
39	<i>Scardinius erythrophthalmus</i>													
40	<i>Silurus glanis</i>													
41	<i>Squalius cephalus</i>													
42	<i>Tinca tinca</i>													
43	<i>Vimba vimba</i>													
44	<i>Zingel streber</i>													
45	<i>Zingel zingel</i>													
46	<i>Anguilla anguilla</i>													
47	<i>Ameiurus melas</i>													
48	<i>Ameiurus nebulosus</i>													
49	<i>Carassius gibelio</i>													
50	<i>Lepomis gibbosus</i>													
51	<i>Neogobius fluviatilis</i>													
52	<i>Neogobius gymnotrachelus</i>													
53	<i>Neogobius melanostomus</i>													
54	<i>Onchorhynchus mykiss</i>													
55	<i>Proterorhynchus semilunaris</i>													
56	<i>Pseudorasbora parva</i>													
	number of spp.	17	18	16	21	27	46	33	49	33	38	43	10	54

Razor fish (*Pelecus cultratus* Linnaeus, 1758): It occasionally migrates from the Danube. It was recorded in the vicinity of Ipolydamásd (Botta 1993).

Perch (*Perca fluviatilis* Linnaeus, 1758): Common species included in almost all descriptions of the fauna.

Minnow (*Phoxinus phoxinus* Linnaeus, 1758): Abundant species in the tributaries and the upper section of the river (Kux & Weisz 1964, Györe et al. 2001). Drifted individuals usually occur in the lower section (Vutskits 1918, Vásárhelyi 1961, Botta 1993).

Bitterling (*Rhodeus sericeus* Pallas, 1776): Abundant species, particularly in the slow flowing sections and backwaters. It is indicated by all authors from the 1960s.

White-finned gudgeon (*Romanogobio albipinnatus* Lukash, 1933): Abundant species, indicated in almost all fauna lists from the 1980s.

Kessler's gudgeon (*Romanogobio kessleri* Dybowski, 1862): Rare species, occurs mainly in the upper section of the river. Most of the authors mentioned it from the 1960s.

Danubian roach (*Rutilus pigus* Heckel, 1852): It occasionally migrates from the Danube. It was recorded once upstream of Szob (Botta 1993).

Roach (*Rutilus rutilus* Linnaeus, 1758): Widely distributed along the entire Hungarian section of the river, recorded in all fauna descriptions.

Balkan golden loach (*Sabanejewia balcanica* Karaman, 1922): Common species. Its occurrence was described in the 1980s (Botta et al. 1984), since then it has been listed in most fauna descriptions.

Brown trout (*Salmo trutta* Linnaeus, 1758): Rare species. Drifted individuals can be found in the lower section of the river (Györe et al. 2001). It was occasionally stocked in the tributaries and the upper section of the river.

Pikeperch (*Sander lucioperca* Linnaeus, 1758): Common species, but it was not mentioned in the early publications. Its occurrence was only described in the 1980s (Botta 1993) and since then it was listed in all fauna studies.

Volga pikeperch (*Sander volgensis* Gmelin, 1788): It occasionally migrates from the Danube. It was recorded at Ipolydamásd (Botta 1993).

Rudd (*Scardinius erythrophthalmus* Linnaeus, 1758): Common species in the backwaters and disconnected oxbows. It was recorded in the 1980s (Botta et al. 1984), since then it has been listed in most fauna descriptions.

Catfish (*Silurus glanis* Linnaeus, 1758): Common species listed in almost all fauna studies.

Chub (*Squalius cephalus* Linnaeus, 1758): Abundant species listed in all publications.

Tench (*Tinca tinca* Linnaeus, 1758): Rare species, it was mainly found in oxbows (Herman 1887, Botta 1993, Györe et al. 2001, Tóth et al. 2005).

Vimba (*Vimba vimba* Linnaeus, 1758): Common species in the lower section. It is listed in almost all publications from the 1990s, and also recorded in our surveys.

Zingel (*Zingel zingel* Linnaeus, 1758): Rare species. It was found at Ipolytölgyes and Tésa (Györe et al. 2001, Tóth et al. 2005).

Danube streber (*Zingel streber* Siebold, 1758): Rare species indicated in almost all fauna publications. Our surveys also verified its occurrence at Ipolytölgyes.

Eel (*Anguilla anguilla* Linnaeus, 1758): Sporadic species. The first occurrence was recorded by Botta et al. (1981). Further confirmations by Keresztessy (1993) and Györe et al. (2001). Its frequency increased in the Middle Danubian region due to stocking programs.

Brown bullhead (*Ameiurus nebulosus* Leseur, 1819): The occurrence of this non-native species was recorded at Vámosmikola in the 1990s (Botta 1993). It is assumed not to present viable population in the river.

Black bullhead (*Ameiurus melas* Rafinesque, 1820): The appearance of this non-native species was proved by our surveys at Ipolytölgyes in October 2009.

- Prussian carp (*Carassius gibelio* Bloch, 1782): Abundant non-native species, mainly in the slow flowing sections and backwaters. Its first occurrence was recorded in the 1990s (Botta 1993).
- Pumpkinseed (*Lepomis gibbosus* Linnaeus, 1758): Common non-native species. Its occurrence was proved in the 1990s (Botta 1993) and most of the publications indicated it since that time.
- Monkey goby (*Neogobius fluviatilis* Pallas, 1814): Common non-native species in the lower section. Its first occurrence was recorded at Ipolytölgyes (Tóth et al. 2005).
- Racer goby (*Neogobius gymnotrachelus* Kessler, 1857): The first data of this non-native species was verified by our survey at Szob in October 2009.
- Rainbow trout (*Onchorhynchus mykiss* Walbaum, 1792): Rare non-native species. Drifted individuals can be found in the lower section of the river (Györe et al. 2001).
- Round goby (*Neogobius melanostomus* Pallas, 1814): The first data of this non-native species was proved by our survey at Ipolytölgyes in August 2009. More specimens were found at Szob in October 2009.
- Tube-nosed goby (*Proterorhinus semilunaris* Heckel, 1837): Common non-native species. Its first records were verified between Ipolydamásd and Tésa in the 1980s (Botta et al. 1984), and since then it has been listed in all fauna studies.
- Stone moroko (*Pseudorasbora parva* Temminck & Schlegel, 1846): Common non-native species. Its first occurrence was verified in the 1990s (Botta 1993).

4 Conclusions

Moderate change in the fish fauna is established in the Ipel River since the end of the 19th century. The number of observed species increased over time and the occurrence of 56 fish species has been reported up to now. Little information is available about the species composition of the fish fauna in the 19th century and beginning of the 20th century. Several remarkable species (*Rutilus rutilus*, *Leuciscus idus*, *Abramis brama*, *Gobio gobio*, *Gymnocephalus cernuus*, *Sander lucioperca*, etc.) are neglected in the early publications, due to the low intensity of fauna research. However, the historical data indicate the occurrence of typical rheophilic (*Acipenser ruthenus*, *Alburnoides bipunctatus*, *Lota lota*, *Zingel streber*, etc.) and limnophilic species (*Carassius carassius*, *Tinca tinca*, *Misgurnus fossilis*, etc.). Habitat requirements of these species are very different and high habitat diversity of the river-floodplain ecosystem can be inferred from their coexistence. Occasional occurrence of migratory fish (*Acipenser ruthenus*, *Ballerus ballerus*) from the Danube can be established. The estimated species number in the original fish fauna is 45 (Table 1), which is lower than in the recent fauna.

The occurrence of ten non-native and one atypical native species (Table 1) has been recorded since the 1980s and most of them have a permanent population. Some can be considered as invasive species and their spreading may be expected in the near future. Most of the original elements of the fish fauna occur nowadays, but presence of *Acipenser ruthenus* has not been verified since the 1960s due to disrupted migration by dams built on the lower section of the river.

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