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Microhabitat-dependent changes in fish assemblages of Hungarian streams and creeks

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Introduction

The introduction of the EU Water Framework Directive (DIRECTIVE 2000) necessitated the phasing in of the Hungarian typology of waterbodies (DÉVAI 1976) and the ecological water qualification (DÉVAI 1992, DÉVAI et al. 1999, HANCZ 1994), or rather the inchoation of purposeful surveys. Within the framework of this work, in 2003 fish research was conducted on the streams in the hilly region of the southern foot of Bükk mountains (Bükkalja) and on the creeks of the lowland Borsodi-Mezőség. The survey of these regions from the fish fauna aspect is a high priority because fish stocks living in these watercourses are rather small and therefore vulnerable. The increasing human impact in these small watercourses results in a significant discrepancy from the "original" stock composition compared to major fish stocks currently living in the rivers. Even so, the only publication on the fish fauna of the Bükkalja and Borsodi-Mezőség geographical regions is from HARKA (1992). The present study on one hand provides new data on the fish fauna of these regions, and on the other hand demonstrates how species composition of stocks changes in water bodies according to human impact.

Key words: small watercourses, fish stocks, human impact

Method

The study area is situated in northeast Hungary, between the Bükk mountains and the River Tisza. Seven small watercourses were examined on twenty sampling sites. All the small watercourses belong to the catchment area of the River Tisza (Fig. 1).

Some sampling sites were affected by human disturbance. K4 and S2 sampling sites, situated on the hilly region, were filled with sediment from human activity. Marsh-like microhabitat resulted, with a rich covering of Macrophytes. Two of the sampling sites situated on the lowland region (G3, Cs2) were dredged and paved. In these sites high water velocity and dredging resulted in decreased covering of macrophytes.

The length of all sampling sites was 100 meters. A

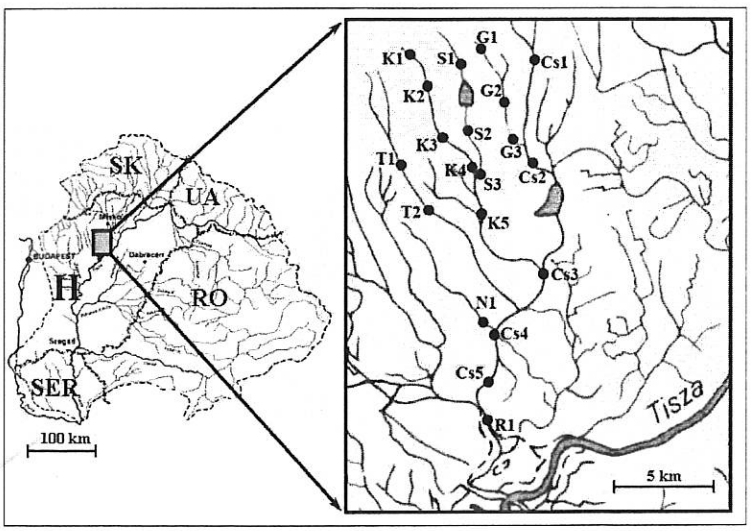

Fig. 1. The catchment area of the River Tisza. Enlarged: sampling sites in the geographical regions Bükkalja and Borsodi-Mezőség.

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Table 1. Species composition of the sampling sites (+++: very frequent, ++: frequent, +: rare occurrence).

	SPECIES	Tardi-s.		Kácsi-stream.					Sályi-stream			Geszti-s.			Csincse					Nád-creek	Rima
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
		T1	T2	K1	K2	K3	K4	K5	S1	S2	S3	G1	G2	G3	Cs1	Cs2	Cs3	Cs4	Cs5	N1	R1
1.	*Rutilus rutilus* Linnaeus, 1758	-	-	-	-	+	+	+	-	+	-	-	+	+	-	+	+	++	++	+	++
2.	*Ctenopharyngodon idella* Valenciennes, 1844	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
3.	*Scardinius erythrophthalmus* Linnaeus, 1758	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	+	+	+	-	+
4.	*Leuciscus cephalus* Linnaeus, 1758	-	-	+++	++	+	+++	-	++	+	+	+++	+++	+	++	+++	-	-	-	-	-
5.	*Leuciscus idus* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+
6.	*Aspius aspius* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+
7.	*Alburnus alburnus* Linnaeus, 1758	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	++	++	+	+++
8.	*Abramis brama* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+
9.	*Gobio gobio* Linnaeus, 1758	+	+	++	++	+	+	+	+++	+	-	+++	++	+	++	+	-	-	-	-	-
10.	*Pseudorasbora parva* Temminck & Schlegel, 1842	+	+	-	+	+	+	+	++	+++	-	-	-	-	-	-	+	+	-	-	-
11.	*Rhodeus sericeus amarus* Bloch, 1782	-	-	+	+	+	++	-	+	+	-	-	-	+	-	-	+	+	+	-	++
12.	*Carassius auratus* Linnaeus, 1758	-	-	-	-	-	+	-	-	+	+	-	-	-	-	-	+	+	+	-	+
13.	*Barbatula barbatula* Linnaeus, 1758	+	+	++	+	-	++	+	+	+	-	+++	+++	+	+	+	-	-	-	-	-
14.	*Misgurnus fossilis* Linnaeus, 1758	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-
15.	*Cobitis elongatoides* Bacescu & Maier, 1969	-	-	-	-	-	+	-	-	++	-	-	-	++	-	-	+	-	+	-	-
16.	*Ictalurus melas* Rafinesque, 1818	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
17.	*Esox lucius* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+
18.	*Lepomis gibbosus* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+
19.	*Perca fluviatilis* Linnaeus, 1758	-	-	-	-	-	+	-	-	+	-	-	-	+	+	+	+	+	+	+	+
20.	*Gymnocephalus cernuus* Linnaeus, 1758	-	-	-	-	-	+	-	-	+	-	-	-	-	+	+	-	-	-	-	-
21.	*Stizostedion lucioperca* Linnaeus, 1758	-	-	-	-	-	-	-	-	-	-	-	-	+	-	++	-	-	+	-	+

low-efficiency electric fishing machine was used to collect fish. Identification of species was carried out according to BERINKEY (1966). A binary data matrix was created from the catch results, and SYN-TAX 5.02 statistical software (PODANI 2001) was applied for the evaulation of this data matrix.

Results and Discussion

In the course of this survey, 21 fish species were collected from 20 sampling sites, increasing to 25 the number of known fish species for the study area. A binary data matrix was created from the data in Table 1. This matrix was evaluated by ordination, nonmetric scaling on Rogers-Tanimoto dissimilarity index. Both methods divide the 20 sampling sites in two major groups (Fig. 2). The first group is composed of sampling sites 1–15, the other sampling sites 16–20. Code numbers of the sampling sites are recorded in Table 1.

Small watercourses situated in the hilly and lowland regions are typed as two major regions according to BANARESCU (1964). The upper (hilly) region of these watercourses are classified as chub region, and the lowland part is referred to perch region. From the 20 sampling sites, the first 15 belong to the chub region, the last five,16–20, belong to the perch region.

Note that sampling sites 16–20 are all situated under 100 m elevation. This considerable detachment of the southest five sampling sites, in addition to the closeness of the River Tisza, accounts for some additional species being drawn up to these sampling points. The extent of water output in these watercourses is large enough to retain species normally found in larger watercourses (e.g. pikeperch, carp bream) Considering the chub-region species composition of the sampling sites, relevant differences can be found.

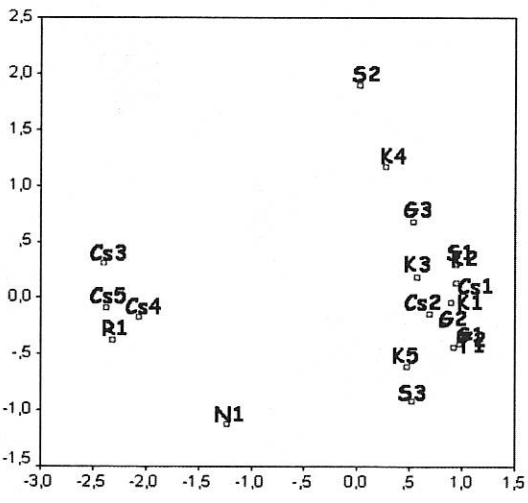

Fig. 2. The results of the ordination (nonmetric scaling, Euclidean distance).

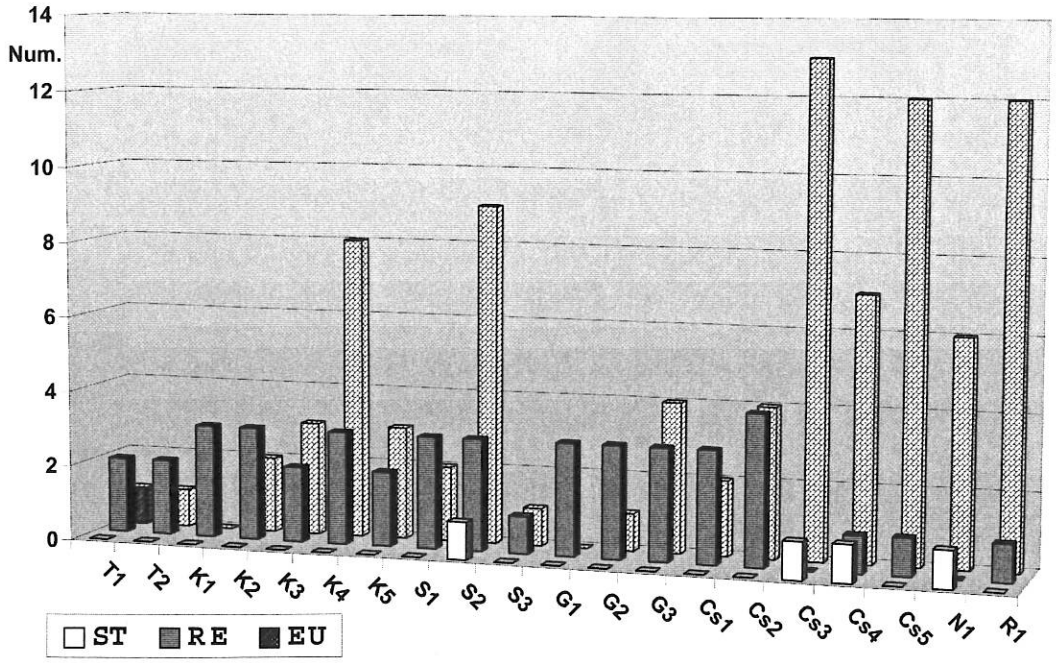

Fig. 3. Numbers of fish species on the sampling sites. Species sorted by water flow requirements.

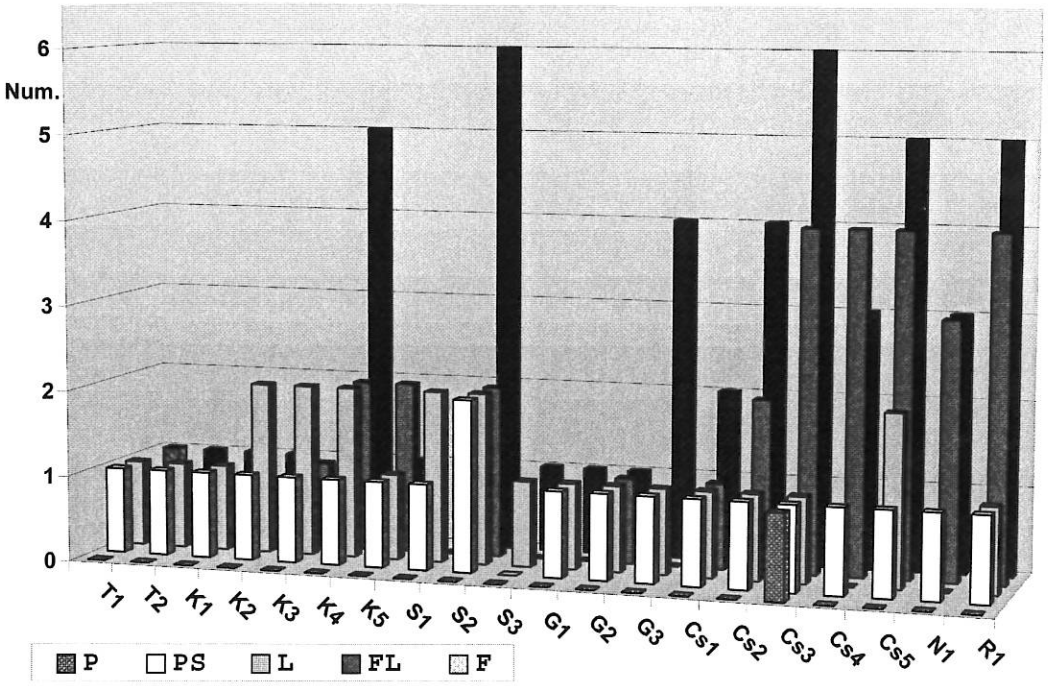

Fig. 4. Numbers of fish species on the sampling sites. Species sorted by reproducive guilds.

Fish species caught on the sampling sites were classified into guilds by different ecological requirements. The first aspect was water drift requirements, with freshwater fish species classified into three guilds: stagnophilous (ST), reophilous (RE) and eurytopic (EU; KERESZTESSY 1998). BALON (1975) classified freshwater fish species into different reproductive guilds: spawning substrate pelagofilous (PEL), ostracofilous (OST), psammofilous (PSZ), litofilous (LIT), fito-litofilous (FIT-LIT) and fitofilous (FIT). Numbers of fish species caught and their representative guilds are shown in Fig. 3 and 4. Both classifiing methods show that fish fauna of the sampling sites affected by human disturbance (K4, S2, G3, Cs2) differ from the fishfauna of the less impacted sampling sites.

On disturbed samping sites situated on the hilly region (K4, S2), the number of EU and FIT species increased due to "still-water-like" conditions. On the dredged lowland-situated sampling sites, the rate of the RE species remain the same as those on the non-disturbed hilly sites due to high water velocity and thin vegetation. Nevertheless, the species composition of the disturbed lowland sampling sites were much more similar to the undisturbed streams stocks than the stocks of disturbed, lowland-like, well-vegetated hilly sampling sites to the less impacted lowland fish stocks (Fig. 2). These relationships arise from identifiable causes.

Fewer RE species can be found in these watercourses, but most of them appear in locations where the strength of the water flow is extended. In the disturbed hilly sites, the RE species remain, but in lower numbers. The larger difference between the stock living in the non-disturbed sampling sites situated in the lowland and the stock living in the disturbed hilly sites is attributed to dissimilar water output conditions and to differing distances from the River Tisza., Runoff is much lower on the hilly region than on the lowland region; therefore, some species are not able to subsist. Some stocks of fish species living in the River Tisza are drawn up to the lowland- situated watercourses; therefore the difference in the species composition is increased further.

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