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Trichoptera of Szigetköz, upper Hungarian Danube Region (Northwest Hungary), II.* Species composition and its changes in some water bodies

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ABSTRACT. Trichoptera of Szigetköz, upper Hungarian Danube Region (Northwest Hungary), II. Species composition and its changes in some water bodies. The caddisfly assemblages of the Danube, both flood area and island, are presented and analysed. The composition changed through time, while the dominancy relations also changed considerably in all water bodies as a consequence of the diversion of Danube and to changes in the water system. The quantities of *Hydropsyche* species diminished, whereas two species became rather frequent or dominant: *Glossosoma boltoni* Curt. and *Agapetus laniger* Pict. The number of known species increased to 86 in Szigetköz, as two species – *Silo nigricornis* Pict. and *Silo piceus* Brau. – have been collected since 2001.

Introduction

The first faunistical compendium was published from the Szigetköz region only two years ago (UHERKOVICH & NÓGRÁDI 2001). That paper introduced all the important faunistical data that had been obtained until the end of 2000. During the period between 1989 and 2000 altogether 84 caddisfly species were taken there, and more than 266 thousand adults were studied and recorded.

The examination of this region went on in the years 2001 and 2002, with a huge material being collected and determined also in the last two years, and we are planning to continue these studies later, mostly to research the change of caddisfly assemblages in the most important water bodies.

In the year 2001 we visited the area four times to obtain further data. During the study of changes we also collected interesting faunistic and other field data. E.g. the maximum number of species collected reached an extraordinary amount during a single evening: forty caddisfly species were taken on 21st June, 2001 at "Püski, Zátonyi–Holt-Duna" site. This sample contains 6494 adults (2961 males and 3533 females), with many rare species among others – which are usually not very rare in Szigetköz – e.g. *Orthotrichia angustella* McL., *Oxyethira tristella* Klap., *Cheumatopsyche lepida* Pict., *Ceraclea senilis* Burm. It was in that year that we found the best biotopes of the newly discovered species, *Hydropsyche exocellata* Dufour in the flood area, near Cikolasziget. Also, further specimens of *Tinodes waeneri* L. were taken at the same site on 14th Aug., 2001, and on 16th August, some kilometres away.

* The first part of the series was published in the same periodical (UHERKOVICH & NÓGRÁDI 2001). The third part of the series will deal with the species composition of Moson Danube (Mosoni–Duna) and its changes, and the ecology and zoogeography of caddisflies of Szigetköz. It is planned to appear in 2004 in the same periodical.

In the year 2001 we obtained evidence for the occurrence of further species, which were not published in our previuos paper (UHERKOVICH & NÓGRÁDI 2001):

Silo nigricornis (Pictet, 1834) – Cikolasziget, floodland water supply system, Aug. 16, 2001 2 ♂♂ (leg. Nógrádi, Uherkovich); Püski, Zátonyi–Holt-Duna ('dead branch of Danube'), May 10, 2001 1 ♂ (leg. Uherkovich).

Silo piceus (Brauer, 1857) – Cikolasziget, floodland water supply system, May 11, 2001 1 ♂ (leg. Uherkovich). This species became frequent also in the Dráva region during the past three years: more than a hundred adults were collected there. Some of the older Hungarian distribution data proved to be wrong, e.g. *Silo pallipes* (Fabricius, 1781) was sometimes determined as *S. piceus*. The ecology of these species differs from each other characteristically. *Silo pallipes* is a relatively frequent inhabitant of smaller mountainous brooks, while *S. piceus* prefers smaller and larger, fast-running, unpolluted rivers of lower elevations.

Thus, the number of known species in Szigetköz increased to 86.

In 2002 we also visited the area three times, taking altogether 29 samples. The richest collection was carried out again at "Püski, Zátonyi-Holt-Duna" on June 4, when 466 males and 1094 females of 37 species were taken. The number of known species did not increase. In this year we also collected *Silo nigricornis* Pict. along the water supply system, e.g. 78 adults at Cikolasziget on May 7, 2002; and some specimens also along the Moson–Danube. *Hydropsyche exocellata* Duf. and other rare, characteristic species of Szigetköz were also taken.

The light trap erected in Halászi also captured great quantities of caddisflies. Although these samples have not been completely elaborated by the time the MS of this paper was closed, until this this time more than 130,000 adults have been determined from that material. We intend to introduce the results in Part III of the series. Also, the origin and zoogeographical analysis of the caddisfly fauna will be outlined later.

In this paper we do not present detailed data of occurrences in the years 2001 and 2002, but only caddisfly assemblages of some water bodies of Szigetköz.

The main types of water bodies in Szigetköz

In our book (NÓGRÁDI & UHERKOVICH 2002) we briefly introduced several water types of Hungary, among others those of the Szigetköz. There, three tpyes of riverine biotopes and one type of stagnant water were presented in detail.In this paper not only the species composition of each caddisfly assemblage will be presented, but also their changes during the years resulting from the changes of the water bodies. We also discuss the quantitative changes of some characteristic species by means of presenting annual activity graphs. The species occuring in each of the water bodiesare shown in Table 6.

Danube (Duna), main branch

The Hungarian section of the Danube is regulated in almost all parts by cutting of larger bends and by building embankments. Large amount of sewage flows into the river mostly from the town Győr (through the Moson Danube). In the lower section, mostly in Budapest, also a great quantity of unpurified (heavily polluted) sewage pours into the river, decreasing the water quality with two orders of magnitude. This great degree of pollution remains in the whole lower section of the Hungarian Danube down to the Croatian/Serbian border, with its water being unsuitable for bathing or for high-quality industrial and agricultural purposes.

Although the Danube is the most important river in Hungary, having the highest water output, its caddisfly assemblages were not studied in the past.

The first considerable examination was initiated by H. Malicky, whose PhD student, P. Chantaramongkol elaborated a set of light trap samples taken along the Danube (Chantaramongkol 1985). Later both along the lower section (in the area of Danube–Dráva National Park, see Nógrádi, Uherkovich 1992, 1999) and along the upper section, in the Szigetköz area, huge materials were collected and elaborated, in order to study the species composition, quantitative relations and changes of the caddisflies. Later Andrikovics et al. (2001) also studied the fauna and its composition above Budapest, using light traps.

The upper section of the Danube – Szigetköz – was altered both in the past (when the shipping line was developed) and in recent times (when the hydroelectric power plants were built at Gabèikovo/Bős). Under the ancient, natural conditions, the Danube below Devín/Dévény ramified into several branches, altering year by year after the inundations. Later one of these branches was deepened and straightened for the shipping route, and some of the other branches were closed by barriers. The Moson-Danube branches out from the main bed of Danube near Rajka, and it meanders on the southwestern margin of the pebbly alluvial deposit.

After the completion of the hydroelectric power plant the bulk of water was diverted into an artifical bed constructed in Slovakia. Thus the water level of the original main branch diminished considerably in the Hungarian Szigetköz, and water output reduced to almost one tenth of the original, and the water velocity also decreased.

We studied the caddisflies of the Danube both before the diversion and after it. Initiallly our sampling did not include the autumn period. Nevertheless we captured here almost 19 thousand adults of 36 species.

Table 1. The most frequent species from Cikolasziget, Duna (Danube, 17º 25' E, 47º 56' N) in 1991–1992, before the diversion of the river

1. táblázat. Cikolasziget, Duna-part (17º 25' E, 47º 56' N) leggyakoribb fajai 1991–1992-ben, az elterelés előtt.

Species	Specimens	P.c.
Hydropsyche sp. indet.	7414	39.48
Psychomyia pusilla F.	5278	28.11
Hydropsyche contubernalis McL.	2600	13.85
Ceraclea dissimilis Steph.	1695	9.03
Oecetis notata Ramb.	467	2.49
Hydropsyche bulgaromanorum Mal.	455	2.42
Hydropsyche pellucidula Curt.	349	1.86
Hydroptila sparsa Curt.	153	0.81
Ceraclea alboguttata Hag.	108	0.58
Sum total 36 species	18 779	100.00

Further important species: *Agapetus laniger* Pict., *Ceraclea nigronervosa* Retz., *Cheumatopsyche lepida* Pict., *Polycentropus flavomaculatus* Pict., *Rhyacophila dorsalis* Curt.

Following the diversion we could not visit the area regularly because of the landscaping and lack of bridges. Later we found and assigned a permanent sampling site, about 7–8 km from the one above. The number of captured specimens was uneven among the years, depending on the actual weather situation and the date of samplings (Fig. 1).

The composition of caddisfly assemblages changed considerably, and the quantitavive parameters became radically different.

At first, *Hydropsyche* species formed the most dominant group of caddisflies, their mass exceeding 60–80 p.c. (Fig. 2). Another volunteering species was *Ceraclea dissimilis* Steph., during the first half of the examined period it was also frequent with over a 5–15 p.c. dominance (Fig. 3).

Later, mostly during 1998–2002 these species were less abundant and *Agapetus laniger* Pict. became the absolute dominant species. Its frequency exceeded 60 p.c. in the year 2001, and it remained over 20 p.c. also in 2002 (Fig. 4). *Glossosoma boltoni* Curt. was known earlier as a rather rare species in Hungary, only some adult specimens were captured during the years 1982–1985, then later in 1993 (Nógrádi 1988, Uherkovich, Nógrádi 1990, Nógrádi, Uherkovich 1996). The first specimens from Szigetköz were collected as late as in 1997, later it became a relatively

frequent species with a dominance of 10–30 p.c. in some samples. Occasionally its yearly dominance also exceeded 2.5 p.c. along the Danube (Fig. 5).

The composition of species resembles those of Austrian branches nera Linz. Some of those species do not occur here *(Hydroptila emarginata* Morton, *Hydropsyche guttata* Pict., *Hydropsyche siltalai* Döhler, *Potamophylax cingulatus* Steph., *Chaetopteryx major* McL.), but most of the species can be common. At Linz the most frequent species were *Psychomyia pusilla* F., *Hydropsyche contubernalis* McL. and *Hydropsyche pellucidula* Curt. (agg.), besides the *Hydropsyche* females (Malicky 1978).

Great changes were observed also in many other cases, e.g. in Moldau (Vltava) and Elbe in the Czech Republik (see Novák 1975, 1989).

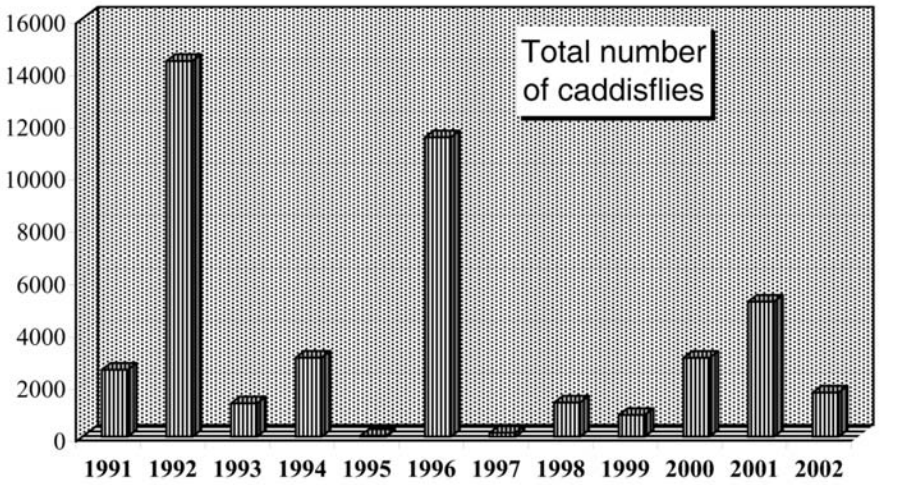

Fig. 1. Number of captured caddisflies along the Danube (Duna), 1991–2002.
1. ábra. A begyűjtött tegzesek mennyiségének változása a Duna mentén, 1991–2002.

Table 2. The most frequent species from Dunaremete, Duna (Danube, 17º 27' E, 47º 53' N) in 1994–2002, after the diversion.
2. táblázat. Dunaremete, Duna-part (17º 27' E, 47º 53' N) leggyakoribb fajai 1994–2002-ben, az elterelés után.

Species	Specimens	P.c.
Agapetus laniger Pict.	4021	38.52
Psychomyia pusilla F.	3838	36.77
Hydroptila sparsa Curt.	659	6.31
Hydropsyche bulgaromanorum Mal.	352	3.37
Mystacides longicornis L.	303	2.90
Oecetis lacustris Pict.	204	1.95
Glossosoma boltoni Curt.	145	1.39
Hydropsyche sp. indet.	105	1.01
Lepidostoma hirtum F.	102	0.98
Ceraclea dissimilis Steph.	71	0.68
Ecnomus tenellus Ramb.	60	0.57
Ceraclea annulicornis Steph.	55	0.53
Sum total 49 species	10439	100.00

Further important species: *Agrypnia pagetana* Curt., *Hydroptila forcipata* Eaton, *Mystacides azurea* L., *Oxyethira tristella* Klap., *Rhyacophila dorsalis* Curt.

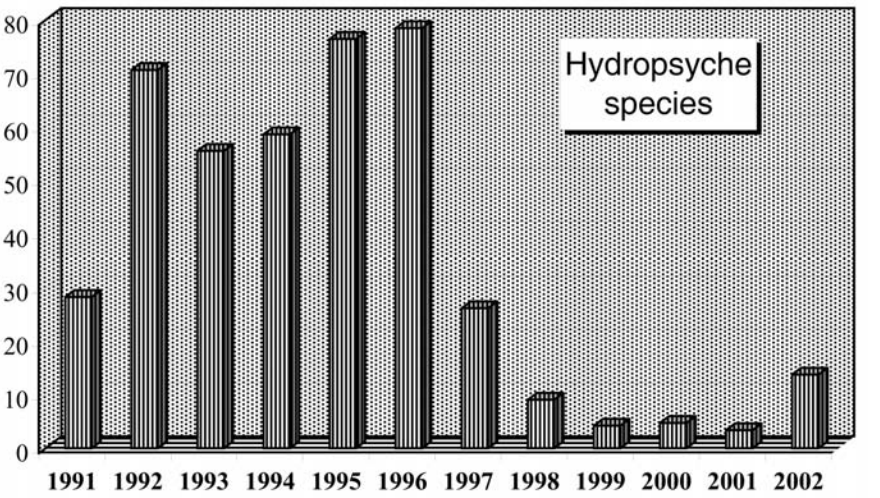

Fig. 2. Annual changes of the relative dominance of *Hydropsyche* species along the Danube, 1991–2002.
2. ábra. A *Hydropsyche* fajok mennyiségének évi változása a Duna mentén, 1991–2002.

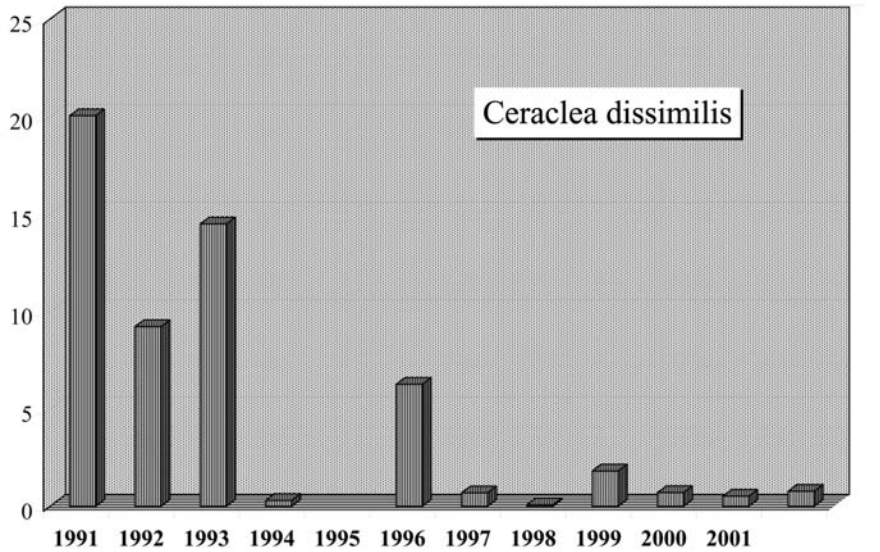

Fig. 3. Annual changes of the relative dominance of *Ceraclea dissimilis* Steph. along the Danube, 1991–2002.
3. ábra. A *Ceraclea dissimilis* Steph. mennyiségének évi változása a Duna mentén, 1991–2002.

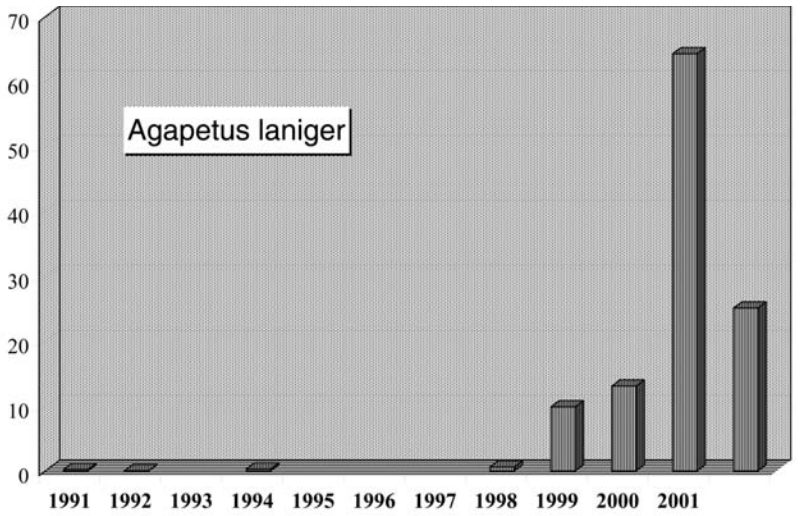

Fig. 4. Annual changes of the relative dominance of *Agapetus laniger* Pict. along the Danube, 1991–2002.
4. ábra. Az *Agapetus laniger* Pict. mennyiségének évi változása a Duna mentén, 1991–2002.

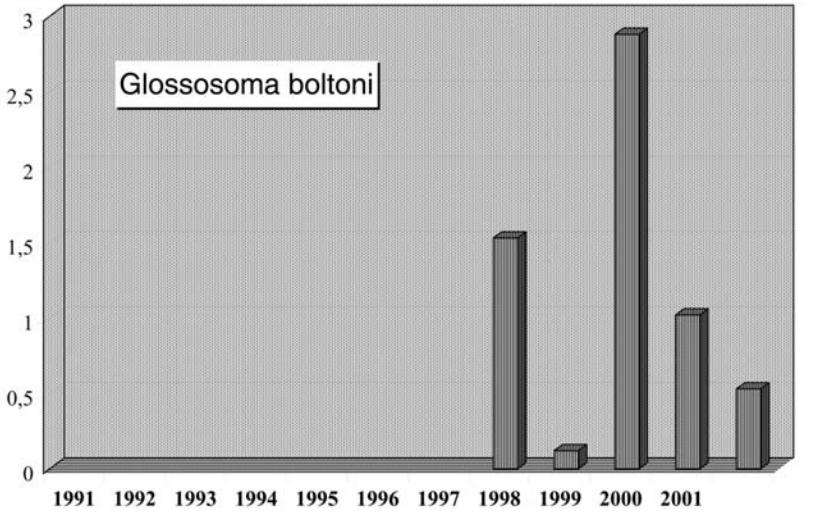

Fig. 5. Annual changes of the relative dominance of *Glossosoma boltoni* Curt. along the Danube, 1991–2002.
5. ábra. A *Glossosoma boltoni* Curt. mennyiségének évi változása a Duna mentén, 1991–2002.

Branch system of the flood area

After the diversion of the Danube to Slovakia the water level of the main branch decreased significantly, and the water output was reduced to almost one tenth of the original mean output. Consequently, the smaller branches dried out and the considerably falling subsoil water level prognosticated a full ecological catastrophe. To escape greater harms, artifical water supplementation was needed. Accordingly, the mouths of small branches were dammed from the main branch, and some branches were connected with others by artifical, newly constructed beds. Thus an unbroken bed, the so-called "water supply system" was developed from Dunakiliti to Ásványráró, in a length of about 25 km on the flood area.

Firstly, water supply was solved by pumping (by Diesel engines) from the Danube, later a gravitational water supply was created by a cross-dam on the bottom of the main branch at Dunakiliti. This solution of water output provision has worked well since eight years.

Fig. 6. The water supply system at Cikolasziget, at the so-called "Kőhídi zárás", with a new ferroconcrete bridge.
6. ábra. Az ártéri vízpótló rendszer Cikolaszigetnél, az úgynevezett "Kőhídi zárásnál", egy új vasbeton híddal.

Fig. 7. The water supply system at Cikolasziget, at the so-called “Denkpál” dam and cataract.
7. ábra. Az ártéri vízpótló rendszer Cikolaszigetnél, az úgynevezett “Denkpál” gátnál és zuhogónál.

Fig. 8. The water supply system at Dunaremete, in an artifical, straight bed, at the bridge leading to the former Danube landing place.
8. ábra. Az ártéri vízpótló rendszer Dunaremeténél, mesterséges, egyenes mederben, az egykori dunai hajóállomásra vezető hídnál.

The caddisfly fauna of the ancient system of small branches was quite varied but not rich. In the branches having stagnant water only some characterless caddisfly species lived, while in others, with slow waterflow, more species occurred. Due to the lack of characteristic caddisfly collectives, we hardly studied these waters.

Since the completion of the water supply system, the caddisfly colonization has already started, and within about five years a new situation formed. After this change we went on to study this permanently changing water body, and high number of samples were collected containing more than forty-thousand adults (Fig. 9).

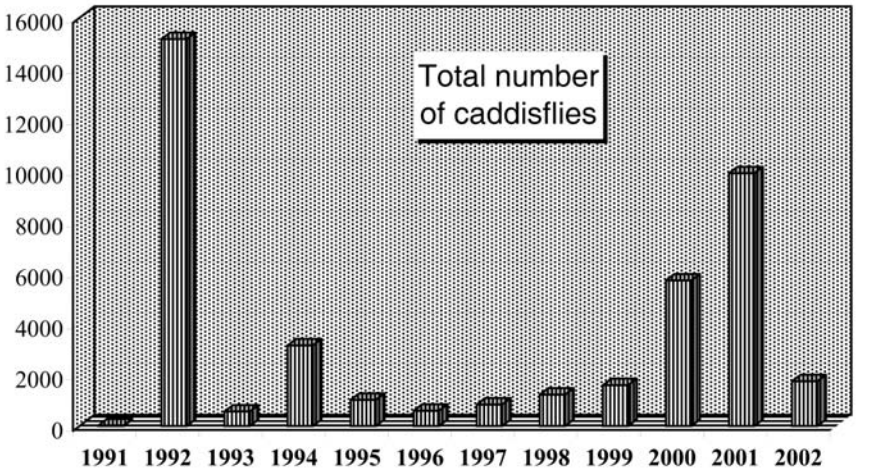

Fig. 9. The number of captured caddisflies along the water supply system, 1991–2002.
9. ábra. A begyűjtött tegzesek mennyisége az „ártéri vízpótló rendszer" mentén, 1991–2002.

Some species characteristic for fast running waters became dominant, while others almost disappeared. Two species (*Agapetus laniger* Pict., *Glossosoma boltoni* Curt.) turned up since the diversion of Danube and the creation of the water supply system. The high dominance of these species is a consequence of the fast running water, which is a new type of running water for Hungary: an artifical "montane river". Both of these species prefer high dissolved oxygene in the water and hard, stony or pebble bed. Along this water supply sytem we took samples several times in some sites. As these sites are not far from each other, the results are shown collectively (Table 3).

The complete list of species in the four sites of the water supply system can be studied also in the Appendix of this paper, in Table 7.

The change of dominance relations can be observed here too, similarly to the main branch of the Danube. The frequency of *Hydropsyche* species decreased (Fig. 10), at the same time *Agapetus laniger* Pict. became the most frequent species during and after 1999 (Fig. 11). *Glossosoma boltoni* Curt. appeared here only in 1997, and sometimes its dominance exceeded 6–7 p.c. (Fig. 12).

The aquatic insect population of the water supply system has developed after the system was constructed. All the standing and flowing waters are colonized by insects relatively soon. For example, after a period of three years, it was possible to find quite many caddisfly species in artifical fish ponds (see NÓGRÁDI & UHERKOVICH 1990). MALICKY (1999) presented a newly constructed canal, in which a rich caddisfly assemblage formed within a few years. As this canal belongs to the water system of the Danube, and it lays only about 50 km far from this area, the composition of caddisflies and the dominant species are rather similar. The most frequent species in Marchfeldkanal, which is a slower flowing water body and in most of its sections has an artifical bed, were *Psychomyia pusilla* F., *Mystacides longicornis* L., *Hydroptila sparsa* Curt., and *Agapetus laniger* Pict. The water supply system of Szigetköz use the original parts of the branch system, but they are connected by artifical beds, and water is faster in them. In contrast with this fast-running water system, stagnant water can be found in the remnants of branches with dense aquatic vegetation or reeds, and in some places there are slowly flowing waters as well.

Table 3. Most frequent species from Szigetköz, in the water supply system of the flood area (17º 24…27' E, 47º 53…56' N), 1993–2002.
3. táblázat. A szigetközi „ártéri vízpótló rendszer" (17º 24…27' E, 47º 53…56' N) leggyakoribb fajai, 1993–2002.

Species	Specimens	P.c.
Psychomyia pusilla F.	6384	28.89
Agapetus laniger Pict.	4686	21.21
Hydroptila sparsa Curt.	3073	13.91
Glossosoma boltoni Curt.	1338	6.06
Hydropsyche sp. indet.	844	3.82
Lepidostoma hirtum F.	631	2.86
Brachycentrus subnubilus Curt.	603	2.73
Mystacides longicornis L.	484	2.19
Goera pilosa F.	510	2.31
Oecetis ochracea Curt.	442	2.00
Ecnomus tenellus Ramb.	363	1.64
Ceraclea dissimilis Steph.	327	1.48
Setodes punctatus F.	313	1.42
Oecetis lacustris Pict.	296	1.34
Oxyethira flavicornis Pict.	245	1.11
Anabolia furcata Brau.	197	0.89
Hydropsyche bulgaromanorum Mal.	161	0.73
Hydropsyche angustipennis Curt.	162	0.69
Rhyacophila dorsalis Curt.	120	0.54
Sum total 62 species	22096	100.00

Further important and characteristic species are: *Cheumatopsyche lepida* Pict., *Cyrnus flavidus* McL. (the single known specimen from Hungary), *Halesus radiatus* Curt., *Hydropsyche exocellata* Dufour, *Ithytrichia lamellaris* Eaton, *Oxyehtira tristella* Klap., *Phryganea bipunctata* Retz., *Rhyacophila dorsalis* Curt., *Silo nigricornis* Pict., *Silo pallipes* Brau., *Tinodes waeneri* L.

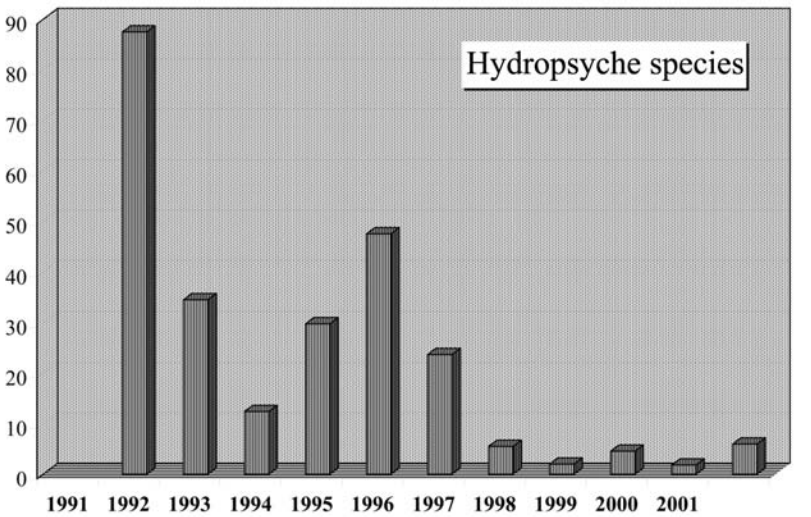

Fig. 10. Annual change of the relative dominance of *Hydropsyche* species along the water supply system, 1991–2002.
10. ábra. A *Hydropsyche* fajok mennyiségének évi változása az „ártéri vízpótló rendszer" mentén, 1991–2002.

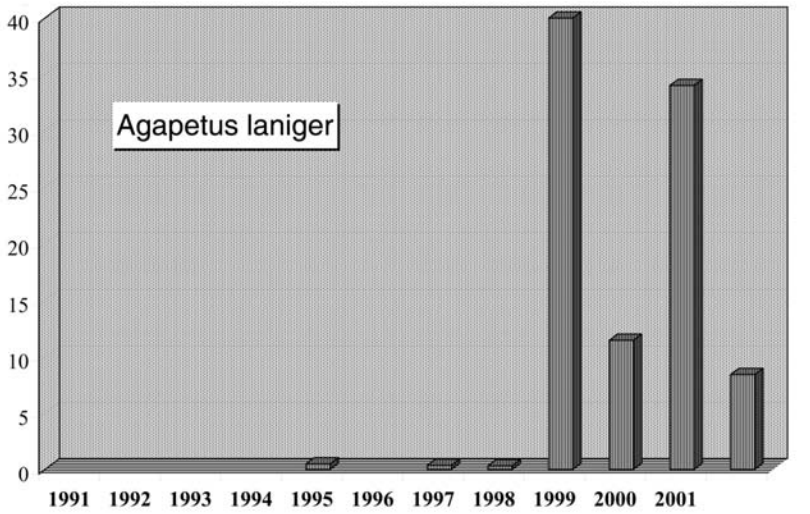

Fig. 11. Annual change of the relative dominance of *Agapetus laniger* Pict. along the water supply system, 1991–2002.

11. ábra. Az *Agapetus laniger* Pict. mennyiségének évi változása az „ártéri vízpótló rendszer" mentén, 1991–2002.

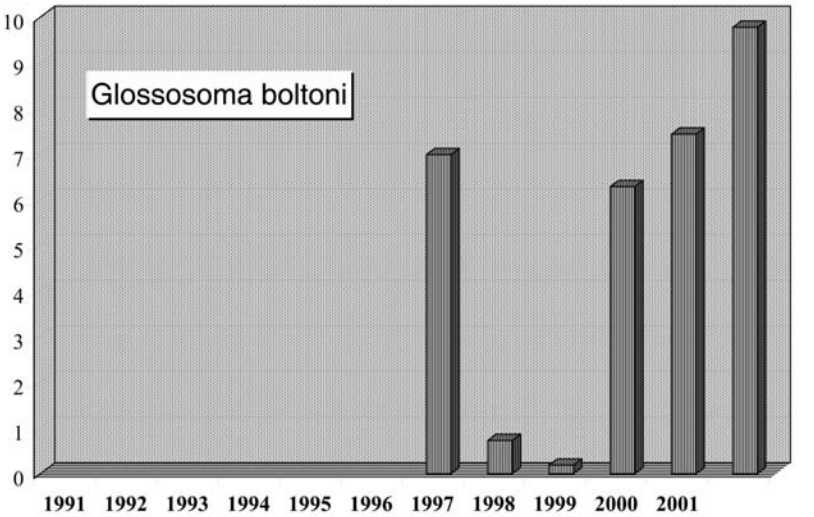

Fig. 12. Annual change of the relative dominance of *Glossosoma boltoni* Curt. along the water supply system, 1991–2002.

12. ábra. A *Glossosoma boltoni* Curt. mennyiségének évi változása az „ártéri vízpótló rendszer" mentén, 1991–2002.

Stagnant waters of the island

The oxbow lakes (dead branches) represent one of the important types of stagnant waters. These waters can be in different phases of eutrophication, with diverse aquatic vegetation and with many types of caddisfly assemblages.

One of the richest oxbow lakes lies in the vicinity of Püski. This lake was cut into two sections by the main flood prevention dike of the Danube. The part lying inside the flood area belongs to the branch system of the Danube (and it is in permanent connection with the water supply sytem), while the other part remained outside the dike and is a permanent stagnant water. At the beginning of the study of this area – in the years 1994–1998 – the surface was covered by dense aquatic vegetation of *Nuphar luteum* L. and other species of reed-grass (Fig. 13).

Fig. 13. The oxbow lake called "Zátonyi-Holt-Duna" in the vicinity of Püski, as viewed from the embankment (1995).
13. ábra. A Püski közelében fekvő holtág, a Zátonyi-Holt-Duna, a védtöltés felől nézve (1995).

A small canal (formerly a branch with regulated bed) flowed out from this lake about a hundred meters from the dike cutting this oxbow lake into two. Later – after the diversion of the Danube – larger amounts of water was supplied into this system called Zátonyi-Duna, thus the water level of this oxbow lake became permanently higher. As a consequence, the aquatic vegetation regressed, first the rich *Nuphar* stand became thin, and then shortly disappeared. Later, in 1999 a new canal was dug from the corner of the lake, with a relatively fast water stream flowing from it. Many net-spinning caddisflies colonized this canal, several of them also being recorded in the samples collected a few meters away from this canal.

Here we took samples in all seasons, yielding almost thirty-thousand specimens of 59 species in the period between 1994 and 2002 (Fig. 14). A certain proportion of the specimens collected were quite probably swept there by air currents or flew there actively from the flood area (from the water supply system and the Danube); but most of them must have developed at the site. The dominant species, *Agapetus laniger* Pict. might develop in other waters too, and maybe also at the collecting site, especially after the second canal was created.

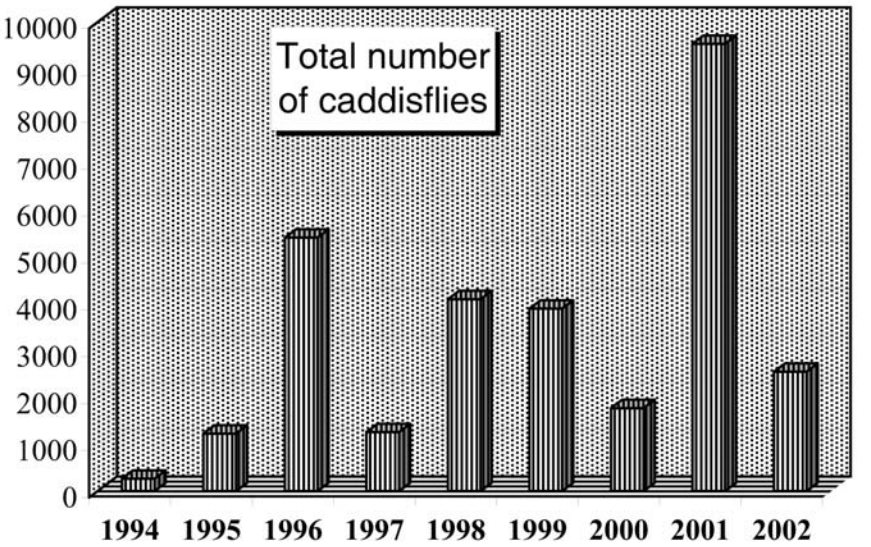

Fig. 14. Number of captured caddisflies at the oxbow lake in the vicinity of Püski, 1994–2002.
14. ábra. A begyűjtött tegzesek mennyisége a Püski közelében lévő holtágnál, 1994–2002.

Table 4. The most frequent species of Püski, dead branches of the Danube (17º 23' E, 47º 53' N), 1994–2002
4. táblázat. Püski, Zátonyi-Holt-Duna (17º 23' E, 47º 53' N) leggyakoribb fajai, 1994–2002.

Species	Specimens	P.c.
Agapetus laniger Pict.	4444	14.85
Psychomyia pusilla F.	4211	14.08
Hydropsyche sp. indet.	3933	13.15
Ceraclea dissimilis Steph.	2972	9.93
Lepidostoma hirtum F.	1913	6.39
Leptocerus tineiformis Curt.	1739	5.81
Mystacides longicornis L.	1556	5.20
Oecetis ochracea Curt.	942	3.15
Glossosoma boltoni Curt.	918	3.07
Hydropsyche contubernalis McL.	793	2.65
Oecetis notata Ramb.	705	2.36
Hydroptila sparsa Curt.	657	2.20
Ecnomus tenellus Ramb.	598	2.00
Neureclipsis bimaculata L.	539	1.80
Ceraclea alboguttata Hag.	470	1.57
Oxyethira flavicornis Pict.	465	1.55
Hydropsyche pellucidula Curt. (agg.)	337	1.13
Oecetis lacustris Pict.	286	0.96
Hydropsyche bulgaromanorum Mal.	270	0.90
Sum total 59 species	29918	100.00

Further important species: *Cheumatopsyche lepida* Pict., *Hydroptila forcipata* Eaton, *Orthotrichia angustella* McL., *Oxyethira tristella* Klap., *Phryganea bipunctata* Retz., *Silo nigricornis* Pict., *Tinodes waeneri* L., *Ceraclea nigronervosa* Retz.

At this single site 59 species were collected during nine years, exclusively by hand (personal collections on light). The most species-rich sample ever was collected here, see Uherkovich and Nógrádi (2001) and the „Introduction" section of this paper. Sometimes more than a thousand, once even almost 6500 specimens, were taken during a single collection of three hours!

During the years 1994–1998 the hydropsychids were the most frequent ones (Fig. 15), reaching frequencies of 20–30 p.c. The net-spinning species showed also some decrease after 1998 (Fig. 16). We already mentioned the high dominance of *Agapetus laniger* Pict. during and after 1999 at other sites. In 2001 its frequency exceeded 35 p.c., but the species had an important mass also in the other years during 1999–2002 (Fig. 17). The ratio of *Lepidostoma hirtum* F. also increased after 1998 (Fig. 18), otherwise this species is very common along the running waters of Szigetköz (Moson Danube and the main branch of the Danube). The Leptoceridae family comprises species with different ecological demands. Many leptocerid species can be very common in stagnant waters. The ratio of these species was relatively even during the nine years of examination (Fig. 19). Also, species belonging to Hydroptilidae are quite different from an ecological aspect; their quantitity was high in the first year of examination (1994) one sample containing almost 20 p.c. of *Hydroptila sparsa* Curt., but because it was the only sample from that year, it could not be evaluated statistically (Fig. 20). Later on only relatively few hydroptilids were taken.

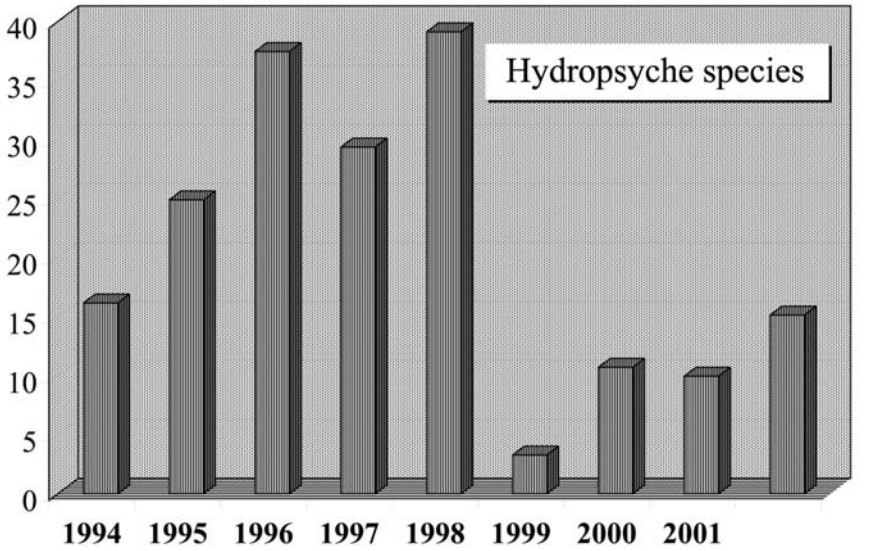

Fig. 15. Annual change of the relative dominance of *Hydropsyche* species at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.

15. ábra. A *Hydropsyche* fajok relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

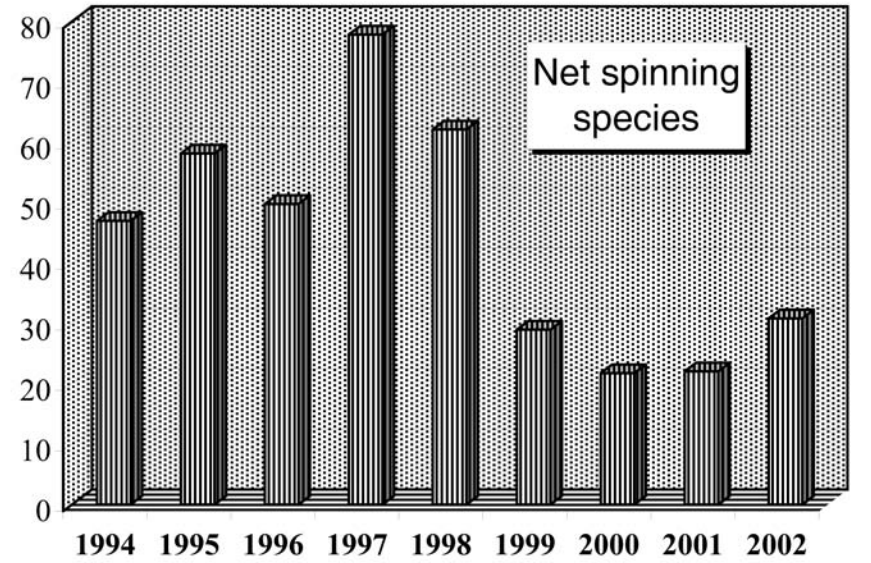

Fig. 16. Annual change of the relative dominance of net-spinning species at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.
16. ábra. Hálószövő fajok fajok relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

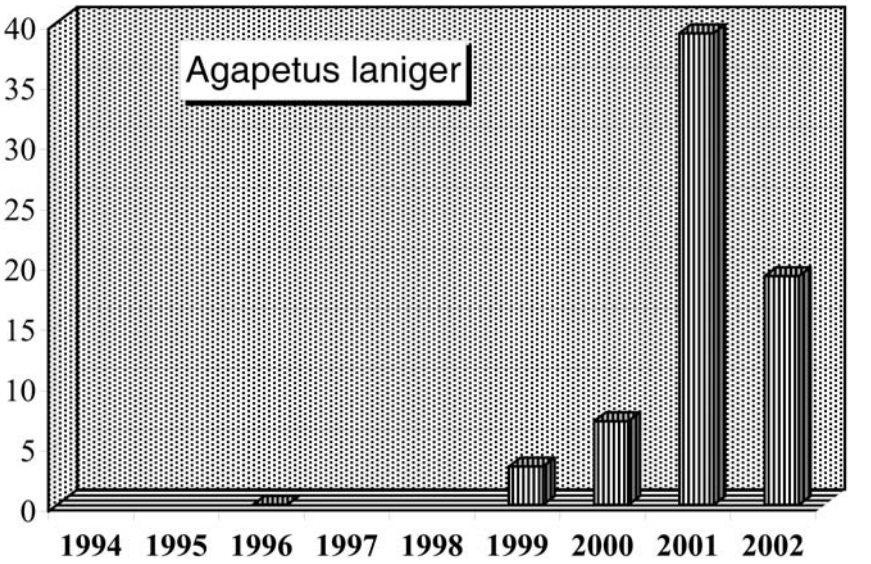

Fig. 17. Annual change of the relative dominance of *Agapetus laniger* Pict. at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.
17. ábra. Az *Agapetus laniger* Pict. relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

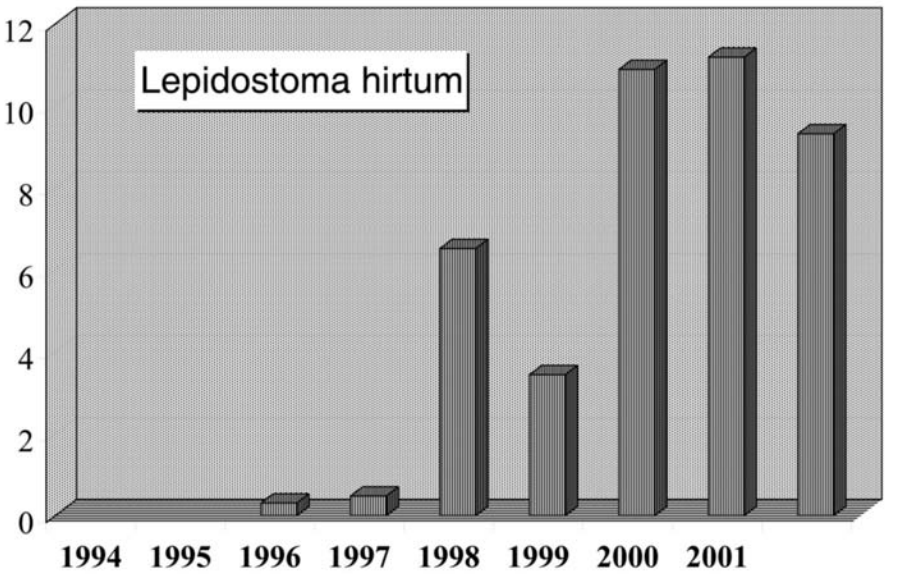

Fig. 18. Annual change of the relative dominance of *Lepidostoma hirtum* F. at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.
18. ábra. A *Lepidostoma hirtum* F. relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

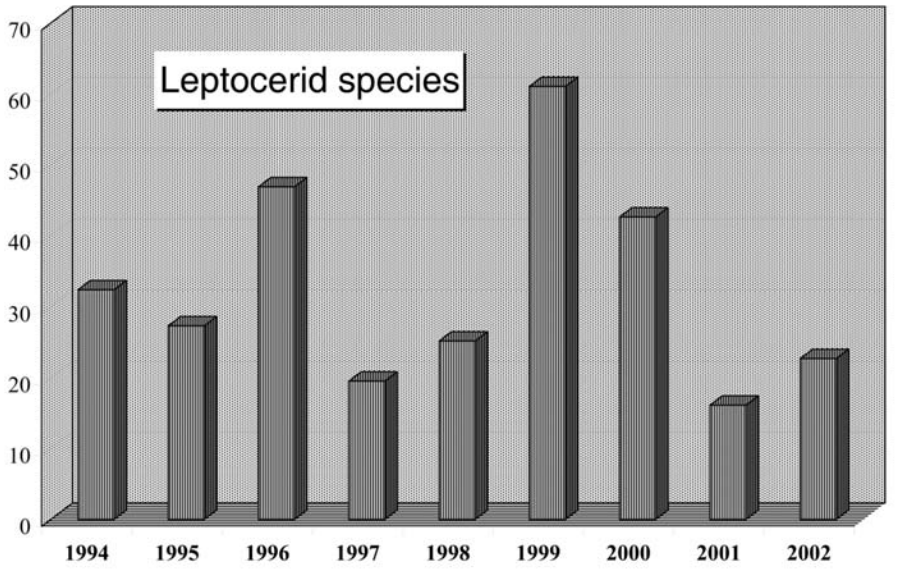

Fig. 19. Annual change of the relative dominance of leptocerid species at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.
19. ábra. Leptocerida fajok relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

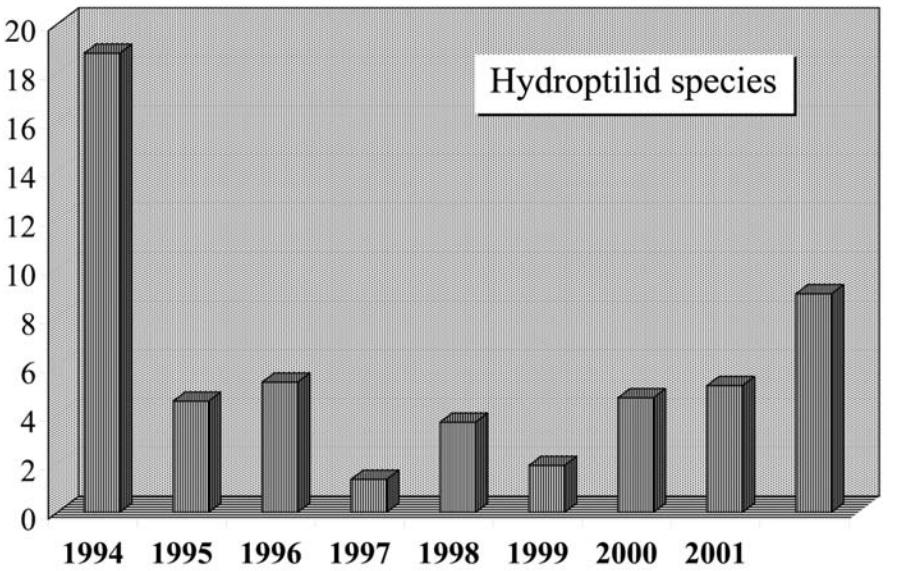

Fig. 20. Annual change of the relative dominance of hydrotilid species at the oxbow lake „Zátonyi-Holt-Duna" in the vicinity of Püski, 1994–2002.
20. ábra. Hydroptilida fajok relatív dominanciaértékének évi változása a Püski közelében lévő Zátonyi-Holt-Dunánál, 1994–2002.

Flowing water in the inner part of the island

In the inner part of the island – between the embankment of Danube and Moson Danube – there are some smaller water courses meandering. The most import member of these waters is the „Zátonyi-Duna" running from Dunakiliti toward Püski, to the previously presented stagnant water body. Originally it had an unimportant water output, and its water was almost stagnant along much of its section. After the start of artifical water supply, large quantities of water were led into the bed of this water course. We collected along this water occasionally between 1994 and 1998, resulting 38 species. The most frequent species were as follows (Table 5):

Table 5. The most frequent species from Zátonyi-Duna, Dunakiliti (17º 18' E, 47º 58' N).
5. táblázat. A Zátonyi-Duna, Dunakiliti (17º 18' E, 47º 58' N) leggyakoribb fajai.

Species	Specimens	P.c.
Psychomyia pusilla F.	2844	41.14
Hydroptila sparsa Curt.	1074	15.54
Goera pilosa F.	952	13.77
Hydropsyche sp. indet.	671	9.71
Ceraclea dissimilis Steph.	367	5.31
Oecetis ochracea Curt.	184	2.66
Ceraclea alboguttata Hag.	131	1.89
Ecnomus tenellus Ramb.	93	1.35
Mystacides longicornis L.	86	1.24
Mytacides azureus L.	84	1.22
Hydropsyche bulbifera McL.	82	1.19
Hydropsyche angustipennis Curt.	57	0.82
Athripsodes cinereus Curt.	50	0.72
Sum total 59 species	6913	100.00

Further important species: *Glossosoma boltoni* Curt., *Phryganea bipunctata* Retz., *Rhyacophila dorsalis* Curt.

Other water bodies

At the beginning of the examinations, we collected in the Lower Szigetköz also, but later the studies were focused onto the Upper Szigetköz, since it was anticipated that the main changes following the diversion of the Danube would occur there. In some cases in the years 1991 and 1992 we collected along smaller channels and moors. Only one very important species was found in the four biotopes of Upper Szigetköz: *Limnephilus elegans* Curt. (Győrzámoly, Patkányos, dike watchman's house, July 9, 1991, 1 > 1 +), and no more specimens were collected later anywhere. This protected species probably disappeared from Hungary: since its collection in Szigetköz no further specimens have been taken. In the 1980s about twenty adults were captured in two other sites (Magyarszombatfa, Lipótfa, see NÓGRÁDI & UHERKOVICH 1990). All the data of these collections have been published in the previous parts of this series of papers (UHERKOVICH & NÓGRÁDI 2001).

Summary

In this part of the series of papers we introduce the composition of caddisfly assemblages of some water bodies of Szigetköz. We have been able to ascertain that following the diversion of the Danube the species composition changed significantly not only in the main branch but in the waters of the flood area and in the waters of the island as well. After the diversion a new type of assemblage has already developed with high frequency of *Agapetus laniger* Pict. and *Glossosoma boltoni* Curt.

In the next, third part of this series we intend to present the caddisfly assemblage and its change in the Moson Danube (Mosoni–Duna).

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Table 6. More detailed data regarding the water supply system, between 1993 and 2002
(see also Table 3 in text)
6. táblázat. Az „ártéri vízpótló rendszer” részletesebb adatai 1993 és 2002 között
(lásd még a szöveg között a 3. táblázatot)

	Cikolasziget, dike watchman's house	Cikolasziget, „Kőhídi zárás”	Cikolasziget, „Denkpál”	Dunaremete, water supply system	sum total	p.c.
Agapetus laniger Pict.	2489	223	1428	546	4686	21.21
Agraylea sexmaculata Curt.	22	1	0	2	25	0.11
Athripodes aterrimus Steph.	2	0	0	7	9	0.04
Anabolia furcata Brau.	89	46	56	6	197	0.89
Athripsodes cinereus Curt.	21	10	3	13	47	0.21
Brachycentrus subnubilus Curt.	593	0	1	9	603	2.73
Ceraclea alboguttata Hag.	15	4	0	36	55	0.25
Ceraclea annulicornis Steph.	46	3	0	2	51	0.23
Ceraclea dissimilis Steph.	191	81	27	28	327	1.48
Ceraclea senilis Burm.	1	0	0	0	1	0.00
Cheumatopsyche lepida Pict.	26	1	1	0	28	0.13
Cyrnus crenaticornis Kol.	23	1	0	0	24	0.11
Cyrnus flavidus McL.	1	0	0	0	1	0.00
Cyrnus trimaculatus Curt.	2	0	0	1	3	0.01
Ecnomus tenellus Ramb.	101	225	2	35	363	1.64
Glossosoma boltoni Curt.	891	1	115	331	1338	6.06
Goera pilosa F.	361	62	27	60	510	2.31
Halesus radiatus Curt.	0	4	0	0	4	0.02
Halesus tesselatus Ramb.	2	20	0	0	22	0.10
Holocentropus picicornis Steph.	1	0	0	0	1	0.00
Hydropsyche angustipennis Curt.	1	35	24	92	152	0.69
Hydropsyche bulbifera McL	4	14	0	0	18	0.08
Hydropsyche bulgaromanorum Mal.	33	14	1	113	161	0.73
Hydropsyche contubernalis McL.	65	20	1	7	93	0.42
Hydropsyche exocellata Dufour	0	0	7	0	7	0.03
Hydropsyche modesta Navás	1	2	0	0	3	0.01
Hydropsyche pellucidula Curt.	19	22	14	17	72	0.33
Hydropsyche sp. indet	327	319	36	162	844	3.82
Hydroptila angustata Mosely	1	0	0	0	1	0.00
Hydroptila forcipata Eaton	8	0	2	0	10	0.05
Hydroptila lotensis McL.	0	21	0	2	23	0.10
Hydroptila sparsa Curt.	603	250	9	2211	3073	13.91
Ithytrichia lamellaris Eaton	1	0	0	0	1	0.00
Lepidostoma hirtum F.	412	1	210	8	631	2.86
Leptocerus tineiformis Curt.	16	0	0	9	25	0.11
Limnephilus affinis Curt.	1	0	0	0	1	0.00
Limnephilus auricula Curt.	1	0	0	0	1	0.00
Limnephilus decipiens Kol.	1	0	0	0	1	0.00

	Cikolasziget, dike watchman's house	Cikolasziget, „Kőhídi zárás"	Cikolasziget, „Denkpál"	Dunaremete, water supply system	sum total	p.c.
Limnephilus griseus L.	2	1	0	0	3	0.01
Limnephilus lunatus Curt.	1	0	0	0	1	0.00
Lype phaeopa Hag.	6	1	2	2	11	0.05
Mystacides azureus L.	7	8	2	5	22	0.10
Mystacides longicornis L	224	41	23	196	484	2.19
Mystacides niger L.	15	0	4	2	21	0.10
Neureclipsis bimaculata L.	3	2	1	15	21	0.10
Oecetis furva Ramb.	26	8	2	25	61	0.28
Oecetis lacustris Pict.	152	40	8	96	296	1.34
Oecetis notata Ramb.	19	1	0	17	37	0.17
Oecetis ochracea Curt.	183	143	54	62	442	2.00
Orthotrichia angustella McL.	3	0	1	0	4	0.02
Orthotrichia costalis Curt.	41	31	0	10	82	0.37
Orthotrichia tragetti Mosely	7	3	0	0	10	0.05
Oxyethira flavicornis Pict.	231	0	2	12	245	1.11
Oxyethira tristella Klap.	4	0	0	0	4	0.02
Phryganea bipunctata Retz.	8	0	0	0	8	0.04
Phryganea grandis L.	28	0	0	0	28	0.13
Psychomyia pusilla F.	3111	293	2402	578	6384	28.89
Rhyacophila dorsalis Curt.	27	14	2	77	120	0.54
Setodes punctatus F.	106	0	0	207	313	1.42
Silo nigricornis Pict.	83	0	0	0	83	0.38
Silo piceus Brau.	1	0	0	0	1	0.00
Stenophylax permistus McL.	0	1	0	0	1	0.00
Tinodes waeneri L.	1	0	1	0	2	0.01
Sum total	10660	1967	4468	5001	**22096**	**100.00**

A Szigetköz, a felső magyarországi Duna-szakasz Trichopterái, II. A faji összetétel és annak változásai néhány víztestben

UHERKOVICH ÁKOS & NÓGRÁDI SÁRA

A Szigetköz különböző víztípusait 12 éven keresztül vizsgáltuk. Ez idő alatt óriási ökológiai változások zajlottak le a Duna elterelése következtében.

A Duna fő medrébe az eredeti átlagos vízmennyiségnek mintegy tizedrészét bocsátották be, az ártér legtöbb mellékága emiatt kiszáradt. Ugyanakkor a Mosoni–Dunába nagyobb vízmennyiség került.

A teljes ökológiai katasztrrófát megelőzendő az ártéren mesterséges vízpótlást alakítottak ki olyan módon, hogy a fő ágtól gátakkal elválasztották a mellékágakat, néhány mesterséges mederszakasszal összekötötték ezeket, ahol szükséges volt. Először szivattyúkkal, majd garvitációs módszerrel (egy Dunakilitinél megépített fenékgáttal megemelve a vízszintet) biztosították a kellően magas vízszintet az ártéren. Ez által az „ártéri vízpótló rendszer" egy hazánkban eddig ismeretlen tulajdonságokkal rendelkező víztípussá vált, amely fizikai sajátságait tekintve leginkább sebesvízű hegyi folyóra emlékeztet.

Ugyanakkor a Duna védtöltése és a Mosoni–Duna által közrezárt szigetben kanyargó vizek is megváltoztak.

A tegzes-együttesek az egyes víztestek változásait érzékenyen követték. A Duna kezdetben rendkívül alacsony vízállású és lassú folyású vizéből eltűnt a korábbi nagy diverzitású tegzes-együttes. A vízmennyiség növekedésével az eredetihez hasonló állapot állt vissza. Az ártéri vízpótló rendszerben tapasztaltuk a legjelentősebb változásokat. Itt a gyorsan rohanó vízben egy teljesen új összetételű együttes alakult ki, jellegzetes dominanciaviszonyokkal. A sziget alaposan vizsgált állóvizében (a püski Zátonyi-Holt-Dunában) az együttes összetétele lényegében nem változott, bár a fajok gyakorisági sorrendje módosult. Ugyancsak gazdag együttes alakult ki ugyanennek a víznek felső, gyorsan folyó részén is.

Általában elmondható, hogy a vizsgálati időszak első felében (az elterelés előtt és közvetlenül utána) a változások esetlegesek voltak, de általában romló tendenciát mutattak. A kilencvenes évek közepén az újonnan létrejött vízmegosztás hatására egyensúly kezdett kialakulni. Erre az a jellemző, hogy a korábban nagy gyakoriságú *Hydropsyche* fajok és egyes Hydroptilidák háttérbe szorultak, ezzel szemben a nem vagy alig képviselt *Agapetus laniger* Pict. és *Glossosoma boltoni* Curt. igen nagy – sok esetben abszolút – dominanciával jelentkezett.

2001-ben és 2002-ben két új fajjal – *Silo nigricornis* Pict. és *Silo piceus* Brau. – gyarapodott a Szigetközből megismert fajok száma, s ezzel 86-ra emelkedett a számuk.

A Mosoni-Duna mentén eddig begyűjtött több mint 300 000 tegzes feldolgozása még folyamatban van, az eredményekről a cikksorozat következő részében kívánunk beszámolni.

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