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MACROZOOBENTHOS IN THE RIVER TISZA AND ITS INFLUENTS

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Abstract

In the studied section of the Tisza, the Oligochaets and the Chironomids were the dominant species of the macrozoobenthos, and the population density of Oligochaets was higher than that of Chironomid larvae. From the 14 Oligochaet species the Tubifex nowaensis was found in the channel line of Tisza, and *Limnodrilus* species and the *Branchiura sowerbyi* in the coastal zone.

From the 21 Chironomid species, *Chironomus fluviatilis, Harnischia fuscimanus* and *Polypedilum intermedius* were dominant. During the present studies seven new Chironomid species were found in the Hungarian fauna. The numbers of species in the Oligochaet communities of Tisza decreased in the late years, but the Chironomid communities became richer, mainly because of occurence of limnophyl species.

In the influents loaded with sewages (Sajó, Zagyva) only the Oligochaet species remain vital. The influence of industrial and communal sewages results in decrease of invertebrate fauna of Tisza.

Introduction

On behalf of the Main Department of Environmental Protection of National Water Conservancy Office samples were collected from various profiles of Tisza from Tokaj to Szeged between 16—24 September, 1985. The aim of this work was to analyze the changes in the invertebrate fauna of Tisza and the effect of influents on its biocenosis.

The first data on the bottom fauna of Tisza were published by Horváth (1962). The studies on endobenthos were begun by Ferencz. His research served as a basis for identification on the bottom fauna of the Tisza, and at present, several specialists are involved in this work. Due to the research started in 1962 at present there is a very rich collection of data on the bottom fauna of the Tisza. The macrozoobenthos of the Szeged and Kisköre sections of Tisza and that of its influents Maros, Szamos, Bodrog, Sajó and Zagyva are known from the studies of Csoknya and Ferencz (1972, 1975) and Ferencz (1968, 1969, 1974a, 1974b). The Oligochaets are the dominant elements of macrozoobenthos of our rivers (Ferencz 1981), as their individual numbers are higher than that of molluscs and Chironomid larvae in the bottom fauna of Tisza and its influents. Based on studies of horizontal distribution of zoobenthos and of the longitudinal profiles it was stated that the coastal biotops provide more favourable life conditions for the Oligochaets, than the bottom of the main current of the river (Ferencz 1968, 1981). The upper section of the Tisza provides less fa-

vourable conditions for the living organisms than its lower sections because of its strong current and coarser silt. Between its influents the largest population of Oligochaets is found in the Lónyai-channel (1.206 i.m^{-2}), while in the Szamos, Sajó, Körös and Maros there are very thin populations of them.

In the studies of the Tisza, 22 Oligochaet species were found, and nearly all of them belonged to the Tubificids. More than 50% of the individuals belonged to *Limnodrilus hoffemeisteri, L. Claparedeianus, L. udekemianus* and *L. profundicola.*

The data recorded by PUJIN et *al.* (1984) on the lower section of the Tisza in Yugoslavia, showed similar results, and Sporka (1982) also observed dominance of *L. hoffemeisteri* in the river Laborec in Czechoslovakia. This species can be found in very different types of water and silt because of its ecological valency (FERENCZ 1981).

The studies on Chironomid fauna of Tisza have been started and are continued by SZÍTÓ (1973, 1974, 1978, 1981).

Materials and Methods

The sediment samples were taken from 19 profiles of the Tisza and its influents (Figure 1, Table 1). In each profile three samples were taken by means of a modified Ekman dredge of 18×31 cm surface at various distances from the right (1) and left (2) bank, and from the channel line (S). The weight of the empty EKMAN dregde was about 30 kg. This made possible to take sediment samples both from the coastal zone and from the channel line.

The sampling sites are denoted by symbols of three numbers or letters (BANCSI et *al.* 1981). Accordingly the symbol 011 means that the sample was collected in the profile no. 1., near the right bank (Tables 1—3., Figures 1—3.).

In the influents, the sediment samples were collected at 500—1000 m from the mouth. The distance from the bank was determined by the slope of the bank, the water depth, and the structure of sediment (Table 1).

Each sample was placed in a separate dish, then washed in a sieve of 250 μm mesh size, and the living organisms were immediately picked from the remained sediment. For identification a Zeiss made microscope was used, and the organisms were divided into groups of Oligochaets, Chironomids, Molluscs and "other". The worms and the larvae of insects were preserved in 85% alcohol and the Gastropods and Lamellibranchiats in 3% solutions of formalin.

The identifacation of Oligohaets was carried out based on studies of Brinkhurs (1963) and Ferencz (1979), and that of Chironomids on studies of Bíró (1981), Cherenovskii (1949), Lanz (1962) and Pinder et al. (1983).

Results and Discussion

The number of individuals of Oligochaets was generally lower in the sediment samples originating from the channel line of the Tisza, than that in the sediment samples from the coastal zones (Figure 2). The maximum number of individuals was found in the section of Kisköre water reservoir (profile No. 9., i.m^{-2}). Oligochaets were not found in the sediment of the channel line under the Kisköre water reservoir (tailwater, profile No. 11.), and above and under the mouth of Körös (profiles No. 15 and 17.).

In the sediment of left and right banks Oligochaets were always found, except for one case of each bank (profiles No. 15. and 11.). The maximum number of individuals was found in the retained water of Kisköre reservoir of Tisza: 900 i.m^{-2} in the sample collected near the right bank of profile No. 10.

In studies of longitudinal profiles of the Tisza in 1985 14 Oligochaet species were found (Table 2). One species belonged to Naididae, one to Lumbriculidae and 12 to Tubificidae. Compared to studies carried out in 1979 the fauna of Oligochaets decreased in species, as at that time there were 22 species (FERENCZ 1981).

Table 1. *Data of sampling spots (1985)*

Symbol	River	Riv. km	Distance from bank (m)	Depth of water (m)	Water temperature (°C)	Type of sediment
1	2	3	4	5	6	7
001	Tisza		23,0	0,8	14,3	clayey sand
01S	Tisza	556,5	—	7,5	14,3	roug h sand
012	Tisza		15,0	3,5	14,3	clayey sand
021	Bodrog		15,0	2,5		deep clayey
02S	Bodrog	1,0	—	4,0	15,4	deep clayey
022	Bodrog		15,0	4,0		deep clayey
031	Tisza		30,0	12,5		fine sand
03S	Tisza	518	—	12,5	14,8	fine sand
032	Tisza		30,0	7,5		fine sand
041	Tisza		15,0	6,5		fine sand
04S	Tisza	497	—	8,0	15,0	rough sand
042	Tisza		10,0	6,0		fine clay
051	Sajó	1,0	5,0	3,0		fine clay
05S	Sajó	1,0	—	3,0	16,6	gravel
052	Sajó		2,0	1,0		gravel
061	Tisza		12,0	3,0		gravel
06S	Tisza	495	—	7,0	21,0	gravel
062	Tisza		30,0	0,6		gravel
071	Tisza		10,0	5,8		sandy clay
07S	Tisza	468	—	5,8	17,0	rough sand
072	Tisza		10,0	4,5		fine sand
081	Tisza		25,0	4,0		clayey
08S	Tisza	439	—	9,1	16,5	rough sand
082	Tisza		13,0	8,1		clay and sand
091	Tisza	15	10,0	4,0		clay
09S	Tisza	145	—	10,5	17,0	clay
092	Tisza	415	13,5	6,0		clay with lots of organic matter
101	Tisza		25,0	7,0		clayey sand
10S	Tisza	406	—	10,5	18,5	fine and rough sand
102	Tisza		30,0	7,0		clayey sand
111	Tisza		15,0	2,0		rough sand
11S	Tisza	390	—	15,0	16,5	fine sand
112	Tisza		15,0	1,6		fine sand
121	Tisza		6,0	2,0		fine sand
12S	Tisza	336	—	10,0	17,5	rough sand
122	Tisza		15,0	1,5		fine sandy clay
131	Zagyva	0,5	1,0	0,5	17,5	clay
13S	Zagyva	0,5	—	1,5	17,5	clay
132	Zagyva	0,5	0,6	0,4	17,5	clay
141	Tisza		0,6	3,0		fine sand
14S	Tisza	320	—	9,5	18,0	fine sand
142	Tisza		12,0	5,5	18,0	clay
151	Tisza		7,0	4,0		fine sand
15S	Tisza	245	—	8,0	18,2	rough sand
152	Tisza		20,0	8,5		rough sand
161	H-Körös		12,0	7,5		fine sand
16S	H-Körös	1,0	—	9,5	18,8	fine sand
162	H-Körös		6,0	3,5		fine sand
171	Tisza		7,0	3,0		fine sand and clay
17S	Tisza	239	—	4,0	18,0	find sand
172	Tisza		7,0	1,5		fine sand
181	Maros	1,0	10,0	0,8		fine sand
18S	Maros	1,0	—	3,0	18,3	fine sand
182	Maros	1,0	4,0	2,5		rough sand
191	Tisza	174,0	7,0	1,0		clayey, deep, reduced
19S	Tisza	174,0	—	3,5	18,8	rough sand
192	Tisza	174,0	5,0	1,0		clayey sand

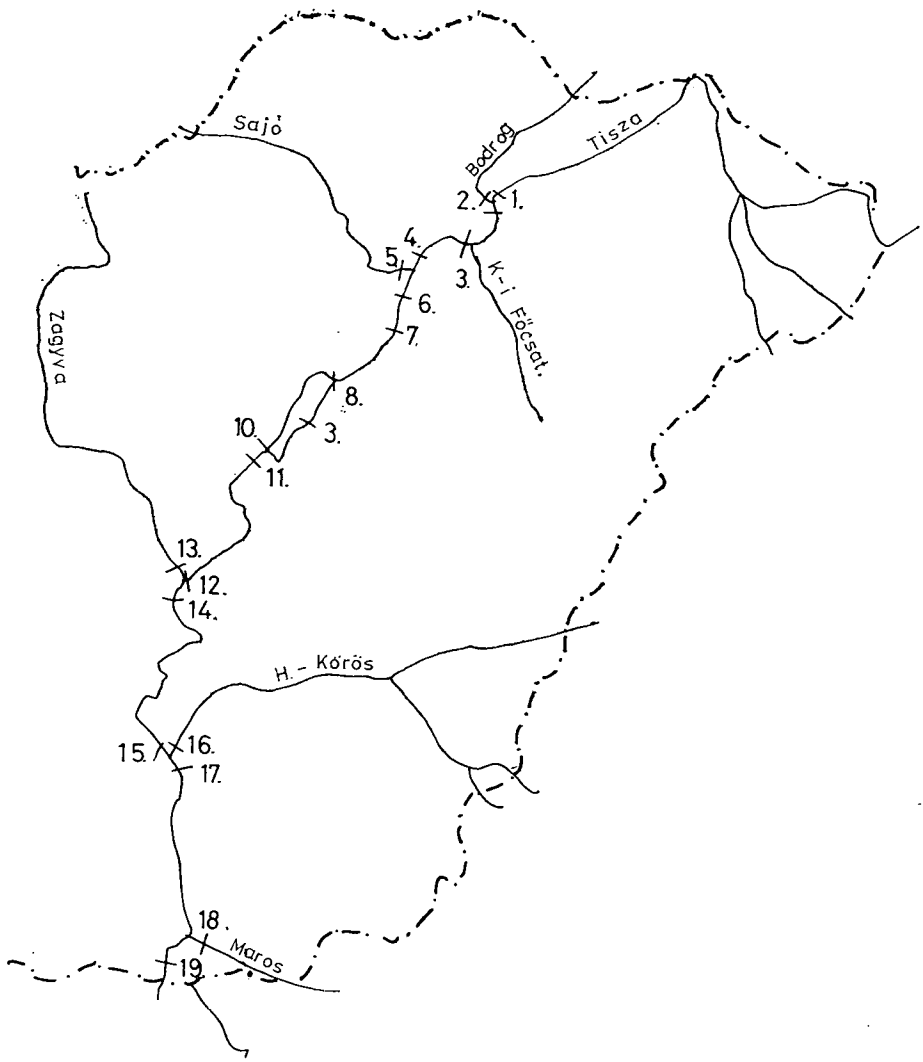
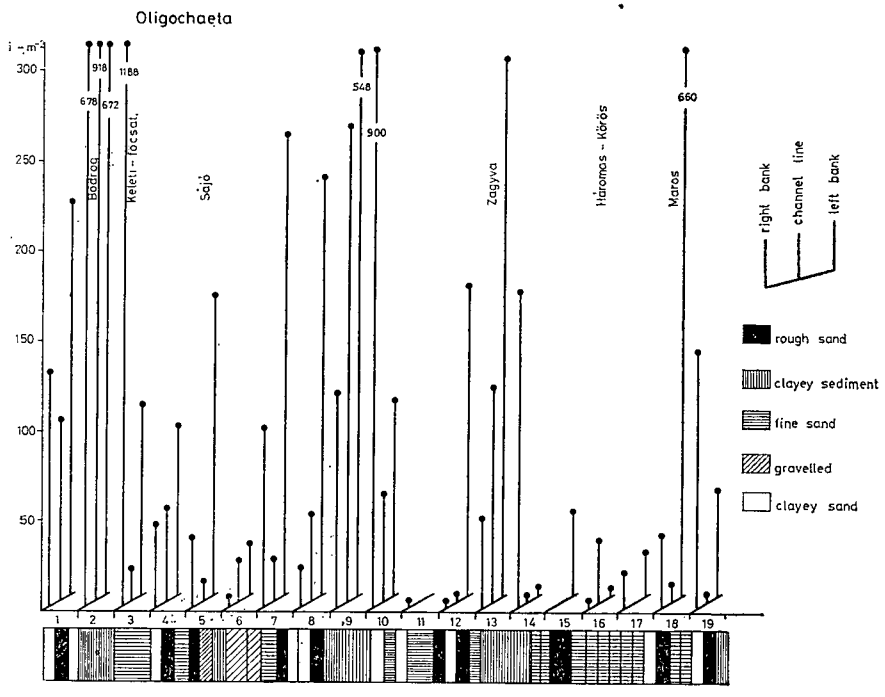


Figure 1. Sampling spots of sediment analyses in 1985

The *Limnodrilus* species were found both in the coastal zone and in the channel line of the studied river section, but the *L. hoffmeisteri* showed the highest population. The *Tubifex newaensis* was also found everywhere except for one sampling spot of the Tisza. The *Branchiura sowerbyi* appeared in the retained section of the Tisza and in the region of Kisköre reservoir it formed very high population density together with *Potamothrix moldaviensis* and *P. hammoniensis* (profiles No. 8. and 10).

Based on a comparison of the results of longitudinal profile studies in 1979 (FERENCZ 1981) and in 1981 (Table 2) it was stated that the Oligochaet fauna of the Tisza was poorer in species, but the population density increased. The *L. hoffmeisteri* remained dominant (Table 2).



Figu re 2. Individual number of Oligochaets in the Hungarian section of Tisza

The region of the mouth of influent Bodrog (profile No. 2.) was rich in Oligochaets (672—918 i.m^{-2}) and both in the coastal zone and in the channel line the B. sowerbyi was the dominant species (Table 2). Near the right bank of the Easteren Main Channel (profile No. 3.) the sediment contained 1.188 individuals per m^2, and the *L. hoffemeisteri* was the most frequently found. The Oligochaet fauna of Sajó was as poor as in 1979 (profile No. 5., Table 2), similar to the mouth of Hármas-Körös (profile No. 16.). Concerning the influents Zagyva (profile No. 18.), the coastal zone of their left bank showed higher population density (Table 2) and dominance of *Limnodrilus* species.

The influents Sajó and Zagyva are loaded with industrial and communal sewage, which results in negative effects on living organisms, especially in the region of the Tisza under the mouths of these influents (profiles No. 6., 14., and 15.). Some authors are of the opinion that the quality of water influences the species composition of Oligochaets only indirectly through the bottom (KORN 1963) and the bottom quality has got decisive role in it (WACHS 1967, PAOLETTI and SAMBUGAR 1984). The clayey sediment makes possible a higher number of individuals, than the gravelly, sandy sediment (Table 2). In general the population density of Chironomid larvae was higher in the coastal zones, than near the channel line, but there were found some discrepancies, too (profiles No. 1., 3., 6., 7., 10., 11. and 18.). The nutrient supply may influence the dispersion, as it has been stated by HILSENHOFF (1967). As the water movement is slower in the coastal zone, the settling of floating materials and organic matters is faster.

The importance and scale of drift is emphasized by GEE (1984). Based on our

Table 2. *Number of individuals of Oligochaets in different profiles of rivers*

Taxon \ Profile and spot	1. 1 S 2	2. 1 S 2	3. 1 S 2	4. 1 S 2	5. 1 S 2	6. 1 S 2	7. 1 S 2
Naididae							
Dero digitata MÜLLER	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Tubificidae							
Branchiura sowerbyi BEDDARD	– – –	0 0 0	+ – 0	– – –	– – –	+ + –	– – –
Potamothrix hammoniensis MICHAELSEN	+ – –	– – +	+ – +	– – –	+ – –	– – –	+ – +
P. moldaviensis VEJDOVSKY et MRAZEK	– – –	– – 0	+ + +	– + +	– – –	+ – +	0 + +
P. isochaetus HRABE	– – –	– – –	– – +	– – –	– – –	– – –	+ – +
Isochaeta michaelseni LASTOCKIN	– – –	– – –	– – +	– – –	– – –	– – –	– – –
Limnodrilus hoffmeisteri CLAPAREDE	0 0 0	– 0 +	+ – 0	+ + +	0 + +	– – –	– + –
L. claparedeianus RATZEL	+ – –	– – –	+ – +	– – –	– – –	– – –	– – –
L. udekemianus CLAPAREDE	– – +	– – +	– – –	+ – –	+ – –	– – –	– – +
L. profundicola VERRIL	– – 0	– – –	– – –	– – –	– – –	– – –	– – –
Psammoryctides moravicus HRABE	– – –	– – –	– – +	– – –	– – +	– – –	– – –
Tubifex tubifex MÜLLER	– + –	– – –	– – +	– – –	– – –	– – –	+ – –
T. newaensis MICHAELSEN	+ – –	– – –	+ – +	+ – –	– – –	– + –	0 – +
Lumbriculidae							
Lumbriculus variegatus MÜLLER	– – –	– – –	– – –	– – –	– – –	– – –	+ – –

Key to the signs used: 1—19: Profile; 1: left bank; S: channel line; 2: right bank; Absent: —; Found: +; in large mass: 0

Table 3. *Number of individuals of Chironomids in different profiles of rivers*

Taxon \ Profile and spot	1. 1 S 2	2. 1 S 2	3. 1 S 2	4. 1 S 2	5. 1 S 2	6. 1 S 2	7. 1 S 2
Tanypodinae							
Procladius choreus MEIGEN	+ + +	+ – +	+ – +	– – –	– – –	– – –	– – –
Tanypus punctipennis MEIGEN	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Chironominae							
Chironomini							
Ch. aprilinus MEIGEN	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Ch. fluviatilis LENZ	– + +	– – –	– – +	– – –	– – –	– – –	– – –
Ch. plumosus LENZ	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Ch. reductus LIPINA	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Ch. riparius MEIGEN	– + –	– – –	– – –	– – –	– – –	– – –	– – –
Ch. semireductus LENZ	– – +	– – –	– – –	– – –	– – –	– – –	– – –
Cryptochir defectus KIEFFER	– – –	– – –	– – –	– – +	– – –	– – –	– + –
Einfeldia dissidens WALKER	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Endochir signaticornis KIEFFER	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Glyptotend. fodiens KIEFFER	– – –	– – –	– – +	– – –	– – –	– – –	– – –
Harnischia fuscimanus KIEFFER	– – –	– + –	+ – +	– – –	– – –	– – –	+ + –
Limnochir. nervosus STAEG.	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Microchir. conjugens KIEFFER	– – –	– – –	– – –	– – –	– – –	– – –	– – –
M. tener KIEFFER	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Paratend. connectens LIPINA	– – –	– – –	– – –	– – –	– – –	– – –	– – –
P. intermedius TSH.	– + –	– – –	– + –	0 – –	– – –	– + +	– 0 –
Polyped. breviant. TSH.	– – –	– – –	– – –	– – +	– – –	– – –	– – –
P. sclaenum SCHRANK	– – –	– – –	– – –	– – –	– – –	– – –	– – –
Thienemannimyia northumbrica EDWARDS	– – –	– – –	– – +	– – –	– – –	– – –	– – –

Key to the signs used: 1—19: Profile; 1: left bank; S: channel line; 2: right bank; Abs t: –; Found: +; in large mass: 0.

8. 1S2	9. 1S2	10. 1S2	11. 1S2	12. 1S2	13. 1S2	14. 1S2	15. 1S2	16. 1S2	17. 1S2	18. 1S2	19. 1S2
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8. 1S2	9. 1S2	10. 1S2	11. 1S2	12. 1S2	13. 1S2	14. 1S2	15. 1S2	16. 1S2	17. 1S2	18. 1S2	19. 1S2
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data it is remarkable that the number of individuals of different groups of organisms have not increased significantly downstream. It can be explained with the fact that the water-level is low. The number of individuals of invertebrates is also influenced by the substrate quality (PERCIVAL and WHITEHEAD 1926, ZWICK 1984). Our data show that the population density of Oligochaets was high in all the sampling spots, where the sediment consisted of fine sand, clay or clayey sand (Figures 2—3).

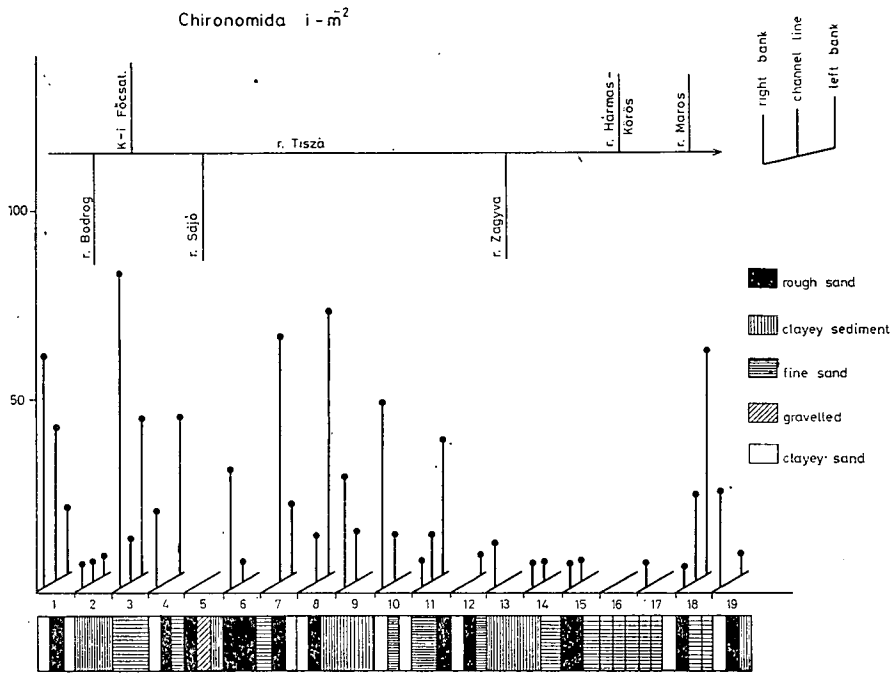

Figure 3. Individual number of Chironomids in the Hungarian section of Tisza

In the present study 21 Chironomid species were found, two of them were predators, and the rest were phytophagous. The individual number of larvae was 0—113, but they were not found in the mouths of Sajó and Körös. Certainly the reason was the naturally low number of individuals (Szító 1981).

The species *Chironomus fluviatilis, Harnishcia fuscimanus* and *Paratendipies intermedius* were found everywhere in the river Tisza, and in some profiles these species were dominant (Table 3).

Compared to data of longitudinal profiles analyzed in 1979, the number of species of Chironomids increased from 14 to 21. But the earlier dominant *Polypedilum nubeculosum* (gr.) disappeared, and the subdominant *Chrypto chironomus* (defectus) was found only in some profiles and its population density was low. Appearance of new *Polypedilum* species in the Tisza is thought to be the result of the five years long drought as during this period the water level of Tisza was constantly low. This situation made possible the appearance of species euryök (lymnophyl, perlorheophyl species) in the Tisza, but their appearance can be also supported by the influences of the two dams constructed on the Tisza (near Tiszalök and Kisköre). Our

statement is supported by the fact, that dominance of *Chironomus fluviatilis* characteristic for the rivers, was found to be significant in some profiles, but similar situation was found with *Harnischia fuscimanus* and *Paratendipes intermedius* species, characteristic for stagnant waters (Table 3). Based on these observations it can be stated that in the low water periods during the vegetation season the Chironomid fauna of the river is transformed significantly. Such changes are speeded up by the effects of dams and the lymnophyl fauna is replaced with rheophyl one. In the sediment samples taken from the channel line of Tisza, both species were found in high individual number, which points to their high level adaptability.

During these studies some new Chironomid species were found in the Hungarian fauna. They are the following: *Einfeldia dissidens, Glyptotendipes fodiens, Harnischia fuscimanus, Paratendipes connect, Polyediulum breviantennatum, Polypedim scalaenum, Thienemannimyia northenshumbrica.* The invertebrate faunae of the Tisza in the retained water section were found to be the richest over the dam. But the communal and industrial sewages of towns Szolnok and Martfű flowing into influents Sajó and Zagyva reduce the invertebrate fauna.

Near the clayey banks of the river one larva of *Palingenia longicauda* (Ephemeroptera) and in the sampling spots of deep silt one larva of *Aeschna affinis* and *Libellula depressa* (Odonata) were found in each profile from Tokaj to Szeged. They were not found in the mouth of influents.

The molluscs were found first near the mouth of the river Bodrog *(Unio pictorum, Valvata piscinalis, Lythoglyphus naticoides)*, where they were also found earlier (B. TÓTH et *al.* 1981). But in the mouths of influents they were not found.

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A Tisza és mellékfolyói makrozoobentosza

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Kivonat

A Tisza vizsgált szakaszán a makrozoobentoszban az *Oligochaeta* és *Chironomida* fajok domináltak, az *Oligochaeta* egyedsűrűség általában meghaladja a *Chironomida* lárvákét.

A 14 *Oligochaeta* faj közül a Tisza sodorvonalában a *Tubifex newaensis*, a parti régiókban a *Limnodrilus* fajok és a *Branchiura sowerbyi* a leggyakoribbak.

A 21 *Chironomida* faj közül dominánsak a *Chironomus fluviatilis*, a *Harnischia fuscimanus* és a *Polypedilum intermedius*. A vizsgálat során hét, Magyarország faunájában új *Chironomida* faj fordult elő.

A Tisza *Oligochaeta* faunája az utóbbi években fajszegényebb, a *Chironomida* fauna elsősorban a limnophil fajok megjelenése miatt gazdagabb lett.

A szennyvizekkel terhelt mellékfolyókban (Sajó, Zagyva) csak az *Oligochaeta* egyedek élnek meg. Az ipari és kommunális szennyezés hatása a Tisza gerinctelen élővilágának szegényedésében tükröződik.

Макрозообентос Тисы и ее притоков

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Резюме

В анализированном отрезке Тисы в макрозообентосе доминировали виды Oligochaeta, Chironomida, концентрация особи Oligochaeta превышает концентрацию личинок Chironomida.

В быстрине Тисы из 14 видов Oligochaeta их самые частные Tubifex newaensis, а в районе берега виды Limnodrilus и Branchiura sowerbyi.

Из 21 Chironomida доминирующие *Chironomus fluviatilis, Harnischia fuscimanus, Polypedilum intermedius.* При анализе найдены 7 новых в фауне Венгрии видов Chironomida. Фауна Oligochaeta Тисы в последние годы беднеет, в то время как фауна Chironomida обогащается появлением видов limnophil.

В притоках вместе со сточными водами Шайо, Задьва выживалит только особи Oligochaeta. Влияние промышленного и коммунального загрязнения отражается в обеднении беспозвоночных организмов Тисы.

Makrozoobentos Tise i njenih pritoka

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Abstrakt

U makrozoobentosu na istraživanoj deonici Tise dominiraju Oligochaeta i Chironomida, pri čemu gustina larava Oligochaeta nadmašuje larve Chironomida. Od 14 vrsta Oligochaeta *Tubifex nowaensis* je najfrekventniji u matici reke, dok u priobalnoj zoni dominiraju vrste roda Limnodrilus i *Branchiura sowerbyi.* Od 21 vrsta Chironomida dominantne su: *Chironomus fluviatilis, Harnischia fuscimanus* i *Polypedilum intermedius.* Konstatovano je 7 novih vrsta Chironomida za faunu Madjarske.

Fauna Oligochaeta Tise zadnjih godina pokazuje opadanje vrsta nasuprot Chironomida, koja se pre svega zbog pojave limnofilnih vrsa obogaćuje.

U pritokama Sajó i Zagyva, opterećenim otpadnim vodama, žive samo Oligochaeta. Uticaj industrijskog i komunalnog zagadjenja reflektuje se u osiromašenju beskičmenjačkih predstavnika reke Tise.