

MACROZOOBENTHOS IN THE RIVER TISZA AND ITS INFLUENTS

A. SZÍRÓ and MARGIT BOTOS

Fisheries Research Institute, Szarvas, Hungary

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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 intermedium* 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 occurrence 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-

avourable 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 Szíró (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 $18 \times 31 \text{ cm}$ surface at various distances from the right (1) and left (2) bank, and from the channel line (S). The weight of the empty EKMAN dredge 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 (BANCSEI *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 $250 \mu\text{m}$ 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 identification of Oligochaets was carried out based on studies of Brinkhurs (1963) and Ferencz (1979), and that of Chironomids on studies of Biró (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)*

| Sym- bol | River | Riv. km | Distance from bank (m) | Depth of water (m) | Water tempera- ture (°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 | rough 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 | fine 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 |

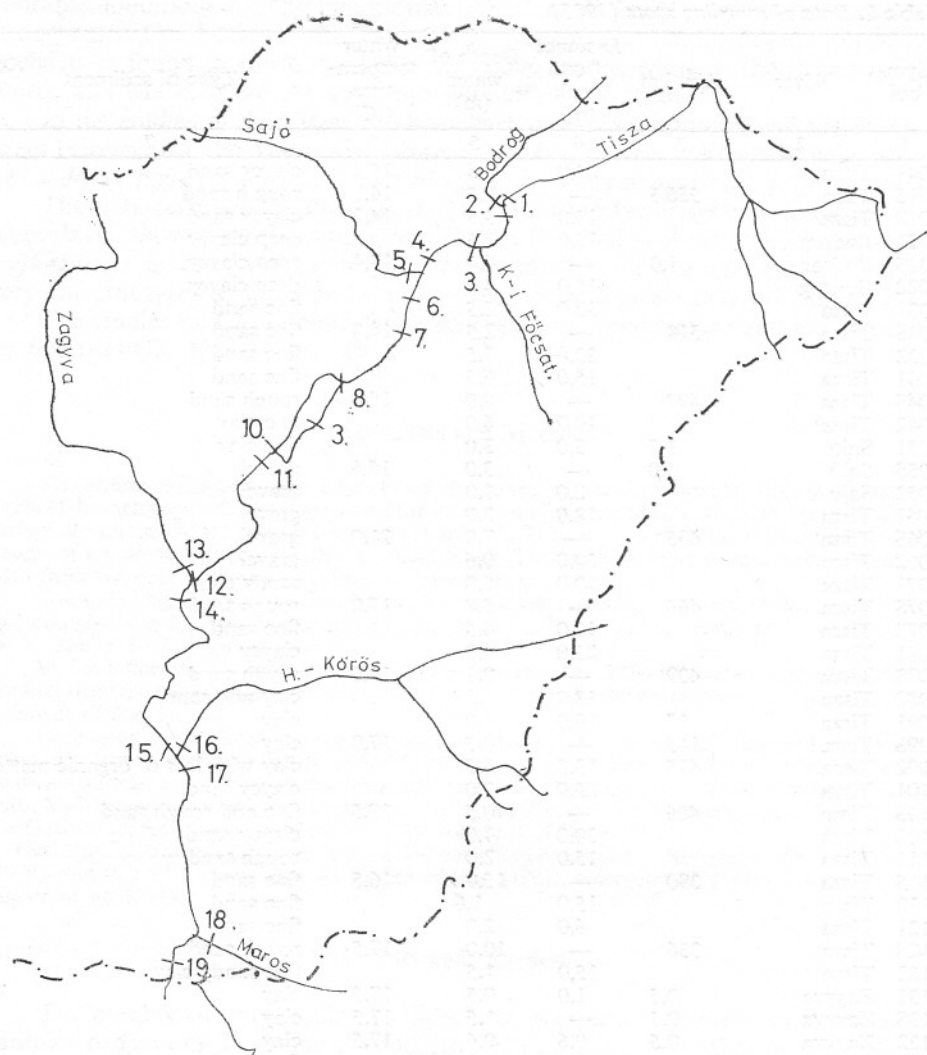


Figure 1. Sampling spots of sediment analyses in 1985

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).

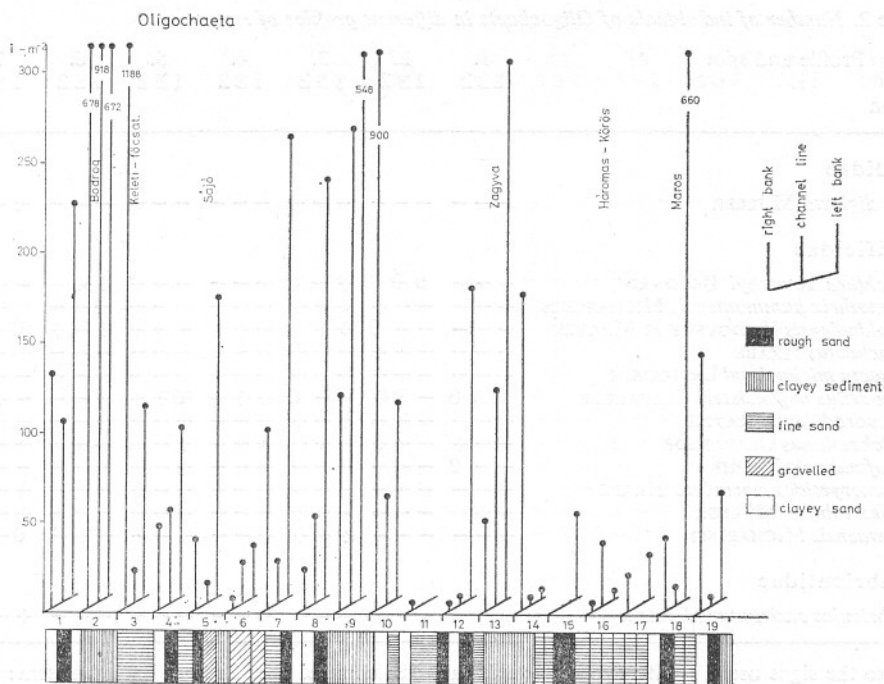


Figure 2. Individual number of Oligochaets in the Hungarian section of Tisza

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 Eastern Main Channel (profile No. 3.) the sediment contained 1.188 individuals per m², and the *L. hoffmeisteri* 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

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

| Profile and spot | 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|--|-------|-------|-------|-------|-------|-------|-------|
| Taxon | 1 S 2 | 1 S 2 | 1 S 2 | 1 S 2 | 1 S 2 | 1 S 2 | 1 S 2 |
| Tanypodinae | | | | | | | |
| <i>Procladius choreus</i> MEIGEN | + + + | + - + | + - + | --- | --- | --- | --- |
| <i>Tanytus punctipennis</i> MEIGEN | --- | --- | --- | --- | --- | --- | --- |
| Chironominae | | | | | | | |
| Chironomini | | | | | | | |
| <i>Ch. aprilius</i> MEIGEN | --- | --- | --- | --- | --- | --- | --- |
| <i>Ch. fluviatilis</i> LENZ | - + + | --- | - - + | --- | --- | --- | --- |
| <i>Ch. plumosus</i> LENZ | --- | --- | --- | --- | --- | --- | --- |
| <i>Ch. reductus</i> LIPINA | --- | --- | --- | --- | --- | --- | --- |
| <i>Ch. riparius</i> MEIGEN | - + - | --- | --- | --- | --- | --- | --- |
| <i>Ch. semireductus</i> LENZ | - - + | --- | --- | --- | --- | --- | --- |
| <i>Cryptochir defectus</i> KIEFFER | --- | --- | --- | + - - | --- | --- | + - - |
| <i>Einfeldia dissidens</i> WALKER | --- | --- | --- | --- | --- | --- | --- |
| <i>Endochir signaticornis</i> KIEFFER | --- | --- | --- | --- | --- | --- | --- |
| <i>Glyptotend. fodiens</i> KIEFFER | --- | --- | - - + | --- | --- | --- | --- |
| <i>Harnischia fuscimanus</i> KIEFFER | --- | - + - | + - + | --- | --- | --- | + + - |
| <i>Limnochir. nervosus</i> STAEG. | --- | --- | --- | --- | --- | --- | --- |
| <i>Microchir. conjugens</i> KIEFFER | --- | --- | --- | --- | --- | --- | --- |
| <i>M. tener</i> KIEFFER | --- | --- | --- | --- | --- | --- | --- |
| <i>Paratend. connectens</i> LIPINA | --- | --- | --- | --- | --- | --- | --- |
| <i>P. intermedius</i> TSH. | - + - | --- | - + - | 0 - - | --- | - + + | 0 - - |
| <i>Polyped. breviar.</i> TSH. | --- | --- | --- | - - + | --- | --- | --- |
| <i>P. sclaenum</i> SCHRANK | --- | --- | --- | --- | --- | --- | --- |
| <i>Thienemannimyia northumbica</i> 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.

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).

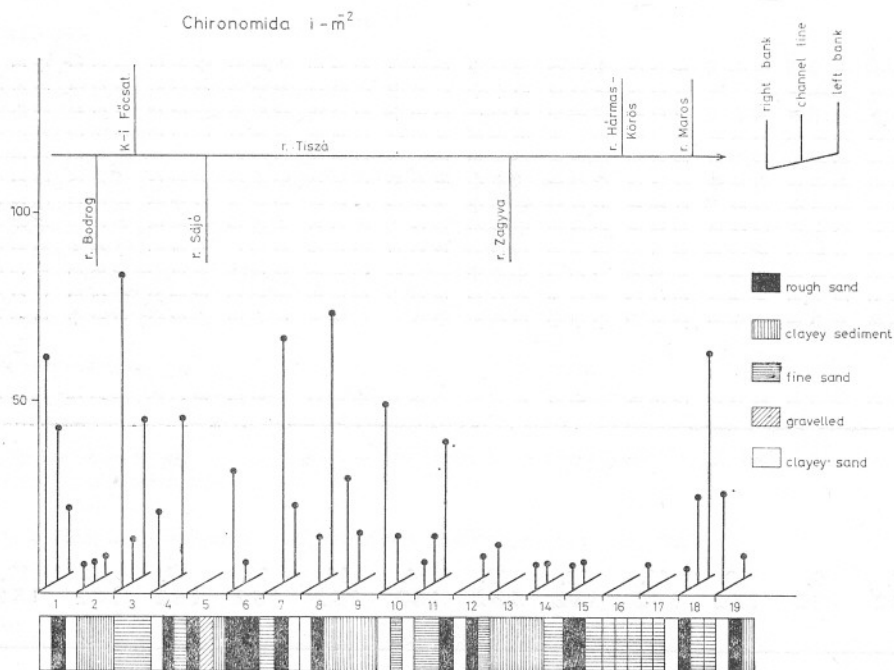


Figure 3. Individual number of Chironomids in the Hungarian section of Tisza

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 *Polypedium nubeculosum* (gr.) disappeared, and the subdominant *Chrypto chironomus* (defectus) was found only in some profiles and its population density was low. Appearance of new *Polypedium* 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*, *Polyedulum breviantennatum*, *Polypedim scalaeum*, *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

SZITÓ A. és BOTOS MARGIT

Haltenyésztési Kutató Intézet, Szarvas

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 *Polypedium intermedium*. 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

Андраш Сито и Маргит Ботош

Исследовательский институт рыбоводства Сарваш

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 частые *Tubifex newaensis*, а в районе берега виды *Limnodrilus* и *Branchiura sowerbyi*.

Из 21 *Chironomida* доминирующие *Chironomus fluviatilis*, *Harnischia fuscimanus*, *Polypedilum intermedium*. 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 выживает только особи *Oligochaeta*. Влияние промышленного и коммунального загрязнения отражается в обеднении беспозвоночных организмов Тисы.

Makrozoobentos Tise i njenih pritoka

Szító, A. i BOTOS MARGIT

Stenica za uzgoj riba, Szarvas

Abstrakt

U makrozoobentosu na istraživanoj deonici Tise dominiraju *Oligochaeta* i *Chironomida*, pri čemu gustina larava *Oligochaeta* nadmašuje larve *Chironomida*. Od 14 vrsta *Oligochaeta* *Tubifex newaensis* 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 intermedium*. 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 vrsta obogaćuje.

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