Acta Biologica Szeged. *20* (1—4), pp. 143—155 (1974)

ZOOBENTHIC STUDIES ON THE LOWER REACHES OF THE TISZA AND MAROS

MAGDOLNA FERENCZ

Department of Zoology, Attila József University, Szeged

(Received September 12, 1973)

Abstract

Zoobenthic investigations were carried out in 1963—64 in the lower reaches (Szeged environment) of the rivers Tisza and Maros. The results of the collections led to the following conclusions:

1. The bottom fauna of the lower reaches of the Tisza is richer than that of the Maros both qualitatively and quantitatively.
2. Substantially fewer animals live on the bottom in the middle of the river beds than near the banks. The proportions of the zoobenthos found near the banks were 74% and 60% in the Tisza and Maros, respectively.
3. The dominant taxonomic group in the Tisza was the Oligochaeta, and in the Maros the Diptera (Chironomidae).
4. The richest bottom zoocoenoses of the rivers were the lithorheophil and pelorheophil.
5. The quantitative distribution of the zoobenthos was affected decisively by the fluctuation of the water-levels of the rivers and by the nature of the bottom.
6. The frequency of the common occurrence of the Oligochaeta + Diptera (Chironomidae) was characteristic in these two rivers.

Introduction

The author began a zoobenthic study of the Tisza and the Maros in 1963. Up to that time there had been no systematic research of a similar nature into these two Hungarian rivers. Since that date the author has been investigating the macrobenthos of the two rivers as a member of the Tisza Research Group.

The Tisza, the largest tributary of the Danube, flows through the most deeply sunken region of the Great Hungarian Plain, absorbing practically every watercourse in the eastern half of the Carpathian basin. Its length is 977 km, its catchment area in all 157,186 km², and its average rate of flow at Szeged 786 m³/sec. Its water level tends to extremes: its depth and range of floods are the greatest in the lower reaches. Flood-waves appear from March and April until May—June.

The largest left-hand tributary of the Tisza is the Maros. Its length is 880 km, its catchment area 27,049 km². It runs into the Tisza at Szeged with an appreciable drop (27 cm/km), depositing alluvium consisting of much medium and coarse sand into the slow water of the Tisza (a drop of 3 cm/km, with an alluvium mainly of fine mud) below its mouth.

The waters of the Tisza and Maros have the same calcium hydrocarbonate features, but the sodium, sulphate and chloride contents in the Maros at times and in certain places attain significant values. The oxygen consumption of the water of the Maros is more than 25 mg/l and thus, with the exception of the short section

at the mouth, is more polluted than the a—*b* mesosaprob Tisza water. This latter is yellowish-grey from the much agitated, fine alluvium, its transparency varying in the range 25—200 mm (average value 90 mm).

During the investigation period the pH of the Tisza water was 6.7—8.1, and that of the Maros 6.2—6.4.

Methods

The bottom samples were taken with a modified Petersen sampler (dredging area: 800 cm^2); the material was washed with a 0.28 mm mesh metal sieve, sorted by hand, and preserved in 6% formalin. The species were determined on non-fresh material.

Collecting sites

Mud samples were collected from the lower reaches of the Tisza (Szeged environment) from June, 1963 to July, 1964, on all occasions in the vicinity of the two banks (ca. 5—6 m from the bank) and from the middle of the bed, i.e. 3 samples per collecting site. The three collecting sites were 3 km apart (Fig. 1).

Collecting site I: Directly below the Szeged Ship-Repair Yard. The right bank is rich in detritus, and thick, soft mud. Water-depth: 0.5—4 m (at high water 6.6 m). The left bank is muddy clay; the water-depth during the collecting period was 0.5—4 m. At the middle of the bed the bottom is sand, with a little mud, and the water-depth is 5—6 m (of the 12 sampling sites, this one had the deepest water).

Collecting site II: 3 river km lower. The right bank is muddy, its water-depth 0.5—4 m; the left bank is muddy sand, its depth 0.5—3 m (at high water 7 m). Here too the middle of the bed is sandy, its depth 2—3 m (max. 5 m).

Collecting site III: A further 3 river km lower. The right bank is stony mud, its depth 0.5—4 m; the left bank is clayey, and in general only 0.5 m deep (at high water 6—8 m).

Simultaneously with the collections from the Tisza, bottom samples were also taken from the Maros, 300 m from the mouth. In the vicinity of the right bank the bottom is muddy sand, its depth 0.5—3 m (max. 9 m). The left-bank samples came from a muddy bottom, where the water-depth was 0.5—1.5 m (max. 9 m). Here too, similarly to the Tisza, the middle of the bed is sandy, and the water generally 1—2 m deep (max. 10 m).

Results

In the material from 101 samplings on altogether 9 occasions (monthly, excepting the winter months), a total of 8964 animals were found.

In the evaluation of the collection results, an answer was sought to the following questions:

1. Is there any difference in the zoobenthic fauna of the lower reaches of the two rivers?
2. What are the differences between the bank-side and central-bed zoocoenosis parts of the rivers?
3. What are the characteristics of the zoocoenoses of the individual bottom types (sandy, muddy, clayey, etc.)?
4. What are the relations to each other of the more important taxonomic groups, and their quantitative distribution?
5. What is the trend of the population dynamics of the more frequent and more typical Oligochaeta species?

From the examination results it can clearly be stated that the zoobenthic fauna of the Tisza is the richer both qualitatively and quantitatively: in 75 samples the total number of individuals was 7875; the average number of individuals per sample was 105, and they represented 13 taxonomic groups. The bottom fauna of the Maros exhibits a poorer composition as regards quality and quantity: in 26 samples there were 1089 individuals, with an average 42 individuals per sample, and 9 taxonomic groups.

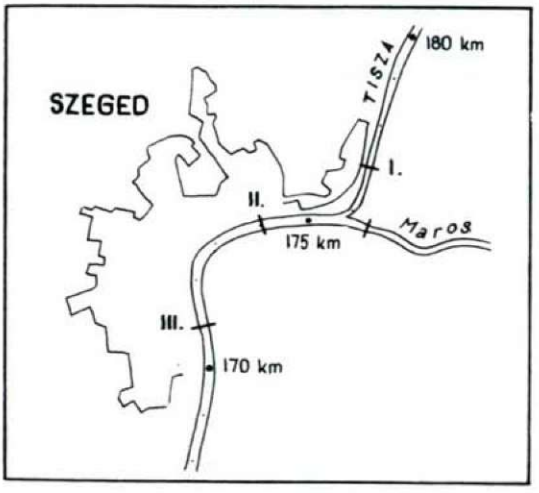

Fig. 1. Collecting sites in the lower reaches of the Tisza and Maros.

The dominant taxonomic group of the bottom fauna of the Tisza is the Oligochaeta, but the Diptera and Mollusca, as the other two groups with major numbers of individuals, also achieve relatively high dominance values. In the Maros, on the other hand, the Diptera is the dominant taxonomic group, showing a very strong predominance compared to the other two (Fig. 2). In the evaluation of these data, however, it should not be forgotten that the material being compared was not obtained from equal numbers of samples.

The zoobenthic fauna of the middle of the bed was the poorest for both rivers:

Tisza: average no. of individuals per sample: 50.25

Maros: average no. of individuals per sample: 32.43.

The richness in individuals of the part-side biotopes was greater:

Tisza: right-bank ave. no. of ind. per sample: 168.71
left-bank ave. no. of ind. per sample: 117.30

Maros: right-bank ave. no. of ind. per sample: 63.33
left-bank ave. no. of ind. per sample: 32.78.

When the individual collecting sites were studied separately as to the nature of their bottom, the zoocoenosis part types could be characterized as follows (Fig. 3):

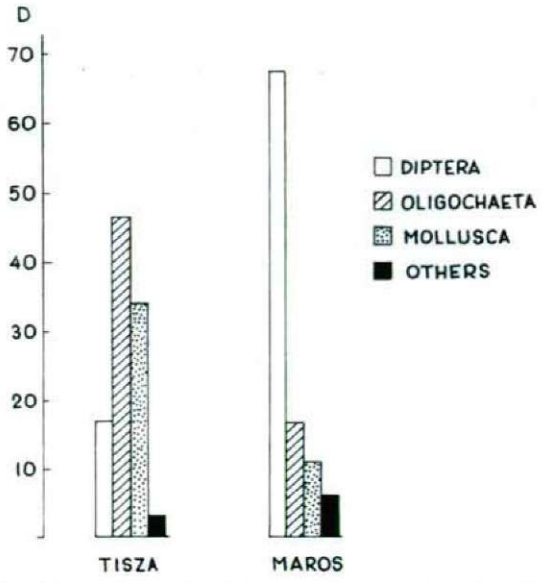

Fig. 2. Percentage distribution of the more important taxonomic groups of the zoobenthos in the lower reaches of the Tisza and Maros.

Lithorheophil: Tisza collecting site III, right-bank, where there are varied stones on the muddy bottom. This is the richest zoocoenosis (2885 individuals per m^2), and the only one where the Mollusca dominance is maximum. The majority of the Mollusca were *Lithoglyphus naticoides*. The Oligochaeta, which generally occur in the highest individual numbers in other sites in the Tisza, here comprise the lowest percentage of the zoocoenosis; typical species are *Tubifex tubifex* and *Limnodrilus* genus. The Diptera similarly lived in low individual numbers in this site.

Pelorheophil: Tisza collecting sites I and II, right-bank, and Maros left-bank; the second richest zoocoenosis (1851 and 415 individuals per m^2). A bottom type rich in organic detritus, its fauna being primarily characterized in the Tisza by maximum Oligochaeata dominance. Those occurring in high individual numbers were mainly *Limnodrilus udekemianus, Limnodrilus michaelseni* and *Isochaetides newaensis. Limnodrilus udekemianus* finds its optimum living conditions on the muddy, detritus-rich bottom, both in standing and in flowing water, and in such places it is to be discovered in high individual numbers.

Argillorheophil: Tisza collecting sites I and III, left-bank. As regards the quantitative richness of the zoobenthos, this zoocoenosis part stands in third place (1503 individuals per m^2). The leading species of Oligochaeta here is *Branchiura sowerbyi*, with *Limnodrilus michaelseni*.

Psammopelorheophil: Tisza collecting site II, left bank, where the average individual number of the zoobenthos is 1387 per m^2; also the Maros right-bank collecting site, which as regards density of individuals was the richest Maros site (63 individuals per m^2). The most frequent Oligochaeta species: *Limnodrilus claparedeanus* (in the Tisza) and *Limnodrilus hoffmeisteri* (in the Maros). This latter species generally occurs typically on sandy-muddy bottoms.

Psammorheophil: Characteristic everywhere in the middle of the beds of the Tisza and the Maros, and the poorest coenosis (598 and 350 individuals per m^2). Characteristic is *Isochaetides newaensis,* and relatively many *Naidida* species. The former species is commonly known to be frequent on sandy river bottoms. For this coenosis type the dominance of the Diptera taxonomic group instead of Oligochaeta is typical in general.

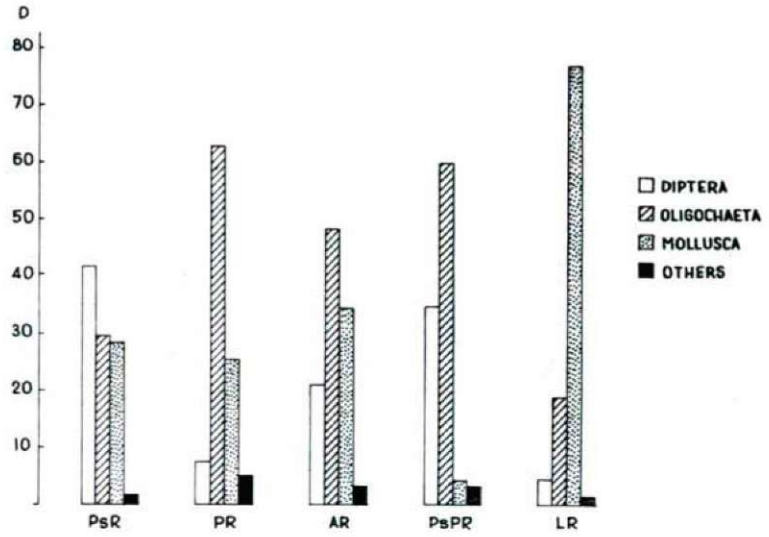

Fig. 3. Percentage distributions of the main zoobenthic taxonomic groups in the two rivers, according to bottom type.
PsR = psammorheophil
PR = pelorheophil
AR = argillorheophil
PsPR = psammopelorheophil
LR = lithorheophil

From a study of the relative percentage distributions (complex dominance) of the more populous taxonomic groups (Oligochaeta, Diptera, Mollusca) and the other groups with lower numbers of individuals ("other"), it can be stated that although there are differences in the individual collecting sites (Fig. 4) in the majority of the individual zoocoenosis types and in the whole of the Tisza reach examined the dominant group of the zoobenthos is the Oligochaeta. For all three collecting sites of the Maros, on the other hand, Diptera dominance is characteristic.

The question arises of what the observations in connection with the mosaic-complex composition of the zoobenthos of the rivers tell us about which are the groups whose members are most closely related, or in other words which occur most frequently together. From the study of the frequency of common occurrence (Agrell index) of the three taxonomic groups which are the most populous and most characteristic of the river reaches under investigation (Oligochaeta,Diptera, Mollusca), with regard to the individual zoocoenoses and the various river reaches, it can be concluded that the frequent joint occurrence of Oligochaeta + Diptera is characteristic of both the Tisza and the Maros:

Zoocoenoses	Ol+D	D+M	Ol+M
Psammopelorheophil	83	40	40
Argillorheophil	83	60	61
Pelorheophil	67	41	52
Lithorheophil	83	67	83
Psammorheophil	59	68	46
Tisza lower reach	76	62	66
Maros lower reach	60	20	12
Tisza central reach	46	23	42

The explanation of this may well be a generally typical mode of nutrition for the species of these two groups. While the predominantly detritophage Chironomida species feed on plant and animal detritus on the surface of the mud, the Annelida eat the thicker layer of mud and the very finely broken detritus, and probably the animal droppings too. In this way they practically complement each other, and are dependent on one another, and this may explain the frequency of their common occurrence.

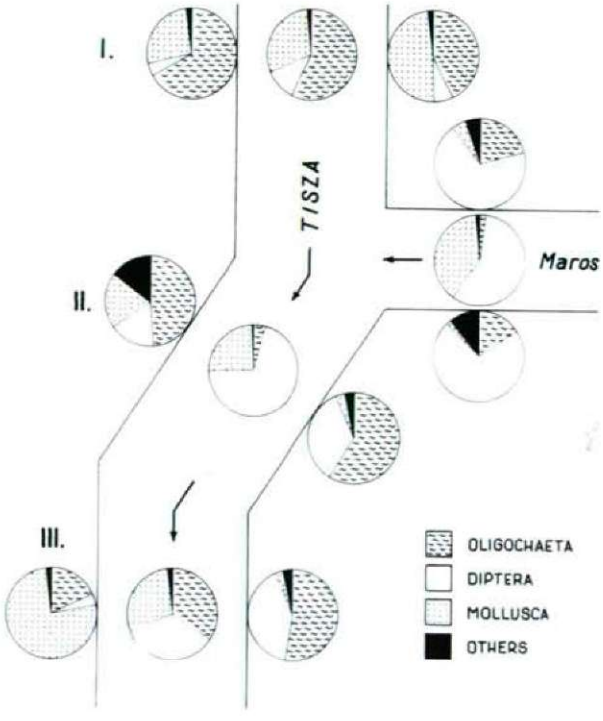

Fig. 4. Percentage distribution of the zoobenthic taxonomic groups in the sampling sites on the Tisza and Maros.

The fact that the Oligochaeta is the dominant taxonomic group in the zoobenthos of the rivers has a dual significance. As a result of their manner of feeding, they contribute greatly to the breakdown of the bottom-mud, promoting the functioning of the bacteria and hence the self-cleaning of the waters. Further, in their large numbers they serve as the most utilizable fish nutriment: their biomass in the Tisza is 3.64 g/m², and in the Maros 1.06 g/m².

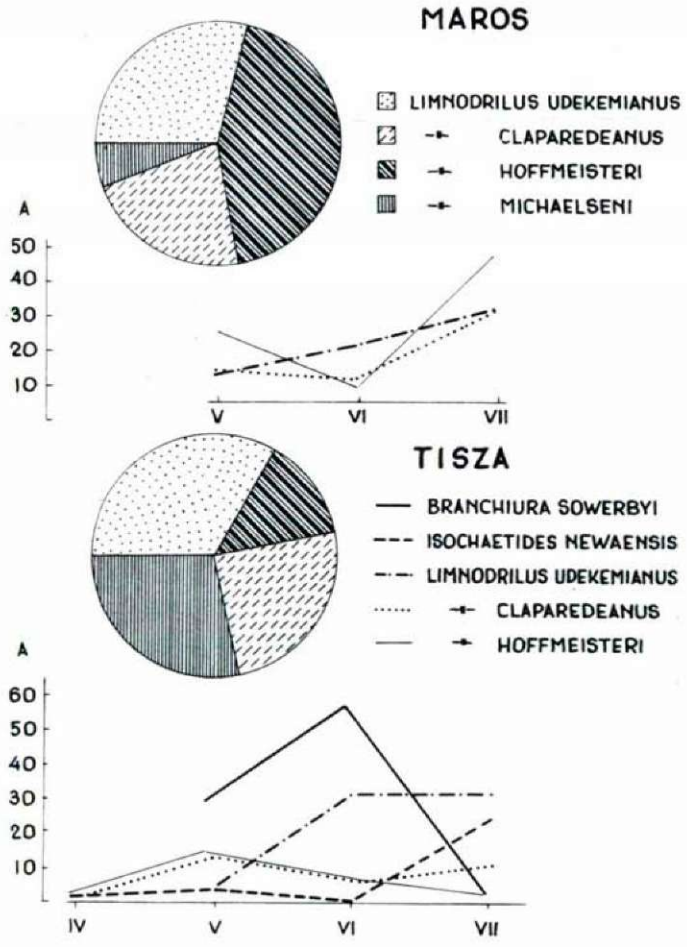

Fig. 5. Percentage distribution and population dynamics of more common Oligochaeta species of the Tisza and Maros.

The qualitative composition of the Oligochaeta is more varied in the Tisza (Fig. 5): here 15 species and taxons live, among which *Branchiura sowerbyi* is dominant, and *Isochaetides newaensis* condominant. Otherwise, about half of the Oligochaeta belong to the *Limnodrilus* genus. The most frequent of the eight species found in the Maros is *Limnodrilus hoffmeisteri, Branchiura sowerbyi,* one of the

largest fresh-water Tubificida, has visibly taken possession of the fresh-waters of Europe too. The author has found it in major amounts in the backwaters of the Tisza, and in the basins of fish lakes too (Fish-Production Research Institute, Szarvas). Because of its large size and frequency, it may play an important role in the nutrition of the fish-stock of natural Hungarian waters. *Isochaetides newaensis* is one of the characteristic species of sandy-muddy river beds. Its occurrence to date is known from Europe, and mainly from the area of the Soviet Union. *Limnodrilus hoffmeisteri* is to be found in smaller individual numbers in every biotope type, mainly favouring sandy bottoms. Its high dominance value in the Maros can probably

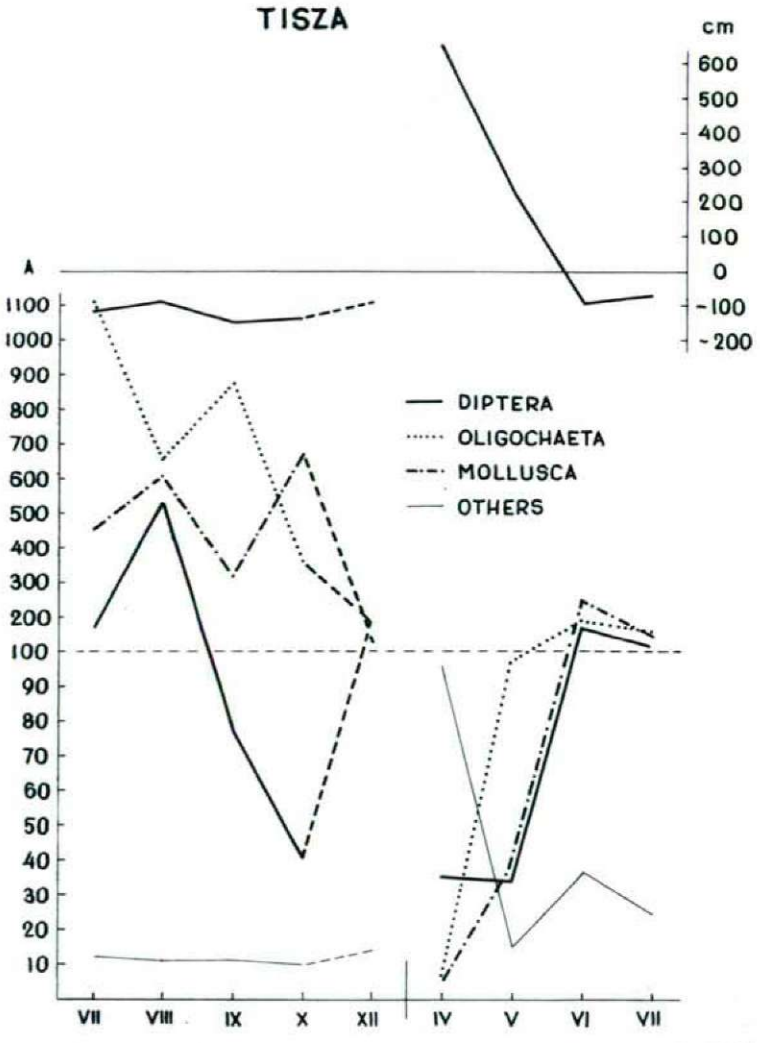

Fig. 6. Population dynamics and connection with the fluctuation of the water level of the Tisza for zoobenthic taxonomic groups.

be explained in that the endurance of this species to the chloride content of the water is considerable.

In the period studied the seasonal quantitative change of the Annelida is fairly great. The maximum is in July, when the new generation (cocoons and juvenile individuals) appears. This is naturally accompanied by a decrease of the prevailing biomass.

The change in the number of Annelida individuals is strongly affected by the fluctuation in the river water level (Figs. 6—7); the number of individuals exhibits a decrease or increase practically parallel to the rising or falling, respectively, of the water level.

88% of the Diptera taxonomic group was Chironomida. The maximum number of individuals could be observed in both rivers in August, this certainly being related to the time of swarming.

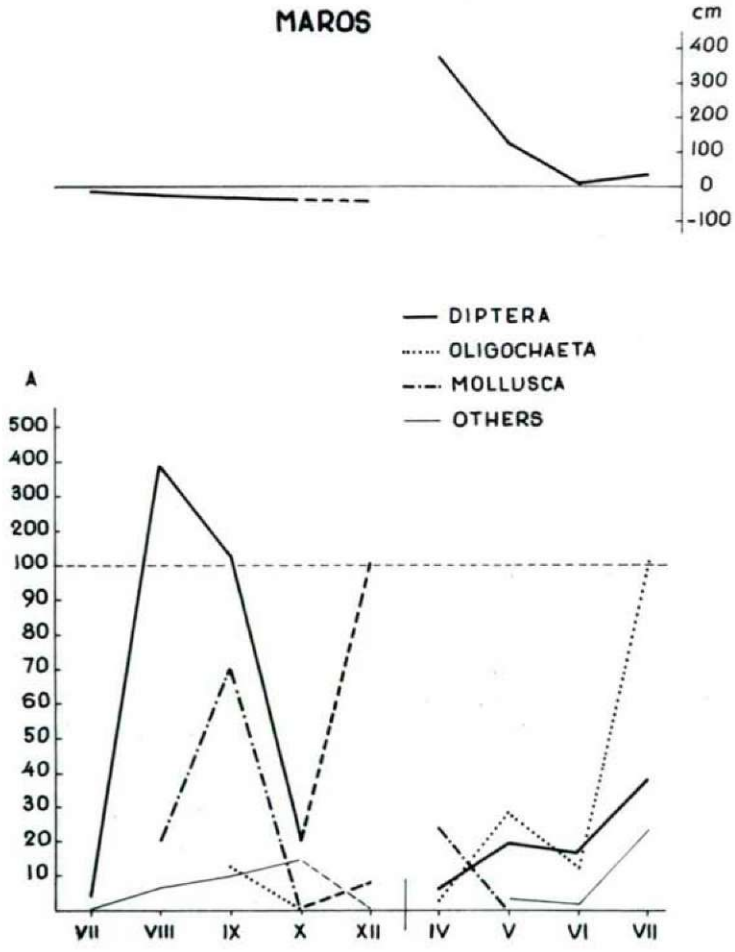

Fig. 7. Population dynamics and connection with the fluctuation of the water level of the Maros for zoobenthic taxonomic groups.

The Mollusca group was mainly represented by the snails *(Lithoglyphus naticoides!)*. The maximum of their dominance coincides with the autumn low-water state (September—October), when too following the rising water more animals collect on the same area.

The other ten taxonomic groups comprise only a small proportion of the zoobenthos of the two rivers. Their greatest dominance value was exhibited at high-water in the Tisza, the numbers of individuals of the Trichoptera and Amphipoda then increasing abnormally.

In the lower reaches of the two Hungarian rivers examined, practically half (43%) of the fauna of the zoobenthos was given by the worms, and mainly by species of the Tubificidae family (Fig. 8). The proportion of Mollusca was somewhat less (31%) (93% Gastropoda). The Diptera larvae and pupae (23%) comprise the main representatives of the Chironomidae family. The other arthropodal groups (Ephemeroptera, Odonata, Trichoptera, Coleoptera) make up 2% of the entire zoobenthos. In both rivers the Trichoptera may-flies and larvae can be found in relatively higher proportions (Tisza: 1.4%, Maros: 2.9%). A still more negligible constituent element of the zoobenthos is the Crustacea (1%).

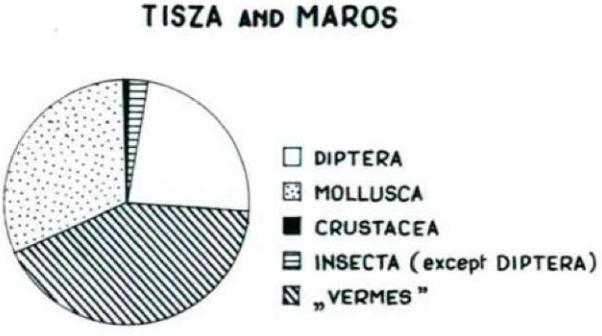

Fig. 8. Percentage distribution of the main zoobenthic taxonomic groups in the lower reaches of the Tisza and Maros (based on combined data).

They cannot be counted with essentially for the zoobenthos, but it was possible to find systematically colony-parts of Hydrozoa, Kamptozoa and Bryozoa species in various amounts on the bottom, in the form of detritus and mainly on Mollusca shells.

From the above proportions (without striving to attain generalities, which would be unsoundly based in the absence of an exact knowledge of the details), it can be concluded that detritophage animals are predominant in the macrofauna on the bottoms of the two rivers. The bottoms of the lower reaches of the rivers are mainly muddy, and generally rich in organic detritus. Such types of habitat are primarily suitable for the worms, molluscs and mosquito larvae in the main, as regards their feeding.

Zoobenthic species list for the lower reaches of the Tisza and the Maros (frequency notation: few –
medium +
many ○
mass ●).

Cnidaria, Hydrozoa
Cordylophora caspia –

Kamptozoa
Urnatella gracilis ○

Annelida, Polychaeta
Hypania invalida –

Oligochaeta
Limnodrilus claparedeanus ○
Limnodrilus michaelseni ○
Limnodrilus udekemianus ●
Limnodrilus helveticus +
Limnodrilus hoffmeisteri ○
Euilyodrilus danubialis +
Euilydrilus moldaviensis –
Euilydrilus hammoniensis –
Tubifex tubifex +
Psammoryctes moravicus –
Isochaetides newaensis ○
Branchyura sowerbyi ○
Criodrilus lacuum –

Hirudinoidea
Helobdella stagnalis –

Mollusca, Gastropoda
Lithoglyphus naticoides ●
Unio crassus +
Unio pictorum –
Dreissena polymorpha +

Tentaculata, Bryozoa
Paludicella articulata –
Plumatella repens +
Plumatella fungosa –
Plumatella fruticosa –
Plumatella emarginata –

Arthropoda, Isopoda
Asellus aquaticus –

Amphipoda
Dicerogammarus haematobaphes –

Gammarus pulex +
Corophium curvispinum +

Phyllopoda

Lepthesterias dahalacensis –

Ephemeroptera

Palingenia longicauda +
Caenis macrura –

Odonata

Gomphus pulchellus +

Trichoptera

Oecetis lacustris –
Orthotrichia tetensii –
Hydropsyche pellucidula ○
Hydropsyche ornatula –
Hydropsyche angustipennis +
Neureclipsis bimaculata –
Tinodes unicolor –
Limnophilus bipunctatus –

Diptera

Culicoides nubeculosus +
Dasyhelea versicolor –
Dasyhelea coarctata –
Chaoborus plumicornis –
Eukiefferiella similis –
Chironomus polytomus +
Chironomus gregarius –
Chironomus flavus ○
Chironomus chlorolobus –
Chironomus rostratus +
Chironomus camptolabis +
Chironomus tenuicaudatus -
Tanytarsus raptorius –
Cladotanytarsus conversus +
Ablabesmyia flavida +
Camptocladius stercorarius –
Paratendipes albimanus ●

References

BRINKHURST, R. O. (1963): Taxonomical Studies on the Tubificidae(Annelida, Oligochaeta) — Int. Rev. Ges. Hydrobiol. 1—89.

FERENCZ, M. (1969): Occurrence of *Hypania invalida* (GRUBE) in the Tisza (Annelida, Polychaeta — Tiscia (Szeged) *5*, 69—71.

FERENCZ, M. (1968): Vorstudium über die vertikale Verteilung des Zoobenthos der Theiss — Tiscia (Szeged) *4*, 53—58.

HRABE, S. (1941): Zur Kenntnis der Oligochaeten aus der Donau — Acta Soc. Sci. Nat. Morav. *13*, 1—36.

KOLOSVÁRY, G. et FERENCZ, M. (1968): Die Bryozoen der Tisza, Maros und Körös — Ann. Móra Ferenc Mus. i, 277—280.

KENNEDY, C. R. (1966): The life history of *Limnodrilus udekemianus* Clap. (Oligochaeta, Tubificidae) — Oikos *17*, 10—18.

MALEVICS, I. I. et ZEVINA, G. B. (1958): Oligochaeta des Rybinsker Stausees — Inst. Biol. "Borok" *3*, 399—406.

PÉCSI, M. (1969): The lowland of Tisza — Publ. Acad. Budapest.

PODDUBNAJA, T. L. (1959): Über die jahreszeitliche Änderung der Tubificidaen Besiedlung in Rybinsker Stausee — Trud. Inst. Biol. Vodochr. *2*, 102—108.

SHADIN, V. (1960): The fauna of rivers and waterreservoirs. The problem of reconstruction of the fauna of rivers under the influence of hydrotechnical buildings — Trav. Inst. Zool. Acad. Sci. URSS *5*, 510—994.

Address of the author:
Dr. MAGDOLNA FERENCZ
Department of Zoology,
A. J. University, H—6701 Szeged,
P. O. Box 428, Hungary