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DATA ON THE HORIZONTAL AND VERTICAL DISTRIBUTIONS OF THE ZOOBENTHOS OF THE TISZA

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Abstract

From layer zoobenthic examinations at bank-side sites in the lower reaches of the Tisza it can be established that the bottom fauna is richest at a water depth of 1—2 m, and in the uppermost 10 cm layers of the clayey bottom. The decrease of the number of individuals among the fauna (at a water depth of 2—3 m) can probably be explained by the more unfavourable conditions developing in the current line. The decrease of the number of individuals is accompanied by the accumulation of the zoobenthic organisms in the uppermost bottom layers. In the deeper layers of the bottom, those Oligochaeta species predominate which live in the bottom of the deeper water, farther from the bank *(Tubifex tubifex, Psammoryctes moravicus)*.

Introduction

In both time and space the zoobenthic fauna is characterized by a constant quantitative and qualitative change. The concrete measurement of this population dynamics and the elucidation of the relations of cause and effect are promoted by the investigation of the vertical and horizontal distributions of the zoobenthos.

The Tisza, Hungary's second largest river, is from many respects a fairly extreme river. The variation of its water level, and consequently the play of its water, is the greatest. The transport of mud in its water is on a yearly average the most considerable in this river. Its mean mud content at Szeged is 560 g/m^3, compared with 130 g/m^3 in the Danube at Baja, while the highest mud contents are 3500 g/m^3 at Szeged, and 900 g/m^3 in the Danube at Baja. The high degree of alluvial transport, particularly in the event of flooding and high water level, is especially characteristic for the lower reaches of the Tisza (NAGY 1971). Naturally, the deposition of alluvium too is more extensive here, where the fall of the water level is only 4 cm/km. The rate of flow of the water at Szeged is 0.5—1.1 m/sec. In the Tisza the water generally falls in the months of August and September, and at the time of collection the water level was continuously negative, at −78 cm.

Naturally, the quantitative and qualitative distributions of the zoobenthic fauna of the rivers are influenced both directly and indirectly, to a large extent, by the hydrographic conditions.

Material and method

The collections were made on the left bank of the Tisza at 166.5 river km, on 6 September 1973; 6 sampling sites were involved, at 1 m intervals, in each of 2 parallel bands separated by a distance of 2 m, from the bank towards the river bed. The width of the river bed at this point was 250 m. The depths of the water near the bank were 0.35 and 0.60 m, and at the points farther from the bank 3 and 3.50 m. In the area examined the bottom was clayey, and the bank line was fairly steep. It was a typical argillorheophil biotope. (KORN 1963, SHADIN 1940, WACHS 1968).

The bottom samples were taken with a tube excavator, 16 cm in diameter (CSOKNYA—FERENCZ 1972), separated in 10 cm thick layers, and washed through a metal sieve with 0.28×0.28 mm apertures. After selection the material was fixed in 4% formalin and then determined.

The aim of this examination was to elucidate the quantitative and qualitative distributions of the mesozoobenthic organisms, and the changes of these distributions as functions of the depths of the water and the bottom.

Results

On the basis of our preliminary cross-sectional examinations it can be stated that there is a decrease of the zoobenthic fauna of the Tisza in the middle of the bed compared with the bank-side.

The present examinations indicate that the highest concentration of the benthic organisms live at a depth of 1—2 m, between the current-line and the bank-side. The most thinly-populated area is the shallower, bank-side part. This latter can probably be explained by the greatest exposure to the effects of fluctuation of the water level. The bottom fauna in the river visibly demands a certain depth of water, and thereby "insures itself" against the change of the water level, and accordingly it prefers to live at greater depths. After the decrease of the number of individuals inwards from the more densely populated sites at a depth of 1—2 m (the cause of which might be explicable by the negative effect of the current-line passing across this zone), their D value again rises, approaching the maximum value at a water depth of 3—4 m.

The maximum D value in the Oligochaeta distribution coincides with that for the overall data, but their number of individuals exhibits a strong decrease with the increase of the water depth.

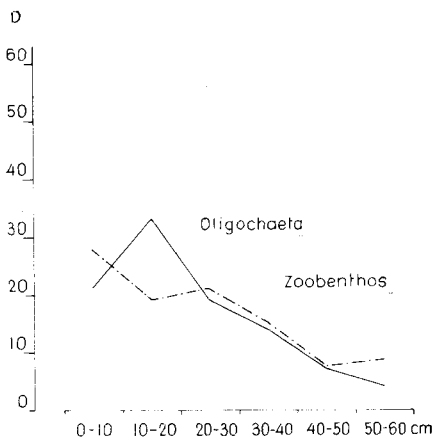

Fig. 1. Vertical distribution of zoobenthos

The highest concentration of zoobenthic organisms is to be found in the uppermost 10 cm layer of the bottom, and downwards from this there is a gradual decrease in the number of individuals. On the other hand, the Oligochaeta species predominate in the 10—20 cm layer of the bottom, and progressively decrease below this (Fig. 1).

If the mutual interrelations of the horizontal and vertical distributions are considered (Fig. 2), it can be established that in the sites farther from the bank

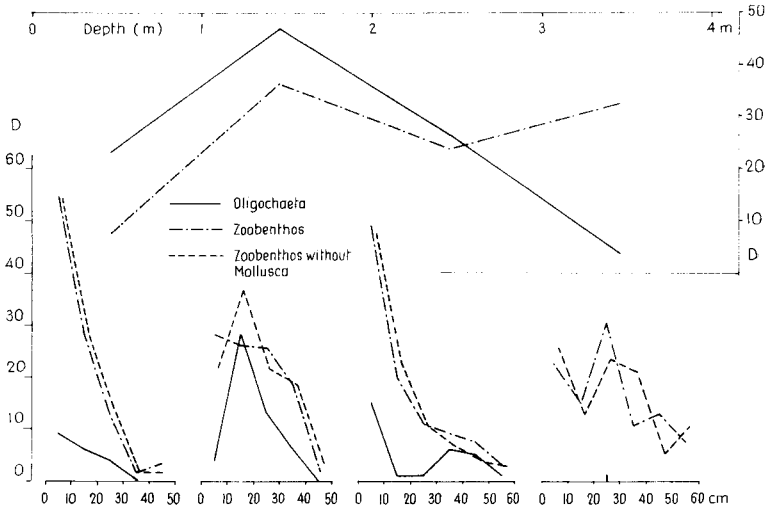

Fig. 2. Vertical and horizontal distributions of zoobenthos

and where the water is deeper the animals also penetrate down to greater depths in the bottom (50—60 cm). Their vertical distribution is more uniform, and there is a maximum concentration at a depth of 20—30 cm and in the bottom. In the shallower sites close to the bank the majority of the zoobenthic organisms live in the uppermost 10 cm layer of the bottom.

In the biotope examined the Oligochaeta comprised only a very small proportion (12%) of the total zoobenthic organisms (this is not characteristic of the Szeged reaches of the Tisza in general). More than half of the species belong to the *Limnodrilus* genus, as established earlier too (FERENCZ 1968).

As regards the vertical distribution of the Oligochaeta species (Fig. 3, a), the *Branchiura sowerbyi* live in the greatest number of individuals in the uppermost 10 cm layer of the bottom. This may be a consequence of the morphophysiological feature of this species that external gills are present at the end of the body. Although their living-tubes approach a length of 30 cm (the length of the individuals may be 10—15 cm), the gilled end of the animal's body protrudes from this. The data of our examinations to date indicate that this species favours a clayey-muddy bottom. Certain literature data suggest that it reacts sensitively to a deficiency of oxygen and to changes in temperature (LISKOVÀ 1964).

In the mud layer at a depth of 10—20 cm the Limnodrilus species predominate: *Limnodrilus hoffmeisteri, L. udekemianus, L. claparedeanus.* All three species, and particularly the first, ar common in the Tisza. In this biotope *L. udekemianus* was

present in a relatively low number of individuals; this tends to multiply to the greatest extent in waters rich in detritus and containing much organic debris.

It is interesting to observe the almost parallel quantitative increases of the *Tubifex* and *Psammoryctes* species in the deeper bottom layers, and finally their absolute predominance at a bottom depth of 40—50 cm. *Tubifex tubifex* and *Psammoryctes moravicus* generally avoid the stronger water currents. The proportion

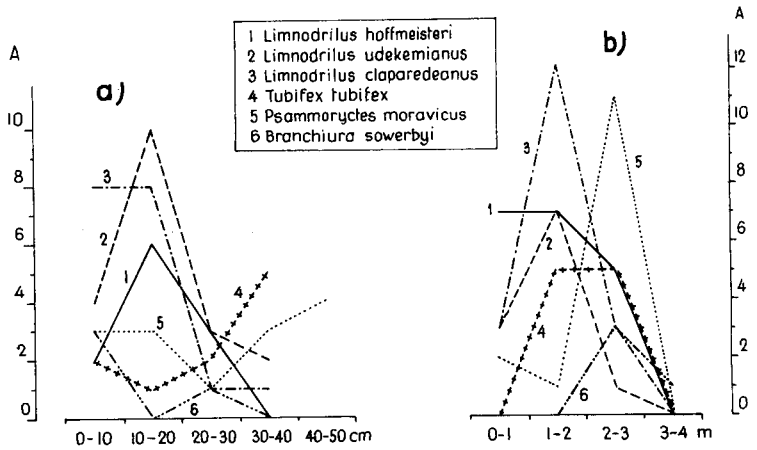

Fig. 3, a. Vertical distribution of Oligochaeta species
Fig. 3, b. Horizontal distribution of Oligochaeta species

of combined occurrence of the *Tubifex* and *Limnodrilus* species, and their relation to each other, are also influenced by the size of the granules of the bottom: in a bottom with finer granules (e.g. clayey) the *Limnodrilus* populations tend to predominate.

With regard to the horizontal distribution of the Oligochaeta species (Fig. 3,b), *Limnodrilus hoffmeisteri* appears to be the only species which lives in the highest number of individuals in the shallower bottom near to the bank, and decreases progressively towards the river bed. *Limnodrilus claparedeanus* and *L. udekemianus*

Table. *Overall abundance (A) values in the vertical distributions of the taxonomic groups of the zoobenthos*

	a	b	c	d	e	f	g	h	i	j
0—10 cm	37	29	—	8	56	—	89	56	28	1
10—20 cm	36	7	1	1	33	2	49	39	40	1
20—30 cm	28	9	—	—	13	—	73	29	19	1
30—40 cm	33	1	—	—	3	—	45	17	12	—
40—50 cm	18	2	—	—	—	—	1	16	5	—
50—60 cm	8	—	—	—	—	—	1	6	1	—

Explanation of symbols:

a = *Palingenia longicauda* larva
b = Chironomida larva
c = Ceratopogonida larva
d = Trichoptera larva
e = Amphipoda
f = Astacus sp. (juv.)
g = Gastropoda
h = Lamellibranchiata
i = Oligochaeta
j = Polychaeta

reach their maxima at a water depth of 1—2 m. *Tubifex tubifex* and *Psammoryctes moravicus* not only inhabit mainly the deeper layers of the bottom, but also favour the deeper water levels. *Branchiura sowerbyi* seems to be a species preferring deeper water: it finds conditions favourable for the satisfaction of its oxygen-demands in the surface layers of the bottom at a depth of 2—3 m in the current line.

It emerges from the overall A data in the Table that the *Palingenia* larvae in the main penetrate down to the deepest layers examined (50—60 cm) in the river--water deposit. As regards the Mollusca species, with regard to the fact that the data relating to the empty shells do not indicate conclusively that the animals reaches these places alive, besides the vertical distribution of the total zoobenthos in Fig. 2, a separate indication has been given of the quantitative data for the other taxonomic groups, with the exclusion of the Mollusca.

Of the other taxons, it is interesting to note the occurrence of *Hypania invalida* (Polychaeta), even though only in isolated examples, at a depth of 30 cm in the bottom.

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