

## SUMMER LONGITUDINAL SECTION INVESTIGATIONS IN THE TISZA AND THE EASTERN MAIN CHANNEL II QUANTITATIVE CHANGES IN THE ZOOPLANKTON

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### Introduction

The Tisza research has recently got a strong stimulus because there are raised several problems by the manifold utilization, pollution, and damming up of its water. The zoobenthos of water responds sensitively to any change in the ecological factors. The exploration, recognition of its regularities is therefore very important for the man.

On the *Rotatoria* and *Cladocera* faunas of the Tisza stretches in Hungary some informations were given by the publications of ÉBER (1955), GÁL (1963), MEGYERI (1955, 1957, 1970). The tributaries flowing into the Tisza were investigated by MEGYERI (1972), the dead-arms of the Tisza also by MEGYERI (1961), and its borrowing pits by VARGA (1928—1930). On the basis of their results, the Tisza seems to have autochthonous planktons, and the tributaries seem to have but a little influence on the water quality of the Tisza, resp. on the species communities developed. The Tisza water became lakelike in the reaches before the barrages. As a result of this, we are meeting a mass production of the planktonic living beings in this place (FELFÖLDY 1969, MEGYERI 1970, 1971, ÁDÁMOSI *et al.* 1974).

On the species communities developed in the Eastern Main Channel a publication was written by GÁL (1964). In his opinion, in the stretch of the Main Channel at Tiszalök the effect of the Tisza can be felt, as yet. Farther from the Tisza, the zooplankton communities become poorer both in species- and individual numbers. An increase in the individual number was only induced by the impoundment at Balmazújváros. The investigations of the authors mentioned were mostly carried out in the summer season.

The aim of our investigations has been to observe in the Tisza and the Eastern Main Channel the quantitative and qualitative changes of the phyto- and zooplankton in the time of low water in the late Autumn.

Apart from the algological investigations (KISS KEVE—SZABÓ 1975), we have performed zooplankton assessment, as well. In this paper, we want to give a brief account of the results of these investigations.

## Sampling, method of investigation

Our investigations were carried out in the period August 24 to 29, 1973. The Tisza was arrived at Tiszacsécsé. In the course of our investigations we strove to move with the same water mass from which we had taken the sample first (UHERKOVICH 1968, KISS KEVE—SZABÓ 1975).

The zooplankton samples were taken in every case from the surface, dipped out from the line of current, possibly in every 10 river-km. On each occasion, 50 to 100 l water was filtered through a plankton-net of 25 l/a quality. The samples were fixed then and there in formalin. Samples were taken from the major tributaries discharging into the Tisza (Szamos, Bodrog), after rowing up to their mouth. Simultaneously with taking phyto- and zooplankton samples, we measured water temperature, Secchi-translucence, quantity of the solved O<sub>2</sub>, performing also subaquatic photometry with Photronic-cells (KISS KEVE—SZABÓ 1975). The qualitative determination of the zooplankton was carried out on the basis of the determining books of VOIGT (1956), BARTOS (1959), DUSSART (1969), КУТИКОВА (1970), GULYÁS (1974), the quantitative surveys were conducted by means of the counting tube. Our results are summarized in Tables (1—2).

Table 1. *Change in the quantity of zooplankton in the Tisza,*

Species	732	725	718	710	703	696	Szamos	686
Sampling site river-km								
<i>Rotatoria</i>								
<i>Asplancha priodonta</i>								
<i>Brachionus calyciflorus</i> var. <i>dorcas</i>							2 560	10
<i>Br. cal.</i> var. <i>dorcas</i> f. <i>spinosa</i>							560	35
<i>Br. angularis</i>							1 600	
<i>Br. diversicornis</i>							12	2
<i>Br. quadridentatus</i> f. <i>typica</i>							960	38
<i>Br. quadr.</i> var. <i>brevispinus</i>							40	4
<i>Br. urceolaris</i>			2		5	10	3 200	140
<i>Cephalodella gibba</i>			8				960	22
<i>Colurella adriatica</i>	4	2	2					
<i>Filinia longiseta</i>	4	4	3	4				10
<i>Keratella cochlearis cochl.</i>		4	8	4				45
<i>K. quadrata</i>	2			6		10		
<i>Lecane bulla</i>		4			4	8		15
<i>L. luna</i>			2					25
<i>Lepadella patella</i>		6				4	20	4
<i>Pedalia mira</i>								
<i>Polyarhra longiremis</i>	4	4	6	6	4	6	2 240	
<i>Testudinella patina</i>								
<i>Trichocerca bicristata</i>	4	8						
<i>Tr. longiseta</i>	2	5			8			
<i>Cladocera</i>								
<i>Bosmina longirostris</i>				8	12			4
<i>Ceriodaphnia laticaudata</i>							20	4
<i>Chydorus sphaericus</i>							18	10
<i>Daphnia longispina</i>						4		
<i>Simocephalus expinosus</i>								6
<i>Copepoda</i>								
<i>Cyclops strenuus</i>						18	40	12
<i>C. vicinus</i>							32	10
<i>Juv. Copepodit</i>							320	20
Altogether:	20	37	31	28	33	60	12 582	416

## The results of investigations

It may be established on the basis of the results achieved in the course of elaborating the samples that at Tiszacsécsé the rapid flowing, strong current of the Tisza (its upper-stretch character) mean unfavourable conditions for the development of zooplankton communities. There could only be found some organisms present but in small individual number (*Keratella cochlearis*, *Polyarthra longiremis*). This thin occurrence of the zooplankton can be explained, apart from the unfavourable ecological conditions, with a lack in food, as well. In these reaches of the Tisza is namely also the phytoplankton poor (UHERKOVICH 1971, KISS KEVE—SZABÓ 1975).

Still before the inflow of the Szamos (the current becoming weaker), the picture of the fauna became a little more vivid. Though in small individual numbers but

*between Tiszacsécsé and Tiszalök, piece/100 l*

674	657	647	633	617	605	590	580	570	560	550	Bodrog	540	530
			6	3	12	8		48		32		64	40
70	108		531	205	804	1 616	5 728	3 680	2 608	12 256	162	18.080	22 784
20	20	102	26								26		
			118	35	272	576	96	224	384	416	20	400	500
18	26	34	32	22	96	112	112	224	144	208	30	32	1 024
60	90	80	275	112	260	368	1 040	944	496	272	40	352	512
4		4	10		8	48	96						
							12	8					
	6	2	3	13	32							64	64
16	46	32	96	64	62	280	304	464	192	624	12	96	448
							36	5				8	16
	8	4			4	10							
		2			10			6					8
						8							
10	16	14	13	6	28	8	64	80	48	304	36	512	1 088
									4	8	8		
							16	6					
						4	4				8		
					2								
	2												
							8		16				
						4				6			4
4	12								8			10	
10					12					8	12		8
	4	6			4	8				30	18	50	128
			13							48	26	30	56
8	34	36	64	35	52	16	224	32		64	8	140	280
228	372	316	1 187	495	1 658	3 066	7 746	5 715	3 932	14 328	398	20 846	26 952

there appeared some new species (*Brachionus urceolaris*, *Bosmina longirostris*).

A more considerable change in the qualitative and quantitative composition of the zooplankton was induced by the water of the Szamos. The Szamos water carried a large quantity (12 582 pieces/100 l) of zooplankton of varied composition. Several members of the *Brachionus* genus were carried off into the Tisza, with a large number of individuals. Apart from the Rotatoria, the number of the juvenile Copepoda was also considerable (320 pieces/100 l).

The Szamos water which was rich in nutriment as well as in phyto- and zooplankton got considerably diluted, as also demonstrated by the samples taken below Vásárosnamény, about 2 km from the mouth. In the samples the common zooplankton elements of the Tisza and Szamos were found but in a considerably lower individual number (416 pieces/100 l).

After the flowing of the Szamos into the Tisza, the algae began a rapid multiplication, achieving their maximum individual number in the stretch between Záhony and Dombrád (KISS KEVE—SZABÓ 1975).

Table 2. Change in the quantity of zooplankton in the Eastern Main Channel, between Tiszalök and Balmazújváros, piece/100 l

Species	Sampling site river-km	5	15	25	35	45
<i>Rotatoria</i>						
<i>Asplanchna priodonta</i>		20	—	4	—	—
<i>Brachionus angularis</i>		120	50	—	12	12
<i>Br. calyciflorus</i> v. <i>dorcas</i>		8 650	600	120	180	168
<i>Br. quadridentatus</i> f. <i>typica</i>		500	20	20	28	50
<i>Br. urceolaris</i>		52	12	24	8	22
<i>Colurella adriatica</i>		2	4	—	12	—
<i>Filinia longiseta</i>		24	8	12	20	70
<i>Keratella cochlearis</i>		200	120	70	48	142
<i>Lecane luna</i>		4	4	12	12	—
<i>Polyarthra longiremis</i>		300	150	86	50	82
<i>Trichocerca bicristata</i>		—	8	2	4	—
<i>Cladocera</i>						
<i>Bosmina longirostris</i>		2	—	2	4	—
<i>Chydorus sphaericus</i>		10	4	10	22	10
<i>Daphnia magna</i>		18	10	—	8	8
<i>D. longispina</i>		4	2	8	12	10
<i>Copepoda</i>						
<i>Cyclops strenuus</i>		50	18	8	4	6
<i>C. vicinus</i>		20	18	—	12	18
<i>Juv. Copepodit</i>		150	150	92	120	200
Altogether :		10 126	1 178	470	556	798

This quantitative multiplication of algae is followed by the zooplankton, as well, although at a slower tempo. The most important plankton-components are here the members of the *Brachionus* genus (88,7 per cent), *Keratella cochlearis*, *Polyarthra longiremis*, and *Filinia longiseta*. Crustacea were mostly represented by the juvenile Copepoda. In the samples, only a few *Cyclops* sp., *Daphnia longispina*, and *Chydorus*

*sphaericus* were found. Below Dombrád, the number of algae decreased but the amount of the zooplankton increased more and more (7746 pieces/100 l). Then, after some decrease, the individual number of the zooplankton again increased, still before the Bodrog flowing into. (14 000 pieces/100 l).

The water of the Bodrog was poor in algae and zooplankton, its species combination being similar to that of the Tisza.

After the inflow of the Bodrog, the individual number of the zooplankton increased rocketingly, reaching its maximum at Tiszalök in the Tisza becoming more and more lake-like (26 952 pieces/100 l). In highest numbers the members of the *Brachionus* genus were present (24 000 pieces/100 l). And also the rate of *Polyarthra longiremis* and *Cyclopses* did considerably increase.

The algal number is very small in this stretch (765 thousand ind/l). This may probably be explained with the deficiency in nutrients and, on the other hand, with the considerable multiplication of the zooplankton. The fact that, by the dammed-up stretch of the bed, favourable conditions are provided for the planktonic living beings, were already demonstrated by several authors (UHERKOVICH 1968, MEGYERI 1970, 1971, ÁDÁMOSI *et al.* 1974).

In the stretch of the Eastern Main Channel at Tiszalök the effect of damming up the water in the Tisza could be felt considerably. The zooplankton species communities developed here were similar to those found in the Tisza both in respect of their individual number and of their species combination.

A lesser increase was only observed at the river barrage at Balmazújváros. The species forming the zooplankton communities found in the Tisza and the Eastern Main Channel are published in the following list.

#### *Rotatoria:*

*Asplanchna priodonta* GOSSE

*Brachionus calyciflorus* var. *dorcas* GOSSE

*Br. cal.* var. *dorcas* f. *spinosa* WIERZEJSKI

*Br. angularis* GOSSE

*Br. diversicornis* DADAY

*Br. quadridentatus* f. *typica* HERMANN

*Br. quadridentatus* var. *brevispinus* EHRB.

*Br. urceolaris* O. F. MÜLLER

*Cephalodella gibbs* EHRB.

*Colurella adriatica* EHRB.

*Filinia longiseta* EHRB.

*Keratella cochlearis cochlearis* GOSSE

*K. quadrata* O. F. MÜLLER

*Lecane bulla* GOSSE

*L. luna* O. F. MÜLLER

*Lepadella patella* O. F. MÜLLER

*Pedalis mira* HUDSON

*Polyarthra longiremis* CARLIN

*Testudinella patina* HERMANN

*Trichocerca bicristata* GOSSE

*Tr. longiseta* SCHRANK

#### *Cladocera:*

*Bosmina longirostris* O. F. MÜLLER

*Ceriodaphnia laticaudata* P. E. MÜLLER

*Chydorus sphaericus* O. F. MÜLLER

*Daphnia longispina* O. F. MÜLLER

*Simcephalus expinosus* KOCH

Copepoda:

*Cyclops strenuus* FISCHER

*C. vicinus* ULJANINE

Juv. Copepodit

The experiences of the quantitative and qualitative changes in zooplankton may be summed up as follows:

At the low water in Autumn, in the upper Tisza region up to the inflow of the Szamos, the zooplankton is poor in species- and individual numbers, owing to the strength of flow and the lack in food. An essential change was induced by the inflow of the Szamos. As a result of a decrease in the flowing speed, an increase in translucence and of the Szamos water rich in nutrients and containing a large algal population, the amount of zooplankton increased in the Tisza more and more. The papers have so far not pointed out unambiguously the fact, experienced by us in the course of our investigations, that in this period a decisive, determinative effect was exerted by the Szamos on the water quality, the phyto- and zooplankton combination of the Tisza. During the later samplings, the species communities developed were primarily formed by the plankton components of the Szamos. The multiplication of these increased more and more as the flow of the river became slower — although the quantity of phytoplankton decreased below Záhony — and it achieved its maximum in the Tisza becoming lake-like at Tiszalök. This mass production of the zooplankton could be felt in the initial stretch of the Eastern Main Channel. In the lower stretches of the Main Channel the number of the zooplankton was low.

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