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LIMNOLOGICAL CHARACTERISTICS OF THE TISZA STRETCH AT KISKÖRE DAM IN 1975

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Abstract

The work is dealing with the physical, chemical, and biological conditions of the middle — dammed up — stretch of the Tisza, as reflected in the flow regimen characterictic of the year 1975 taking into consideration the passing of flood-waves and the effect of dammings.

Materials and Methods

For studying the water of the Tisza, samples were taken in the reaches between Tiszakeszi and Tiszaroff (467—380 river km), with a fortnightly, resp. at Tiszakeszi a monthly, frequency. Samplings took place on the days February 12, 25, March 11, 25, April 8, 22, May 6, 20, June 2, 12, July 2, 15, 25, August 12, 26, September 21, October 14, 21, November 3, 18, December 2, 16.

For the chemical analyses there was taken 5 l drawn sample. A special sampler was used to determine the dissolved O_2 and the free CO_2. A large part of the components were determined on the sampling day, on the basis of the VITUKI (1970) and Felföldy's works (1974). At the river barrage, the water quantity transmitted per hour was read off from diagrams made by the VIZITERV, taking into consideration the position of the piston rod, resp. the water consumption of the turbine.

The total bacterial count was determined with a direct method (0.45_μ), (Sartorius membrane filter). The algae were prepared from drawn water, fixed with Lugol's solution. Chlorophyll was determined by being dissolved with mentanol (FELFÖLDY 1974). The zooflagellates were determined from living samples, from the netted and formalin-fixed samples of Rotatoria and Crustacea.

Results

Physical conditions

The formation of the Tisza flow regimen in 1975 was primarily determined by the comparatively mild Winter of 1974, poor in precipitation, the rainfalls in the early Spring, as well as by the changing Summer and Autumn weather.

In the mountains and hills of the Tisza watershed area, the sparse snow cover may have got a very sudden thaw. In the Tisza and its tributaries, a flood of rapid course already began in late December and culminated at Kisköre with a water output of 1,346 cc.m/sec, on January 5.

As a result of rainfalls in the early Spring, the first flood-wave of the so-called green- (spring-) flood began in early March, being one day after the flood of the

Bodrog and two days ahead of the flood of the Sajó. Culmination followed at Kisköre on March 18, with 920 cc.m/sec water output.

The second and third flood-wave of the spring-flood — meaning the greatest flood of 1975 — passed till Tiszalök in a well-separable form. The river barrages at Tiszalök and Kisköre have induced the union of flood-waves, by regulating the downflow of water masses, equalizing the fluctuations of water output, and decraesing their rapid downflow.

In the formation of the second flood-wave, the water mass arriving from the watershed area of the Upper-Tisza region, and the water mass transported by the Szamos have primarily played a role. The flood-wave, passing through the section at Vásárosnamény in 15 days, represented 1.2 thousand million cc.m water quantity and culminated with 1,760 cc.m/sec, on April 6.

The third flood-wave at Vásárosnamény meant about 1.5 thousand million cc.m water mass in 23 days. It is characteristic of its slower course that it culminated with only 1,270 cc.m/sec water output on April 18.

The flood of the Bodrog supplied, in 35 days, 1,2 thousand million cc.m, that of the Sajó, in 17 days, 266 million cc.m water into the Tisza.

The second and third flood-wave passing in the section of the Kisköre river barrage lasted for 43 days and culminated with 2,223 cc.m/sec on April 24. During this time, the water mass flowing through was 5,3 thousand million cc.m.

With the passing of the spring-flood, the flood-period of the year 1975 came to an end. As a result of the changing summer and autumn weather, smaller flood-waves often passed in the course of the year but their water quantity is not considerable.

The "small-water period" which is characteristic of the Tisza, only lasted from late September until the middle of October.

In 1975, only 16.8 thousand million cc.m water passed in the Kisköre section. The river barrage was dammed for 317 days. For 48 days — when the floods were passing — the Tisza flew in natural state.

Suspended matter content of the Tisza

On the basis of the systematic investigations in 1974, it was established that the suspended matter, content of the Tisza is a very important parameter for the water quality of the reservoir (Cf. VÉGVÁRI, 1976).

Investigating into the connections between flow regimen and the suspended matter content, we could ascertain that the largest drift mass was transported by the ascending line of the flood-wave (cf. Fig. 1). Before culmination this decreases and remains at an approximately standing little value until the flood-wave had passed (Fig. 1). On April 8, 1975, on the basis of the water sample taken from the ascending line of the spring-flood, the suspended matter content of the water passing through the Kisköre section surpassed 1 ton/sec. Then the water output of the Tisza was still 1,341 cc.m/sec. On April 22, after the culmination of the flood-wave, even at 2,151 cc.m/sec water output, there was passing not more than 150—200 kg/sec floating matter.

If filling takes place from the ascending line of flood-wave, then 200—300 thousand ton floating drift gets into the reservoir, together with 300 million cc.m water. Is filling beginning after the culmination of flood-wave, then the floating matter getting into the reservoir is a tenth of the former one. It is decreasing thus to 20 to 30 thousand ton. It follows from the data unambiguously that — if technically realizable — it is advisable from the point of view of water quality to begin filling the reservoir after the culmination of the flood-wave.

Water-chemical conditions

It is unequivocally verified by the results of the systematic investigations of 1974 and 1975 that the total iron content transported by the Tisza water is of mineral origin. Its quantity changes — as a result of the geochemical character of the reservoir of the Tisza and tributaries — in a close connection with the suspended matter content.

The total iron content transported by the Tisza is well represented by the data measured at the spring-flood. On the basis of the sample taken on April 8, 1975, from the ascending line of flood-wave, at 1,341 cc.m/sec water output, the total amount of iron flowing through the Kisköre section was 37.8 kg/sec. In the same place, on April 22, after the culmination of flood-wave, with 2,151 cc.m water output, 6.3 kg/sec flew down. It can be calculated from the results that from the sediment of the reservoir filled out of the ascending line of the flood-wave 8—9 thousand ton iron, while from the water arriving after the culmination 800—900 ton iron may get into the reservoir.

In 1975, because of the extreme water course and the high floating-matter content, the photosynthetic oxygen production of the water was negligible. The dissolved oxygen content of the Tisza was influenced primarily by weather (temperature) factors and the quantity of the atmospherical oxygen dissolved in the course of water movements.

Then oxygen supply of the Tisza water was favourable in the great part of the year, its oxygen saturation varied between about 80—100 per cent. Values about 40—60 per cent were only measured in a few cases. It can be established by reason of the annual datum-series that the change in temperature conditions can be well perceived at the seasonal changes in the dissolved oxygen content. There were measured in the winter and spring periods higher, in Summer and early Autumn lower values. In the course of the whole year, corresponding to the literary data (B. Tóth 1976), the oxygen dynamics characteristic of river-waters could be observed.

The typical river-water character was represented by the change in the free carbon dioxide, as well. In flood time there were generally measured higher (between 9—11 mg/l), in the small-water period, however, lower values (5—7 mg/l).

The seasonal dynamics of the carbon dioxide content was considerably influenced by the concentrations of hydrogen-carbonate, calcium, magnesium, etc., transferred by the Tisza and its tributaries.

The change in the chemical oxygen needs of the Tisza generally depends on the different flow regimen conditions because the ratio of the organic component in the suspended matter transferred by the water is very high in flood-time, raising in this way the chemical oxygen demand considerably.

The values of the chemical oxygen demand ,measured with acid potassium permanganate, generally varied between 4 and 6 mg/l. At samples taken from the ascending line of floods, 10—14 mg/l quantities were measured.

The chemical oxygen demand, measured with acid potassium dichromate, varied between 19—22 mg/l. In case of a water of a larger suspended matter content, it achieved even 39.6 mg/l.

According to our calculations, the chemical oxygen demand of the reservoir filled in from the ascending line of the spring flood-wave, and measured with acid potassium permanganate, would however be, on the basis of the water sample from April 8, 1975, 4,260 ton. On the other hand, the momentary dissolved oxygen content would only be 3,264 ton. According to the datum-series, measured on April 22, 1975, after culmination, the chemical oxygen demand, calculated for 300 million cc.m water, turned up to be not more than 5,500 t, with an O_2 content similar to the previous one. In this case, even a part of the momentary dissolved oxygen content of the water is sufficient to decompose the organic matter getting in together with the supplied water, so that 6.88 mg/l dissolved oxygen has still remained as an excess. Although the data are reflecting a momentary situation, — the natural purifying of the Tisza being a result of more complicated processes, demanding a longer time — it can be established, at any rate, that in the interest of the undisturbed oxygen circulation, it is advisable to begin the filling of the reservoir after the flood-wave having culminated.

The dynamics of the mineral-matter content of the Tisza was primarily determined by water courses, as well as by the quantities of the minaral matter transferred by the Tisza and its tributaries.

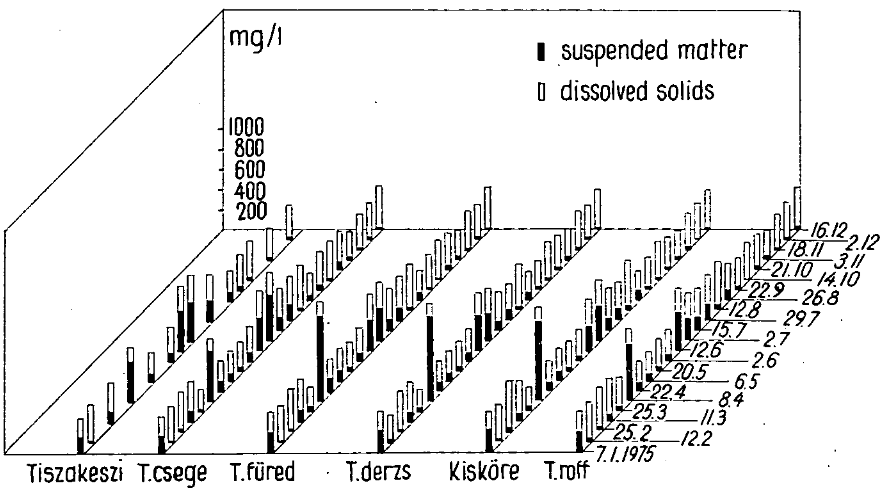

Fig. 1. Formation of suspended matter, dissolved matter, and dry matter content of the Tisza, in 1975.

At flood, the diluting effect of the water mass arriving prevailed; in cases like this, a considerable decrease in the concentration of kations and anions was observed. In a small-water period, the mineral-matter content of the Tisza-water has also risen, together with the increase in conductivity.

Picking out of the annual investigational series some time-points to be characterized with different water outputs, as well as the concentrations of kations and anions belonging to these, we have observed that the quantity of mineral matters flowing through the same section not considerably changed by the changes in the flow regimen — with the exception of hydrogen-carbonate.

It can be read from the Table below that the quantity of anions and kations in the traffic of materials is mostly independent of the water output, although their concentration increases or decreases in the proportion of the quantities transferred by the single tributaries.

Sampling date	Water ouput cc.m/sec	kations kg/sec							
		sodium		calcium		potassium		magnesium	
		A	B	A	B	A	B	A	B
March 11	537	15.0	15.0	32.5	32.5	1.3	1.3	6.1	6.1
April 8	1341	15.0	37.4	48.9	81.1	1.0	3.2	6.6	15.2
May 6	797	15.0	22.3	36.7	48.2	1.7	1.9	6.7	9.1

Sampling date	Water ouput cc.m/sec	Anions kg/sec					
		cloride		sulphate		hydrogenecarbonate	
		A	B	A	B	A	B
March 11	537	23.9	23.9	27.5	27.5	110.7	110.7
April 8	1341	20.3	59.7	34.8	68.7	260.5	276.5
May 6	797	16.6	35.5	17.2	40.8	140.5	164.3

A = the ion quantity flowing through the Kisköre section in a second;
B = the ion quantity that would have flown through the Kisköre section in a second if the diluting effect of the arriving water mass had not been present.

The formation of the sodium content is most striking: on March 11, 1975 at 573 cc.m/sec water output and 28.0 mg/l 15 kg, on April 8 at 1,341 cc.m/sec water output and 11.25 mg/l 15 kg, on May 6 at 797 cc.m/sec water output and 18.75 mg/l also 15 kg sodium ion streamed through the Kisköre section in a second.

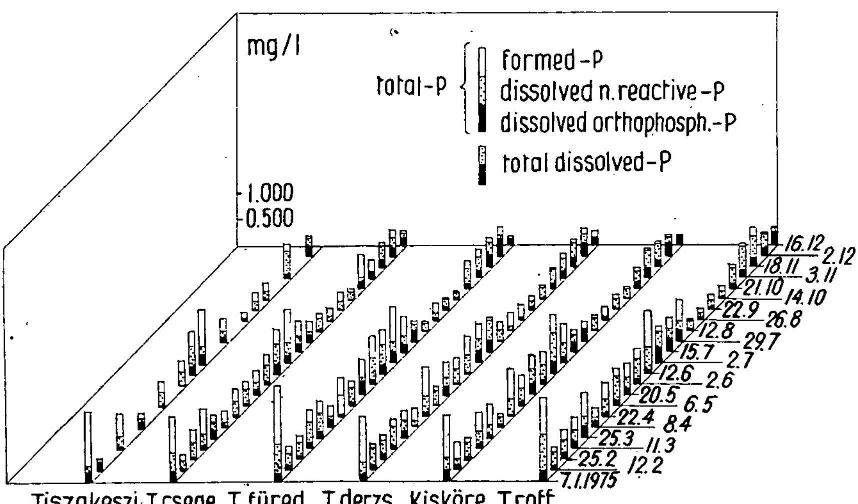

Fig. 2. Change in the quantity of phosphorus forms, in the investigated stretch of the Tisza, in 1975.

From among the anions, alone the quantity of hydrogen-carbonate has approached the calculated values. This can supposedly be explained with the regularities of the carbon dioxide-carbonate-hydrogencarbonate equilibrium system.

The plant nutritive matters which are important from the point of wiev of trophity and eutrophication — the various forms of phosphorus and nitrogen — are present in the Tisza water, which is the supplying water of the Kisköre Reservoir, in a considerable quantity. The extreme flow regimen and high suspended matter content is however, limiting the incorporation of the plant nutritive matters into the living organism. It is verified by the results of the investigations in the previous years, as well, that the nitrogen and phosphorus content of the different water-bodies flows away with the water mass, without any particular change. It was, however, made possible by the hydrological conditions changed as a result of the Kisköre damming — i. e., the considerable dropping of flowing speed, the silting of suspended matters, etc. — the formation of conditions which made the high plant nutritive matter content of the Tisza water already accessible to the autotroph organisms. (In the Autumn of 1973, we have observed an algal bloom of *Chlamydomonas*-type.)

This state was changed by the consecutive smaller and larger flood-waves, the high suspended matter content became a limiting factor again, owing to the returned river-water state, in the dammed Tisza reaches. Thus, in 1975, there was not observed any phenomenon like that in 1973, only some water colouration to a lesser extent.

It is easy to see on the basis of the results of the water-chemical investigations (Figs. 2—3) that may we take for basis any state of any flow regimen, the quantity of the inorganic plant nutritive matter in the water of the Tisza can never be considered as an inhibitive factor of photosynthesis (B. TÓTH 1976).

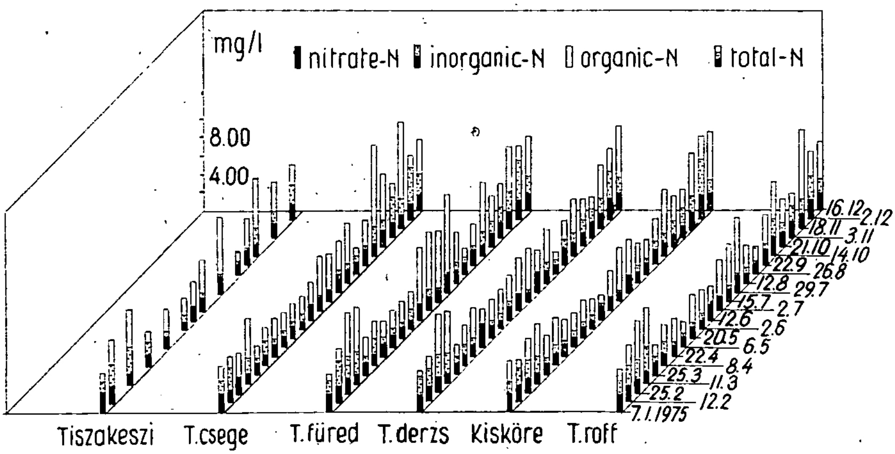

Fig. 3. Change in the quantity of nitrogen-forms, in the investigated stretch of the Tisza, in 1975.

It follows from this that in the Tisza the algal blooms characteristic of the eutrophic state can develop whenever the factors inhibiting the production cease, or are artificially ceased, to exist. The eutrophic state comes, therefore, into being most probably if in the warm period, as a result of riverbed-damming, the suspended matter content of the Tisza water is deposited, its translucense becomes stronger. This manifests itself, to a still greater extent, if an association of living beings of high species and individual number, developed as a result of the damming at Tiszalök, finds advantageous conditions in the district of the Kisköre river barrage.

In case of storing, the approachability of vegetable nutritive materials can take place very quickly if the conditions of standing water had developed and the suspended mater deposited. After filling it was finished, it seems advisable to avoid any intervention having an effect on the whole water mass of the reservoir. The use of the plant nutritive matters, as well as the disturbance of the stability, of the ecosystem, already developed in the space of the reservoir, are to be prevented by an up-to-date water management. In order to avoid an early eutrophication of the Kisköre Reservoir, we should endeavour, therefore, that by harmonizing water management and the aims of the protection of water quality, the operation of the river barrage should serve at the same time for the manifold usefulness of the existing water-reserve.

Bacteriological investigations

The occurrence of *Planctomyces bekefii* Gim. is sporadic, their number varied between 6 and 120 thousand ind./l. The bacterial count in the Tisza fluctuated between 5 and 192 million ind./ml (0.88—34.5 mg/cc. m) (Fig. 4). Their value changed approximately together with the suspended matter (Fig. 5). It is to be seen in the Figure that the connection approaches the linear one but a considerable part of the points can be found in the lower value ranges (150 mg/l suspended matter and below 60 million ind/ml total bacterial count about its 90 per cent/. In case of damming, the bacterial count follows the change in suspended matter in the longitudinal section.

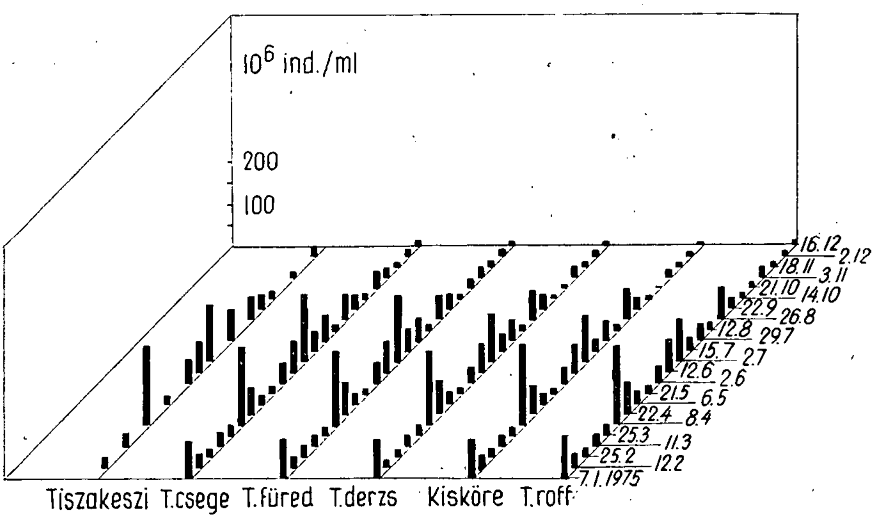

Fig. 4. Change in the total bacterial count in the investigated stretch of the Tisza, in 1975.

That is to say, the total bacterial count decreases as we approach the river barrage and after that it increases (HAMAR 1976).

On the basis of our estimate, in 1975 about 150 thousand ton bacteria passed the Tisza in the Kisköre section.

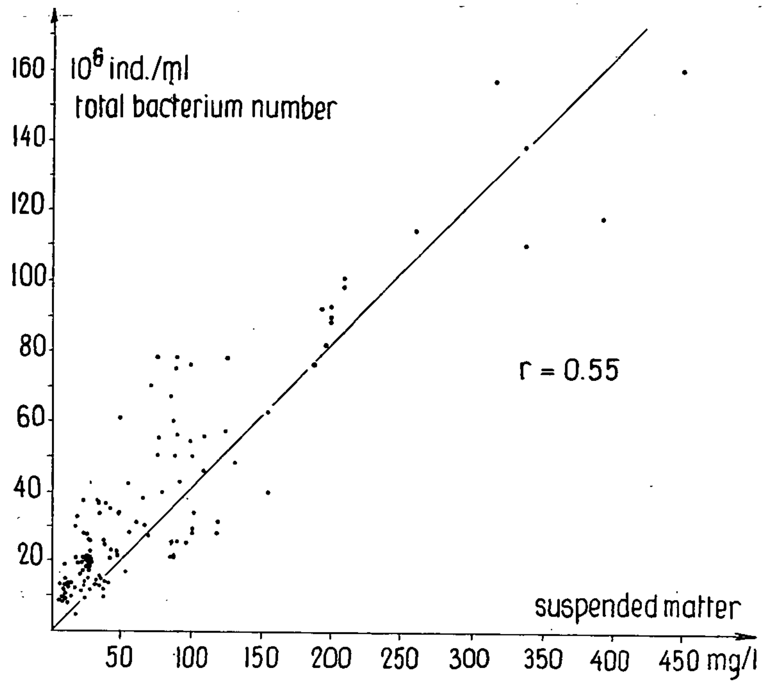

Fig. 5. Connection between the changes in the total bacterial count.

Algological investigations

In the course of the systematic algological investigations, performed between Tiszakeszi and Tiszaroff, 53 species, which are new for this stretch, were added to the list, as compared with the previous year. These are:

Anabaena affinis LEMM.
Anabaena spiroides KLEB.
Anabaenopsis raciborskii WOLOSZ.
Gomphosphaeria lacustris CHOD.
Lyngbya martensiana MENEGH.
Microcystis aeruginosa KÜTZ.
Oscillatoria granulata GARD.
Oscillatoria tenuis AG.
Phormidium molle (KÜTZ.) GOM.
Romeria leopoliensis (RACIB.) KOCZ.
Euglena oxyuris f. *minor* DEFL.
Euglena polymorpha DANG.
Trachelomonas hispida v. macropunctata SWIR.
Ceratium hirundinella (O. F. MÜLLER) SCHRANK.
Cyathomonas truncata (FRES.) FISCH.
Antophysa vegetans (O. F. MÜLLER) STEIN

Dinobryon sertularia EHR.
Heterochromas sociale (KENT.) LEMM.
Heterochromas vulgaris (CIEN.) PSER
Monas uniguttata SKUJA
Paraphysomonas vestita (STOKES) SAEDELEER
Amphora ovalis KÜTZ.
Hantzschia amphioxys (EHR.) GRÜN.
Melosira granulata (EHR. RALF.
Navicula cincta (EHR.) KÜTZ.
Navicula cryptocephala var. *intermedia* GRÜN.
Navicula cryptocephala var. *veneta* (KÜTZ.) GRÜN.
Navicula viridula KÜTZ.
Nitzschia linearis W. SMITH
Nitzschia longissima var. *reversa* GRÜN.
Navicula radiosa KÜTZ.
Nitzschia sigmoidea (EHR.) W. SMITH
Nitzscia sublinearis HUST.
Rhicosphaeria curvata (KÜTZ.) GRÜN.
Chodatella ciliata LEMM.
Coelastrum microporum NÄG.
Gonium pectorale MÜLLER
Lambertia gracilipes (LAMB.) KORSCHIK.
Pediastrum duplex MEYEN
Phacotus lenticularis EHR.
Scenedesmus armatus CHOD.
Scenedesmus denticulatus LAGERHEIM
Scenedesmus granulatus W. & W.
Scenedesmus intermedius CHOD.
Scenedesmus intermedius var. *bicaudatus* HORTOB.
Scnedesmus quadricauda var. *bicaudatus* HANGS.
Siderocystis fusca KORSCHIK.
Tetraedron trigonum (NÄG.) HANGS.
Tetraedron elegans PLAYT.
Tetrastrum staurogenieforme (SCHROED.) LEMM.
Closterium aciculare T. WEST.
Closterium acutum var. *variabile* (LEMN.) KRIEGER
Plactonema lauterborni SCHMIDLE.

In the investigated stretch, there wasn't observed any algal bloom. At the end of Summer — early in August, a blue-green alga, so far unknown in the Tisza: *Anabaenopsis raciborskii* WOLOSZ. was found, and similarly the *Anabaena affinis* LEMM., *Anabaena spiroides* KLEB., and *Microcystis aeruginosa* species, generally causing algal blooms.

It seems to us that the *Cryptomonas* species, belonging to the Pyrrophyta phylum (erosa, marssonii, platyuris, pusilla, ovata) become permanent in the dammed stretch.

From the living samples there turned up some colourless Flagellatae that could not stand being fixed ,some sorts of Monas and Heterochromas, as well as *Antophysa vegetans* (O. F. M.) STEIN and *Paraphysomonas vestita* (STOKES) SEAD. the occurrence of which indicates pollution (HAJDU 1975). It may be concluded from the systematic appearance of *Chrysococcus biporus* SKUJA and its large individual number in the time of dammings that this species is qualified as a eutrophic indicator.

The frequency of diatoms (Bacillariophyceae) is known, the newly-found species had a low individual number and were already known from the Tisza (UHERKOVICH 1971).

The result of the effect of damming is proved by the increase in the species number of green algae (Chlorophyta), as well.

The quantitative dynamism of algae was not at all so strong as in the previous years (ÁDÁMOSI et al. 1974, HAMAR 1976).

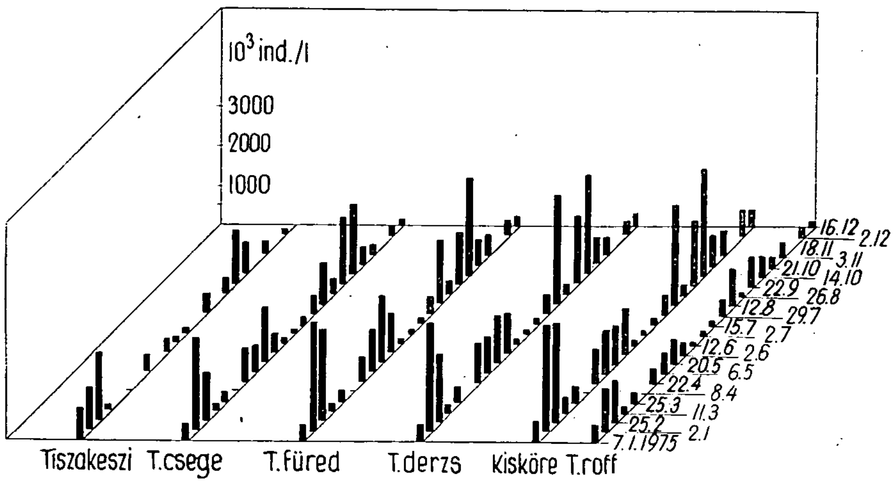

Fig. 6. Change in the total algal count in the investigated stretch of the Tisza, in 1975.

The cause of this may have been the lack of a lasting small water. There was a small water in the early Autumn and in Winter for a shorter or longer time. In the time of the winter small water, the individual number of the stock was surprizingly high (Fig. 6), being characterized by the multiplication of the diatom Stephanodiscus tenuis Hust. The temperature was 1 to 2.5 °C on February 12 and 25, but transparency — compared with that of the Tisza — is very high, 75 to 40 cm. The effect of damming could be demonstrated also in this case (Fig. 6).

The richness in species is characteristic of the early-autumn phytoplankton. Apart from the *Stephanodiscus tenuis* and *Nitzschia actinastroides* species, the green algae were dominating. In the time of floods, the total algal count was measured on April 30/30 thousand ind (1). The total algal count of the winter and late autumn dammings was very similar (about 3 million ind (1). In the time of dammings, the effect of damming increasing the total algal count was always verifiable.

As a result of damming, there appeared, in a systematic way, more and more species, not known in the Tisza so far, in the stretch investigated by us, showing the change in the character of the river. A part of these species refer to the increase in eutrophization (blue-green algae inducing algal bloom, *Chrysococcus biporus*, *Stephanodiscus tenuis*, etc.) while the colourless Flagellatae belonging to the family of Chrysophyseae *(Paraphysomonas vestita, Heterochromas socialis, H. vulgaris, Monas uniguttata, Anthophysa vegetans)* indicate an increase in the organic-matter content.

The values of chlorophyll content are very low, they could not be measured and were below 27 mg/cc.m. A conformity between chlorophyll content and total algal count is only in their tendency. Cf. Fig. 7.

On the basis of estimations, in 1975, in the Kisköre section, about 117 ton chlorophyll was passing.

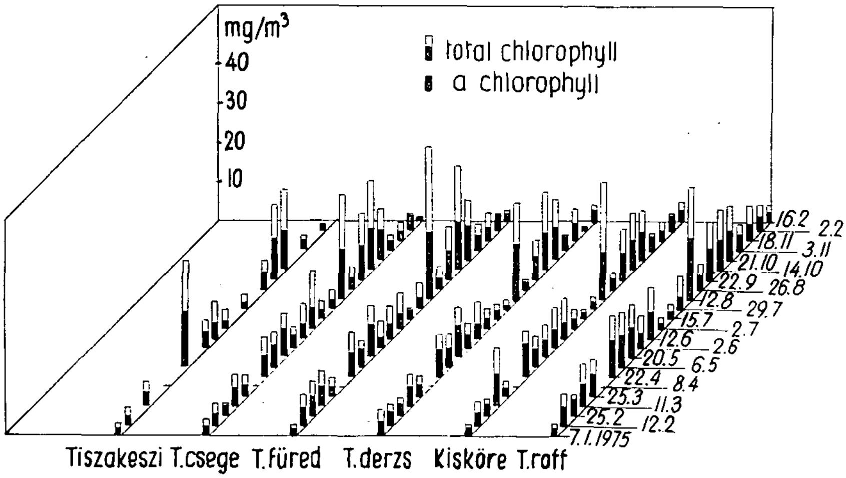

Fig. 7. Change in the chlorophyll content in the investigated stretch of the Tisza, in 1975.

Zooplankton investigations

In the course of the systematic investigations in 1975, we studied the Zooflagellata fauna. In the investigated river reaches, there were found the following species:

Bicoeca cylindrica (LACKEY) BOURR.
Bicoeca lacustris J. CLARK
Bicoeca planctonica KISS.
Bodo angustus (DUJ.) BLÜTSCHLI
Bodo ovatus (DUJ.) STEIN
Bodo variabilis (STOKES) LEMM.
Codonosiga botrytis (EHR.)
Codonosiga longipes STOKES
Pleuromonas jaculans PERTY
Rhynchomonas nasuta (STOKES) KLEBS
Salpingoeca bütschlii LEMM.

The majority of the enumerated species are organisms characteristic of a standing and somewhat polluted water. Their quantity is generally negligible.

The systematic investigations in 1975, in case of Rotatoria and Crustacea planktons, showed about the same picture as in the earlier years (ÁDÁMOSI et al. 1974, BANCSI 1975). Species composition and the density of individuals varied seasonably, as a result of the phenological rhythm and of the effect of the flow regimen of the Tisza (Fig. 8).

In addition to the species, found frequently enough in the year of the investigation, we have observed some organisms not known before. These are:

Dicranophorus caudatus (EHR.)
Euchlanis allata VORONKOV
Itura aurita (EHRB.)
Keratella quadrata var. *curvicornis* (EHRB.)

Euchlanis allata has got into the river from the watershed area of the Upper-Tisza region. Besides *Wolga spinifera* WESTERN, this species also survived, even if casually, but in the whole space above the Kisköre river barrage. Some species referring to pollution were found only casually (e. g., *Epiphanes senta* (O. F. MÜLLER)) .The characteristic species belong to *Brachionus, Filinia, Keratella, Polyarthra, Notholca, Rotatoria* genera.

From among Cladocera, in the same way as in the previous years (BANCSI 1976), *Bosmina longirostris* O. F. MÜLLER was the characteristic species of the investigated area. Individual density is, in the majority of cases, very low.

In the corse of investigating the Copepoda-plankton, there was found a *Calanoida* taxon, *Eudiaptomus gracilis* LILLJEBORG. The number of *Cyclopoida* species is higher; *Acanthocyclops vernalis* FISCHER, *Eucyclops serrulatus* FISCHER, as well as *Thermocyclops oithonoides* SARS can be considered as characteristic.

In the first quarter of the year (January-April) the medium species number and the low individual density are characteristic of the Rotatoria plankton. After the

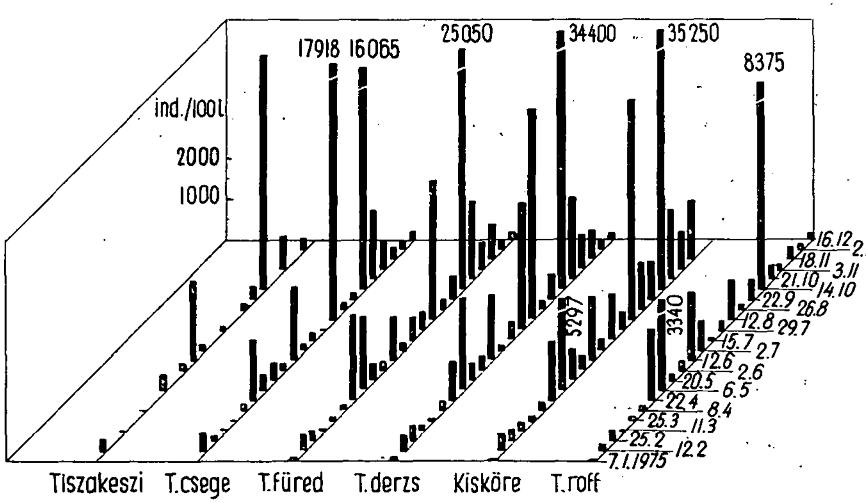

Fig. 8. Dynamics of the Rotatoria and Crustacea palnktons in the investigated stretch of the Tisza, in 1975.

flood of medium water output in January, in the cold water, there did not develop any fairly considerable Rotatoria stock, in February and March, either. The spring maximum appeared in the second half of April, and it could not be washed away even by the flood-wave. Thus in the period of its passing down, in the stretch between Tiszafüred—Kisköre, they were found in a considerable enough individual number. This must have been connected with the survival of the stock arriving in the water mass, recliding from the flood-plain, and developing there. Following this, until the middle of June, the species number of Rotatoria was again higher.

In the course of the year, the highest individual number was found on October 14, at the end of the small-water period, lasting from the second half of September until the middle of October. After this, in the dammed river stretch, the number of Rotatoria was for a while still high. Then, in the period of the end-of-year flood-wave, the Rotatoria plankton was again formed by species occurring in a scarce number.

The number of Cladocera species did generally not surpass a few hundreds per 100 litre. The subordinate role of Cladocera is characteristic of this year, too.

The very high individual density of the Copepoda-plankton in certain periods was the result of a considerable number of the forms being in copepodit and nauplius stage. The well enveloped individuals can only be found generally in a small number in the plankton of the Tisza.

The zooplankton of the Tisza has been determined by the flood-waves, damming, and the composition of the species-communities arriving together with the water receding from the flood-plain, this year, as well.

The floristic and faunistic investigations into the flood-plain water surfaces may bring us nearer to the understanding of peculiarities, seasonal changes of the river and, in this way, to revealing the hydroecological conditions of the Tisza.

The fundamental knowledge is anyway, necessary to elaborate the full picture

References

ÁDÁMOSI et. al. (1974): Duzzasztás hatása a Tisza vízminőségére a kiskörei vízlépcső térségében (Effect of damming on the quality of Tisza water, in the area of the Kisköre river barrage). — Hidrol. Közl. *12*, 570—576.

BANCSI, I. (1976): Zooplankton investigations in the dammed Tisza reaches. — Tiscia (Szeged) *11*.

FELFÖLDY, L. (1974): A biológiai vízminősítés (Biological water qualification). Vízügyi hidrobiológia 3., VÍZDOK, 1—242.

HAMAR, J. (1976): Data to the bacteriological and algological conditions of the region of Kisköre River Barrage. — Tiscia (Szeged) *11*.

HAJDÚ, L. (1975): *Paraphysomonas vestita* (STOKES) de SAEDLEER előfordulása hazánkban (Occurrence of *Paraphysomonas vestita* (STOKES) de SAEDLEER in this country).— Bot. Közl. *62*, 9—12.

B. TÓTH, M. (1976): Hydrochemical conditions of the river Tisza. 2. Seasonal dynamism of the oxygen household and nitrogen-phosphorus forms. — Tiscia (Szeged) *11*.

UHERKOVICS, G. (1971): A Tisza lebegő paránynövényei (The floating microplants of the Tisza). — Szolnok, 1—282.

VÉGVÁRI, P. (1976): Water motion in the Tisza and its connection with the suspended matter content. — Tiscia (Szeged) *11*.

VITUKI (1970): KGST Egységes Vízvizsgálati Módszerek (COMECON, Uniform Methods for Water Investigation). — Budapest.