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STRUCTURE AND DYNAMICS OF ZOOPLANKTON IN THE DEAD THEISS

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Abstract

The dead Theiss Čurug—Biserno ostrvo represents a branch of the river Theiss, created after the cutting of the river bed in the last centruy. In the period 1983—1987, the structure and dynamics of the zooplankton in this eco-system, important for fishing, were investigated. In the stated period in the structure of zooplankton, a total number of 80 species were ascertained, out of which 16 *Protozoa* (20%), 43 *Rotatoria* (53,75%), 13 *Cladocera* (16,2%) and 8 *Copepoda* (10%). The most frequent species out of *Rotatoria* belong to the genera *Branhionus, Keratella* and *Polyarthra.* These genera make the most represented genera also in other waters of the Pannonian basin. It may be of interest to mention the presence of the species *Liliferotrocha subtilis,* appearing more and more frequently, not being recorded earlier. Out of Cladoceras, most frequently are present the species *Bosmina longirostris, Daphnia cuculata* and *D. longispina,* while of *Copepodas Eudiaptomus gracilis* and *Thermocyclops crassus.*

The number of species varies yearly and seasonally. The largest number is in the summer period. The quantitative structure is also variable yearly and seasonally. The largest values were recorded in the year 1984, 6.730 ind. dm^{-3}.

Introduction

The Dead Theiss Čurug-Biserno ostrvo represents the old flow of the river Theiss, created after cutting the river bed in 1958. BUKUROV (1948).

Characterized this stagnant tributary as a lake and was of the opinion that "it will be a deep lake for long, since instead of river mud, it is covered with eolitic material and swamp vegetation". For a long period this eco-system has been used for fishing, since very good living conditions prevail for the life and nutrition of a great number of fish species. Therefore it is used more and more in fishing tourism. For this reason it is becoming the object of hydrobiologic researches (RISTIĆ et *al.* 1974, KALAFATIĆ et *al.* 1982, PUJIN et *al.* 1986). As the zooplankton represents an important component in the nutrition of many kinds of fish, the aim of this work was to present the structure and dynamics of zooplankton in this insufficiently investigated locality.

Materials and Methods

The research includes the period 1983—1987. The material was collected in seasonal intervals. The samples for qualitative structure were taken by a plankton net made of milling silk No. 22, while for the quantitative analyse the method of filtering 1 l water was applied. The material was mainly tested in fixed state, in 4% formalin.

Results and Discussion

In the qualitative structure of zooplankton, as in other waters, participate the groups of *Protozoa, Rotatoria, Cladocera* and *Copepoda.* In the investigated period, a total number of 81 species were ascertained, out of which 16 *Protozoa,* 43 *Rotatoria,* 14 *Cladocera* and 8 *Copepoda.* The structural content of the zooplankton, expressed in percentage, would be represented as follows: *Protozoa* 20%, *Rotatoria* 53%, *Cladocera* 17% and *Copepoda* 10%. The list of Protozoa is not complete as the material was tested in fixed state, and as such was not suitable for more detailed determination. The number of species varied yearly and also seasonally. The greatest variation is in the summer period and the smallest in winter. The greatest variation in relation to particular years are in spring, since in this period the conditions also vary. The represented species by year are shown in Tab. 1.

As it can be seen, the number of species varies by year although the limits are not large. Mainly, yearly about 50 species are recorded in the first three years and a somewhat larger number, 59 and 61 in the years 1986 and 1987. In this list, besides the genuine plankton species, included are periphitonous species.

In such waters during tests these species also appear, so that we usually take them in consideration. As in other waters of Vojvodina, the most diverse group is Rotatoria. The represented species appear also in other waters and if we would compare the qualitative structure of the Dead Theiss with the river Theiss, we would notice that over 70% of represented species of *Rotatoria,* could be found in both eco-systems (PUJIN, STANOJEVIĆ 1979, PUJIN, RAJKOVIĆ 1979, PUJIN 1983). Besides the variation of species number by year, evident are also the differences by season (Fig. 1).

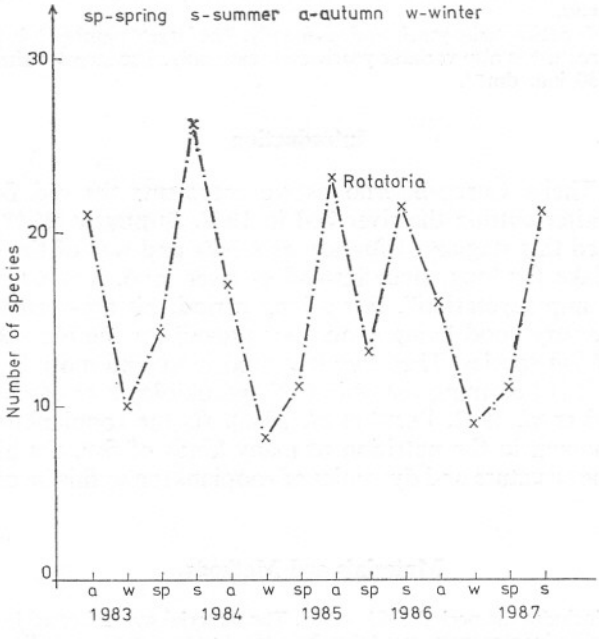

Fig. 1. Seasonal variatons of the number of species Rotatoria in the Dead Theiss Čurug—Biserno ostrvo (1983—1987)

Table 1. *Qualitative composition of zooplankton in the Mrtva Tisa (Yugoslavia) for the period 1983—1987*

Species	1983	1984	1985	1986	1987
Protazod					
Actinosphaerium eichorni (EHR.)		+		+	+
Aspidisca costata (DUJ.) CL et L.	+	+		+	
Arcella vulgaris EHR.	+	+	+	+	+
Centropyxis aculeata STEIN	+	+	+		
Difflugia limnetica LEVANDER	+	+	+	+	+
D. pyriformis PERTY	+		+		
Carchaesium polypinum L.			+	+	
Didinium nasutum O.F.M.				+	+
Dileptes anser O.F.M.			+	+	+
Epistylis plicatilis EHR.	+	+			+
Paramecium aurelia EHR.	+	+	+	+	+
P. caudatum EHR.			+	+	+
Tintinnidium fluviatilis STEIN et KENT	+	+	+	+	+
Tintinnopsis lacustris ENTZ.	+	+	+	+	+
Vorticella campanulata EHR.	+	+	+	+	+
V. microstoma EHR.			+	+	+
Rotatoria					
Anueropsis fissa GOSSE	+	+	+	+	+
Asplanchna brightwelli GOSSE	+	+	+	+	+
A. priodona GOSSE	+	+	+	+	+
A. sieboldi (LEYDIG)		+		+	
Brachionus angularis GOSSE	+	+	+	+	+
B. budapestinensis DADAY	+	+	+	+	+
B. calyciflorus PALLAS	+	+	+	+	+
B. diversicornis DADAY	+			+	+
B. leydigi COHN				+	+
B. quadridentatus HERMANN	+			+	
B. urceolaris O.F.M.	+	+		+	
B. urceolaris var. *rubens* EHR.			+	+	
Cephalodella gracilis EHR.	+	+	+		
C. tecta DONNER	+				
C. ventripes (DIXON—NUTALLI)	+	+			
Colurella adriatica (EHR.)	+		+	+	+
C. colurus (EHR.)	+	+	+	+	+
C. oblonga DONNER			+		
C. uncinata (EHR.)	+	+	+	+	+
Dicranophorus forcipatus (MÜLL).			+		
Epiphanes senta (MÜLLER)					+
Euchlanis dilatata (EHR.)		+		+	
E. oropha GOSSE	+				
Filinia brachiata (ROUSSELET)			+		
F. longiseta (EHR.)	+	+	+	+	+
Keratella cochlearis GOSSE	+	+	+	+	+
K. cochlearis var. tecta GOSSE	+	+	+	+	+
K. hiemalis CARLIN	+	+			
K. quadrata (MÜLLER)	+	+	+	+	+
K. valga f. *monospina* (KLAUSSENER)	+	+	+	+	+
Lecane ludwigi (ECKSTEIN)	+	+			
L. lunaris (EHR.)	+	+	+		
Liliferotrocha subtilis RODEWALD			+	+	+
Polyarthra dolichoptera IDELSON	+	+	+	+	+
P. euryptera WIERZEJSKI	+	+	+	+	+

Species	1983	1984	1985	1986	1987
P. major BURCKHARDT	+	+			
P. vulgaris CARLIN	+	+	+	+	+
Pompholyx sulcata HUDSON			+	+	+
Rotaria neptunoidea HARRING				+	+
R. rotatoria (PALLAS)	+	+	+	+	+
Synchaeta stylata WIERZEJSKI		+		+	+
S. pectinata EHR.	+	+	+	+	+
Trichocerca capucina (WIER. et ZACHARIAS)			+	+	+
T. rattus (MÜLLER)	+	+	+	+	+
Cladocera					
Alona quadrangularis (O.F.M.)	+	+	+	+	+
Alonella excisa FISCHER					+
Bosmina coregoni BAIRD	+	+	+		+
B. longirostris (O.F.M.)	+	+	+	+	+
Ceriodaphnia quadrangula O.F.M.					+
Chydorus sphaericus O.F.M.	+	+			+
Daphnia cuculata SARS	+	+	+	+	+
D. longispina O.F.M.	+	+	+	+	+
Diaphanosoma brachyurum (LIEVIN)	+	+		+	+
Leptodora kindti (FOCKE)		+	+		
Moina micrura (KURZ) ŠRAMEK—HUŠEK		+		+	+
M. rectirostris (LEYDIG)					+
Scapholeberis kinhi SARS					+
Sida cristalline (O.F.M.)		+			+
Copepoda					
Acanthocyclops robustus (SARS)				+	+
A. vernalis (FISCHER)	+	+	+	+	+
Cyclops strenuus FISCHER				+	+
C. vicinus ULJANIN	+	+	+	+	+
Eucyclops serrulatus (FISCHER)				+	+
Eudiaptomus gracilis SARS	+	+	+	+	+
Mesocyclops leuckarti CLAUS		+	+	+	+
Thermocyclops crassus (FISCHER)	+	+	+	+	+

Cladocera and Copepoda were represented with far smaller number of species. In the investigated period, we ascertained 14 species Cladocera and 8 species *Copepoda*. In this case, as with Rotatoria, we considered genuine plankton species — *Bosmina longirostris, Moina micrura,* the species of the genus *Daphnia* and *Ceridaphnia,* as well as periphitonous *Chydorus, Leptodora* and *Sida.* It should be mentioned that *L. kindti* and *S. crystallina* appeared in particular periods in greater number. These species are characteristic for slow and stagnant waters with a well developed macro-vegetation. ŽIVKOVIĆEVA (1973) asertained *S. crystallina* in Obedska bara (Vujića okno) as permanently present in the period April to September. The same author noted as dominant species *Bosmina longirostris,* which was the case also in the Dead Theiss.

The majority of ascertained species of Copepoda appeared in all investigated years, except *A. robustus, C. strenuus* and *E. serrulatus.* A similar structure of Cladocera and Copepoda was ascertained in the Theiss (RATAJAC 1981, PUJIN et *al.* 1984). In relation to variation in number of the species Cladocera and Copepoda by year, the largest number appeared in 1987 (13 species Cladocera and 8 Copepoda),

the smallest in 1985. Seasonal variation of species number is also expressed. The largest number appear in summer and the least in winter (Table 2).

According to the results of previous investigations, a similar structure of zooplankton was ascertained (RISTIĆ et *al.* 1974). However, according to KALAFATIĆ et *al.* (1982), a much poorer zooplankton structure is quoted for this eco-system, especi-

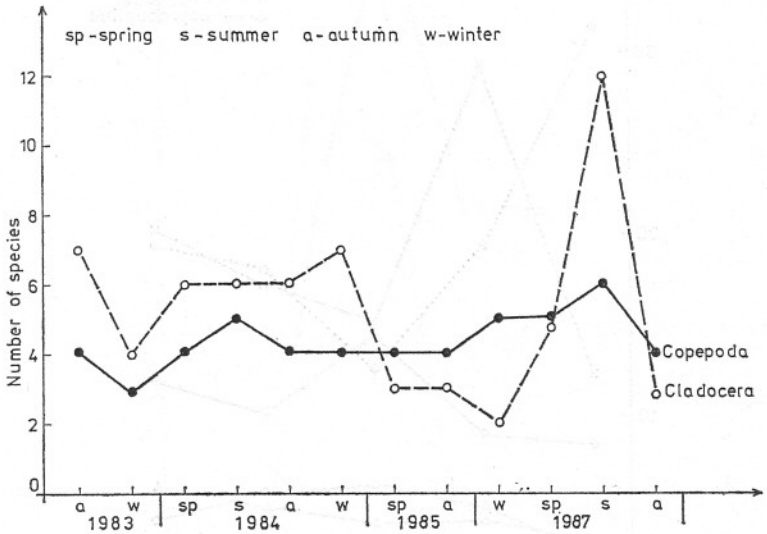

Fig. 2. Seasonal variations of the number of species Crustacea in the Dead Theiss Čurug—Biserno ostrvo (1983—1987)

ally regarding Rotatoria — only 11 species. According to these data, the number of species of Cladocera was somewhat larger (15), while the number of Copepoda was the same (8). These differences probably can be attributed to the period of sample taking. Namely, the quoted authors were taking the samples only in April and June.

The quantitative structure of zooplankton varies by year (Fig. 3). The largest values were obtained in the year 1984. On the base of these values, this eco-system could be characterised as eutrophic with differences in the degree of eutrophisation, depending on the region. These differences were pointed out also in previous researches (RISTIĆ et *al.* 1974).

Seasonal variations of the quantitative structure are also expressed. Since, for the production of zooplankton, crustacea are exceptionally important, we are giving the variations on Fig. 4 for Copepoda and Cladocera by season for the year 1987. The particulars show that the maximum of Cladocera and Copepoda fall in summer, while nauplius stadium of Copepoda in spring. In the winter period the values are the lowest.

Conclusion

On the basis of dynamics and structure of zooplankton in the Dead Theiss Čurug-Biserno ostrvo, in the period 1983—1987, we can conclude the following:

In the investigated period in the structure of zooplankton, a total of 80 species

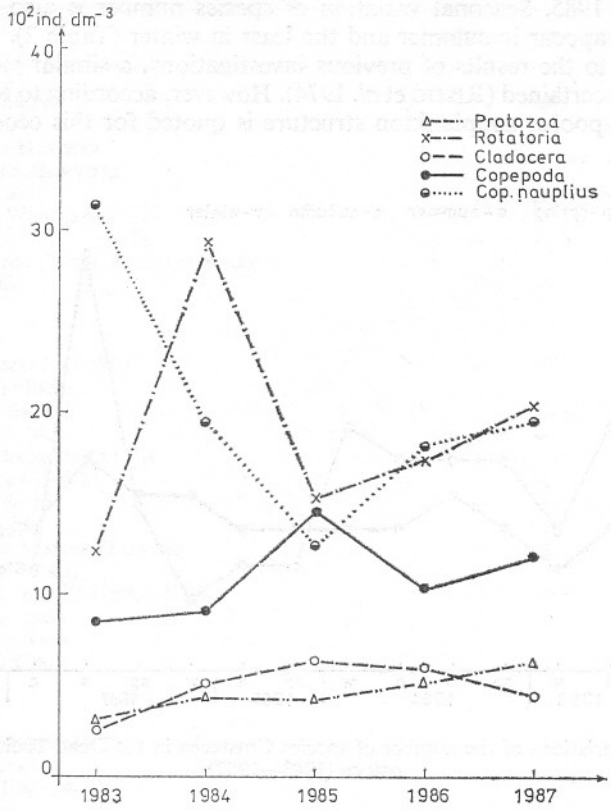

Fig. 3. Mean values (ind. dm^{-3}) of zooplankton in the Dead Theiss Čurug—Biserno ostvro (1983—1987)

was ascertained, out of which 16 Protozoa (20%), 43 Rotatoria (53.75%), 13 Cladocera (16.2%) and 8 Copepoda (10%).

Rotatoria represent the most diverse group and the largest number of species belong to the genus *Brachionus, Keratella, Polyarthra.* Especially interesting is the appearance of species *Liliferotrocha subtilis,* which was not recorded earlier while now it is more and more present in summer.

Of Cladoceras, permanently present are species *Bosmina longirostris, Daphnia cuculata* and *D. longispina,* and of Copepoda, *Eudiaptomus gracilis* and *Thermocyclops crassus.*

In relation to the river Theiss, about 70% species in the Dead Theiss are present in both water eco-systems.

The number of species varies by year and seasonally. The largest number of species appear in summer, the smallest in winter.

The quantitative structure also varies yearly and seasonally. The highest values were recorded in 1984, 6.730 ind.dm^{-3}.

On the base of such a structure, we can characterize the Dead Theiss Čurug-Biserno ostrvo as an eutrophic water with certain variations of degree, depending on the region.

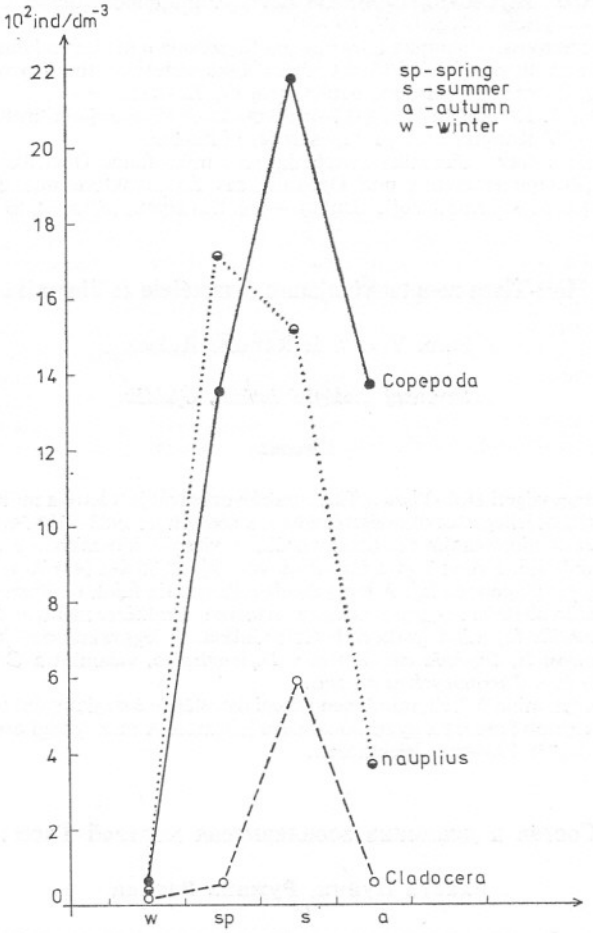

Fig. 4. Seasonal variations of numerical values of Crustacea in the Dead Theiss Čurug—Biserno ostrvo (1987)

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A Holt-Tisza zooplanktonjának összetétele és dinamikája

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Kivonat

A csúrog—gyöngyszigeti Holt-Tisza a Tisza szabályozásával jött létre a múlt században. Ebben a halászat szempontjából jellegzetes ökoszisztémában, a szerzők az 1983—1987-es időszakban a zooplankton összetételét és dinamikáját tanulmányozták. A vizsgált időszakban a zooplankton összetételében 80 faj fordult elő. Ennek 20%-a (16) Protozoa faj, 53.75%-a (43) Rotatoria, 16,2%-a (13) Cladocera, és 10%-a (8) Copepoda faj. A leggyakoribb Rotatoria fajok (a *Branchionus, Keratella* és *Polyarthra*) az Alföldön általában elterjedt nemhez tartoznak. Említésre méltó az ezidáig nem regisztrált *Liliferotrocha subtilis* faj mind gyakoribb előfordulása. A leggyakrabban jelenlévő Cladocera fajok: *Bosmina longirostris, Daphnia cuculata* és a *D. longispina,* valamint a Copepodák közül az *Eudiaptomus gracilis* és a *Thermocyclops crassus.*

A zooplanktonnak mind fajbeli, mind mennyiségi összetétele évszakonként és évenként különbséget mutat. A legnagyobb fajszám a nyári hónapokra jellemző. A mennyiségi összetétel legnagyobb értéke (6.730 ind. dm^{-3}) 1984-ben jelentkezett.

Состав и динамика зоопланктона мертвой Тиссы

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Резюме

Мертвая Тиса в районе м. Чуруг—Жемчужный остров является рукавом реки Тиса, созданным пересечением русла реки еще в прошлом веке. В период с 1983 по 1987 г.г. проводились испытания состава и динамики зоопланктона этой, в рыболовном отношении, интересной экосистемы. В течение вышеуказанного периода, в составе зоопланктона наблюдалось всего 80 видов, из которых 16 Protozoa (20%), 43 Rotatoria, (53,75%), 13 Cladocera (16,2%) и 8 Copepoda (10%). Чаще всего к составу вида Rotatoria относятся роды *Brachionus, Keratella Polyarthra.* Указанные часто появляются и в других водоемах паннонского бассейна. При этом интересно указать на присутствие вида *Liliferotrocha subtilis,* появляющегося все чаще, что ранее не наблюдалось. Из Cladocera чаще всего наблюдается присутствие видов *Bosmina longirostris, Daphnia cuculata* и *D. longispina,* а из *Copepoda-Eudiaptomus gracilis i Thermocyclops crassus.*

Количество видов варьирует как по годам, так и по сезонам. Самое большое количество наблюдается в летнем периоде. Количественный состав также варьирует по годам и сезонам. Самые большие значения наблюдались в 1984 годи — 6.730 инд. $дм^{-3}$.

Sastav i dinamika zooplanktona mrtve Tise

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Izvod

Mrtva Tisa Čurug—Biserno ostrvo predstavlja rukavac reke Tise nastao presecanjem korita još u prošlom veku. U periodu 1983—1987 ispitivani su satsav i dinamika zooplanktona ovog u ribolovnim pogledu interesantnog ekositema. U navedenom periodu u sastavu zooplanktona ukupno je konstatovano 80 vrsta, od toga 16 Protozoa (20%), 43 Rotatoria (53,75%), 13 Cladocera (16,2%) i 8 Copepoda (10%). Najčešće vrste u sastavu Rotatoria pripadaju rodovima *Branchionus, Keratella* i *Polyarthra*. Ovi rodovi čine najzastupljenije rodove i u drugim vodama panonskog bazena. Interesantno je navesti prisustvo vrste *Liliferotrocha subtilis*, koja se sve češće javlja, a ranije nije bila zabeležena. Od Cladocera su najčešće prisutne vrste *Bosmina longirostris, Daphnia cuculata* i *D. longispina*, a od *Copepoda, Eudiaptomus gracilis* i *Thermocyclops crassus*.

Broj vrsta varira kako po godinama, tako i sezonama. Najveći je u letnjem periodu. Kvantitativni sastav takodje varira po godinama i sezonama. Najveće vresnosti su zabeležene 1984. god. 6.730 ind. dm^{-3}.