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Long-term changes of Crustacean (Cladocera, Ostracoda, Copepoda) assemblages in Szigetköz Floodplain Area (Hungary) 1991–2002

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Abstract: In this paper the distribution of Cladocera, Ostracoda and Copepoda species in the different sites (main channel of the Danube, active floodplain, protected floodplain) of the Szigetköz is described. Due to the intensive water engineering activities the composition of the zooplankton assemblages were basically changed in the area disappearing individual characteristic of the Crustacean fauna. Between 1991 and 2002 106 Crustacean taxa (69 Cladocera, 11 Ostracoda, 26 Copepoda) were recorded in the Szigetköz. In the last 5 years 16 Cladoceran and 8 Copepod species were disappeared as well as *Moina brachiata* and *Alona intermedia* have widely distributed in the Szigetköz. The most diverse communities were formed in the Lipóti-march, 92 species were recorded among the 106 and the mean annual species richness (34) was also here the largest.

Zusammenfassung: Es wurden die langjährigen Veränderungen der Zusammensetzung der planktonischen Crustaceengemeinschaften (Cladocera, Ostracoda, Copepoda) von den verschiedenen Gewässern des Nebenarmsystems der Kleinen Schüttinsel („Szigetköz") untersucht. Zwischen 1991 und 2002 wurden 106 Taxa erwähnt. In den letzten 5 Jahren waren von diesen schon die Vertreter von l6 Cladocera und 8 Copepoda Taxa nicht auffindbar, gleichzeitig aber sind die Taxa *Moina brachiata* und *Alona intermedia* häufig geworden.

Key words: Danube, Szigetköz, Cladocera, Ostracoda, Copepoda

Introduction

The Szigetköz Foodplain Area is situated in the northwestern part of Hungary, between 1850–1793 rkm and divided into three section: main Danube branch, active floodplain and protected floodplain. In the nineties significant hidrological and morfological changes were occurred on the Szigetköz Danube stretch mainly due to the construction of the Dunakiliti water reservoir and the regulation of the river. The active connection between the abandoned Danube stretch and the side-arm system in the floodplain was disappeared and the water supply of the protected floodplain was materialized through the artificial water recharge system. Due to the intensive water engineering activities the characteristic of the alluvial stages, the water-supply, the trophic structure and the composition of

phytoplankton KISS (1998) and zooplankton assemblages BOTHÁR (1998) were basically changed in numerous active and protected floodplain side arms. In consequence of the artificial water recharge system the water flow and the connection with the main river become permanent in most part of the side arms disappearing individual characteristic and special phytoplankton and zooplankton assemblages.

Intensive hydrobiological investigations of this region started in 1989 by the Hungarian Danube Research Station to monitor the environmental impacts of the river regulation. The aim of this study to investigate the Cladocera, Ostracoda and Copepoda fauna of this region and detect long-term changes in the composition of Crustacean assemblages.

Material and Methods

Sampling was carried out 3 or 4 times a year (usually May, July, August and October) in the main Danube (Dunakiliti 1843 rkm, Ásványráró 1816 rkm, Szap 1811 rkm) from 1994, in the active floodplain (Schisler dead-arm, Csákányi-Danube, Ásványi-Danube) from 1991, and in the protected floodplain (Lipóti march (from 1993) and Zátonyi-Danube (from 1992).

The zooplankton sample was collected from the open water and filtered through a 70 μm mesh net then preserved in 4% formalin. Between 1991 and 1998 sampling was more extensive BOTHÁR et al. (1994), quantitative samples were taken from different habitats: integrated samples from the surface layer of the open water, from the whole water column, from the bottom, and from water bodies among littoral vegetation and aquatic macrophytes. From 1999 the survey was widen out with ostracodological studies because the ostracod fauna of the Szigetköz is absolutely unexplored. Microcrustaceans was enumerated by using inverted microscopy and identified to species level.

Results and Discussion

Between 1991 and 2002 106 Crustacean taxa (69 Cladocera, 11 Ostracoda, 26 Copepoda) were recorded in the Szigetköz (Table 1.). *Bosmina longispina* and the 11 Ostracoda species were new faunistic records on the Szigetköz. The results show similarities as compared with GULYÁS (1994) species list. From 58 Cladocera and 29 Copepoda species, 50 Cladocera and 24 Copepoda correspond with our results. During the twelve years 13 taxa (*Alona guttata* var. tuberculata, *Alona rustica, Daphnia magna, Ceriodaphnia setosa, Lathonura rectirostris, Leptodora kindtii, Macrothrix rosea, Moina micrura, Cyclops stenuus, Eudiaptomus zachariasi, Paracyclops affinis, P. poppei* and *Bunops serricaudata*) were found only on occasion and were proved to be rare species of the Szigetköz. The most frequent species were *Bosmina longirostris, Chydorus sphaericus, Disparalona rostrata, Pleuroxus aduncus, Pleuroxus truncatus, Scapholeberis mucronata, Sida crystallina, Acanthocyclops robustus* and *Eucyclops serrulatus*.

In the last 5 years 16 Cladocera and 8 Copepoda species were disappeared from the sampling sites. Most part of the absent species belong to the macrophyte-associated species and supposedly we could not detect the lack of the detailed examination of macrophyton communities. The disappearence of *Bosmina coregoni, Daphnia pulex* and *Monospilus dispar* probably caused by the changes of alluvial characteristic, current velocity and the increased eutrophication. The abundance of euplanktonic copepod species (*Cyclops vicinus, Acanthocyclops robostus, Thermocyclops oithoides, T. crassus*) also decreased similar to the observation of VRANOVSKY (1997).

On the contrary in the last few years some species present or its abundance increased in the sampling sites. In 1999 *Moina brachiata* appeared in the Schisler dead-arm and in the last three years it has widely distributed in the Szigetköz. In the nineties *Alona intermedia* was detected only from the active floodplain but between 1998 and 2002 this species inhabited most part of the sampling sites.

41 taxa (27 Cladocera, 3 Ostracoda, 11 Copepoda) were recorded on the sampling sites of River Danube. The assemblages were characterised by the dominance of copepodites and nauplii and the abundance was low (10 ind./100 L).

The consequence of the artificial water recharge system the water level was increased in the side arms of the active floodplain. The number of the species and the abundance of the assemblages was decreased in the Ásványi-Danube and the Csákányi-Danube. The abundance of the assemblages was the largest in the Schisler dead-arm supposedly because of the homogeneous or sometimes mixed stands of *Ceratophyllum demersum*. 66 taxa (44 Cladocera, 3 Ostracoda, 19 Copepoda) were occurred and the rare *Alona rustica* and *Leptodora kindtii* were recorded only in this side arm. The zooplankton communities were characterized by the dominance of *Bosmina longirostris, Sida crystallina, Eudiaptomus gracilis, Eucyclops serrulatus* and *Mesocyclops leuckarti*. The abundance of euplanktonic *Acanthocyclops robustus* was significant decreased at the same time *Moina brachiata* became frequent in the dead-arm.

The most diverse assemblages were formed in the side arms of the protected floodplain. In the Zátonyi-Danube which is the main arm of the water recharge system on the protected floodplain, the water level was gradually increased and the different macrophyton communities were degraded. The abundance of the macrophyte-associated species decreased but these species were existed in the new habitats which formed among the flooded willow-beds. In the Lipóti-march 92 species were recorded among the 106, which have been collected in the Szigetköz since 1991 and the mean annual species richness (34) was also here the largest. The preserve value of this ox-bow lake is prominent in the Szigetköz, the uniformisation of the assemblages and the disappearance of the species have not occurred in this sampling sites. During the sampling period 10 Cladocera, 4 Ostracoda and 3 Copepoda were detected only from this site among others the rare *Acroperus elongatus* and *Ceriodaphnia setosa*. The most characteristic species of the march were *Ceriodaphnia megops, Ceriodaphnia reticulata* and *Polyphemus pediculus*. Since 1993 there was no significant differences in the composition of

the zooplankton assemblages, the species number and the ratio of the macrophyte-associated species was also high. The most frequent species were *Pleuroxus truncatus* and *Sida crystallina*.

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Table 1. Distribution of the species in the Szigetköz between 1991 and 2002.

CLADOCERA	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Acroperus elongatus (Sars)						L		P	L			
Acroperus harpae (Baird)	S	A	L	AP	AP	L	L	P		L	X	AP
Alona affinis (Leydig)	S	P		L					DL	S	D	P
Alona costata Sars		S		A	S			SL		SL	P	AP
Alona guttata Sars		S	S	A	LS	LS	A	AP	L			P
A. guttata var. *tuberculata* Kurz					S							
Alona intermedia Sars				A		S		AP	A	SL	AP	X
Alona quadrangularis (O.F.M.)	A	A	AP	X	D	D	P	X	AP			X
Alona rectangula Sars	S	S	AP	AP	AP	AP	AP	AP	P			
Alona rustica Scott				S								
Alonella excisa (Fischer)		A		L							L	P
Alonella exigua (Lilljeborg)			P	P								
Alonella nana (Baird)	S	S	P	P			L	AP	AP	AP	AP	L
Bosmina coregoni Baird				D	D	D	D					
Bosmina longirostris (O.F.M.)	A	A	AD	X	AD	AD	PD	X	X	X	X	X
Bosmina longispina Leydig										D		
Bunops serricaudata (Daday)												L
Camptocercus lilljeborgi Schoedler			P	P	L	L	L	L	LD		A	L
Camptocercus rectirostris Schoedler											AP	L
Ceriodaphnia dubia Richard				L			L	L				
Ceriodaphnia laticaudata P.E.M.			S	L	L							
Ceriodaphnia megops Sars	S		SL	L	L	L	L	L				L
Ceriodaphnia pulchella Sars	S	A			L	SL	L	L	X		AP	L
Ceriodaphnia quadrangula (O.F.M.)				A	L					X	X	X
Ceriodaphnia reticulata (Jurine)			L		L		L		L	L	L	L
Ceriodaphnia setosa Matile						L						
Chydorus gibbus Sars	S	S	AP	AP			L	AP	AP			
Chydorus latus Sars	S					L	AP	P	L			
Chydorus ovalis Kurz						P	AP	AP	S			
Chydorus piger Sars				P			P			S		
Chydorus sphaericus (O.F.M.)	X	X	X	X	X	X	X	X	X	X	X	X
C. sphaericus var. *caelatus* Schoedler			L		L							
Daphnia cucullata Sars	S	A		AD			D			AD	AD	X
Daphnia hyalina Leydig	A		P			D		A	X			
Daphnia longispina O.F.M.			L	L		PD	L	L	AD		L	
Daphnia magna Straus			L									
Daphnia pulex Leydig			L	L	L							
Diaphanosoma brachyurum (Liévin)	S	A	S	A	AP	AP		AP	AP	AP	DP	AP
Disparalona rostrata (Koch)	S	A	AP	AP	X	DP	AP	P	D	X	AP	DP
Eurycercus lamellatus (O.F.M.)	S	S	AP	AP	L	L	L	AP	A	D		
Graptoleberis testudinaria (Fischer)		S	S	P	AP	AP	AP	AP	AP	P	X	P

Table 1. (continued)

CLADOCERA	**'91**	**'92**	**'93**	**'94**	**'95**	**'96**	**'97**	**'98**	**'99**	**'00**	**'01**	**'02**
Iliocryptus agilis Kurz	S	A					L		D			L
Iliocryptus sordidus (Liévin)	S	A		A	D		AP		D			
Kurzia latissima (Kurz)				L				L				
Lathonura rectirostris (O.F.M.)					A							
Leptodora kindtii (Focke)	S											
Leydigia leydigi (Schoedler)	S	S		A					L			
Macrothrix hirsuticornis N.et Brady	S	S		AD	AD			L	D		X	L
Macrothrix laticornis (Fischer)	S	S	L									
Macrothrix rosea (Liévin)			L									
Megafenestra aurita (Fischer)			L				L	AP				
Moina micrura Kurz		A										
Moina brachiata (Jurine)									S	SL	X	X
Monospilus dispar Sars	S		P	AP	A							
Oxyurella tenuicaudis (Sars)					L	P	P		L			
Pleuroxus aduncus (Jurine)	S	S	AP	AP	AP	P	AP	AP	D	X	D	A
P. aduncus var. *coelatus* Weigold				AP						A	X	DL
Pleuroxus laevis Sars		A		L	L	P	P					
Pleuroxus trigonellus (O.F.M.)	S	S	P	AP	L		AP	AP				
Pleuroxus truncatus (O.F.M.)	S	S	S	SL	L	SL	SL	SL	X	P	X	X
Pleuroxus uncinatus Baird	S			…					S			
Polyphemus pediculus (Linné)				…L	L	L	L	L		L	L	
Pseudochydorus globosus (Baird)				L	L	L	AL	P				
Scapholeberis rammneri D. et P.			L	A				P				
Scapholeberis mucronata (O.F.M.)	S	S	AP	AP	X	AP	X	AP	L	SL	P	AP
Sida crystallina (O.F.M.)	S	S	AP	AP	AP	LS	AP	AP	LS	AD	X	LS
Simocephalus exspinosus (Koch)			L	L	AL	L	L	SL				
Simocephalus serrulatus (Koch)	S			AP		P	P	AP				
Simocephalus vetulus (O.F.M.)	S	S	AP	AP	X	AP	AP	AP	AL	X	P	P
Total: 69	**31**	**30**	**34**	**47**	**36**	**33**	**37**	**37**	**33**	**24**	**27**	**30**
COPEPODA	**'91**	**'92**	**'93**	**'94**	**'95**	**'96**	**'97**	**'98**	**'99**	**'00**	**'01**	**'02**
Acanthocyclops robustus (Sars)	A	A	AP	X	X	X	X	SP	X	DP	A	LS
Acanthocyclops vernalis (Fischer)		S		D				D		DS		
Canthocamptus staphylinus (Jurine)											X	AL
Cryptocyclops bicolor Sars			P	P	L							
Cyclops strenuus Fischer											D	
Cyclops vicinus Uljanin	A	A		X			D					
Diacyclops bicuspidatus (Claus)	S	S	SL								AL	
Ectocyclops phaleratus (Koch)		S	LS	AP	AL	SP	LS	L			L	
Eucyclops macrurus (Sars)	S		P	AP	P	P				L	L	L
Eucyclops macruroides (Lilljeborg)				P	L	L						
Eucyclops serrulatus (Fischer)	S	AP	SP	X	X	SP	X	AP	X		X	X
Eucyclops speratus (Lilljeborg)		S		P	A	P	L	SL				
Eudiaptomus gracilis (Sars)	A		S	L	DS	S		A	X	AP	X	S
Eudiaptomus zachariasi (Poppe)			L									
Eurytermora velox (Lilljeborg)	S	A	S	AP	X	AP	X	X		D	L	P
Macrocyclops albidus (Jurine)	S	S	AP	AP	AL	P	AP	AP	L	P	AP	L
Macrocyclops distinctus (Richard)			L	P								

Table 1. (continued)

COPEPODA	**'91**	**'92**	**'93**	**'94**	**'95**	**'96**	**'97**	**'98**	**'99**	**'00**	**'01**	**'02**
Macrocyclops fuscus (Jurine)				P	AP	L		L				
Megacyclops viridis (Jurine)	S	A	L	AP	L	L	L	L			L	
Mesocyclops leuckarti (Claus)	S	A	SL	A	X	SL	X	X		X	SL	AP
Microcyclops varicans (Sars)	S	S		P		L					L	L
Paracyclops affinis (Sars)											AP	
Paracyclops fimbriatus (Fischer)	S	S	S	AP		S	SD			P	P	
Paracyclops poppei (Rehberg)				L								
Thermocyclops crassus (Fischer)	S	S	AP	X	L	AP	AP	DP				
Thermocyclops dybowskii (Lande)			SL	AP			L					
Thermocyclops oithonodes (Sars)		A	S	S	S	AP	L	A			L	
Total: 26	**13**	**15**	**17**	**22**	**15**	**16**	**13**	**13**	**4**	**8**	**16**	**9**
OSTRACODA	**'91**	**'92**	**'93**	**'94**	**'95**	**'96**	**'97**	**'98**	**'99**	**'00**	**'01**	**'02**
Bradleystrandesia obliqua (Brady)										P		
Cypria ophtalmica (Jurine)									DL		D	A
Cyclocypris laevis (O. F. M.)											L	L
Cyclocypris ovum (Jurine)											L	L
Cypridopsis elongata (Kaufmann)											AP	L
Cypridopsis vidua (O. F. M.)											DP	L
Dolerocypris fasciata (O. F. M.)											L	
Limnocythere inopinata (Baird)												X
Notodromas monacha (O.F. Müller)									L			L
Physocypria kraepelini G.W. Müller												P
Prionocypris zenkeri (Ch. et Toth)									SL			
Total: 11									**3**	**1**	**6**	**8**
Total Crustacea:106	**44**	**45**	**51**	**69**	**51**	**52**	**50**	**50**	**40**	**33**	**49**	**47**

Key: D = Danube, A = active floodplain, S = Schisler dead-arm, P = protected floodplain, L = Lipóti-march, X = all sampling sites of the monitoring area.

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