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DATA ON ZOOPLANKTON OF BOVILLA WATERBODY

TË DHËNA MBI ZOOPLANKTONIN E TRUPIT UJOR TË BOVILLËS

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Përmbledhje

Gjatë studimit ndërdisiplinor në Liqenin e Bovillës gjatë periudhës 2006-2008 u krye edhe vlerësimi i zooplanktonit, i cili është përbërës i rëndësishëm për funksionin e një ekosistemi ujor, për qarkullimin e lëndës dhe energjisë në trupin ujor. Vlera maksimale e zooplanktonit ishte gjatë verës dhe vjeshtës, përkatësisht në periudhën korrik – shtator të viteve 2007 dhe 2008. Përfaqësuesit e grupit *Copepoda* ishin mbizotërues, kryesisht fazat larvare të tyre; më i zakonshëm ndër llojet e tjera *Cyclpoida* ishte kopepodi *Cyclops vicinus*. Llojet *Rotifera*, si *Polyarthra trigla, Keratella quadrata, Asplanchna priodonta* dhe *Ascomorpha* sp., kanë pasur vlera kulmore, veçanërisht në pranverë deri në fund të verës. Llojet *Cladocera*, si *Diaphanosoma brachiurums, Bosmina longirostris* dhe *Ceriodaphnia quadrangula* shtoheshin gjatë fundit të verës, ndërsa *Bosmina longirostris* dhe *Daphnia* spp. U panë më me shumicë gjatë pranverës.

Duke u mbështetur në të dhënat stinore të zooplanktonit mund të pohojmë, nga njëra anë karakterin e theksuar stinor të zhvillimit të tij, dhe nga ana tjetër ndryshime të shpeshta edhe brenda periudhës së shkurtër të marrë në shqyrtim. Këto ndryshime janë të lidhura edhe me faktin se Liqeni i Bovillës përfaqëson një trup ujor të paformuar plotësisht, dukuri kjo e vërtetuar edhe në mjaft ekosisteme ujorë artificialë në vende të tjera.

Abstract

The zooplankton of an artificial lake, important as drinking water supply for Tirana city, was studied in the years 2006-2008. Maximum of the total zooplankton was evidenced during summer and autumn; following the analyses the highest value was registered in July – September 2007 and 2008. The species of the subclass *Copepoda* were dominant during the all investigated period, especially the larval and kopepodid stages which were presented with great numerical values. The cyclopoid copepod *Cyclops vicinus* was dominant among other species of *Cyclpoida*. *Rotifera* species, *such as Polyarthra trigla, Keratella quadrata, Asplanchna priodonta* and *Ascomorpha* sp., showed peaks, particularly in spring, summer and late summer. *Cladocera* species, like *Diaphanosoma brachiurums, Bosmina longirostris* and *Ceriodaphnia quadrangula* increased in late summer, whereas *Bosmina longirostris* and *Daphnia* spp. were prominent in spring.

There has been a recorded clear change among species and timing of zooplankton composition for the short time period; most probably, it can be linked with an unsaturated water body, as it is the Bovilla reservoir. It might be related also to biotic diversity, as to zooplankton quantity that showed certain changes in the pelagic area.

Key words: Eutrophication, environment, freshwater biodiversity, ecosystem, water quality, ecological monitoring, zooplankton bioindicators, Bovilla reservoir

Introduction

Man-induced eutrophication or changes in biodiversity are nothing new: they are a well-known consequence of human culture. Eutrophication phenomena accompanied all human settlements. Even in the early days of mankind human activities resulted in ecosystem changes. Since classical and medieval times there have been 'clean-ups' of unsanitary, plague-ridden cities.

Eutrophication is thus the oldest environmental problem of human civilization and not a recent phenomenon. However, with the significant increase of human population over recent decades, eutrophication has developed from a more or less local to a global issue. The consequences of this, such as discolored waters, 'rotten' bottom water, odor and reduced fishing yields are obvious to even a casual observer (Wassmann & Olli, 2005)

The consequences of that are changes in qualitative and quantitative compositions of biocenoses. Because of that it is possible to explore conditions in some ecosystems by using composition of organisms that live in it – bio-indicators (Uhlman, 1998). The zooplankton species are important part of the trophic pyramid in all kind of aquatic basins; hence, they are important food chain in the production of freshwater ecosystems. Being rather tolerant to different environmental conditions, many zooplankton species are good indicators of water quality and can be used for the ecological monitoring of water bodies (Ramadan, 1963; Hutchinson, 1967; Sladacek & Tucek, 1975; Pujin, 1982; 1987; Tilman, 1984; Somer, 1989; Strashkraba *et al.,* 1993; Reh, 1997; Zurek, 1991; Gliwicz, 1977; 1988; Gliwitz *et al.,* 2001; Shumka, 1994; 1996; 1998; 2000).

The aim of this study was to explore the zooplankton of Bovilla reservoir (Tirana) and determine the water quality on the basis of the noted bioindicative species. Preliminary data were partly presented at the III Congress of Ecologists of Macedonia with international participation, 06-09.10.2007, Struga, and published at the related proceedings (Shumka & Nikleka, 2008)

Material and methods

The zooplankton in the open part of the Bovilla reservoir was investigated on with a two-month frequency, during May 2006- September 2008, along with other physical, chemical and biological parameters that are presented in this volume (Çullaj *et al*., Nr. 2; Koni *et al*., Nr. 3; Hoxha & Emiri, Nr. 6; etc.), within the joint research project SCOPES 2005-2008 (nr. IB7320-111032). The samples were collected at the open part of the reservoir respectively at the depths of 0, 3, 5, 10, 15, in three different stations (S1, dam; S2, right arm; S3, left arm) during period May 2006-May 2007; and only in S1, but adding also the depths 20, 30 and 40 m, during July 2007-may 2008. Two liters of water,

taken with Ruttner bottle (2 L) ate each depth for the quantitative analyses, was soon filtered with Nanzen plankton net (mesh size 20 μm) (Fig. 4-1), collected in plastic bottles (50 ml), and soon fixed with formaldehyde (up to 4%) in the boat. Another vertical net sample was taken with Nanzen plankton net (mesh size 20 μm) for the qualitative analyses.

The counting was done immediately after collection, using an inverted optical microscope OPTICA 2000**;** for the determination of species was used also a stereomicroscope. The photographs of some zooplankton species are made with MOTIC-1200 microscope. The estimation was made based on Standard Methods for the Examination of Water and wastewater (Clesceri *et al.,* 1997). Saprobic analysis was done using standard Pantle-Buck method (Pantle-Buck, 1955), based on qualitative and relative quantitative composition of *Rotifera*, *Cladocera* and *Copepoda* species. Data elaboration was done in Microsoft Excel and using the Software C2 for ecological and palaeoecological data analysis and visualisation (Juggins, 2003).

Results and discussions

About 39 zooplankton species were identified in the open part of the reservoir, listed in table 4-1, that belong to *Cladocera* (21 species), *Rotatoria* (11) and *Copepoda* (7). *Brachionus angularis, Keratella cochlearis, Trichocerca capucina, Polyarthra trygla and Pompholyx sulcata* were found the most widespread from *Rotatoria;* from *Cladocera* there were *Bosmina longirostris* f. *typical,* and from *Copepoda* the most widespread there were the species *Cyclops vicinus* and *Mesosclops leuckarti.* Copepod species were dominant during the all investigated period, especially the larval and copepodid stage. The cyclopoid *copepod Cyclops vicinus* was dominant among other species of *Cyclpoida*. *Rotifera* species such as *Polyarthra trigla*, *Keratella quadrata, Asplanchna priodonta* and *Ascomorpha* sp., showed peaks, particularly in spring, summer and late summer. *Cladocera* species, like *Diaphanosoma brachiurums, Bosmina longirostris* and *Ceriodaphnia quadrangula* increased in late summer, whereas *Bosmina longirostris* and *Daphnia* spp. were prominent in spring.

Quantitatively, only few species were dominant, listed already in table 4-2, like rotators: *Asplanchna priodonta, Brachionus angularis, Kellicotia longispina, Keratella cochlearis, K. quandrangula, Polyarthra trygla*, cladocers *Bosmina longirostris* f. *typical*, f. *brevicornis*, f. *pellucida* B*. longispina, Diaphanosoma brachiurum*, copepods: *Cyclops vicinus, Eudiaptomus gracilis, Mesosclops leuckarti*, etc. (Table 4-2; Fig. 4-2 & 4-3) The most widespread and absolutely abundant was *Bosmina longirostris* f. typical (up to 1000 individuals/L in September 2006). Nauplius stage and copepodits were moderately present, too.


Figure 4-1

Figure 4-1. Moments of sampling zooplankton with Nanzen plankton net / Çaste nga kampionimi i zooplanktonit me rrjetë planktonike Nanzen (May 2006; Photo: Miho).

Figure 4-2. *Rotatoria* species from Bovilla: **a)** *Brachionus angularis*; **b)** *Asplanchna priodonta;* **c)** *Asplanchna priodonta* in different seasons. / Llojet *Rotatoria* nga Bovilla: **a)** *Brachionus angularis*; **b)** *Asplanchna priodonta;* **c)** *Asplanchna priodonta* në stinë të ndryshme (original drawing from L. Shumka).

Figure 4-3. Main species of *Cladocera* from Bovilla: **a)** *Bosmina longirostris;*
b) *Diaphanosoma brachiurum.* / Llojet *Cladocera* kryesore nga Bovilla: **a)** *Bosmina longirostris;* **b)** *Diaphanosoma brachiurum.*


Figure 4-2c


Figure 4-2a

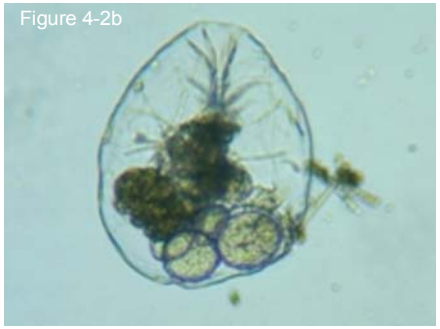
Figure 4-2b


Figure 4-3a


Figure 4-3b

Table 4-1. Checklist of zooplankton species observed in Bovilla waters, with related saprobic classes (s) and saprobic index (SI); o, oligosparobic; o–β, oligo-beta-saprobiç; β–α, beta-alfa-saprobic. / Lista e llojeve të zooplanktonit të gjetura në Bovillë, me klasat përkatëse saprobike (s) dhe treguesin saprobik (SI) (Pantle & Buck, 1955); o, oligosparobik; o–β, oligo-beta-saprobik; β–α, beta-alfa-saprobik.

Months & Zooplankton species	s	SI	May-06	July-06	Spet-06	Nov-06	Jan-07	March-07	May-07	July-07	Sept-07	Nov-07	Jan-08	March-08	May-08
ROTATORIA															
Brachionus quadridentatus	β–α	2.2	+	+	+	+			+						
Brachionus angularis	β–α	2.5	+	+	+	+	+	+	+	+	+	+	+	+	+
Keratella cochlearis	o	1.9	+	+	+	+	+	+	+	+	+		+	+	+
Keratella.c.v.macracantha	o	1.55	+						+						
Keratella quandrangula	β–α	1.55	+	+				+	+	+	+	+	+	+	+
Kellicotia longispina	o	1.1	+	+	+	+	+	+	+						
Ascomorpha ecuaudis	β–α	1.2	+	+	+			+	+						
Asplanchna priodonta	β–α	1.2	+	+	+			+	+						
Epiphane sp.	β–α	1.2	+	+	+			+	+					+	
Filinia longiseta	o	2.35	+	+	+		+	+	+				+	+	+
Lepadella sp.	o	1.7	+	+	+				+						
Pedalion sp.	β–α	1.5	+	+		+	+	+							
Pleosoma truncatum	β–α		+	+					+				+		
Polyarthra trygla	β–α	2.1	+	+	+	+	+	+	+	+	+	+	+	+	+
Polyarthra vulgaris	β–α	2.1	+	+	+	+		+	+						
Pompholyx sulcata	β–α	2.25	+	+	+	+	+	+	+		+				+
Synchaeta pectinata	β–α	2.2	+	+					+						
Testudinella sp.	β–α	1.5		+			+		+						
Trichocerca capucina	o	1.4	+	+		+	+	+	+	+	+	+	+	+	+
Trichocerca rectangularis	o	1.4		+	+				+						
Trichocerca similes	o	1.4		+	+	+	+		+						
CLADOCERA															
Allonella sp.	o	1.2												+	
Alona gutatta	o	1.2	+	+											
Bosmina longirostris f. brevicornis	o–β	1.55	+		+	+	+	+	+						
Bosmina longirostris f. pellucida	o–β	1.55	+	+	+	+	+		+						

Months & Zooplankton species	s	SI	May-06	July-06	Spet-06	Nov-06	Jan-07	March-07	May-07	July-07	Sept-07	Nov-07	Jan-08	March-08	May-08
Bosmina longirostris f. typical	o–β	1.55	+	+		+	+	+	+	+	+		+	+	+
Ceriodaphnia rectangulis	o–β	1.4												+	+
Chydorus sp.			+	+	+		+		+						
Diaphanosoma brachiurum	o	1.4				+			+	+	+		+		+
Moina longirostris	o	1.4												+	+
Scapholeberis mucronara	o	1.65	+	+	+	+			+						
COPEPODA															
Cyclops vicinus	o	1.55	+	+	+	+	+	+	+	+	+	+	+	+	+
Eucyclops serrulatus	o	1.55	+	+					+					+	+
Eudiaptomus gracilis								+							
Mesosclops leuckarti	o	1.55	+	+	+	+	+	+	+	+	+	+	+	+	+
Copepodit stage			+	+	+	+	+	+	+	+	+	+	+	+	+
Nauplius stage			+	+	+	+	+	+	+	+	+	+	+	+	+

Table 4-2. Most abundant species (more than 10 individuals/L) found in Bovilla, with their related ecological values, depth and period. **/** Llojet më të bollshme (me mbi 10 individë/L) të gjetur në Bovillë, bashkë me vlerat ekologjike përkatëse, thellësinë dhe periudhën.

Zooplankton groups (Ecological values)	Maximum value (x 1000 ind/m^3)	Depth, m	Period
ROTATORIA:			
Asplanchna priodonta (β–α, 1.2)	10-15	3, 10	March-08
	10-100	1-5	May-08
Brachionus angularis (β–α, 2.5)	10-15	1-3	March-08
Kellicotia longispina (o, 1.1)	20	5	May-07
Keratella cochlearis (o. 1.9)	30-110	3-5	May-06
	25-60	3-5	July-06
	20-70	3-5	Sept-06
	10	3	Nov-06
	10	3-5	Jan-07
	10	3	March-07
	20-100	3-5	May-07
	20-45	1-3	Sept-07
	15	5	May-08

Zooplankton groups (Ecological values)	Maximum value (x 1000 ind/m^3)	Depth, m	Period
Keratella quandrangula (β–α, 1.55)	10-15	1	July-07
Polyarthra trygla (β–α, 2.1)	50-90	3-5	May-06
	25-45	3-5	Sept-06
	55-90	3-5	May-07
	10-20	1-3	July-07
	10	1, 5, 15	March-08
	10-75	1-30	May-08
CLADOCERA:			
Bosmina longirostris f. brevicornis (*o*–β, 1.55)	10	5	March-07
Bosmina longirostris f. typical (*o*–β, 1.55)	100-220	3-10	May-06
	90-220	3-5	July-06
	100-1000	3-5	Sept-06
	10-35	3-5	Nov-06
	10-30	3-10	Jan-07
	10-120	1-5	March-07
	10-120	3-15	May-07
	10-200	1-3	July-07
	20-920	1-5	Sept-07
	20	5-10	March-08
	20-200	1-30	May-08
Bosmina longirostris f. pellucida (*o*–β, 1.55)	20	10	Jan-07
	10	3-5	March-07
Bosmina longispina	20	1	May-08
Diaphanosoma brachiurum (o, 1.4)	20-235	3-5	Sept-06
	10	3	Nov-06
	90	10	May-07
	10-20	1-3	July-07
	20-120	1-3	Sept-07
	15	5	May-08
COPPEPODA:			
Cyclops vicinus (o, 1.55)	50-120	3-10	May-06
	65-160	3-10	July-06
	30-180	1-10	Sept-06
	10-80	1-10	Sept-06
	10-60	3-10	Jan-07

Zooplankton groups (Ecological values)	Maximum value (x 1000 ind/m^3)	Depth, m	Period
	10-40	3-10	March-07
	50-150	3-15	May-07
	10-65	1-5	Sept-07
	10	10-15	May-08
Eudiaptomus gracilis	10	10-15	May-08
Mesosclops leuckarti	10-15	1-15	March-08
	10-50	10-15	May-08
Nauplius stage	20-120	3-15	May-06
	55-300	1-10	July-06
	30-220	3-15	Sept-06
	10-35	3-15	Nov-06
	10-25	3-10	Jan-07
	10-100	1-15	March-07
	20-190	1-20	May-07
	10-330	1-5	Sept-07
	10-50	1-20	March-08
	15-165	1-40	May-08
Copepodit stage	80-120	3-5	May-06
	50-220	1-5	July-06
	20-180	1-10	Sept-06
	3, 15	1-10	Nov-06
	10	1-3	Jan-07
	10-55	1-15	March-07
	10-80	1-30	May-07
	10-320	1-5	Sept-07
	10-25	5-15	May-08

The zooplankton showed maximum during September (Fig. 4-4) (3'450 individuals/L), dominated mainly from *Bosmina longirostris* f. *typical, Keratella cochlearis, Diaphanosoma brachiurum* and *Cyclops vicinus*. Considerable number of *Bosmina* females was revealed with eggs. Zooplankton growth was quite scarce during isothermic period, which correspond to November-January (Tab. 4-3; Fig. 4-4); it is worth to mention that during that period the highest rainfall happen in the region and the water is at its highest level.

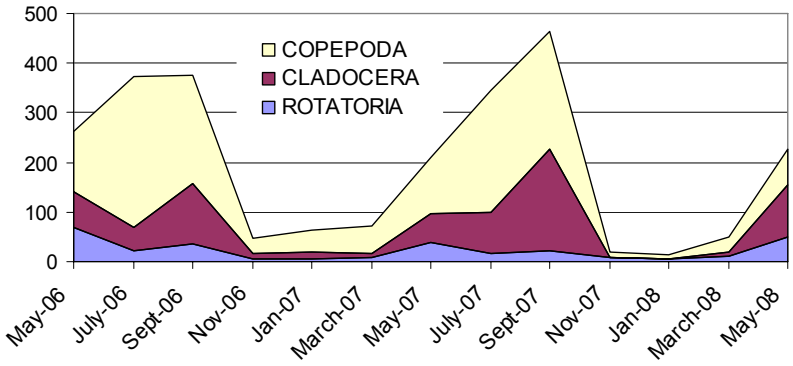

Figure 4-4. The dynamics of the average values (x 1000 ind/m^3) of different zooplankton groups in Bovilla, in station S1, close to the dam, during May 2006-May 2008. / Ecuria e vlerave mesatare (x 1000 ind/m^3) të grupeve të ndryshme të zooplanktonit në Bovillë, në stacionin S1, ngjitur me digën, gjatë majit 2006 - majit 2008.

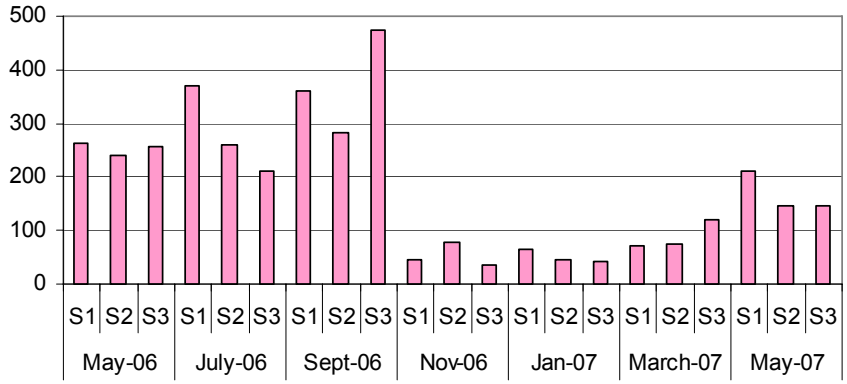

Figure 4-5. Dynamics of average values (x 1000 ind/m^3) of zooplankton showing the differences between three stations. / Ecuria e vlerës mesatare (x 1000 ind/m^3) të zooplanktonit ky vihen në dukje ndryshimet midis tre stacioneve.

Some occasional differences were observed between three main sampling stations during the first year in the water body (Fig. 4-5), where most of them seem not to be significant. Therefore, in the next year the samples were taken only in the station S1, which is the deepest station, close to the dam, and where the main tower is situated that takes the water for the Drinking Water Treatment Plant.

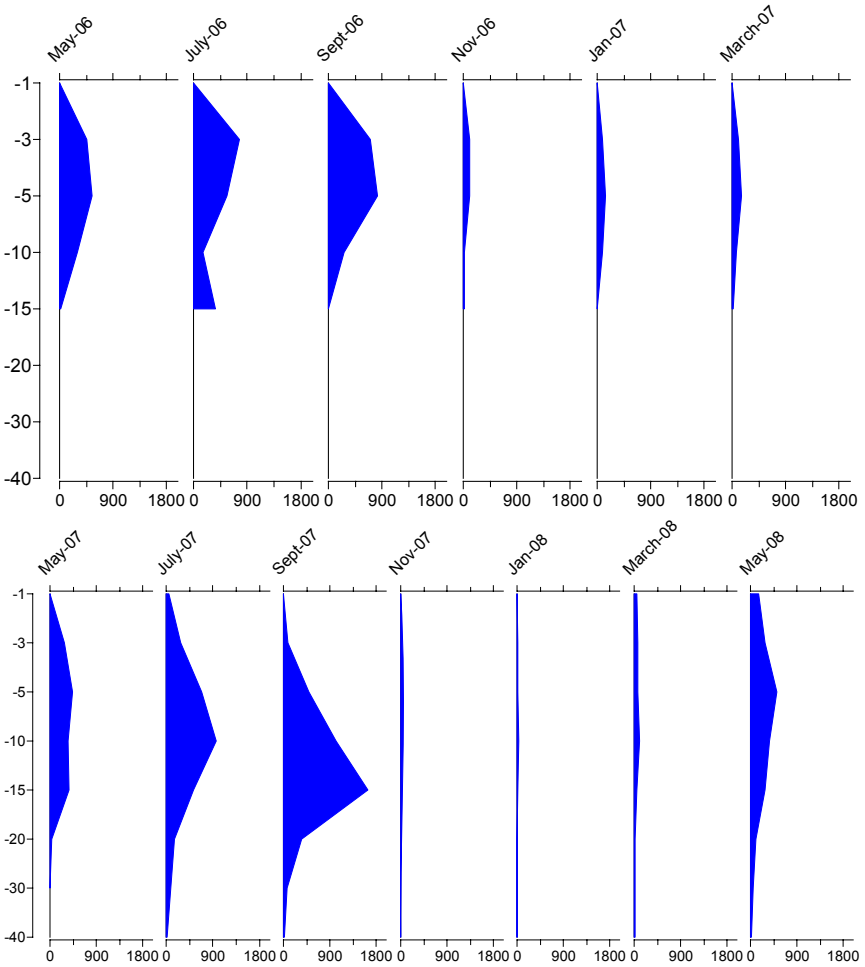

Figure 4-6. The zooplankton dynamics (x 1000 ind/m^3) in the station S1, close to the dam, during the whole study period (May 2006-May 2008), in the whole water column in Bovilla. / Ecuria e zooplanktonit (x 1000 ind/m^3) në stacionin S1, ngjitur me digën, gjatë gjithë periudhës studimore (maj 2006-maj 2008) në kolonën ujore të Bovillës.

As it is shown in the table 4-3 and in the histograms of figures 4-6 and 4-7, the most productive layers with zooplankton was epilimnion, especially the depth between 3 – 10 m. In hyplimnion (especially below 20 m of depth) the zooplankton growth was very limited. Using standard method used by Pantle-Buck (1955) based on qualitative and relative quantitative composition of *Rotifera, Cladocera* and *Copepoda* species, the major zooplankton

components of recorded species belongs to water category I, and I – II category. Values of saprobic index (Tab. 4-1) during the investigated period varied within limits from 1.2 to 2.16, which correspond to oligosaprobic and β−mesosaprobic waters.

Table 4-3. The zooplankton values (x 1000 ind/m^3) in Bovilla, along the whole water column in three different sampling stations and the related average values, during the whole study period (May 2006-May 2008). / Vlerat e zooplanktonit (x 1000 ind/m^3) në Bovillë, në gjithë kolonën ujore në tre stacionet e ndryshme gjatë gjithë periudhës studimore (maj 2006 - maj 2008); ROT, *Rotatoria*; CLAD, *Clodocera*; COP, *Copepoda*; TOT, Total.

7	Months	*May-06*			*July-06*		
	Groups / Stations	***S1***	***S2***	***S3***	***S1***	***S2***	***S3***
-1	*ROT:*	0.0	0.7	1.3	0.0	0.3	1.1
	CLAD:	0.1	0.0	1.0	0.0	0.0	2.4
	COP:	0.0	0.0	30.1	0.0	0.0	151.0
	TOT:	**0.1**	**0.7**	**32.4**	**0.0**	**0.3**	**154.5**
-3	*ROT:*	104.4	204.0	205.1	52.5	90.6	56.2
	CLAD:	114.1	121.0	100.0	116.0	117.0	96.0
	COP:	235.0	330.0	332.0	600.0	539.0	277.0
	TOT:	**453.5**	**655.0**	**637.1**	**768.5**	**746.6**	**429.2**
-5	*ROT:*	168.8	135.5	109.9	57.1	0.0	5.01
	CLAD:	120.0	112.0	221.0	117.0	100.0	227
	COP:	264.0	187.0	231.0	387.0	299.0	221.0
	TOT:	**552.8**	**434.5**	**561.9**	**561.1**	**399.0**	**453.0**
-10	*ROT:*	78.0	3.0	2.0	3.1	0.0	0.0
	CLAD:	111.0	0.0	0.0	1.0	0.0	0.0
	COP:	107.0	93.0	42.0	154.0	149.0	20.0
	TOT:	**296.0**	**96.0**	**44.0**	**158.1**	**149.0**	**20.0**
-15	*ROT:*	1.0	2.0	1.0	0.0	0.0	0.0
	CLAD:	2.0	2.0	0.0	1.0	0.0	0.0
	COP:	10.0	5.0	3.0	370.0	2.0	1.0
	TOT:	**13.0**	**9.0**	**4.0**	**371.0**	**2.0**	**1.0**
Mean	*ROT:*	**70.4**	**69.0**	**63.9**	**22.5**	**18.2**	**12.5**
	CLAD:	**69.4**	**47.0**	**64.4**	**47.0**	**43.4**	**65.1**
	COP:	**123.2**	**123.0**	**127.6**	**302.2**	**197.8**	**134.0**
	TOT:	**263.1**	**239.0**	**255.9**	**371.7**	**259.4**	**211.5**

Depth , m	**Months**	***Spet-06***			***Nov-06***		
	Groups / Stations	***S1***	***S2***	***S3***	***S1***	***S2***	***S3***
-1	*ROT:*	1.0	2.6	15.6	1.0	6.2	5.4
	CLAD:	0.0	2.0	27.7	0.0	4.0	6.0
	COP:	0.0	11.0	119.0	0.0	11.0	42.1

	TOT:	**1.0**	**15.6**	**162.3**	**1.0**	**21.2**	**53.5**
-3	*ROT:*	81.5	110.8	86.3	19.7	16.3	0.0
	CLAD:	254.0	243.0	1233.0	16.0	25.0	25.0
	COP:	376.0	472.0	516.0	75.0	108.0	73.0
	TOT:	**711.5**	**825.8**	**1835.3**	**110.7**	**149.3**	**98.0**
-5	*ROT:*	92.4	7.1	0.0	0.3	0.0	0.0
	CLAD:	334.0	215.0	142.0	33.0	23.0	11.0
	COP:	399.0	297.0	211.0	69.0	114.0	14.0
	TOT:	**825.4**	**519.1**	**353.0**	**102.3**	**137.0**	**25.0**
-10	*ROT:*	2.0	0.0	0.0	0.0	0.0	0.0
	CLAD:	18.0	1.0	0.0	7.0	0.0	0.0
	COP:	248.0	58.0	15.0	2.0	74.0	0.0
	TOT:	**268.0**	**59.0**	**15.0**	**9.0**	**74.0**	**0.0**
-15	*ROT:*	0.0	0.0	0.0	0.0	0.0	0.0
	CLAD:	1.0	0.0	0.0	0.0	0.0	0.0
	COP:	67.0	0.0	0.0	11.0	0.0	0.0
	TOT:	**0.0**	**0.0**	**0.0**	**11.0**	**0.0**	**0.0**
Mean	*ROT:*	**35.4**	**24.1**	**20.4**	**4.2**	**4.5**	**1.1**
	CLAD:	**121.4**	**92.2**	**280.5**	**11.2**	**10.4**	**8.4**
	COP:	**218.0**	**167.6**	**172.2**	**31.4**	**61.4**	**25.8**
	TOT:	**361.2**	**283.9**	**473.1**	**46.8**	**76.3**	**35.3**

Depth , m	**Months**	***Jan-07***			***March-07***		
	Groups / Stations	***S1***	***S2***	***S3***	***S1***	***S2***	***S3***
-1	*ROT:*	1.0	7.4	5.8	1.0	15.0	20.2
	CLAD:	0.0	2.0	2.0	7.0	101.0	124.0
	COP:	0.0	12.0	51.2	0.0	18.0	157.0
	TOT:	**1.0**	**21.4**	**59.0**	**8.0**	**134.0**	**301.2**
-3	*ROT:*	9.1	14.2	1.0	15.7	20.0	5.0
	CLAD:	1.0	11.0	22.0	2.0	12.0	34.0
	COP:	82.0	116.0	91.0	88.0	119.0	98.0
	TOT:	**92.1**	**141.2**	**114.0**	**105.7**	**151.0**	**137.0**
-5	*ROT:*	13.0	0.0	0.0	17.0	0.0	0.0
	CLAD:	33.0	11.0	0.0	37.0	22.0	35.0
	COP:	96.0	41.0	38.0	101.0	61.0	58.0
	TOT:	**142.0**	**52.0**	**38.0**	**155.0**	**83.0**	**93.0**
-10	*ROT:*	0.0	0.0	0.0	1.0	0.0	0.0
	CLAD:	34.0	0.0	0.0	0.0	0.0	0.0
	COP:	49.0	6.0	0.0	78.0	2.0	67.0
	TOT:	**83.0**	**6.0**	**0.0**	**79.0**	**2.0**	**67.0**
-15	*ROT:*	0.0	0.0	0.0	1.0	0.0	0.0
	CLAD:	0.0	0.0	0.0	1.0	0.0	0.0
	COP:	0.0	0.0	0.0	11.0	0.0	0.0

	Months	Jan-07			March-07		
	TOT:	0.0	0.0	0.0	13.0	0.0	0.0
Mean	ROT:	4.6	4.3	1.4	7.1	7.0	5.0
	CLAD:	13.6	4.8	4.8	9.4	27.0	38.6
	COP:	45.4	35.0	36.0	55.6	40.0	76.0
	TOT:	63.6	44.1	42.2	72.1	74.0	119.6

Depth, m	Months	May-07			July-07	Sept-07	Nov-07	Jan-08	March-08	May-08
	Groups / Stations	S1	S2	S3	S1	S1	S1	S1	S1	S1
-1	ROT:	0.6	4.0	6.4	13.0	1.0	1.0	1.0	20.0	95.0
	CLAD:	0.0	0.1	3.2	11.0	0.0	0.0	0.0	0.0	40.0
	COP:	0.0	0.1	39.1	29.0	2.0	0.0	0.0	25.0	30.0
	TOT:	**0.6**	**4.2**	**48.7**	**53.0**	**3.0**	**1.0**	**1.0**	**45.0**	**165.0**
-3	ROT:	94.3	183.2	188.5	27.8	20.2	15.0	9.0	30.0	61.0
	CLAD:	90.7	77.0	73.0	220.0	28.0	0.0	0.0	0.0	210.0
	COP:	92.0	316.0	314.0	35.0	46.0	12.0	10.0	45.0	20.0
	TOT:	**277.0**	**576.2**	**575.5**	**282.8**	**94.2**	**27.0**	**19.0**	**75.0**	**291.0**
-5	ROT:	135.2	133.2	93.9	42.5	49.4	22.0	16.0	20.0	199.0
	CLAD:	93.3	121.0	123.0	219.0	170.0	4.0	3.0	20.0	230.0
	COP:	214	187	184.0	426.0	280.0	19.0	6.0	25.0	85.0
	TOT:	**442.5**	**441.2**	**400.9**	**687.5**	**499.4**	**45.0**	**25.0**	**65.0**	**514.0**
-10	ROT:	15.1			27.0	63.2	13.0	11.0	15.0	8.0
	CLAD:	101.0			212.0	354.0	3.0	4.0	20.0	215.0
	COP:	232.0			721.0	605.0	32.0	13.0	70.0	140.0
	TOT:	**348.1**			**960.0**	**1022.2**	**48.0**	**28.0**	**105.0**	**363.0**
-15	ROT:	18.0			8.0	32.0	8.0	5.0	10.0	10.0
	CLAD:	97.0			3.0	988.0	2.0	4.0	10.0	75.0
	COP:	256.0			514.0	632.0	18.0	13.0	30.0	205.0
	TOT:	**371.0**			**525.0**	**1652.0**	**28.0**	**22.0**	**50.0**	**290.0**
-20	ROT:	8.0			**3.0**	**0.0**	**1.0**	**0.0**	**0.0**	**15.0**
	CLAD:	12.0			**2.0**	**81.0**	**1.0**	**0.0**	**0.0**	**30.0**
	COP:	9.0			**145.0**	**267.0**	**8.0**	**4.0**	**25.0**	**70.0**
	TOT:	**29.0**			**150.0**	**348.0**	**10.0**	**4.0**	**25.0**	**115.0**
-30	ROT:	2.0			2.0	**0.0**	0.0	0.0	0.0	15.0
	CLAD:	1.0			2.0	**23.0**	1.0	0.0	0.0	20.0
	COP:	2.0			85.0	**45.0**	3.0	1.0	20.0	15.0
	TOT:	**5.0**			**89.0**	**68.0**	**4.0**	**1.0**	**20.0**	**50.0**
-40	ROT:				1.0	0.0	0.0	0.0	0.0	5.0
	CLAD:				1.0	2.0	0.0	0.0	10.0	0.0
	COP:				15.0	22.0	2.0	0.0	0.0	20.0
	TOT:				**17.0**	**24.0**	**2.0**	**0.0**	**10.0**	**25.0**
Mean	ROT:	**39.0**	**106.8**	**96.3**	**15.5**	**20.7**	**7.5**	**5.3**	**11.9**	**51.0**

	Months	May-07			July-07	Sept-07	Nov-07	Jan-08	March-08	May-08
	CLAD:	56.4	66.0	66.4	83.8	205.8	1.4	1.4	7.5	102.5
	COP:	115.0	167.7	179.0	246.3	237.4	11.8	5.9	30.0	73.1
	TOT:	210.5	145.9	146.4	345.5	463.9	20.6	12.5	49.4	226.6

Bovilla ecosystem seems still not to be saturated with concern to a define species number (and composition) to a higher extent than lakes. In particular, it is valid for the first impoundment phase that this water body currently is facing. Possibly, it explains why also unusual zooplankters may become abundant, i.e. domination of *Bosmina* species.

Way forward

Bovilla watershed is relatively densely inhabited and the human impact is quite evident. As relatively new reservoir, it can be also characterized by a load surge in terms of easily degradable organic matter initiated by the inundation of bottom soil with its vegetation.

A period of approximately 10 years seems to be necessary to achieve a stage in which the rate of change is substantially retarded. To that fact there is enough time to consider that Bovilla actually is crossing the achievement stage of slowly changes in the water processes. It is only theoretical, while the nature process after intervention are combined intensively with human interaction due to the land structure, livestock presence and land cover as well.

Literatura

Clesceri S. L., Greenberg E. A., Eaton D. A. (Eds.) (1998): Standard Methods for the Examination of Water and Wastewater (20th Ed.). Published by the American Public Health Association. 1-1220. http://www.standardmethods.org

Fernando H.C., Gurgel J., Moyo N. (1998): A global view of reservoirs Fisheries, Internat. Rev. Hydrobiol., 83: 31-42

Gliwicz M. (1977): Food size selection and seasonal succession on filter feeding zooplankton in a. eutrophic lake. Ekol. Pol., 25: 179-225

Gliwicz M. (1988): Predation and the evolution of vertical migration behaviour in zooplankton. Nature. 320: 746

Gliwicz M., Ślusarczyk A., Ślusarczyk M. (2001): Life history synchronization in a long-lifespan singe-cohort *Daphnia* population in a fishless alpine lake. Oecologia, 128: 368

Henssen D. O., Faafeng B. A., Andersen T. (1995): Replacment of herbivore zooplakton species along gradients of ecosystem productivity and fish predation pressure. Can. J. Fish Aquat. Sci., 52: 733-742

Hutchinson G. E. (1967): A treatise on limnology. Vol. 2, Wiley. 1115 p. in the Engish Channel. Limnol. Oceanogr. 45: 44-54.

Juggins S. (2003): C2 - Software for ecological and palaeoecological data analysis and visualisation. University of Newcastle. http://www.staff.ncl.ac.uk/stephen.juggins

Pantle E., Buck H. (1955): Die biologische Uberwachung der Gewsser und die Darstellung der. Ergebnisse. Gas- und Wasserfech, 96: 604

Pujin V. (1982): Fauna Rotatoria u Dunavu kod Novog Sada i njen saprobiolo{ki zna~aj. Vodoprivreda 14, 75/76: 109-112

Pujin V. (1987): Sastav i dinamika faune Rotatoria kao Parametar kvaliteta vode. JAZU Savetovanje Rijeka Sava, zastita i koriscenje. Zagreb: 484-491

Ramadan F.M., Klimowicz H., Swelim A.A. (1963): The pollutional effect of industrial waste on rotifers. Pol. Archiv. Hydrobiol. 11: 97-108

Reh Z. (1997): Rotatoria in zooplankton and microzooperiphyton of the Pavlovsko Lake (Boxitogorsk,Leningrad Region) as indicators of the water saprobity. XIII International ecological camp Baltic- Ladoga, St. Petersburg.

Shumka S. (1994): Annual zooplanktron dynamics of Lake Prespa. MsC thesis. Institute of Biology, Faculty of Natural Sciences and Mathematics, Skopje, University St. Cyril and Methodius: 1-114

Shumka S. (1996): Qualitative composition and diversity of zooplankton from Prespa Lake. First Congress of Mac. biol.: 125

Shumka S. (1998): Significance of Zooplankton for the functioning of Lake ecosystem. Symposiumon Sustainable Development of Prespa region. Korcha.

Shumka S. (2000): Zooplanktonot kako indikator za ezerskata eutrofija (Golemo Prespansko Ezero). Oteševo. Zbornik na trudovi. Međun. simp.: 24-29

Shumka S., Nikleka E. (2008): A ten year of life story of development of zooplankton population at the Bovilla reservoir, Tirana - Albania. Proceedings of III Congress of Ecologists of Macedonia with international participation, 06-09.10.2007, Struga. Special issues of Macedonian Ecological Society. Vol. 8, Skopje: 114-118

Sladacek V. (1983): Rotifers as indicators of water quality, Hydrobiologia, 100: 169-201

Sladacek V., Tucek F. (1975): Relation on the saprobic index to BOD5. Wat. Res. 9: 791-794

Sommer U. (1989): Plankton ecology. Berlin-Heidelberg, Sptinger-Verl.: 1-369

Straskraba M., Tundisi J.G., Duncan A. (1993): State-of-the-art of reservoir limnology and reservoir management. In Comparative Reservoir Limnology and Water Quality. VIVL. 24: 1332-1335

Tilman D. (1984): Resource Competition and Community Structure. Princeton, New Jersey.

Uhlman D. (1998): Reservoirs ecosystems. Internat. Rev. Hydrobiol. 83. Special Issue: 13-20

Wassmann P., Olli K. (2004): Drainage basin nutrient inputs and eutrophication: an integrated approach. University of Tromsø, Norway: 1-325

Žurek R., Lewkovicz R., Rouchetti D., Augustin D. (1991): The relationship between zooplankton and biotic, abiotic factors. Acta hydrobiol., vol. 33, F.3/4: 209-228