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FISHERY OF SOME TRIBUTARIES AND RESERVOIRS AND ZOOPLANKTON AT THE DRINI CATCHMENT: THE NEEDS OF BETTER CONCEPTION OF THE MONITORING PRACTICES AT TRANSBOUNDARY WATER BODIES

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SYNOPSIS

Keywords:
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This paper will present some of the results of investigations on reservoirs zooplankton and fishery at various tributaries on Albanian side of the catchment.

The management of trans-boundary water bodies is priority on the various international meetings and participation of actors at different levels including scientific one is necessary in order to achieve joint management practises and approach integrated river basin management.

SINOPSIS

Ključne riječi:
Prekogranični,
upravljanje vodom,
ribarstvo,
zooplankton,
nutrijenti,
izvor

RIBARSTVO NA NEKIM PRITOKAMA I AKUMULACIJAMA I ZOOPLANKTON U SLIVU DRIMA: POTREBE ZA BOLJOM KONCEPCIJOM I MONITORINGOM NA PREKOGRANIČNIM VODAMA

Ovaj rad prikazuje neke od rezultata istraživanja zooplanktona i ribarstva na akumulacijama raznih pritoka na albanskoj strani sliva.

Upravljanje prekograničnim vodenim površinama je prioritet većeg broja međunarodnih sastanaka i učešće predstavnika na različitim nivoima, uključujući i naučni, neophodno je u cilju postizanja zajedničke prakse upravljanja i pristupa integrisanom upravljanju rječnim slivom.

INTRODUCTION

Albania is well known for its rich and complex hydrographic network composed of rivers, lakes, reservoirs, coastal lagoons and seas. The area of inland waters is divided as follows: natural lakes 400 km2; artificial lakes (electricity production) 70 km2; artificial reservoirs (irrigation) 40 km2; wetlands and coastal lagoons 150 km2 and rivers.

Natural lakes. About 247 natural lakes of different types and dimensions, and a considerable number of artificial lakes, are located inside the country. Based on their origin, they are divided into tectonic lakes (4), glacier lakes (134), karstic lakes (94) and fluvial lakes (15). Among the more important ones are the transboundary lakes of Shkodra (Skadar Lake), Ohrid and Prespa - the most important and the largest ones in the Balkans with European significance.

The Drini (Drim) River watershed comprises a considerable area of 14173 km^2 (within Albania) (KABO, 1990), continuing also beyond Albanian borders, covering very important aquatic ecosystems, not only from the economic point of view but also naturally. Beside the river course, its related tributaries and closely related artificial lakes of the Drini cascade (Fierza, Komani and Vau-deja) in the Drini watershed are situated by the big trans-boundary lakes of Ohrid, Prespa and Shkodra, three groups of mountainous glacial lakes of Lura, Ballgjaj and Dhoksi. Close to the Drini delta an important lagoon system is situated, with three main lagoons: Merxhani, Ceka and Kenalla.

Based on various approaches the area of Albania could be divided into three different districts according to species distribution: the Prespa lake district, district around Butrinti Lagoon and the rest of the Albanian area (SANDA &al., 2005). The last district could be further divided into two sub districts. The first one, comprising Ohrid-Drin-Skadar system, is characterized by much higher number of species than the second sub district, which includes the watersheds of the rivers Mat, Ishmi, Erzen, Shkumbin, Seman and Vjose.

The freshwater ichtyofanua of Albania has a special importance within the European one. Nevertheless, the studies dedicated to it are still very scarce. The information regarding the fish is coming through the publications KARAMAN (1924), KOLLER (1926), VINCIGUERRA (1933), POLJAKOV & al. (1958), OLIVA (1961), KARAMAN (1971), SORIC (1990), RAKAJ (1995), CRIVELLI (1997), SANDA & al.(2005), CRIVELLI & SHUMKA (2006), ECONOMIDIS (1979) etc.

Increase in human population and development of tourism cause harmful changes in ecosystems. The consequences of that are the 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 - bioindicators. Being rather tolerant to different environmental conditions, many rotifer species are good indicators of water quality and they can be used for the ecological monitoring of water bodies (S L A D E C E K & T U C E K , 1975; S L A D E C E K , 1983; P U J I N , 1992; K O S T O S K I et al., 2001). The aim of this study was to explore fauna of Rotifera from eastern littoral zone of Lake Ohrid and to determine the water quality on the basis of the noted bioindicative rotifers.

MATERIAL AND METHODS

The Albanian territory is characterized by the eight separate river systems (Ohrid-Drini-Shkodra), Mati, Ishmi, Erzeni, Shkumbini, Semani, Vjosa and the area of Butrinti Lagoon) that directly outflows to the Adriatic Sea. In period 2001-2006 sampling was done in the system of concern at the points marked in the map using both different mash size nets and electro fishing as well. The period of fish sampling was mostly done during the summer time. The specimens were conserved in formaldehyde and stored in the collection of the laboratory of zoology and hydrobiology at the Agriculture University in Tirana.

A qualitative zooplankton study was carried out with seasonal dynamic during 2001 - 2004. The samples were taken from localities in eastern littoral zone of the lakes as a part of the Drini Watershed. Saprobiological analysis was done by using standard Pantle-Buck method (P A N T L E - B U C K , H , 1955) based on qualitative and relative quantitative composition of Rotifera, Cladocera and Copepoda species.

RESULTS AND DISCUSSION

The following fish species have been identified during our examinations:
Squalius cephalus (Linnaeus, 1758), *Pachychilon pictum* (Heckel and Kner, 1858), *Barbus rebeli* (Koller, 1926), *Gobio gobio* (Linnaeus, 1758), *Cyprinus carpio* (Linnaeus, 1758), *Alburnus sp., Scardinius erythrophthalmus* (Linnaeus, 1758), *Rhodeus sericeus* (Pallas, 1776), *Pseudorasbora parva* (Temminck & Schlegel, 1846), *Rutilus sp., Carassius gibelio* (Bloch, 1782), *Chondrostoma sp., Alburnoides bipunctatus* (Bloch, 1782), *Telestes montenegrinus* (Vukovic, 1963), *Phoxinus phoxinus* (Linnaeus, 1758), *Pseudophoxinus minutus* (Valenciennes, 1844), *Cobitis ohridana* (Karaman, 1928), *Barbatula zetensis* (Soric, 2001), *Gambusia affinis* (Baird and Girard, 1853), *Gasterosteus aculeatus* (Linnaeus, 1758), *Salmothymus ohridanus* (Steindachner, 1892), *Salmothymus obtusirostris* (Heckel, 1851), *Salmo sp., Salmo trutta* (Linnaeus, 1758), *Salmo marmoratus* (Cuvier, 1829), *Thymallus thymallus* (Linnaeus, 1758), *Lethenteron zanandreai* (Vladykov, 1955), *Petromyzon marinus* (Linnaeus, 1758), *Knipowitschia croatica* (Mrakovcic, Kerovec, Misetic & Schneider, 1994), *Pomatoschistus sp., Anguilla anguilla* (Linnaeus, 1758), *Salaria fluviatilis* (Asso, 1801).

Based on various approaches the area of Albania could be divided into three different districts according to species distribution: the Prespa Lake district, district around Butrinti Lagoon and the rest of the Albanian area (S A N D A , 2005). The last district could be further divided into two sub districts. The first one, comprising Ohrid-Drin-Scadar system, is characterized by much higher number of species than the second sub district, which includes the watersheds of the rivers Mat, Ishmi, Erzen, Shkumbin, Seman and Vjose. The freshwater ichtyofanua of Albania has a special importance within the European one. The following species are of special importance from the zoogeographical point of view: *Pachychilon pictum* (Heckel and Kner, 1858), *Chondrostoma sp., Cobitis ohridana* (Karaman, 1928), *Salaria fluviatilis* (Asso, 1801), *etc.*

During the investigated period 114 zooplankton species were identified. Their qualitative and quantitative composition varied depending on season and locations.

It is well known that eutrophication processes caused by enrichment in nutrients result in an increase of photosynthetic biomass. In the water ecology, however, the factors which drive the shift in species composition of the assemblage along trophic gradients are still poorly understood (R E Y N O L D S , 1996).

The effects of eutrophication on zooplankton communities are highly variable due to differences in lake characteristics and food-chain structure. Brooks and Dodson (1965) observed changes in the size classes of zooplankton when planktivorous fish were introducted to New England lakes and suggested the later wellknown size-efficiency hypothesis which stated that removal of the larger zooplankton species by predation would favor smaller species because of the removal of superior competitors. In Micro Prespa and Macro Prespa lake the eutrophication caused a general increase in the number of crustacean species (Tab. 1). The presence of the species *Leptodora kindti* (Focke, 1844), *Daphnia cucullata* (O. F. Müller, 1785)*, Ceriodaphnia laticaudata* (P. E. Müller, 1867)*, Bosmina longirostris f. typica* (O. F. Müller, 1785)*, Bosmina longirostris f. pellucida* (O. F. Müller, 1785)*, Bosmina longirostris f. similes* (O. F. Müller, 1785)*, etc.,* are in favour of our conlsusion.

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. The aim of this study was to explore fauna of Rotifera-Cladocera and Copepoda (Cyclopoda & Calanoida) from Lake Ohri, Micro Prespa, Macro Prespa, Fierza and Shkodra and to determine the water quality on the basis of the noted bioindicative zooplankton species. During the investigated period 118 species were identified. Their qualitative composition varied depending on season and locations. The most diverse composition was recorded in summer. The rotifer composition in the quiet bays with macrophyte vegetation is rich and more exuberant then in sand localities. Majority of noted species were oligo- β-mesosaprobic and α-mesosaprobic indicators, except for *Rotaria rotatoria* (Pallas, 1766), that belongs to α-mesosaprobic water. Saprobiological testing based on rotifera showed that the water was oligo- β.mesosaprobic.

Table 1. Presence of various zooplankton species in course of Drini catchment

Nr.	Species	Ohrid Lake	Prespa Lake Micro	Prespa Lake Ma	Fierza A. Lake	Shkodra Lake
	ROTATORIA					
1	*Brachionus quadridentatus* (Ehrenberg, 1832)		+	+		
2	*Brachionus cacyciflorus v. brycei* (Palals, 1776)		+	+	+	+
3	*Brachionus c.v. dorcas* (Gosse, 1871)					+
4	*Brachionus urceolaris*(Müller, 1773)					+
5	*Brachionus unceolaris v. Sericus* (Varga, 1932)		+			
6	*Brachionus plicatus* (Müller, 1786)					+
7	*Brachionus forficula* (Wierzejski, 1891)					+
8	*Brachionus diversicornis* (Daday)		+			+
9	*Brachionus angularis* (Gosse, 1851)	+	+	+	+	+
10	*Lophocaris salpina* (Ehrenberg, 1834)					+
11	*Lophocaris oxysternon* (Gosse, 1851)					+
12	*Mytilina crassipes* (Lucks, 1912)		+			
13	*Mytilina mucronata* (Ehrenberg, 1832)		+			+
14	*Euchlanis mentea* (Ehrenberg, 1832)					+
15	*Euchlanis dilatata* (Ehrenberg, 1832)					+
16	*Dipleuchlanis propatula* (Gosse, 1886)		+			
17	*Anuraeopsis fissa*(Gosse, 1851)		+			
18	*Keratella cochlearis* (Gosse, 1851)	+	+	+	+	+
19	*Keratella.c.v.macracantha* (Lauterborn, 1921)		+			
20	*Keratella cochlearis v. Hispida* (Lauterborn, 1921)		+			
21	*Keratella ticinensis* (Callerio, 1921)					+
22	*Keratella valga* (Ehrenberg, 18342)					+
23	*Keratella quadrata* (Müller, 1786)		+	+		
24	*Kellicotia longispina* (Kellikot, 1921)	+	+	+	+	+
25	*Notholca acuminate* (Ehrenberg, 1832)					+
26	*Squatinella rostratum* (Ehrenberg, 1832)		+			
27	*Squatinella tridentatus v. Mutica* (Ehrenberg, 1843)					+
18	*Lepadella ovalis*(Müller, 1786)		+			
29	*Lepadella patella* (Müller, 1773)	+	+	+	+	+
30	*Lepadella rhomboids* (Gosse, 1886)		+			
31	*Lepadella ehrenbergi* (Perty, 1850)					+
32	*Lecane luna* (Müller, 1776)	+	+	+	+	+
32	*Lecane curvirostris* (Yamamoto, 1941)		+			

34	*Lecane elsa* (Nitzsch, 1827)		+			
35	*Lecane nana* (Murray, 1913)					+
36	*Lecane elasma* (Harring and Myers, 1926)		+			
37	*Lecane quadridentata* (Ehrenberg, 1832)					+
38	*Lecane hamata (*Chengalath&Mulamoottil, 1974)		+			
39	*Lecane closterocera* (Schmarda, 1853		+			
40	*Lecane bulla* (Gosse, 1851)		+			
41	*Lecane lunaris* (Ehrenberg, 1832)	+	+	+	+	+
42	*Lecane obtuse* (Hauer, 1889)					+
43	*Scaridium longicaudum* (O.F.Muller, 1876)					+
44	*Monommata aequalis* (Ehrenberg, 1832)					+
45	*Cephalodella forficula* (Ehrenberg, 1831)		+			
46	*Cephalodela misgurnus* (Wulfert, 1937)	+	+			
47	*Decphalodela giba* (Wulfert, 1937)					+
48	*Trichocerca bicristata* (Gosse, 1887)					+
49	*Trichocerca capucina* (Wierzejski&Zacharias, 1893)	+	+	+	+	+
50	*Trichocerca similes* (Wierzejski, 1893)		+			
51	*Trichocerca longispina* (O.F. Müler, 1773)	+	+	+		+
52	*Trichocerca myersi* (Hauer, 1931)		+			
53	*Trichocerca rattus* (Müller, 1776)	+	+	+		+
54	*Trichocerca pusilla* (Lauterborn, 1898)		+	+		
55	*Trichocerca porcellus* (Gosse, 1886)					+
56	*Trichocerca rectangularis* (Evens, 1947)		+			
57	*Asplanchna priodonta* (Gosse, 1850)		+	+		+
58	*Polyarthra vulgaris* (Ehrenberg, 1834)	+	+	+	+	+
59	*Polyarthra trygla* (Ehrenberg, 1834)		+	+		
60	*Synchaeta pectinata* (Ehrenberg, 1832)					+
61	*Pleosoma truncatum* (Leavander, 1889)	+	+	+		+
62	*Testudinella mucronata* (Gosse, 1886)					+
63	*Testudinella patina* (Anderson, 1889)		+			
64	*Testudinella incise* (Hennann, 1773)					+
65	*Testudinella pseudoliptica* (Bartos, 1887)		+			
66	*Testudinella palladina trilobata* (Bartos, 1887)	+				
67	*Pompholyx sulcata* (Hudson, 1885)		+			
68	*Pompholyx complanata* (Gosse, 1851)		+	+		+
69	*Pedalia mira* (Hudson, 1871)		+			
70	*Pedalion sp.*	+				

71	*Rotari rotatoria* (Pallas, 1766)	+				
72	*Phylodina megalotrocha* (Ehrenberg, 1832)	+				
73	*Epiphane sp.*		+	+		
74	*Ascomorpha ecuaudis* (Gosse, 1889)		+	+		+
75	*Filinia longiseta* (Ehrenberg, 1834)	+	+	+	+	+
	CLADOCERA					
1	*Sida crystalina* (O. F. Müller, 1785)	+	+			+
2	*Diaphanosoma brachiurum* (Levin, 1848)	+	+	+	+	+
3	*Daphnia pulex* (De Geer, 1778)	+?				
4	*Daphnia pulicaria* (Forbes, 1893)	+				
5	*Daphnia longispina* (O. F. Müller, 1785)	+	+	+		+
6	*Daphnia magma* (O. F. Müller, 1785)					+
7	*Daphnia cucullata* (O. F. Müller, 1785)		+	+		
8	*Scapholeberis mucronara*	+			+	
9	*Simocephalus vetulus* (O. F. Müller, 1785)	+	+	+		
10	*Simocephalus serrulatus*	+	+	+	+	+
11	*Ceriodaphnia laticaudata* (P.E.Müller. 1867)		+			
12	*Bosmina coregoni* (Baird, 1845)					+
13	*Bosmina longirostris f. typical* (O. F. Müller, 1785)		+	+		
14	*Bosmina longirostris f. brev.* (O. F. Müller, 1785)			+		
15	*Bosmina longirostris f. pell.* (O. F. Müller, 1785)		+			
16	*Bosmina longirostris f. similes* (O. F. Müller, 1785)		+			
17	*Acroperus harpae* (Baird, 1834)	+	+		+	+
18	*Alona rectangulus* (Lilljeborg, 1900)	+	+	+	+	+
19	*Alona gutatta* (G.O.Sars, 1862)		+			
20	*Alona quadrangularis* (O. F. Müller, 1776)		+	+		
21	*Alonella excise* (Lilljeborg 1853)	+	+	+	+	+
22	*Alonella exigua* (Lilljeborg 1853)					+
23	*Pleuroxus aduneus* (G.O.Sars, 1861)		+	+		+
24	*Pleuroxus laevis* (G.O.Sars, 1861)					+
25	*Chydorus sphaericus leonardi* (O. F. Müller, 1785)	+	+	+	+	+
26	*Leptodora kindti* (Focke, 1844)		+	+		+
27	*Rinchotalona rostrata* (G.O.Sars, 1861)	+				
	COPEPODA					
1	*Eudiaptomus gracilis* (G.O. Sars, 1863)	+				

2	*Archtodiaptomus steindachneri* (Rich 1897)	+	+	+		
3	*Archtodiaptomus kerkyrenchis* (Rich, 1897)		+	+		
4	*Mesocyclops leukarti* (Claus, 1857)	+	+	+		+
5	*Macrocyclops albidus* (Jurine, 1820)		+	+	+	+
6	*Eucyclops serrulatus* (Fischer, 1851)		+	+	+	
7	*Eucyclops macruroides* (Lilljeborg, 1901)		+			
8	*Thermocyclops oithonensis* (Jurine, 1820)		+			
9	*Cyclops ochridanus* (Kiefer, 1932)	+				
10	*Megacyclops viridis* (Jurine, 1820)					+
11	*Acanthocyclops vernalis* (Fischer, 1853)					+
12	*Diacyclops bicuspidatus* (Claus, 1857)					+

Based on the table analyses for the all water systems it is clear that there is a "continuity" in the mega Drini water body, while specific differences of Ohrid and Prespa have to be underlined.

DATA, ENVIRONMENTAL GOALS AND ABATEMENT MEASURES

One of the requirements of the EC Water Framework Directive is to set realistic environmental goals for a river system, the purpose of which is to restore the river system to a "good ecological status". Such environmental goals are very useful tools for decision makers.

However, realistic environmental goals may only be established if they are based on sound and reliable data and knowledge of the river system. It is essential to obtain a good knowledge of the present status of the river system, and also to know how long it may take to detect the response in a river system to changes caused by planned or implemented mitigation measures. To that fact common efforts to be undertaken by neighbouring countries are required including biological monitoring.

All these considerations require monitoring data from a long time period. In the Balkan area, monitoring programmes were interrupted during the years of war and conflicts, and the countries are presently re-establishing and strengthening their monitoring programmes (BORGVANG, S.A et.al. 2006).

In addition to the long time series, a minimum of sampling frequency is also necessary. This is especially important for rivers, since river water quality is usually affected by seasonality and discharge. Both factors need to be compensated for in order to discern the specific anthropogenic or natural processes that affect water quality over time. In case of infrequent sampling or too short time periods we take a great risk to detect trends that in reality is caused by high short-term random natural fluctuations (BORGVANG, S.A et.al. 2006).

CONCLUSIONS

In the wider Drini system and its tributaries there has been identified 32 fish species.

During the investigation period 118 zooplankton species were identified. Their qualitative and quantitative composition varied depending on season and locations.

The realistic environmental goals may only be established if they are based on sound and reliable data and knowledge of the river system. It is essential to obtain a good knowledge of the present status of the river system, and also to know how long it may take to detect the response in a river system to changes caused by planned or implemented mitigation measures. To that fact common efforts to be undertaken by neighbouring countries are required including biological monitoring.

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