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DYNAMICS AND DISTRIBUTION OF MACROZOOBENTHOS IN THE TOPLICA RIVER, A TRIBUTARY OF THE KOLUBARA

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Abstract - Hydrobiological investigations of the macrozoobenthos were carried out at eight localities in the Toplica river (a right-hand tributary of the Kolubara river) from April 2000 to January 2001.

The bottom fauna was composed of 19 groups of macroinvertebrates with 85 determined taxa (61 identified to the species level, 24 to the generic level). The most varying groups were the insect orders Trichoptera (20 taxa), Ephemeroptera (15), and Diptera (13), while Isopoda, Decapoda, and insects belonging to orders Collembola, Heteroptera, Megaloptera, and Planipennia were the most uniform.

The species *Gammarus pulex fossarum* Koch and *Dugesia gonocephala* Duges were the most abundant forms at the river source, and representatives of Ephemeroptera and Gammaridae were the most numerous in its upper course (at the second, third, and fourth locality). The Mollusca and Chironomidae larvae were the most abundant forms at the fifth locality (in the middle course), but no constant dominance of any animal group was recorded at the sixth one, where the dominance alternated among Chironomidae larvae (April, July 2000), Oligochaeta (October 2000), and Mollusca (January 2001). The lower course of the river (the seventh and eighth locality) was characterized by the dominance of the species of the phylum Mollusca (*Amphimelania holandri* Ferussac, *Fagotia esperi* Ferussac, and *Theodoxus transversalis* Pfeiffer).

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INTRODUCTION

Aquatic ecosystems (including mountain streams) that receive industrial, agricultural, communal, and other wastewaters are under constantly increasing threat. This unquestionably results in a reduced variety of the macrozoobenthos fauna. Organisms of the bottom fauna are characterized by relatively poor mobility, sensitivity to environmental changes, and relatively long life cycles. They are therefore exposed for a long time to the influence of various ecological events and represent a sensitive indicator of changes in abiotic environmental factors (including those of anthropogenic nature). Variety of the zoobenthos community declines under the conditions of the water quality deterioration, when the species with a broad ecological valence survive and increase in abundance. In view of these considerations, it can be asserted that the pattern of structure and composition of benthos communities in streams provides a true picture of their ecological state and points to the changes that are not momentary, but rather result from long-term action of environmental factors.

Investigation of macrozoobenthos of the Toplica river (a mountain stream bottom fauna of which has not been studied to date) represents a challenge to researchers because of its zoogeographic position and low exposure to anthropogenic influence. The present study was undertaken to establish the faunistic composition and the changes of aquatic invertebrate communities along the river course.

MATERIAL AND METHODS

Macrozoobenthos was investigated seasonally at eight localities in the Toplica river (Fig. 1) from April of 2000 to January of 2001. Along a 30-*km* stretch of the river's course, material for quantitative determination was collected with a net according to Surber from sectors measuring 300 cm^2 in area. Qualitative composition of the macrozoobenthos was established by searching through material obtained from the riverbed.

Identification of aquatic invertebrates was performed with the aid of keys for determination (Ž a d i n 1940; W e s e n b e r g 1943; C a r a u s u *et al.* 1955; L e p n e v a 1964, 1966; H i c k i n 1967; H y n e s 1977; M a c a n 1979; R o s k o š n y 1980; G l ö e r *et al.* 1985; E d i g t o n and H i l d r e w 1981) at the Institute of Zoology, Faculty of Biology, University of Belgrade.

The Shannon-Weaver index was used to estimate α-diversity and the Sørensen similarity index to estimate β-diversity (S o u t h w o o d 1978).

The Toplica river (a right-hand tributary of the Kolubara) arises at 540 *m* a.s.l. on the prominence known as Berkovačka Glava. It is formed by confluence of the Berkovački and Popadić brooks in the village of Popadić. The Dubrovac and Nanomirnica rivers are its most important right-hand tributaries.

Locality T1 - represents one of the sources of the Toplica river, a spring at 300 *m* a.s.l. The bottom consists of small rocks. Depth of the spring varies from 0.08 *m* (July) to 0.20 *m* (January), width from 0.50 *m* (April) to 0.70 *m* (October, January). Water temperature fluctuated from 9°C (January) to 14°C (July).

Locality T2 - occurs 150 *m* downstream from the spring, at 295 *m* a.s.l. The riverbed is composed of large rocks. Depth is from 0.03 to 0.07 *m*. Width varies from 1.35 *m* (January) to 2.00 *m* (April). Water temperature ranges from 9°C (January) to 14°C (April). According to the Huet classification (H u e t 1961), the current is slow (0.25 *m/s*, April) and moderate (0.33-0.36 *m/s*).

Locality T3 - is situated 20 *m* downstream from the mouth of the Rajčina river at 290 *m* a.s.l. The bottom is rocky. Average depth of the river fluctuates from 0.04 *m* (October) to 0.07 *m* (April, January), its width from 1.3 *m* (October) to 2.5 *m* (July). The current is fairly slow (0.22 - 0.28 *m/s*). The lowest water temperature (9°C) was measured in January, the highest one (16°C) in July.

Locality T4 - occurs 20 *m* downstream from the confluence of the Berkovački and Popadić brooks, at 190 *m* a.s.l. The river is wide from 1.4 to 2.5 *m* and deep from 0.04 to 0.09 *m*. The bottom is rocky. In regard to flow rate, the river belongs here to the category of streams with a moderate speed throughout all months of the investigations except for January (0.66 *m/s*). Water temperatures fluctuated from 8°C (January) to 23°C (July).

Locality T5 - is located 100-*m* upstream of the Banja Vrujci spa, at 180 *m* a.s.l. The riverbed has been modified by man; it is shallow (depth from 0.04 *m* in July to 0.09 *m* in April and January) and 1.4 to 4 *m* wide. Water temperature varies from 8°C (January) to 28°C (July). The water flows over a rocky bottom at a rate of 0.30 *m/s*.

Locality T6 - is situated 10 *m* downstream from the mouth of the thermal stream from the Banja Vrujci spa, at 170 *m* a.s.l. The bottom is composed of small rocks. Width of the riverbed varies from 2.5 *m* (October) to 5 *m* (January), its depth from 0.17 *m* (April) to 0.20 *m* (October, January). Current speed is moderate in all months of the investigation except in April (0.65 *m/s*). The water was the coldest (17°C) in January and the warmest (26°C) in April and July.

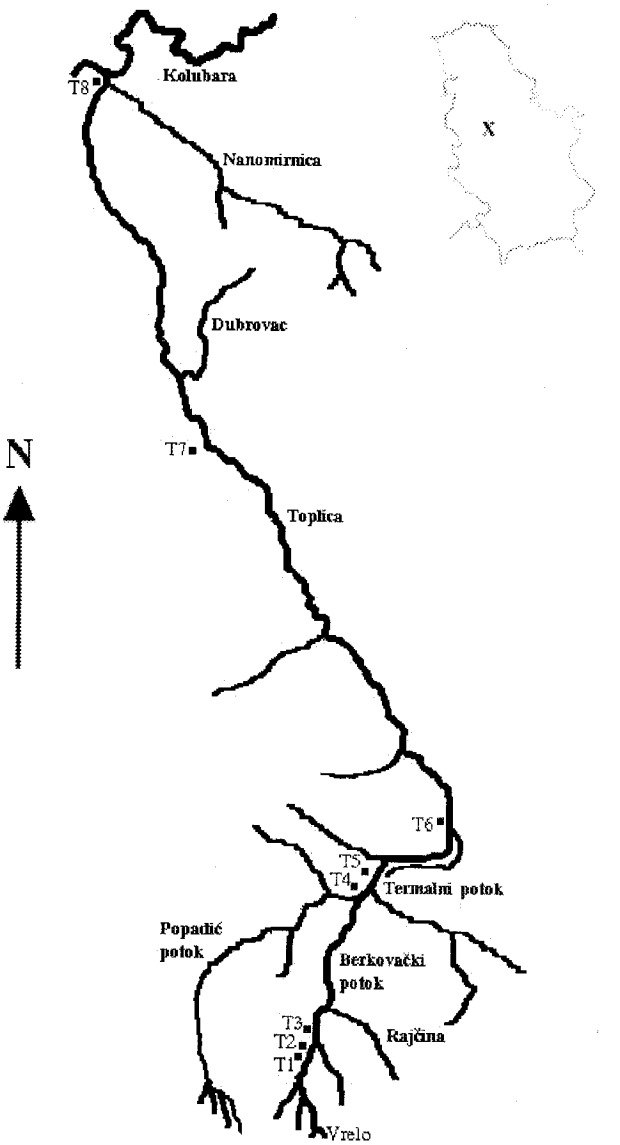

Fig. 1. Investigated localities in the Toplica river. Location of the Toplica river in Serbia is indicated by the letter X in the upper right-hand corner of the figure.

Locality T7 - occurs in the village of Gornji Mušić, at 150 *m* a.s.l. The bottom is rocky, but muddy near the right bank. The river is 3.5 to 6 *m* wide and 0.28 *m* deep. The flow rate varies from very slow in January to slow in July and October. The lowest water temperature (12°C) was measured in January and the highest one (24°C) in July.

Locality T8 - is located 100 *m* upstream from the site where the Toplica river empties into the Kolubara river, at 125 *m* a.s.l. The bottom is rocky, but mud collects near the

right bank. The riverbed is 3.5 *m* (July) to 6 *m* (January) wide and 0.10 *m* (October) to 0.28 *m* (April) deep. The flow rate varies from 0.12 *m/s* (April, January) to 0.24 *m/s* (October), water temperature from 10°C (January) to 19°C (April).

RESULTS

Investigations of the bottom fauna of the Toplica river revealed the presence of 85 taxa (identified to the level of species or genus) belonging to 19 groups of invertebrates.

The most varying groups were the insect orders of Trichoptera (20 taxa), Ephemeroptera (15), and Diptera (13), while the most uniform (with a single determined taxon each) were Isopoda, Decapoda, Collembola, Heteroptera, Megaloptera, and Planipennia.

In macrozoobenthos of the Toplica river, the order of Trichoptera (Table 1) was represented by 20 taxa (identified to the species or genus level) belonging to 10 families. The greatest variety was recorded for the family Hydropsychidae (six species), which differs from other families in being more tolerant to pollution (Table 1). Relative uniformity of the families Glossosomatidae, Leptoceridae, Lepidostomatidae, Odontoceridae, and Sericostomatidae (represented by a single taxon each) is a consequence of the fact that the species of these families can be found only in waters less burdened with organic pollution. Trichoptera larvae were the most varying at locality T3 (10 taxa belonging to six families) and T4 (nine taxa of four families) and the least diverse at locality T7 (one taxon). Representatives of the genus *Allogamus* were found most often (at five localities).

Ephemeroptera larvae were represented by 15 taxa belonging to six families (Table 1). The greatest numbers of determined taxa were recorded for the families Heptagenidae (*Rhithrogena semicolorata*, *Ecdyonurus* sp., *E. insignis*, *E. forcipula*, and *E. aurautiacus*), Ephemerelidae (*Ephemerella* sp., *E. ignita*, and *E. major*), and Ephemeridae (*Ephemera* sp., *E. danica*, and *E. vulgata*). The species *E. danica* had the greatest frequency of occurrence (at six localities). These larvae were the most diverse at locality T4 (10 taxa) and T3 (nine taxa).

Diptera (without species of the families Simulidae and Chironomidae) in macrozoobenthos of the Toplica river were represented by 13 taxa belonging to six families (Table 1). The families of Limoniidae (*Dicranota bimaculata*, *Antocha vitripennis*, *Ormosia* sp., *Orimargula* sp., and *Hexatoma* sp.) and Athericidae (*Atherix* sp., *A. ibis*, and *A. marginata*) were the most varying. The greatest number of taxa (five) was recorded at the fifth and eighth locality, while the species *Antocha vitripennis* was found the most frequently (at four localities).

Along the river's course, the abundance of zoobenthos (Fig. 2) varied from 265 ind/m^2 at locality T6 in October to 15,385 ind/m^2 at locality T4 in October, when the dominance of the species from the family Gammaridae (7327 ind/m^2) was established. At the source, the most abundant species were *Gammarus pulex fossarum* (1298 ind/m^2) and *Dugesia gonocephala* (1032 ind/m^2). In the upper course of the river (localities T2, T3, and T4), specimens of Ephemeroptera and Gammaridae were the most numerous forms (Fig. 2a and 2c), constituting the most abundant organisms of the benthofauna at the fourth locality, with 22,442 ind/m^2. At locality T5, Chironomidae larvae were the most abundant forms (Fig. 2d). The sixth locality was characterized by the lowest average abundance of bottom organisms (1499 ind/m^2), and no constant dominance was recorded for any animal group, instead dominance was alternating among Chironomidae larvae (April, July), Oligochaeta (October), and Mollusca (January). In the lower course of the river downstream (localities T7 and T8), the dominant forms were the species of the phylum Mollusca, namely *Amphimelania holandri*, *Fagotia esperi*, and *Theodoxus danubialis* (Fig. 2b).

During the course of the investigations, the greatest variety of zoobenthos communities (Table 1) was recorded at locality T3, with a diversity index value of 2.5. This indicates environmental factors favorable for development of a varying bottom fauna. Due to modification of the riverbed and inflow of wastewaters from households, the least diversity of species (1.0) was recorded at the fifth locality.

Based on the results presented in Fig. 3, it can be stated that the greatest degree of similarity was established between the benthos communities of localities T1 and T2 (0.63) and T2 and T3 (0.61). A similarity greater than 0.50 was recorded only between localities T3 and T4 (0.56) and T2 and T4 (0.54). The lowest similarity index was displayed by the bottom fauna of the seventh locality in relation to the majority of other localities (except for the sixth and eighth) e.g. 0.15 in relation to locality T1 and 0.20 in relation to locality T5. The zoobenthos communities of the fifth and sixth locality exhibited a medium degree of mutual similarity. The bottom community of the eighth locality had an equal degree of similarity to those observed at most of the other localities (0.34-0.48) except for the first one (0.26).

Table 1. Qualitative composition of the bottom fauna of the Toplica river.

Animal group	Locality							
	1	2	3	4	5	6	7	8
Turbellaria								
Dugesiidae								
Dugesia gonocephala	+	+	+	+	+	+	+	+
Dugesia sp.						+		
Nematomorpha								
Gordiidae								
Gordius aquaticus			+	+				
Mollusca								
Sphaeriidae								
Pisidium sp.		+				+	+	
Ancylidae								
Ancylus fluviatilus	+	+	+	+				+
Lymnaeidae								
Lymnaea peregra				+	+	+		+
Melaniidae								
Amphimelania holandri						+	+	+
Fagotia acicularis							+	+
F. esperi							+	+
Neritidae								
Theodoxus danubialis							+	+
Planorbidae								
Planorbarius corneus	+							
Oligochaeta								
Ned. Oligochaeta		+	+	+		+		+
Isopoda								
Asellidae								
Asellus aquaticus	+	+						
Gammaridae								
Gammarus pulex fossarum	+	+	+	+	+	+	+	+
G. balcanicus	+	+	+	+		+		+
G. sp.	+	+	+	+	+			+
Decapoda								
Astacidae								
Astacus astacus						+		
Collembola								
Isotomurus sp.	+		+					
Ephemeroptera								
Baetidae								
Baetis sp.	+	+	+	+	+	+		+
B.vernus				+				
Heptagenidae								
Ecdyonurus sp.	+	+	+	+	+			

Animal group	Locality							
	1	2	3	4	5	6	7	8
E.insignis			+					
E.austriacus	+	+	+	+				
E.forcipula	+	+						
Rhithrogena semicolorata	+	+	+	+				
Caenidae								
Caenis moesta				+			+	+
Ephemerellidae								
Ephemerella sp.		+		+				+
E.ignita		+	+	+				+
E.major				+				
Ephemeridae								
Ephemera sp.			+					
E.danica		+	+	+	+	+		+
E.vugata								+
Leptophlebiidae								
Paraleptophlebia cincta	+		+					
Odonata								
Cordulegasteridae								
Cordulegaster sp.					+			
G.annulatus			+					
Gomphidae								
Gomphus vulgatissimus							+	
Onychogomphus forcipatus				+	+	+	+	+
Libellulidae								
Orthetrum albistylum					+			
Plecoptera								
Nemouridae								
Nemoura sp.	+	+	+	+				
Perlidae								
Dinocras cephalotes			+					
Perla burmeisteriana	+	+		+				
Heteroptera								
Aphelocheiridae								
Aphelocheirus aestivalis							+	+
Megaloptera								
Sialidae								
Sialis fuliginosa			+				+	
Planipennia								
Osmylidae								
Osmylus fulvicephalus	+			+				

Table 1.- Continued

Animal group	Locality							
	1	2	3	4	5	6	7	8
Coleoptera								
Hydrophilidae								
Hydraena gracilis	+			+				+
Elmidae								
Elmis aenea	+	+	+	+	+	+	+	
Stenelmis sp.			+	+		+	+	+
Limnius sp.		+	+		+			+
Haliplidae								
Haliplus lineolatus					+			
Helodidae								
Helodes marginata		+	+	+		+		
Scirtes sp.				+				
Gyrinidae								
Gyrinus sp.				+				
Dytiscidae								
Dytiscus marginalis								+
Diptera								
Limoniidae								
Dicranota bimaculata	+		+		+			
Hexatoma sp.	+	+						
Antocha vitripennnis			+	+	+			+
Orimargula sp.			+					
Ormosia sp.		+						
Stratiomyidae								
Oxycera meigenii		+						
Athericidae								
Atherix sp.								+
A.ibis				+				+
A.marginata							+	
Ceratopogonidae								
Bezzia sp.					+			+
Tabanidae								
Tabanus sp.					+			
Heptatoma sp.					+			
Tipulidae								
Tipula sp.								+
Simulidae								
Simulium sp.	+			+	+	+		

Animal group	Locality							
	1	2	3	4	5	6	7	8
Chironomdae								
Ned. Chironomdae		+	+	+	+	+	+	+
Trichoptera								
Limnephilidae								
Anabolia nervosa		+	+					
Allogamus sp.	+	+	+		+	+		
Stenophylax sp.				+				
Potamophylax cingulatus	+		+					
Glossosomatidae								
Glossosoma sp.	+	+						
Helicopsychidae								
Helicopsyche bacescui		+	+	+			+	
Hydropsychidae								
Hydropsyche bacescui		+	+					
H.angustipennis		+	+	+		+		
H.contubernalis				+		+		
H.dissimulata				+	+			
H.instabilis					+			
H.saxonica				+				
H.pellucidula				+	+			
Rhyacophilidae								
Ryacophila pascoei			+	+				
Ryacophila nubila			+	+				
Leptoceridae								
Athripsodes bilineatus			+					+
Polycentropodidae								
Cyrnus glavidus	+							
Lepidostomatidae								
Lepidostoma hirtum					+			
Odontoceridae								
Odontocerum albicorne								+
Sericostomatidae								
Sericostoma personatum			+					

Shannon diversity index "H"	1.94	1.84	2.5	2.17	1.0	1.46	1.30	1.43
Saprobic index "S"	1.62	1.65	1.65	1.69	1.82	1.86	1.94	1.68
Total number of taxa	25	28	36	38	24	18	16	28

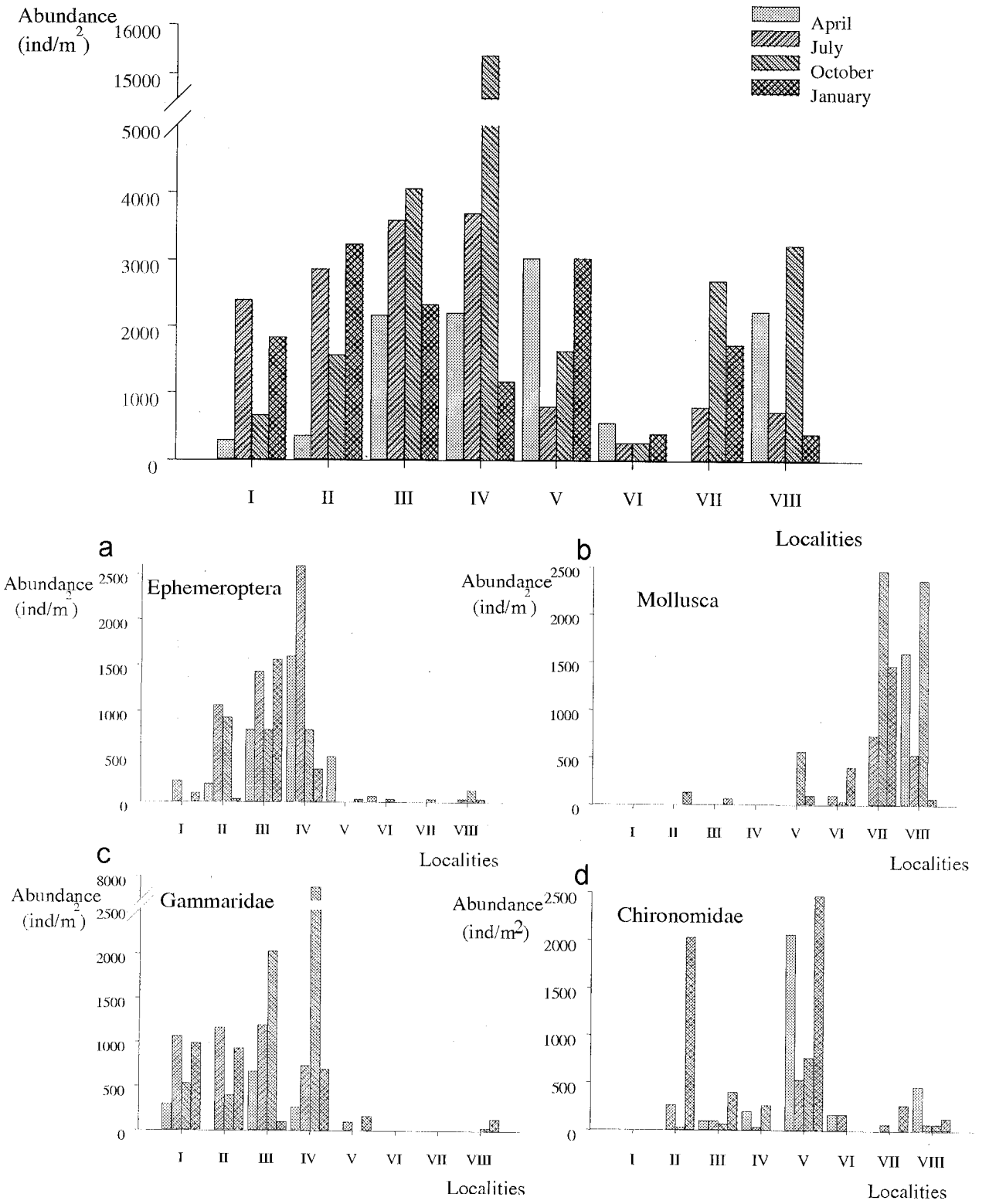

Fig. 2. Average abundance of macrozoobenthos at the investigated localities.

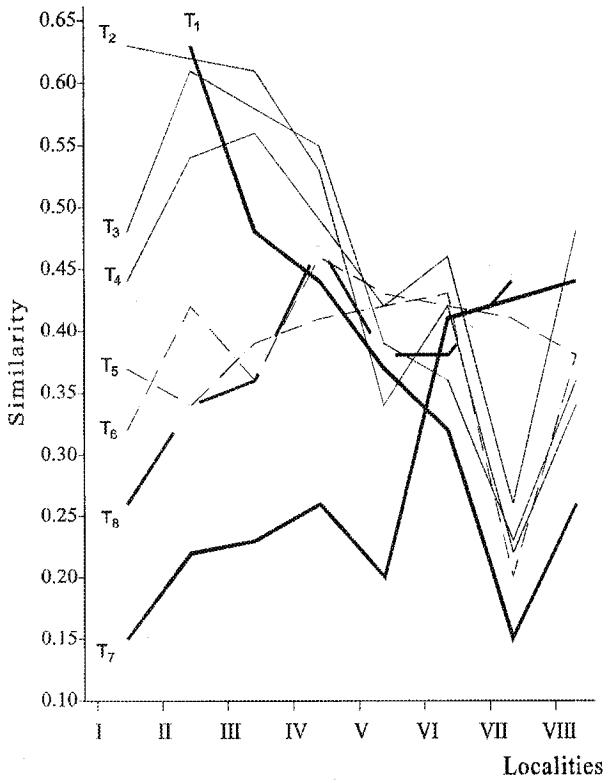

Fig. 3. Similarity index values at the investigated localities.

DISCUSSION

Despite the fact that the Toplica river is a small mountain stream, it is characterized by relatively great variety of the macrozoobenthos (85 taxa belonging to 19 groups), especially of the insect groups Trichoptera and Ephemeroptera (with 20 and 15 taxa, respectively). Great diversity of the larvae of these insects is also characteristic of other mountain streams of Serbia, in which Trichoptera and Ephemeroptera are dominant groups in the bottom fauna: the Lisinski Potok brook (F i l i p o v i ć 1965), the Grošnička Reka river (B a r a č k o v 1973), the Prizrenska Bistrica river (S h u k r i u 1979), the Svrljiški and Trgoviški Timok rivers (S i m i ć 1993), the Kriveljska Reka river (M a r k o v i ć and M i l j a n o v i ć 1995), the Lomnička Reka river (K o n t a 1997), the Obnica river (M a r k o v i ć *et al.* 1997), the Jablanica river (M a r k o v i ć *et al.* 1998), the Pusta Reka river (S t r a h i n i ć 2000), the Vlasina river (P a u n o v i ć 2001), the Crvena Reka river (Ž i v i ć *et al.* 2001) or subdominant: the Đetinja river (M a r k o v i ć 1995), the Banja river (Marković *et al.* 1997a), the Kolubara river (M a r k o v i ć *et al.* 1999).

In the macrozoobenthos community of the Toplica river, the first four localities stand apart from the others, being characterized by a high species diversity, the greatest variety of Ephemeroptera and Trichoptera, pronounced dominance of specimens of Gammaridae and Ephemeroptera, and a high degree of mutual similarity.

Although no great similarity was expected between the river source and the second locality in view of specificity of the fauna of springs (M a r k o v i ć 1998), a similarity index of 0.63 was established between them. This is probably a consequence of the fact that the river course dried up upstream from the first locality in all seasons of investigation, what resulted in a greater influence of the spring's benthofauna than expected. At the same time, the second locality is also characterized by a great similarity (0.61) to the bottom fauna of the third locality (while the similarity between the first and the third locality was considerably lower - 0.48), so the region of the spring cannot be clearly set apart. Such a relationship of benthocoenoses at the first three localities is mainly due to changes in the composition of the Trichoptera fauna. To be specific, the second and the third locality are characterized by the appearance of tolerant species (*Anabolia nervosa* and *Hydropsyche angustipennis*), while more sensitive species of the genus *Glossosoma* disappear at the third locality (Table 1).

The bottom fauna of the third and the fourth locality is characterized by a great diversity (with diversity index values of 2.5 and 2.2, respectively) and variety of the benthofauna (36 and 38 taxa, Table 1), high diversity of Ephemeroptera and Trichoptera (which is characteristic of the zoobenthos fauna of the upper course of streams), and considerable mutual similarity, although differences between these two localities exist, primarily in composition of the Trichoptera fauna. Specifically, more sensitive species of the genus *Allogamus* disappear due to inflow of waste waters (the fourth locality occurs in an inhabited place), while an increase is observed in the variety of tolerant species of the family Hydropsychidae (Table 1).

Although the fifth locality is located only about 400 *m* downstream from the one preceding it, significant changes occur in the composition and structure of the zoobenthos community: a decrease was observed in both the diversity (1.0, Table 1) and the number of species (24 taxa, Table 1), Chironomidae larvae were eudominant (Fig. 2d), and Diptera the most varying group (with five taxa). Such pronounced changes are the consequence of modification of the riverbed and inflow of wastewaters.

Inflow of thermal water from the Banja Vrujci spa, run-off of fertilizers from tilled land, and return of the

river to its natural bed cause significant differences between the benthos communities of the fifth and sixth locality in spite of their proximity to each other. A decline was observed in the number of species (18 taxa, Table 1) and average abundance of bottom organisms at the sixth locality, together with the absence of constant dominance of any one animal group there, dominance alternating between Chironomidae larvae (April, July) and Oligochaeta (October), while Diptera larvae disappear completely and the variety of species of the phylum Mollusca increases. All of this led to the similarity index between the fifth and sixth localities of only 0.43, which is lower than similarity of the bottom fauna at the fourth and sixth localities, so it is clearly impossible to isolate the middle course of the Toplica river.

The seventh locality exhibited attributes of the lower river course in being characterized by a low number of species and poor variety of Ephemeroptera and Trichoptera (one taxon), as well as by a relatively slight degree of similarity to bottom communities of the other localities. Its main characteristic is a great variety and absolute dominance of Mollusca (Table 1). In this it approaches the eighth locality, with the greatest similarity benthofauna to its (0.44). However, due to the absence of inhabited places and capacity of the river for self-purification, the variety of Ephemeroptera increases significantly at the eighth locality, where six taxa were recorded and more sensitive species of Trichoptera (*Odontocerum albicorne* and *Athripsodes bilineatus*) were also found. This makes the bottom fauna of this locality most similar to that of locality T4, the index of similarity between them being 0.48. The bottom community of the eighth locality therefore cannot be considered wholly typical of the biocoenosis of the lower course of the river, even though the locality belongs to it in regard to geographic position.

CONCLUSION

Investigations of macrozoobenthos in the Toplica river (a right-hand tributary of the Kolubara river) were performed from April 2000 to January 2001.

The bottom fauna was composed of 19 groups of macroinvertebrates with 85 determined taxa (61 identified to the species level, 24 to the level of genus). The insect orders of Trichoptera (20 taxa), Ephemeroptera (15), and Diptera (13) were the most varying groups.

The species *Gammarus pulex fossarum* Koch and *Dugesia gonocephala* Duges were the most abundant forms at the source of the river, and representatives of Ephemeroptera and Gammaridae were the most numerous in its upper course (at the second, third, and fourth locality). Mollusca and Chironomidae larvae were the most abundant forms at the fifth locality (in the river's middle course), but no constant dominance of any animal group was recorded at the sixth locality, where the dominance was alternating among Chironomidae larvae (April, July), Oligochaeta (October), and Mollusca (January). The lower course of the river (the seventh and eighth localitiy) was characterized by dominance of species of the phylum Mollusca (*Amphimelania holandri* Ferussac, *Fagotia esperi* Ferussac, and *Theodoxus transversalis* Pfeiffer).

The greatest variety of the benthos community was recorded at the third locality (with a diversity index value of 2.5) and the least one at the fifth locality (1.0). The greatest similarity of bottom fauna communities was established to exist between the first and the second locality (with a similarity index value of 0.63) and between the second and the third locality (0.61), while the least similarity was observed between the first and the seventh locality (0.15) and between the fifth and the seventh locality (0.20).

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ДИНАМИКА И ДИСТРИБУЦАЈА МАКРОЗООБЕНТОСА У РЕЦИ ТОПЛИЦИ, ПРИТОЦИ КОЛУБАРЕ

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Хидробиолошка истраживања макрозообентоса реке Топлице, десне притоке Колубаре, обављена су на 8 локалитета у периоду од априла 2000. до јануара 2001. године.

Фауну дна сачињава 19 група макроинвертебрата са 85 детерминисаних таксона (61 на нивоу врсте и 24 на нивоу рода). Инсекатски редови: Trichoptera (20 таксона), Ephemeroptera (15) и Diptera (13) су највеће разноврсности, док су Isopoda и Decapoda као и инсекти из редова Collembola, Heteroptera, Megaloptera и Planipennia најуниформнијег састава.

У извору су најбројније врсте *Gammarus pulex fossarum* Koch и *Dugesia gonocephala* Duges, а у горњем току реке (други, трећи и четврти локалитет) представници Ephemeroptera и Gammaridae. У средњем току на петом локалитету најбројнији су пужеви (Mollusca) и ларве Chironomidae, а на шестом локалитету није забележена изразита доминација једне животињске групе, већ се по доминацији смењују ларве Chironomidae (април, јул), Oligochaeta (октобар) и Mollusca (јануар). У доњем току реке (седми и осми локалитет) констатована је доминација врста из филума Mollusca (*Amphimelania holandri* Ferussac, *Fagotia esperi* Ferussac и *Theodoxus transversalis* Pfeiffer).