

WATER QUALITY ASSESSEMENT OF JABLANICA RIVER BASED ON AQUATIC MACROINVERTEBRATE COMMUNITY

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ANALIZA KVALITETA VODE REKE JABLANICE NA OSNOVU ZAJEDNICE VODENIH MAKROINVERTEBRATA

Apstrakt

Cilj rada je da se prikažu rezultati ocene kvaliteta vode reke Jablanice (sliv Kolubare) zasnovane na prisutnoj zajednici vodenih makroinvertebrata. Jablanica je relativno kratka (25 km) desna sastavnica, koja u blizini Valjeva sa Obnicom (leva sastavnica) formira Kolubaru. Kolubara, kao poslednja veća pritoka Save, protiče kroz područje sa izraženim i različitim antropogenim uticajima. Sama Jablanica nastaje spajanjem većeg broja potoka sa obronaka planina Jablanik i Medvednik. U skladu sa zahtevima EU prilikom ocene stanja rečnih sistema neophodno je utvrđivanje referentnih uslova. Da bi se utvrdilo recentno stanje, i usaglašenost sa zahtevima za dostizanje referentnog statusa, izvršeno je ispitivanje ove reke u aprilu 2013. godine na tri lokaliteta gornjeg toka. Kao parametri za ocenu kvaliteta vode, korišćeni su sledeći pokazatelji: ukupan broj taksona, saprobni indeks (SI; Zelinke & Marvan), BMWP i ASPT skorovi, broj taksona grupa Ephemeroptera, Plecoptera and Trichoptera (EPT) i indeks diverziteta (SWI; Shannon-Wiener's indeks). Zabeležena su ukupno 72 taksona makroinvertebrata. Kao najraznovrsnije grupe izdvajaju se Trichoptera (16 taksona) i Ephemeroptera (15 taksona). U odnosu na saprobnu vrednost, utvrđeno je da je većina prisutnih taksona osetljiva na organsko zagađenje (ksenosaprobn i oligosaprobn organizmi). Dobijene vrednosti praktično svih korišćenih pokazatelja kvaliteta vode, upućuju na veoma dobar status (klasa I), čime su ispunjeni uslovi da se ispitivani deo toka Jablanice može smatrati referentnim stanjem, za potrebe istraživanja sliva Kolubare. Puštanje u rad akumulacije u Rovnima (srednji tok Jablanice) može izmeniti zatečeno stanje, zbog čega je neophodan redovni monitoring.

Ključne reči: Saprobní indeksi, referentni uslovi, kvalitet vode, reka Jablanica, Srbija

Key words: Saprobic Indices, Reference conditions, Water Quality, Jablanica River, Serbia

INTRODUCTION

The Jablanica River is a relatively short right branch of the Kolubara River, which along with the left branch (the Obnica River), near the city of Valjevo (western Serbia) forms the Kolubara River (at elevation of 190 m.a.s.l.). The Jablanica itself is formed by numerous mountain brooks, flowing from the northern slopes of Mt. Jablanik (1274 m.a.s.l.) and from the eastern slopes of Mt. Medvednik (1244 m.a.s.l.). The river is 25 km long, with a drainage area of 150 km². In its middle course, near the settlement of Rovni there is dam construction ongoing, which is not yet in operative state. The future reservoir will alter the aquatic biota and the water status of this river. Because the Jablanica is a short watercourse and is situated in relatively unpolluted surroundings, without high influence of settlements, except the city of Valjevo, it is considered as a clean mountain river. As one of the constituencies of the Kolubara, it could be regarded as a spring part of this river. Knowing that the Kolubara basin is densely populated, and under various anthropogenic pressures, for the purpose of ecological monitoring and restoration in the basin, it is important to have referent null point for comparison. For the upper stretch of the Jablanica River the water quality assessment based on aquatic macroinvertebrates was done in year 2013, in order to check if this part of river could be considered as the "referent" point (referent conditions).

MATERIALS AND METHODS

The sampling was performed in April of 2013 (high water level regime) at three sampling sites (Table 1). Semi-quantitative samples were taken with a standard benthological hand net (25x25 cm, 500 µm mesh size), in accordance with the AQEM protocol (2001). All samples were preserved with 60-80% ethanol solution and further processed in the laboratory. Identification of macroinvertebrates was done using appropriate taxonomic keys.

Table 1. Sampling localities of the Jablanica River

Locality	N lat	E long	Altitude (m.a.s.l.)
JAB 1	44° 11' 31''	19° 41' 37''	498
JAB 2	44° 12' 23''	19° 42' 23''	370
JAB 3	44° 12' 57''	19° 43' 15''	321

As water quality indicators following metrics were used: Total number of taxa, Saprobic Index (SI; Zelinka and Marvan, 1961), BMWP (Biological Monitoring Working Party) Score, ASPT (Average Score Per Taxon), number of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa (Armitage et al, 1983) and Diversity Index (Shannon, 1948). Saprobiological analysis were carried out using a list of bioindicator organisms according to Moog (1995). The AQEM software was used for all calculations (AQEM, 2002). Water quality assessment was performed in accordance with the national legislation (Official Gazette of the R. of Serbia 74/2011), based on ecological status classes for small and medium-sized streams, altitude up to 500 m, with the dominance of large substrates.

RESULTS AND DISCUSSION

A total of 72 aquatic macroinvertebrate taxa were identified. Having in mind that some groups, most notably chironomids, were not identified to the species level, the diversity is probably higher. Trichoptera (16 taxa) and Ephemeroptera (15 taxa) were found to be the most diverse groups. The highest diversity was recorded at the site JAB 1, with 50 identified taxa, while the lowest was found at the locality JAB 2 with 38 recorded taxa. The recorded diversity is slightly higher than in some previous investigations (57 taxa; Stefanović et al., 2009). Marković et al. (1998) during early 1990s recorded 100 taxa in total in the Jablanica River, but this research covered a prolonged period of time (three years). With regard to taxonomic composition, the dominance of Trichoptera and Ephemeroptera corresponds to results of Stefanović et al. (2009) where the dominance of the same groups was recorded (Ephemeroptera – 19 taxa, Trichoptera – 14 taxa), while in the case of Marković et al. (1998), besides Ephemeroptera (19 taxa), dominance of Oligochaeta (21 taxa) were also found. These differences in diversity and taxonomic composition, in comparison to previous research, could be explained by selection of sampling sites – in our study, where only upper river stretch was investigated.

Regarding the percentage share of the groups, Ephemeroptera were found to be the most abundant (38,3%), while Coleoptera (19,3%), Diptera (16,1%) and Trichoptera (13,2%) were also significant members of the macroinvertebrate assemblages.

In relation to ecological classification of taxa regarding its saprobic valence (Moog, 2002) the majority of taxa are sensitive to organic pollution, with 21% of identified taxa belonging to xeno- and oligosaprobic organisms. Taxa tolerating the low degree of organic pollution (β – mesosaprobic) were present with 17,5%, while taxa adapted to higher organic load (α – mesosaprobic and polysaprobic organisms) with only 5% of total community. However, it should be mentioned that for the majority of taxa (56,5%) there is a lack of data regarding its saprobic preferences. Assemblages in all three localities have the same structure regarding sensitivity to organic pollution (Figure 1).

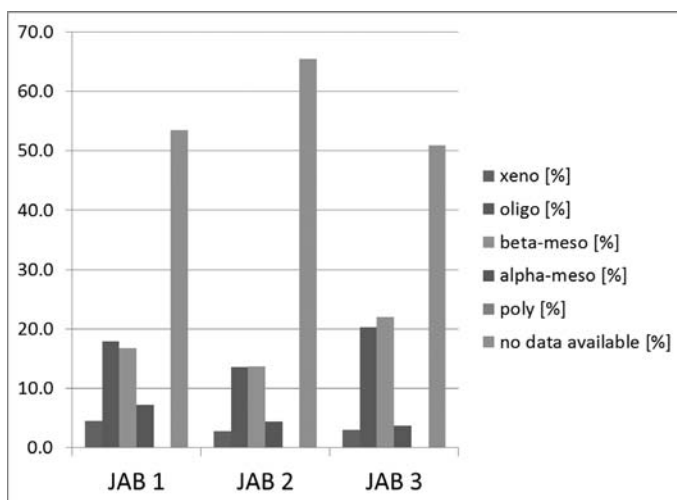


Figure 1. Percentage participation (%) of main saprobic groups in the community of the Jablanica investigated localities

Table 2. Values of calculated metrics and water quality classes for upper stretch of the Jablanica River

Locality	JAB 1		JAB 2		JAB 3	
Total Number of Taxa	50	I	38	I	46	I
SI	1.523	I	1.536	I	1.539	I
BMWP	162	I	142	I	169	I
ASPT	7.043	I	6.762	II	7.348	I
SWI	3.101	I	2.574	I	3.283	I
EPT	24	I	19	I	26	I

In regard to obtained values of used metrics, water quality at all sampling sites, is assessed as very good (class I), except in the ASPT at site JAB 2, whose value corresponds to II quality class (Table 2). Having in mind results of some previous investigations of this river (Marković et al. 1998; Stefanović et al. 2009) it could be noted that water quality of this river remained of high quality for longer period of time. Considering this, the Jablanica River, and particularly its upper part could be used as reference point for the assessment of the Kolubara River. Future forming of the Rovni reservoir lake could affect this upper part of the river as well, so it is important to maintain continuous monitoring.

CONCLUSIONS

During the investigation of the Jablanica River 72 macroinvertebrate taxa were identified. In regard to species richness, Trichoptera and Ephemeroptera were found to be dominant groups. Number of taxa per locality was high, and varied from 38 to 50, corresponding to very good water quality (class I).

Obtained values of saprobic index (SI), BMWP, SWI and EPT indicate very good water quality at investigated sites. The ASPT values, except at site JAB 2 (class II) also corresponds to very good water quality. In relation to ecological classification of taxa regarding its saprobic valence, it was found that the majority of taxa are sensitive to organic pollution. Overall good water quality of the River Jablanica in this study, confirms that this river has potential to be used as referent point for monitoring of its recipient river Kolubara.

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REFERENCES

AQEM Consortium, (2002): Manual for the application of the AQEM system. A comprehensive method to assess European streams using benthic macroinvertebrates developed for the purpose of the Water Framework Directive. Version 1.0 (www.aqem.de), February 2002, 202 pp.

Armitage, P.D., Moss, D., Wright, J.F., Furse, M.T. (1983): The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. *Water Research*, 17: 333-347.

Marković, Z., Miljanović, B., & Mitrović-Tutundžić, V. (1998) Macrozoobenthos as a water quality parameter in the river Jablanica [Serbia, Yugoslavia]. In 27. jugoslovenska konferencija o aktuelnim problemima zastite voda Zastita voda '98, Kotor (Yugoslavia), 9-12 Jun 1998. Jugoslovensko drustvo za zastitu voda, 369-372 str.

Moog, O. (2002): *Fauna Aquatica Austriaca. Katalog zur autökologischen Einstufung aquatischer Organismen Österreichs. Teil III, B, Metazoa.* – Bundesministerium f. Land- u. Fortwirtschaft, Wien.

Official Gazette of the RS 74/2011. The parameters of ecological and chemical status of surface waters and parameters of the chemical and quantitative status of groundwater.

Official Gazette of the RS 96/2010. Regulation on establishment of surface and groundwater bodies.

Shannon, C. E. (1948): A mathematical theory of communication. *The Bell System Technical Journal*, 27: 379–423.

Stefanović, K., Nikolić, V., Tubić, B., Tomović, J., Atanacković, A., Simić, V., Paunović, M. (2009) Aquatic macroinvertebrates of the Jablanica River, Serbia. *Archives of Biological Sciences*, 61(4): 787-794.

Zelinka, M., Marvan P. (1961): Zur Präzisierung der biologischen Klassifikation der Reinheit fließender Gewässer. *Archiv für Hydrobiologie*, 57: 389–407.