



University of Belgrade, Technical Faculty in Bor  
29<sup>th</sup> International Conference Ecological Truth  
& Environmental Research



# EcoTER'22

## Proceedings



*Editor*

*Prof. Dr Snežana Šerbula*

*21-24 June 2022, Hotel Sunce, Sokobanja, Serbia*



University of Belgrade, Technical Faculty in Bor  
29<sup>th</sup> International Conference Ecological Truth  
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## **PREFACE**

*In today's world, the environment has been endangered by the use of outdated technology, fossil fuels and environmental law violations. Therefore, environmental and many other scientists all over the world have been concerned about finding sustainable technology in resolving these issues. That is why environmental research and ecological truth are at the focus of the 29<sup>th</sup> International Conference Ecological Truth & Environmental Research 2022 (EcoTER'22), which will be held in Sokobanja, Serbia, 21–24 June 2022. On behalf of the Organizing Committee, it is a great honor and pleasure to wish all the participants a warm welcome to the Conference.*

*We hope to convey the message of the conference, which is that a transformation of attitudes and behavior would bring the necessary changes. This is also an opportunity for the participants who are experts in this field to exchange their experiences, expertise and ideas, and also to consider the possibilities for their collaborative research.*

*The 29<sup>th</sup> International Conference Ecological Truth & Environmental Research 2022 is organized by the University of Belgrade, Technical Faculty in Bor, and co-organized by the University of Banja Luka, Faculty of Technology, the University of Montenegro, Faculty of Metallurgy and Technology – Podgorica, the University of Zagreb, Faculty of Metallurgy – Sisak, the University of Pristina, Faculty of Technical Sciences – Kosovska Mitrovica and the Association of Young Researchers, Bor.*

*These proceedings include 85 papers from the authors coming from the universities, research institutes and industries in 6 countries: Bulgaria, Italia, Albania, Bosnia and Herzegovina, Montenegro and Serbia.*

*As a part of this year's conference, the 4<sup>th</sup> Student section – EcoTERS'22 is being held. We appreciate the contribution of the students and their mentors who have also participated in the Conference.*

*Financial assistance provided by the Ministry of Education, Science and Technological Development of the Republic of Serbia is gratefully acknowledged by the Organizing Committee of the EcoTER'22 conference.*

*The support of the Platinum donor and their willingness and ability to cooperate have been of great importance for the success of EcoTER'22. The Organizing Committee would like to extend their appreciation and gratitude to the Platinum donor of the Conference for their donation and support.*

*We appreciate the effort of all the authors who have contributed to these Proceedings. We would also like to express our gratitude to the members of the scientific and organizing committees, reviewers, speakers, chairpersons and all the Conference participants for their support to EcoTER'22. Sincere thanks go to all the people who have contributed to the successful organization of EcoTER'22.*

*Prof. Snežana Šerbula,*

*President of the Organizing Committee*



## INDICATIVE ECOLOGICAL STATUS ASSESSMENT OF SELECTED STREAMS ON ROGOZNA MOUNTAIN BASED ON AQUATIC MACROINVERTEBRATES

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### Abstract

*This paper presented indicative ecological status assessment of four investigated streams of Rogozna Mountain based on aquatic macroinvertebrate community. A total number of 116 taxa from 16 taxa groups were identified at 9 selected localities within the study area. The aquatic insects were the most dominant group in the benthic community in respect to taxa richness, while the rest of the community consisted of taxa groups with lower participation. General conclusion is that the degree of organic pollution of the surveyed streams is low and indicative ecological status of streams in the study area, based on aquatic macroinvertebrates community, could be assessed as good to moderate.*

**Keywords:** aquatic macroinvertebrates, Rogozna Mountain, streams, ecological status assessment

### INTRODUCTION

Rogozna is a mountain in the southwest part of Serbia, situated in a triangle composed of the river flows of the upper and central flow of the Ibar River and the Raška River, 12 km from Novi Pazar [1]. Aquatic ecosystems in this area are poorly investigated.

The area is recognized as the potentially significant for ore extraction, thus it is a subject of potential investigations on the cost effectiveness, social aspects, but also biodiversity. The study area (=23.63 km<sup>2</sup>) is under the potential impact of exploration drilling activities of Au, Cu, Pb, Zn and Ag [2].

The aim of this study is to assess the state of ecological status and baseline aquatic macroinvertebrates diversity of target area with the idea of continuing further research because of investigative geological works and potential mining activities could cause substantial damage to environment, including aquatic ecosystems of target area.

### MATERIALS AND METHODS

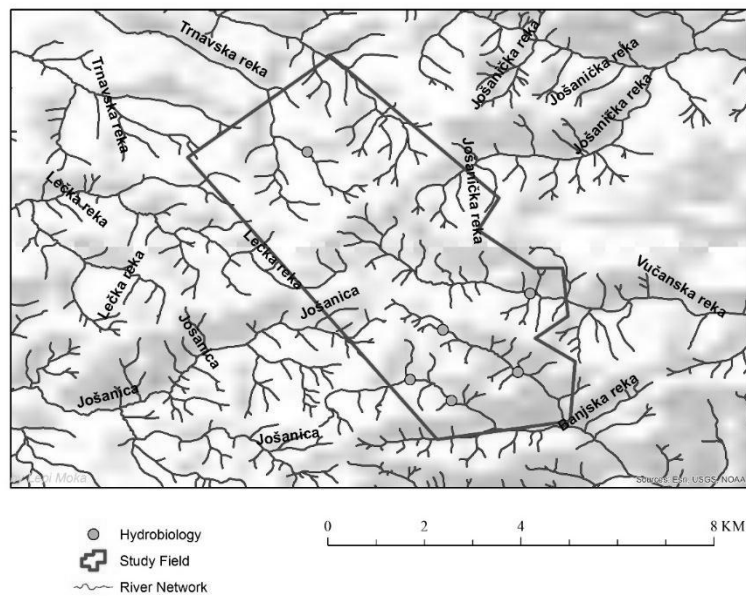
Aquatic macroinvertebrates are the most frequently used for the integrated quality assessment of rivers based on the requirements of the Water Framework Directive [3].

Samples have been collected using Kick and Sweep (K&S) method (adapted [4]), from all microhabitat types and the procedure was standardized according to time which was spent for



sampling and it was proportional to the evaluated habitat percentage and the sampling section [5]. Biological indices calculation was done using the ASTERICS 4.04 software package.

Data were collected during the period of April and September 2021 at 9 localities as detailed in Figure 1: two from the Barska reka, two from the Karavansalijska reka, three from the Kašaljska reka, one from ephemeral pond near Kašaljska reka and one on the Netvički potok. Selected sampling sites Karavansalijska and Kašaljska reka are draining to Ibar through Banjska and Barska reka, while Netvički potok drains to Raška through the Trnavska reka.

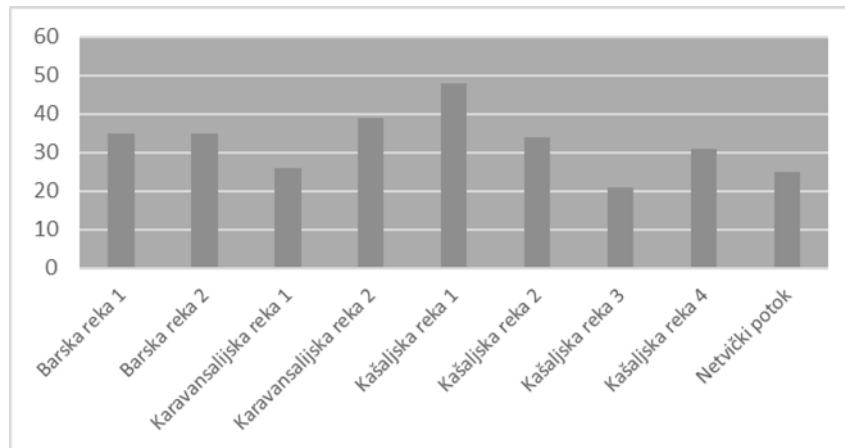


**Figure 1** Sampling locations within the study area

## RESULTS AND DISCUSSION

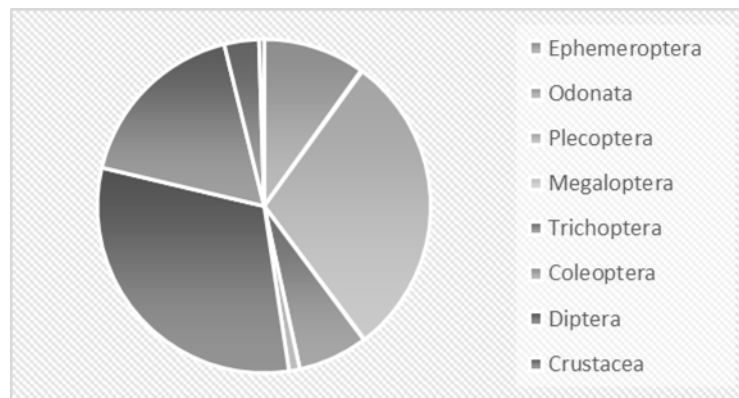
A total number of 116 taxa from 16 taxa groups were identified within the area of investigation.

The highest number of taxa (48) was recorded at site Kašaljska reka 1, while the lowest number of taxa (21 taxa) was recorded at site Kašaljska reka 3. A significant taxa richness was also detected at locality Karavansalijska reka 2 (39 taxa), on both sites in Barska reka (35), followed by Kašaljska reka 2 (34), while a smaller number of taxa were registered on sites Karavansalijska reka 1 (26) and Netvički potok (25). The number of recorded taxa per site presented at Figure 2.



**Figure 2** Number of taxa per sampling sites

The aquatic insects were the most dominant group in the community in respect to taxa richness (78.64%), while the rest of the community consisted of Crustacea (family Gammaridae) (17.41%) and Oligochaeta (3.37%). Other taxa groups had lower percentage participation in the benthic community (Figure 3). Insect orders, Diptera (31.06% - almost 90% belonged to the Chironomidae family) and Plecoptera (29.73%) were present with the highest percentages in the total community. Ephemeroptera (9.87%) and Trichoptera (6.87%) constituted an important component of the community, but had lower percentage participation.



**Figure 3** Proportions of different aquatic invertebrate taxa, expressed as a percentage of the overall aquatic macroinvertebrate community

Regarding the tolerance to organic pollution, the majority of detected species within the area could be considered as sensitive. Thus, according to the ecological classification of the taxa, with regard to saprobic conditions (saprobic valence) of Moog [6], 20.45% species were tolerant to moderate organic load (beta-mesosaprobic). 14.79% of the identified species belong to the oligosaprobic group (tolerant of low rates of organic matter loading), 8.6% of the taxa could be characterized as alpha-mesosaprobic (tolerant of high organic matter loading), while 5.54% belong to the xenosaprobic group (tolerant to only the very lowest rate of organic matter loading). 0.9% recorded species were adapted to high organic load

(polysaprobic). For almost half of the community (49.73%) there is no data for classification with regard to saprobic tolerance.

Surveyed localities belong to river Type 6, based on national legislature [7,8]. For this type of river, the following metrics were used to evaluate the ecological status of the investigated streams: Zelinka and Marvan Saprobic Index SI [9], total number of taxa per site, percentage participation of subfamily Tubificinae (Oligochaeta), EPT index (number of Ephemeroptera, Plecoptera and Trichoptera) and number of sensitive taxa. Indicative status assessment was performed according to the procedure proposed by Paunović *et al.* [10], based on the class boundaries shown in Tables 2 and 3.

The values of SI indices varied per sampling location. Low values on Barska reka 2 (1.247) and Karavansalijska reka 2 (1.154) indicated high status (I class), which indicate low level of organic pollution. Higher values of SI on sites Karavansalijska reka 1 indicate to a higher level of organic pollution and moderate ecological status (III class). Registered values for the rest of sampling sites indicate good ecological status (II class) (Table 3).

Number of present groups of organisms in the macrozoobenthic community (Number of taxa) indicates to the overall diversity. Higher scores indicating high status (I class) for the all investigated streams (Table 3).

Status assessment according to percentage participation of the subfamily Tubificinae (Oligochaeta) in the macroinvertebrate community revealed good status (II class) for most localities, except Barska reka 1 and Karavansalijska reka 1. Good status is not reached at these two sites, which means higher level of organic pollution present and moderate ecological status.

EPT Index (Ephemeroptera, Trichoptera and Plecoptera Index) is based on the premise that high-quality streams usually have the greatest species richness of these groups. The greater the pollution, the lower the species richness is expected which is the most obvious among three aquatic insects orders - Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), since majority of the species belonging to mentioned insects are sensitive to environmental stress - pollution, habitat degradation and change in hydrology of streams. Thus, the higher values of EPT index are associated with non-impacted or slightly impacted streams, while decline of index indicates increasing of environmental stress.

The number of EPT taxa per locality varied in range from 8 to 18 (Table 2). The highest value of the EPT index was recorded at sites Barska reka 2 and Karavansalijska reka 2 (18 taxa), while number of EPT taxa at localities Netvički potok (8 taxa) and Karavansalijska reka 1 (9 taxa) were lower. Water quality according to EPT index at all investigated locality characterised good status assessment (II class).

According to the number of sensitive taxa on all investigated localities were reached good status (II class) (Table 3).

Table 2 Values of calculated macroinvertebrate metrics

Metric/Locality	Barska reka 1	Barska reka 2	Karavansalijska reka 1	Karavansalijska reka 2	Kašaljska reka 1	Kašaljska reka 2	Kašaljska reka 3	Kašaljska reka 4	Netvički potok
Saprobic Index (Zelinka & Marvan)	1.514	1.247	2.222	1.154	1.715	1.567	1.99	2.075	1.974
Number of Taxa	35	35	26	39	48	34	21	31	25
Tubificinae (Oligochaeta) [%]	7.45	0	6.88	0.25	1.82	2.67	0	1.09	0.33
EPT taxa	18	14	9	18	17	15	12	10	8
Number of sensitive taxa	7	7	5	9	11	8	5	4	7

Table 3 Assessment of ecological status based on macroinvertebrate metrics

Metrics/Locality	Barska reka 1	Barska reka 2	Karavansalijska reka 1	Karavansalijska reka 2	Kašaljska reka 1	Kašaljska reka 2	Kašaljska reka 3	Kašaljska reka 4	Netvički potok
Saprobic Index (Zelinka & Marvan)	II	I	III	I	II	II	II	III	II
Number of Taxa	I	I	I	I	I	I	I	I	I
Tubificinae (Oligochaeta) [%]	-	+	-	+	+	+	+	+	+
EPT taxa	+	+	+	+	+	+	+	+	+
Number of sensitive taxa	+	+	+	+	+	+	+	+	+
Indicative ecological status	III	II	III	II	II	II	II	III	II

+ Good status; - Good status not reached.

## CONCLUSION

The overall status of rivers in the Study area could be assessed as good to moderate. Based on used community indices, the general conclusion is that the degree of organic pollution of surveyed streams is low. This is also confirmed by the taxa richness (characteristic number of species for small streams of hilly-mountainous regions of ecoregion 5 and 6 [10]) and community structure (appearance of taxa characteristic for small streams of hilly-mountainous regions of ecoregion 5 and 6 [10]).

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