



University of Belgrade, Technical Faculty in Bor



# ECO TRUTH

30<sup>th</sup> International Conference Ecological Truth  
& Environmental Research  
2023

# Proceedings

Editor  
Prof. Dr Snežana Šerbula





University of Belgrade, Technical Faculty in Bor



# ECOTRUTH

30<sup>th</sup> International Conference Ecological Truth  
& Environmental Research  
2023

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Prof. Dr Snežana Šerbula



**PROCEEDINGS**

**30<sup>th</sup> INTERNATIONAL CONFERENCE**

**ECOLOGICAL TRUTH AND ENVIRONMENTAL RESEARCH – EcoTER'23**

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**Cover design:**

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**Publisher:** University of Belgrade, Technical Faculty in Bor

**For the publisher:** Prof. Dr Dejan Tanikić, Dean

**Printed:** University of Belgrade, Technical Faculty in Bor, 100 copies, electronic edition

**Year of publication:** 2023

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ISBN 978-86-6305-137-9

CIP - Katalogizacija u publikaciji  
Narodna biblioteka Srbije, Beograd

502/504(082)(0.034.2)

574(082)(0.034.2)

**INTERNATIONAL Conference Ecological Truth & Environmental Research (30 ; 2023)**

Proceedings [Elektronski izvor] / 30th International Conference Ecological Truth & Environmental Research - EcoTER'23, 20-23 June 2023, Serbia ; organized by University of Belgrade, Technical faculty in Bor (Serbia) ; co-organizers University of Banja Luka, Faculty of Technology – Banja Luka (B&H) ... [et al.] ; [editor Snežana Šerbula]. - Bor : University of Belgrade, Technical faculty, 2023 (Bor : University of Belgrade, Technical faculty). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. - Preface / Snežana Šerbula. - Tiraž 100. - Bibliografija uz svaki rad.

ISBN 978-86-6305-137-9

а) Животна средина -- Зборници б) Екологија – Зборници

COBISS.SR-ID 118723849



**30<sup>th</sup> International Conference  
Ecological Truth and Environmental Research – EcoTER'23**

*is organized by:*

**UNIVERSITY OF BELGRADE  
TECHNICAL FACULTY IN BOR (SERBIA)**

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## **PREFACE**

*The 30<sup>th</sup> international conference Ecological Truth & Environmental Research – EcoTER'23 kept three areas in focus: ecology, environmental protection and sustainable development. The conference will be held on Mt Stara Planina in hotel Stara Planina, Serbia, 20–23 June 2023. The monograph is published on the occasion of the 30th anniversary of the conference. On behalf of the scientific and organizing committee, it is a great honor and pleasure to wish all the participants a warm welcome to the conference.*

*The monograph is published on the occasion of the 30<sup>th</sup> anniversary of 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 30<sup>th</sup> international conference Ecological Truth & Environmental Research – EcoTER'23 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 103 papers from the authors coming from the universities, research institutes and industries in 11 countries: Australia, USA, Brazil, Spain, Portugal, Libya, Italy, Bulgaria, Bosnia and Herzegovina, North Macedonia, and Serbia.*

*As a part of this year's conference, the 5<sup>th</sup> Student Session – EcoTERS'23 is being held. We appreciate the contribution of the students and their mentors who have also participated in the conference.*

*The support of the Gold donor and their willingness and ability to cooperate has been of great importance for the success of the EcoTER'23. The organizing committee would like to extend their appreciation and gratitude to the Gold 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 the EcoTER'23. Sincere thanks go to all the people who have contributed to the successful organization of the EcoTER'23.*

*Prof. Snežana Šerbula,*

*President of the scientific and organizing committee*



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## INDICATIVE ECOLOGICAL STATUS ASSESSMENT OF RIBNICA RIVER (KOLUBARA BASIN) BASED ON AQUATIC MACROINVERTEBRATES

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### Abstract

*This paper aims to present indicative ecological status of the Ribnica River, a tributary to the Kolubara River, based on aquatic macroinvertebrate community. On 7 selected localities a total of 123 taxa were identified. These taxa belong to 14 taxonomic groups. Macroinvertebrate community was dominated by insect groups, mainly Diptera, Trichoptera and Ephemeroptera, while other groups are less diverse and have lower abundance. Overall water quality was moderate or better with exception of the site located between Paštrić village and Mionica, which showed deterioration in all biological quality indices. This can be explained by the presence of numerous farms in the vicinity which have a negative impact on taxa richness and composition of macroinvertebrate community.*

**Keywords:** benthos, macroinvertebrates, ecological status, Ribnica River.

### INTRODUCTION

The Ribnica River is a right tributary of the Kolubara River, formed in Brežje (Kozomor) by the Paklešnica and the Manastirica brooks. The upper part of the river valley is gorge-shaped, while the lower part flows through the Paštrić village and the Mionica before confluence to the Kolubara River. The River Ribnica is categorized as Type 3 watercourse in national legislation [1]. These watercourses are located at altitudes up to 500 masl with domination of hard substratum composed of bedrock, large stones and cobbles. Aquatic habitats of the river Ribnica reflect typical conditions of Type 3 watercourse. The bottom is mainly composed of stones and cobbles with deposits of sand and detritus in sections with slower water flow. Water depth varies from 30 cm to 1 m and water width from 3 m to 10 m. Water levels and flow vary significantly throughout the year. The aim of this study is to provide an assessment of ecological quality of river Ribnica and to provide biodiversity baseline of aquatic macroinvertebrate community.

### MATERIALS AND METHODS

For the integrated quality assessment of rivers based on the requirements of Water Framework Directive, benthic macroinvertebrates are the most commonly used component of aquatic communities [2]. For this study samples were collected on 7 selected sites on the entire course of the river Ribnica. Field work was conducted in autumn of 2022. All

investigated sites were located on the main course of the Ribnica River, from its source (Ribnica 7 site), confluence of the Paklešnica and Manastirica brooks, to the most downstream (Ribnica 1 site) before its confluence to the Kolubara River. Locations of sampling sites are presented in Figure 1. Samples were collected using Kick and Sweep method performed following the EN 27828:1994 standardized protocol using a hand net (0.25×0.25 m, mesh size of 500 µm) [3]. For calculation of biological indices Asterics 4.04 software was utilized [4].

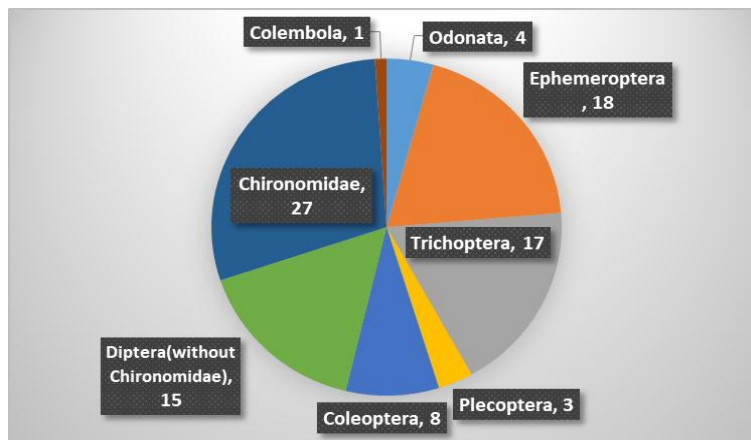


**Figure 1** Sampling sites on the Ribnica river

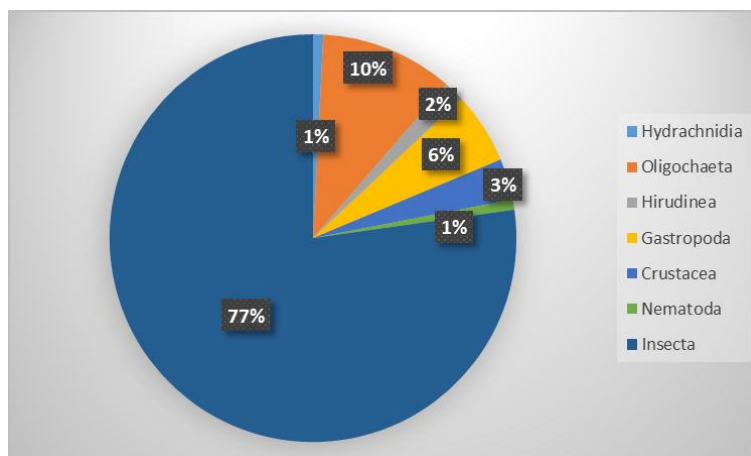
## RESULTS AND DISCUSSION

A total of 123 taxa from 14 taxa groups were identified during the investigation of the river Ribnica. Taxa richness of macroinvertebrate groups is presented in Figure 2 while the structural composition is presented in the Figure 3. The overall diversity of aquatic macroinvertebrate community of the river Ribnica was high. The community was dominated by aquatic insects, as is expected for this kind of habitats. The most diverse group was Diptera with 42 species which was dominated by the family Chironomidae (non-biting midges) and its 27 species recorded. Beside these groups, large number of species of other insect groups were recorded: Ephemeroptera (18 species), Trichoptera (17) and Coleoptera (8), while Odonata and Plecoptera were represented with 4 and 3 species, respectively. Relatively high number of species (13) was recorded within the Oligochaeta, a group of aquatic worms. Within the molluscs gastropods 8 taxa were recorded, while representatives of Bivalvia were not recorded. Other taxa groups were represented with only one or two species. The highest number of taxa was recorded for the Ribnica 3 site (44) and the lowest for the Ribnica 2 (16). Comparison of taxa richness of investigated sites of the river Ribnica is presented in Figure 4. The diversity of macroinvertebrate community of the river Ribnica reflected through

Shannon-Wiener index was high for all investigated sites. The highest ( $H'$ ) index calculated for the Ribnica 4 and the lowest for the Ribnica 2 site.



**Figure 2** Taxa richness of different insect groups in the macroinvertebrate community of the river Ribnica



**Figure 3** Structural composition of the aquatic macroinvertebrate community of the river Ribnica based on taxa groups

All investigated sites belong to river Type 3 in national legislative [1,5]. Following metrics were used for the ecological status assessment: Number of taxa, Saprobic index (Zelnika & Marvan), BMWP score, Average Score Per Taxon (ASPT), Diversity index (Shannon-Wiener), Number of Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) species (EPT), number of recorded families, and percentage of family Tubificidae in the community. Indicative ecological status assessment was performed according to procedure proposed by Paunović *et al.* [6,7] and results are presented in the Table 1.

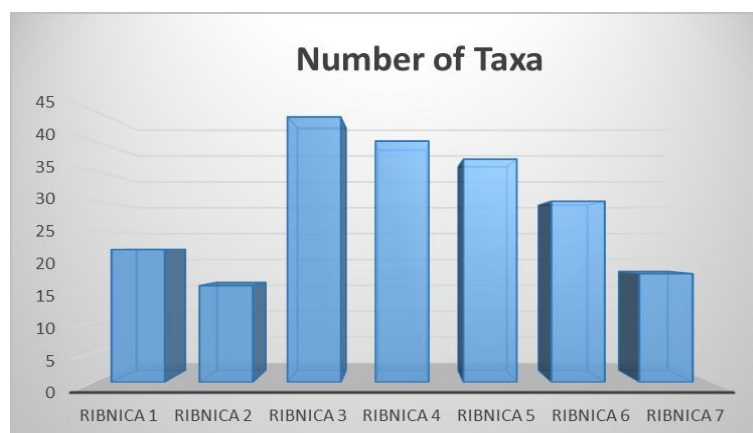
Ecological status based on the number of recorded taxa and high values of the diversity index, was regarded as high (water quality class I-II). The same assessment was made based on ASPT index. Very high number of species from different families indicates that the ecological status was excellent for all investigated sites.

**Table 1** Ecological status of Ribnica River based on macroinvertebrate community

	Ribnica 1	Ribnica 2	Ribnica 3	Ribnica 4	Ribnica 5	Ribnica 6	Ribnica 7
Number of Taxa	I	II	I	I	I	I	II
Saprobic Index (Zelinka & Marvan)	II	III	II	II	II	II	II
BMWP Score	III	III	II	I	I	II	II
Average score per Taxon	II	II	II	II	II	II	I
Diversity (Shannon- Wiener-Index)	I	II	I	I	I	II	II
EPT	II	IV	III	I	II	III	III
Number of Families	I	I	I	I	I	I	I
Tubificidae %	+	+	+	+	+	+	+
<b>Ecological status</b>	III	IV	III	II	II	III	III

I – excellent, II – good, III – moderate, IV – poor, V – bad; + good status reached.

Good or better ecological status for all sites was reflected by Tubificidae % metrics. BMWP metric evaluates the ecological status of all sites as good or better. The only site that did not reach moderate ecological status is the Ribnica 2 which is located downstream the Paštrić village, and the metric that gave unfavourable result was EPT index. This site was characterized by the overall lower diversity and parameters that are derived from the number of recorded taxa, which could reflect the effects of anthropogenic pressures present in the vicinity (farming, agriculture, waste disposal and stone quarries). Insect groups Ephemeroptera, Plecoptera and Trichoptera are regarded as sensitive taxa, and deterioration in their numbers reflects habitat quality degradation. Previous knowledge on the macroinvertebrate fauna of this river is very limited. Only available publication is Jović *et al.* [8]. Their paper list a presence of 43 taxa for both the Ribnica and the Lepenica rivers. This is a considerably lower number in comparison with this study (123). Couple of notes should be made: Jović *et al.* [8] investigated fewer sites (3) and some groups such as Chironomidae, Oligochaeta and Amphipoda were not identified past the group level.



**Figure 4** Species richness of investigated sites of the river Ribnica, sites are arranged based on their location, from the most downstream to the most upstream

## **CONCLUSION**

This study showed that overall ecological status of the Ribnica River was moderate or better. The majority of biological quality indices showed that the water quality was good or better. The exception was the site in the vicinity of Paštrić village which shows deterioration in water quality. Rich fauna of aquatic macroinvertebrates of the river Ribnica consisting mostly of insect taxa was expected given the type of watercourse, and it reflected preserved habitats and good ecological status of this watercourse mainly in the middle part of the course of the river, while on sites located in the vicinity of human settlements decrease in the diversity of macroinvertebrate community and deterioration of water quality were observed.

## **ACKNOWLEDGEMENT**

*Publication of manuscript was supported by Ministry of Science, Technological Development and Innovation of Republic of Serbia (contract number: 451-03-47/2023-01/200007).*

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