Evaluation of Bega River Water Quality Using Biotic Indices

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Abstract
The main purpose of the topic is to research ecological indices resulting from the analysis of zoo-benthos communities in order to use them combined as a method of diagnosing the water quality of the Bega River in the area of Timisoara. A major importance in achieving the strategy of conserving the biodiversity of benthic habitats is the study of benthos, especially for understanding the changes that occur in the qualitative parameters of zoo-benthic communities, but also their habitats under the influence of different types of anthropogenic pressures. The present study started in February 2014 and took place over a period of two years in which quantitative samples of benthos were taken seasonally. By locating the sampling stations at various representative points of the Bega River, upstream and downstream of the central area of Timisoara, it was possible to conduct a general analysis and investigation of benthic macro invertebrates communities.

Keywords: Bega River, biotic indices, pollution.

1. Introduction

Biological pollution of surface water with wastewater can produce the following effects [1, 2]:
- changing the physical quality by changing the temperature, color, electrical conductivity, radioactivity, by forming deposits of bottom, floating films or foam;
- changing the organoleptic qualities of organisms;
- change in chemical qualities due to changes in pH, due to a reduction in the amount of oxygen due to organic substances brought by wastewater, due to changes in hardness, due to increased content of toxic substances;
- destruction of fauna and flora and the development of certain bacteria that may contain many pathogens.

One of the many characteristics of the anthropogenic impact on the environment under natural conditions is the pollution of water, especially surface water as a result of household, agricultural and industrial pollution.

Chemical analyzes reflect the current state of the waters. No matter how frequent and precise they are, they are indicative, do not show the general condition, and the pollution waves can go unnoticed between two samples. Instead, living organisms are always subject to environmental conditions and survive those that withstand all pressures, tolerance being different from species to species, some being more tolerant (euribiont species) and others less (stenobiont species). Thus, the presence or absence of a species is a more accurate indicator of monitoring the quality of the

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aquatic environment than the physico-chemical analyzes that are periodic [3-6].

2. Materials and methods

The present study started in February 2014 and took place over a period of two years in which quantitative samples of benthos were taken seasonally (5 samples for season).

Samples containing benthic macro invertebrates were collected with Ekman Sampler and stored in 8% formaldehyde from upstream, middle and downstream of Timisoara city [7-13].

The collecting stations (S) were located as follows: S1 is located upstream of Timisoara city, this station is located near Ghiroda village, upstream of potable water treatment station, S2 is located upstream of sewage water treatment station of Timisoara, S3 is located near Sânmihaiu Roman village from Timis County and downstream of sewage water treatment station of Timisoara and station S4 is located near Otelec village, before the border line with Serbia Country (Figure 1).

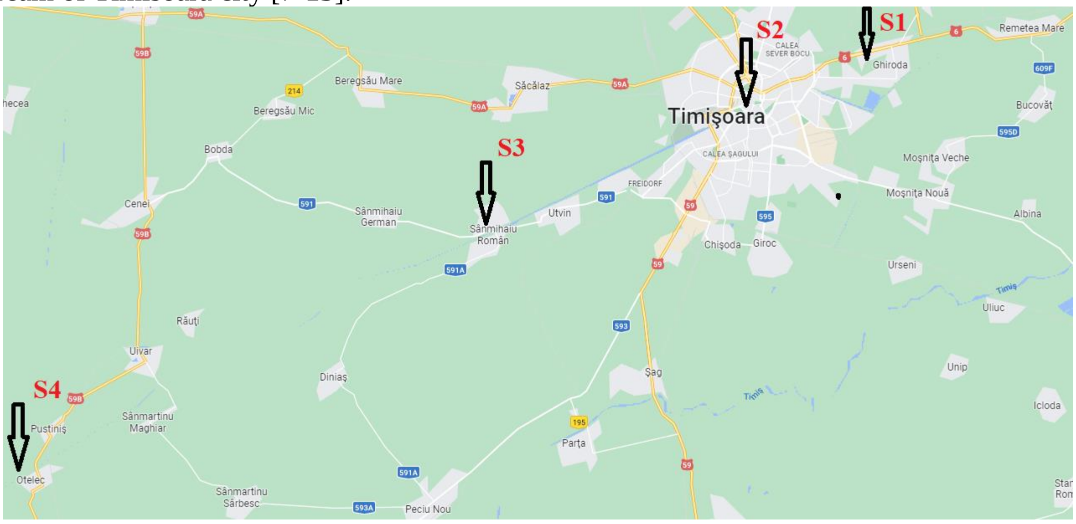

Figure 1. The sampling location of station on Bega River water

There have been calculated the distribution of benthic macro invertebrates [12, 14, 15].

3. Results and discussion

In the Bega River there are benthic communities formed by a number of ten groups of benthic macro invertebrates: *Oligochaeta* subclass, *Diptera* order (larvae of the family *Chironomidae*, *Ceratopogonidae* and *Tipulidae*), *Lamelibranchiata* class, *Hirudinea* class, *Gastropoda* class, *Gastropoda* class, *Trichoptera* order, *Isopoda* order, *Coleoptera* order and *Odonata* order (Tables 1-4).

Table 1. Distribution of benthic macro invertebrates identified at station S1

Invertebrate group	Month			
	February (n)	April(n)	June (n)	October (n)
Oligochaeta	287	206	298	204
Lamelibranchiata	532	494	345	607
Hirudinea	0	0	0	0
Nematoda	52	34	21	16
Gastropoda	653	720	529	807
D. Ceratopogonidae	47	32	12	19
D. Chironomidae	97	109	92	85
D. Tipulidae	32	24	15	7
Trichoptera	0	0	0	0
Isopoda	0	0	0	0
Coleoptera	23	17	14	8
Odonata	45	13	0	0

D. –Dipter

Table 2. Distribution of benthic macro invertebrates identified at station S2

Invertebrate group	Month			
	February (n)	April (n)	June (n)	October (n)
Oligochaeta	356	405	443	396
Lamelibranchiata	81	79	88	72
Hirudinea	0	0	0	0
Nematoda	5	7	8	5
Gastropoda	904	1298	1308	902
D. Ceratopogonidae	9	12	5	9
D. Chironomidae	48	45	39	44
D. Tipulidae	3	1	2	5
Trichoptera	0	0	0	0
Isopoda	0	0	0	0
Coleoptera	0	0	0	0
Odonata	0	0	0	0

D. – Dipter

Table 3. Distribution of benthic macro invertebrates identified at station S3

Invertebrate group	Month			
	February (n)	April (n)	June (n)	October (n)
Oligochaeta	3567	2932	4001	3532
Lamelibranchiata	0	0	0	0
Hirudinea	38	32	29	35
Nematoda	0	0	0	0
Gastropoda	0	0	0	0
D. Ceratopogonidae	0	0	0	0
D. Chironomidae	7134	7124	7145	7129
D. Tipulidae	0	0	0	0
Trichoptera	0	0	0	0
Isopoda	17	9	18	9
Coleoptera	0	0	0	0
Odonata	0	0	0	0

D. – Dipter

Table 4. Distribution of benthic macro invertebrates identified at station S4

Invertebrate group	Month			
	February (n)	April (n)	June (n)	October (n)
Oligochaeta	1267	1009	976	953
Lamelibranchiata	83	89	95	68
Hirudinea	0	0	0	0
Nematoda	5	9	8	7
Gastropoda	285	269	303	283
D. Ceratopogonidae	48	41	38	46
D. Chironomidae	435	395	385	487
D. Tipulidae	0	0	0	0
Trichoptera	155	127	320	189
Isopoda	0	0	0	0
Coleoptera	0	0	0	0
Odonata	0	0	0	0

D. – Dipter

4. Conclusions

The presence in the surface waters of the chironomids, as well as of any representative of the order *Diptera*, means waters polluted with organo-mineral materials or in the process of pollution. The density of these species - an indicator in the benthos of flowing or stagnant water can therefore provide information on the degree of pollution or pollution.

In our research, *Chironomidae* was highlighted in all benthos samples from sampling stations on the Bega River circuit, from the entrance to the city, to the S4 station in Otelec, located 53 km from Timisoara. However, the highest values were recorded in the samples from station S3, after which they decrease towards station S4. Their presence in the water since the entrance to the city shows us the initiation of a process of impurity, a little slower at first, but which during the crossing of the city of Timisoara is amplified. For this reason, the highest values of this biotic index are recorded in the benthos from the S3 station, after which it decreases more than 20 times at the S4 station, probably with further decreasing trends.

The lack of EPT bodies in station S1, station S2 and station S3 brings additional arguments regarding the questionable quality of Bega waters when passing through these points. Further, higher values are recorded for the S4 station, especially during June. Based on these results we can conclude that station S4 is the only station where the values of this ratio approach a positive one, which means a higher water quality.

Following the statistical analysis and interpretations of the results of these ecological indices, we can say that at station S3 all the calculated indices indicate a lower quality water compared to the other stations. Due to the fact that the S1 and S2 stations lack individuals such as *Ephemeroptera*, *Trichoptera* and *Plecoptera*, we can say that the water quality level is not very good.

At station S4 there are groups of indicators indicating a higher water quality (*Trichoptera*), which leads us to conclude that due to the fact that between station S3 and S4 there are no major sources of pollution, water quality begins to improve. This is also due to the self-cleaning process.

Following the study, we propose permanent biomonitoring of surface waters, because the physico-chemical conditions of the waters are constantly changing. We also recommend the development and development of new multimetric biological indices, which take into account chemical and physical factors and which reflect as effectively as possible the ecological status of the waters.

For the efficient characterization of the ecological state of surface waters, we recommend to take into account the nature, size and number of pollution sources and not only the abiotic typology of rivers. We recommend continuing the monitoring studies of polluted water, as well as the development and marketing of products to help streamline conventional wastewater treatment plants.

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