Research Regarding the Use of Benctonic Macro Invertebrates on Bega River Water Quality Determination in the Timisoara Area

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Abstract
The benthic macro invertebrates are considered in this century to be one of the most important biological parameters for the quality of surface waters and they have the following characteristics: they live in constant contact with the sediments where pollutants are accumulated, have a fairly long-lasting lifecycle, are present in all types of aquatic ecosystems, are easily collected and quite easy to identify.
The aim of this paper is to show the use of benthic macro invertebrates on Bega River water quality determination in the Timisoara area. After the identification of macro invertebrates has done, it have been performed the density, abundance and frequency of the sample. Based on these values, we can say that the upstream segment waters falls into the category of superior quality compared to the waters of the central segment, especially in the downstream segment.

Keywords: Bega River, benthic macro invertebrates, water quality.

1. Introduction

An important indicator of water quality in aquatic ecosystems is the structure of macrozoobenthos communities [1]. Benthic invertebrates are sensitive indicators of ecosystem quality change, because they highlight the long-term changes in water quality, unlike assessments physical-chemical factors that highlight situations of moment [2].
The structure and distribution of the different benthonic macro-invertebrates communities is considered to be one of the important indicators of the surface waters' quality [3-5].
Benthic macro invertebrates have a fundamental role in absorbing and filtering substances in aquatic ecosystems, reason for that they are good indicators of organic load, in the main, and of mineral water pollution.
Benthic invertebrates fauna is considered one constant compartment in the structure of the biocenosis water systems [6-10].
The benthic macro invertebrates are good indicators of localized conditions, as many of the benthic macro invertebrates have limited migration patterns or a sessile mode of life. Most species have a complex life cycle of one year or more. Sensitive life stages will respond quickly to

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stress; the overall community will respond more slowly [11].
The aim of this paper is to show the use of benthic macro invertebrates on Bega river water quality determination in the Timisoara area.

2. Materials and methods

The samples have been collected in November 2016, when were collected 20 quantitative samples of benthic zones, in the Bega River in order to show the effects of human impact on benthic community structure and dynamics of different ecosystems from Bega River water.
Samples were collected from the upstream, middle and downstream of Timisoara city. The benthic samples were collected with Ekman-sampler with a surface of 225 cm^2 and were subsequently washed with benthic nets (meshes of 250 µm) and stored in 8% formaldehyde [12-15].
The collecting stations (S) were located as follows (figure 1):
S1 is located upstream of Timisoara city, 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.
S4 is located near Otelec village, before the border line with Serbia Country.

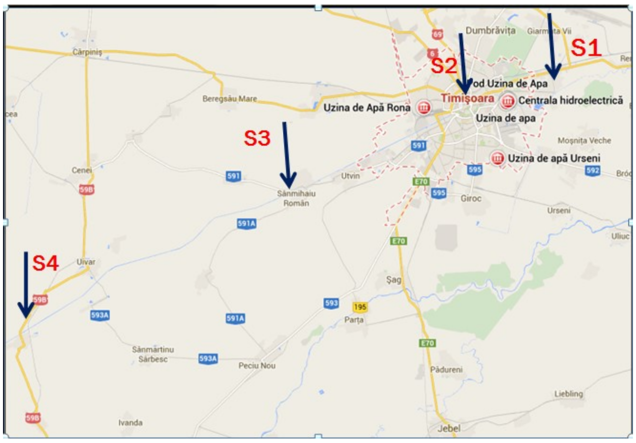

Figure 1. The location of the sample collecting stations on Bega River water

There have been calculated the density (Di = ni / Sp), the abundance (A= (ni / N)*100) and the frequency (F = Ni*100/Np), where ni represents the total number of individuals for the i series, Sp the total researched area, N the total number of individuals belonging to all species (from the sample or the studied samples), Ni the number of stations within which been identified the subjected species, Np the total number of stations [16, 17].

3. Results and discussion

After the laboratory work was carried out, it was identified ten groups of benthic macroinvertebrates (table 1): *Oligochaeta* subclass *Hirudin* class, *Lamelibranchiata* class, *Gastropod*a class, *Nematoda* phylum, *Diptera* order (larvae of the families *Chironomidae, Ceratopogonidae and Tipulidae*), *Isopoda* order, *Trichoptera* order, *Odonata* order, *Coleoptera* order and macro invertebrates density is presented in figure 2.

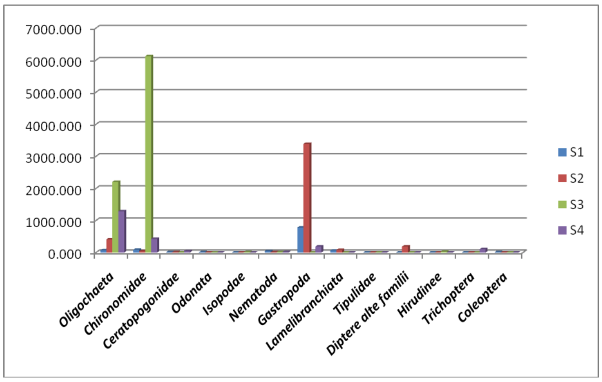

Figure 2. Macro invertebrate’s density (individual’s m2) from Bega River

The high tolerance to the impurification of *Oligochaeta* subclass and *Chironomidae* order has been demonstrated in numerous studies [18-21]. These two groups of invertebrates show significantly larger tolerance limits, adapting to various environmental conditions [22, 23].
At the first station (S1) have been identified groups which Lorenz (2003) [24] considered that they are indicators of unpolluted water (*Lamelibranchiata* class, *Gastropoda* class, *Odonata* order).
Analyzing the macro invertebrates density (figure. 2), we can say that at the first stations the density of individual’s that belong to the *Oligochaeta* subclass and *Chironomidae* order have a density which is smaller than the density of individual’s that belong to the *Gastropoda* class which means that the degree of impurification of this station is very small.

Analyzing the macro invertebrates density at the second station (figure. 2) we can notice an increase of the density values of groups which are classified as indicators of unpolluted water (*Lamelibranchiata* class, *Gastropoda* class). At this station we can notice the highest density values of sensitive groups to the pollution

At the station three (S3) we can observe that the values of density for sensitive groups to the pollution (*Lamelibranchiata* class, *Gastropoda* class) start to decline and increase the density values of groups show significantly larger tolerance limits of pollution (*Oligochaeta* subclass and *Chironomidae* order).

At this station we can notice the highest density values to the groups who have a high tolerance to the pollution.

Also at S3 are identified individual's that belong to the *Hirudin* class and *Isopoda* order, groups who show significantly larger tolerance limits at impurification and the disappear the individual's that belong to the *Lamelibranchiata* class, *Gastropoda* class, *Odonata* order.

The last station (S4) it is located near Otelec village, before the border line with Serbia Country. At this station decrease the density values of individual's that belong to the *Oligochaeta* subclass and *Chironomidae* order and appear the individual's that belong to the *Gastropoda* class. Also at this station are identified individual's than belong to the Trichoptera order, macro invertebrates who are considered indicators of the indicators of unpolluted water [24].

Regarding to the numerical abundance we can notice that is in correlation with the density, if the values of density grow up, then the numerical abundance shows increased values (figure 3).

Table 1. Groups of benthic macro invertebrates in relation with the collection stations

Groups	Station 1 (S1)	Station 2 (S2)	Station 3 (S3)	Station 4 (S4)
Oligochaeta	x	x	x	x
Hirudinea			x	
Lamelibranchiata	x	x		
Gastropoda	x	x		x
Nematoda	x	x		x
Chironomidae	x	x	x	x
Ceratopogonidae	x	x		x
Tipulidae			x	x
Isopodae			x	
Trichoptera				x
Odonata	x			
Coleoptera	x			

x-the presence

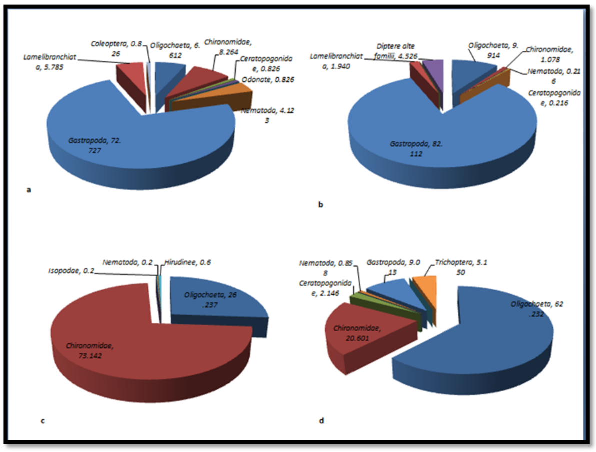

Figure 3. The numerical abundance of the invertebrates group at: a- first station, b- station 2, c- station 3, d- station 4.

Analyzing the frequency (figure 4), individual's belong to the *Oligochaeta* subclass show a 80 % frequency at the first station, a 60 % frequency at the second station and a 100% frequency at the three and the last station.

Individual's belong to the *Diptera* order (larvae of the *Chironomidae* families) show a 60 % frequency at the first station, a 80 % frequency at the second station and a 100% frequency at the three and the last station.

Individual's belong to the *Gastropoda* class show a 100 % frequency at the first station, a 80 % frequency at the second station and a 20 % frequency at the last station (fig. 4).

Macro invertebrates belong to the *Lamelibranchiata* class has show a 100 % frequency at the first station, a 80 % frequency at the second station and at station 3 and 4 the this invertebrates disappear.

Individual's belong to the *Trichoptera* order has a 40 % frequency at the last station.

Macro invertebrates belong to the *Nematoda* phylum show a 20 % frequency at the first and the second station, individual's belong to the Hirudin class has a 60 % frequency at the station three and individual's belong to the *Isopoda* order has a 20 % frequency at the same station (figure 4).

Individual's belong to the *Odonata* order show a 20 % frequency at station 1.

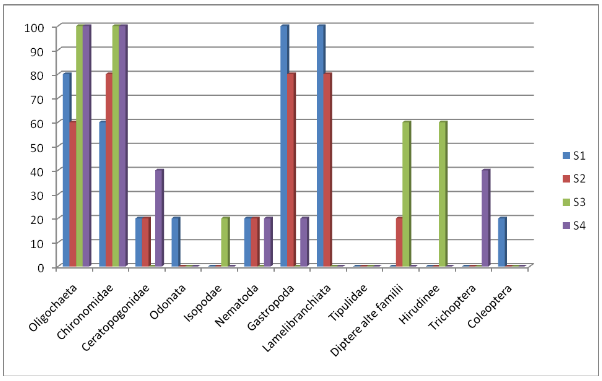

Figure 4. Macro invertebrate's frequency in the Bega River (%)

4. Conclusions

Ten groups of benthic macro invertebrates have been identified: Oligochaeta subclass Hirudin class, Lamelibranchiata class, Gastropoda class, Nematoda phylum, Diptera order (larvae of the families Chironomidae, Ceratopogonidae and Tipulidae), Isopoda order, Trichoptera order, Odonata order, Coleoptera order.

In conclusions we can say:

- at the first and the second station has been identified groups who are considered indicators of unpolluted water (Lamelibranchiata class, Gastropoda class, Odonata order), and at the three station this groups disappear,
- at the second station was notice the highest density values to the groups who are indicators of unpolluted water and to the three station was notice the highest density values to the groups who have a high tolerance to the pollution (*Oligochaeta* subclass*, Diptera* order),
- at the last station decrease the density values of the groups who have a high tolerance to the pollution and appear macro invertebrates who are considered indicators of the indicators of unpolluted water.

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