Research Regarding the Changes that Occur in the Structure of Benthic Macro Invertebrates Communities as a Result of Anthropogenic Activities

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Abstract
An important role in the monitoring of the water quality is represented by the benthic macro invertebrates. They are a key component in the transfer of matter and energy in the aquatic ecosystems.
In May 2015, 20 quantitative samples of benthic sample were collected at different seasons in the Bega River water. Samples were collected from the upstream, middle and downstream of Timisoara city.
The aim of this paper is to identify the changes that occur in the structure of benthic macro invertebrates' communities due to anthropogenic activities.
Once the identification of saprobionte organisms 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 water, benthic macro invertebrates

1. Introduction

Starting with the last century the benthic macro invertebrates are considered an important step in biomonitoring of surface waters. Their great importance is based on trophic base for the fish and the role that they serve as biological indicators, they offer clues to the environmental conditions were they are living [1-3].
Because they have a relatively short life cycle and are living in direct contact with the substrate, benthic macroinvertebrates can characterize the condition of an ecosystem and reveal the natural or anthropic changes [4, 5].

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Most species have a complex life cycle of one year or more. Sensitive life stages will respond quickly to stress; the overall community will respond more slowly [6].
The aim of this paper is to identify the changes that occur in the structure of benthic macro invertebrates' communities due to anthropogenic and natural activities.

2. Materials and Methods

In May 2015, 20 quantitative samples of benthic sample were collected at different benthic zone in the Bega River water in order to identify the changes that occur in the structure of benthic macro invertebrates' communities due to anthropogenic activities.

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 [7-10].

The collecting stations (S) were located as follows (Figure 1):

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

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. 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 [11, 12].

3. Results and discussion

Once the identification of saprobionte organisms has done, it have been identified ten groups of benthic macro invertebrates: *Oligochaeta* subclass, *Hirudin* class, *Nematoda* phylum, *Diptera* order (larve of the families *Chironomidae, Ceratopogonidae* and *Tipulidae*), *Isopoda* order, *Trichoptera* order, *Odonata*, order, *Coleoptera* order (Table 1). After the density was performed 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 at this station is very small (Figure 2).

Some groups like *Oligochaeta* subclass and *Chironomidae* order are known for that they live in environments where the contamination level is high [13-16] and other groups as *Lamelibranchiata* class, *Gastropoda* class, *Odonata* order are considered indicators of unpolluted water [17].

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.

Table 1. Groups of saprobionts 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

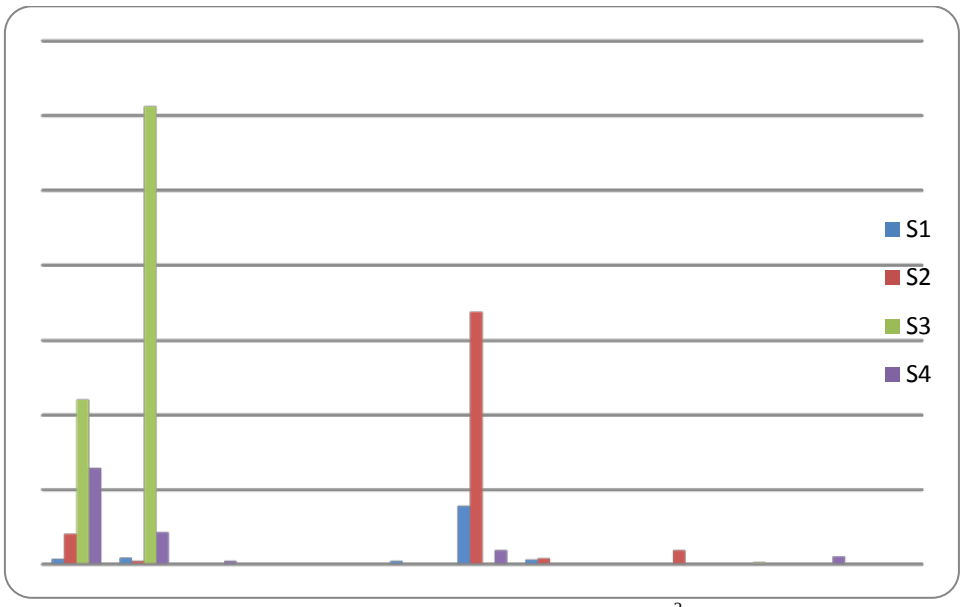

Figure 2. Macro invertebrate's density (individual's m^2) from Bega River

At station three (Figure 2) the situation was changing, we see an increase of the density values at groups that have a high tolerance to the impurification.

At the last station we can see a decrease of 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 [17].

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).

Analysing the frequency (Figure 4), 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 *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.

Macro invertebrates belong to the *Gastropoda* class show a 100% frequency at the first station, an 80% frequency at the second station and a 20% frequency at the last station (Figure 4). Individuals belong to the *Lamelibranchiata* class has shown a 100% frequency at the first station, an 80% frequency at the second station and at station 3 and 4 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).

Individuals belong to the *Odonata* order show a 20% frequency at station 1.

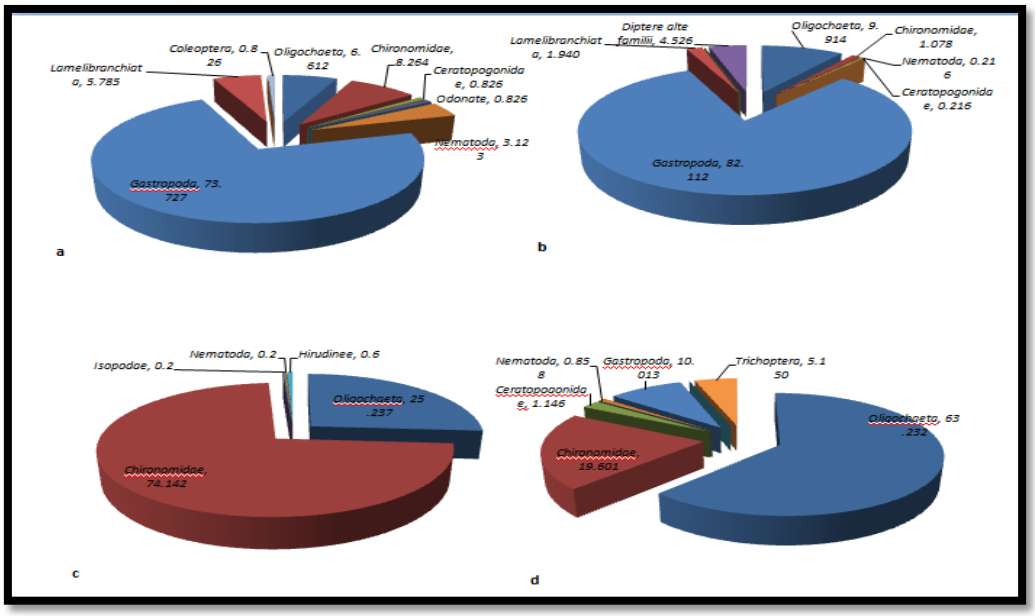

Figure 3. The numerical abundance of the invertebrates group at:
a- first station, b- station 2, c- station 3, d- station 4

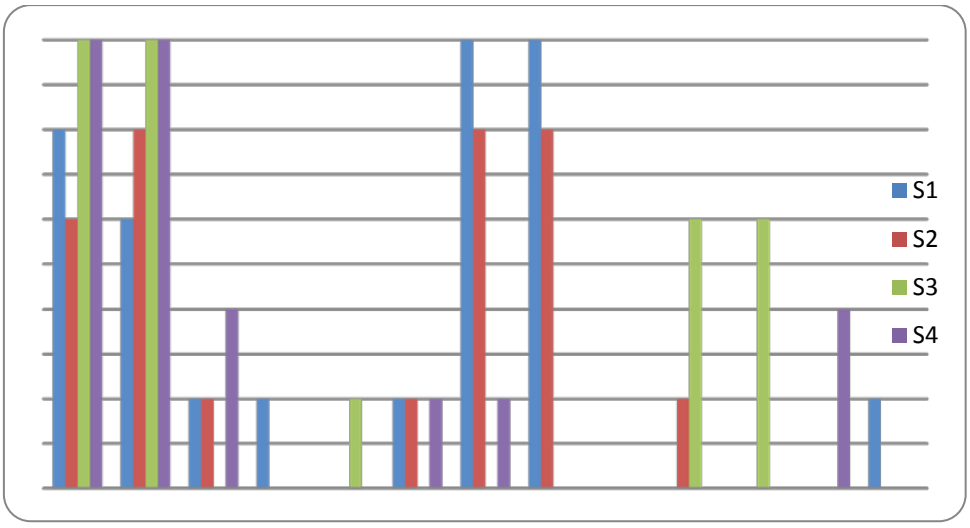

Figure 4. Macro invertebrate's frequency in the Bega River (%)

4. Conclusions

In conclusions we can say that have been identified ten groups of benthic macro invertebrates: *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 and:

- at the first and the second station has been identified groups who have a high sensitivity to pollutionare and they are considered indicators of unpolluted water (*Lamelibranchiata* class, *Gastropoda* class, *Odonata* order), and at the three station this groups disappear,

- at 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 appear macro invertebrates who are considered indicators of the indicators of unpolluted water.

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