



The ecological status and macroinvertebrate diversity of the Nerodime River in Kosova

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Abstract

Macroinvertebrates are a mandatory required Biological Quality Element by the WFD as indicator for the ecological status of the surface waters. In this paper we present the results of the investigation of macroinvertebrate benthic fauna in the river Nerodime in Kosovo, conducted from June to September 2012. The EPT index and Hilsenhoff's family biotic index (BI) were calculated to evaluate the Ecological status of the river Nerodime.

Key words: macroinvertebrates, ecological status, benthic fauna, river Nerodime, EPT, BI

1. Introduction

The state of Kosovo is located in South–East Europe, in Central Balkan Peninsula. Geographic position, climate conditions, altitude and high mountains that surround the country have influenced its hydrographic network. Four river basins that comprise Kosovo's watersheds drain into three seas: the Adriatic Sea (43.5%), the Aegean (5.8%) and the Black Sea (50.7%).

The importance of biological parameters as indications of the health of the river is highlighted in the European water Framework Directive (EWFD, 2000). The general goal of the Directive is to achieve good water status for all water bodies within the territory of the EU by year 2015 (Pont *et al.*, 2006).

Among the biological quality elements, the macroinvertebrates are by far the most frequently used group for bio-indication in standard water management (De Pauw *et al.*, 1992; Rosenberg and Resh, 1993; Metcalfe- Smith, 1994; Hering *et al.*, 2004). Macroinvertebrates are organisms that form an integral part of an aquatic environment and have ecological and economic importance. They are bottom-dwelling organisms and include insects, crayfish, snails, clams and aquatic worms.

The main threats for living organisms of freshwater ecosystems are habitat destruction and the changes in physical and chemical parameters due to discharges of untreated wastewaters, industry, agriculture pollution, acidification, etc.

Benthic macroinvertebrates are found in most aquatic habitats, they have limited mobility, they play an important role in food web, they have a relatively long life span and their sampling is easy.

Macroinvertebrates act as biological indicators because they react quickly to changes in water quality conditions. Some of them are sensitive; some are semi tolerant or tolerant to different pollutants. Thus, macroinvertebrate species should reflect deleterious events that have occurred in the aquatic environment during any stage of their development (Cairns and Pratt, 1993). Therefore, the species composition and their abundance in aquatic ecosystems are the basis for water quality monitoring and classification.

The aim of this study was to evaluate the Ecological status of river Nerodime based on macroinvertebrate fauna as an indicator of water quality.

River Nerodime is the left tributary of the River Lepenci. It is the main river in the municipality of Ferizaj. It originates on the eastern side of Mount Jezerc (42°22'09"N 21°04'48"E) at an altitude of 660 m. The length of the river is 41km² and reaches 228km² catchment area. The river bed width is 2-5m, and water flows with average speed of 0.9 m³ / sec (Figure 1). The river Nerodime in its middle flow enters the city of Ferizaj where it becomes collector of many

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pollution substances from municipal wastewaters, agriculture, industry and other sources (Kosova Environmental Protection Agency (2008–2009).

Although with the poor flow, river Nerodime has an important hydrographic role due to the bifurcation phenomenon its two tributaries form. One tributary of the river flows into river Sitnica (Black Sea basin) and the second one into the river Lepenc (Aegean Sea basin) (Kosova Environmental Protection Agency (2008–2009).



Figure 1. A view from Nerodime River in Kosova

2. Materials and methods

Both qualitative and quantitative analyses of macroinvertebrates in three localities (T1, T2 and T3) along the course of the river Nerodime was performed during the period June to September 2012. The organisms were collected with the help of the D frame net or with Surber net with mesh holes of up to 500 μ , in different habitat types. The collected samples in the field were preserved in 75 % alcohol and were transported in the laboratory in the Department of Biology at Faculty of Mathematics and Natural Sciences where they were classified with the help of adequate keys (McCafferty,1981; Merritt and Cummins,1984). Two indices were used to evaluate the quality of water in river Nerodime: Biotic index (BI) and the (EPT) Ephemeroptera-Plecoptera-Trichoptera taxa/family index. (Lenat, 1988). The ratio and number of these macroinvertebrates change with the stream food resources and human impacts and therefore can be used as a tool for assessing the ecological status of the biotic community and water quality. The Hilsenhoff biotic index (BI) modified by Bode (Bode-s et al. 1988)and adapted from Hilsenhoff (1997) was calculated to assess the organic pollution based on the tolerance values of macroinvertebrate species to various levels of dissolved oxygen. The classification of collected animals for calculation of both indices in our investigation is done to family level.

3. Results

The results of our research are presented in tables 2 and 3. During our investigation of the benthic macroinvertebrate fauna in river Nerodime in total 2192 specimens were collected. In taxonomic terms these organisms belong to 23 different families of 10 animal groups. (Table 2). Taxa Richness indicates the health of the community through its' diversity, and increases with increasing habitat diversity, suitability, and water quality (Plafkin et al., 1989). Among the recorded groups in our study, Ephemeroptera and Plecoptera have the highest diversity of the families-5, followed by Diptera and Trichoptera, respectively. Other groups (Oligochaeta, Hirudinea, Mollusca, Amphipoda, Odonata) were represented by a small number of taxa. The taxa richness was highest (18-17) in upper and middle part of the river (T1 and T2) and it decreased significantly down the river to 7 (T3) .In the first two sampling sites (T1and T2), families of Ephemeroptera, Plecoptera and Trichoptera comprised up to 97% of macronvertebrates. The number of EPT taxa is 9-11 families, (EPT score 44%) whereas the value of Biotic index (Hilsenhoff's family Biotic Index) BI is 3.62-3.18, that indicates very good, respectively excellent water quality (Figure 2).

Table 2. Macroinvertebrate structure in the sampling localities in the river Nerodime

	Macroinvertebrate groups	Sampling localities		
		T1	T2	T3
	<i>Trichoptera</i>			
1	Hydrophychidae	+	+	
2	Rhyacophilidae	+	+	
3	Glossosomatidae	+	+	
	<i>Ephemeroptera</i>			
4	Ephemeridae	+	+	
5	Heptagenidae	+	+	
6	Caenidae	+		
7	Baetidae	+	+	
8	Ephemerellidae	+	+	+
	<i>Plecoptera</i>			
9	Perlidae	+	+	
10	Perlodidae	+		
11	Nemouridae	+		
12	Capnidae		+	
	<i>Odonata</i>			
13	Galopterygidae	+		
14	Gomphidae	+	+	
	<i>Diptera</i>			
15	Tipulidae	+	+	
16	Chironomidae	+	+	+
17	Simuliidae			+
18	Tabanidae	+	+	+
	<i>Oligochaeta</i>			
19	Lumbricidae	+		
	<i>Amphipoda</i>			
20	Gammaridae	+	+	+
	<i>Mollusca</i>			
21	Lymnaeidae			+
	<i>Hirudinea</i>			
22	Hirudinidae		+	+
	<i>Crustace</i>			
23	Astacidae		+	

Table 3. The values of Hilsenhoff's family Biotic Index (Hilsenhoff, 1997) in sampling localities in the river Nerodime

Localities	Biotic index	Water quality	Degree of organic pollution
T1	3.62	Very good	Possible slight organic pollution
T2	3.18	Excellent	No apparent organic pollution
T3	7.92	Poor	Very significant organic pollution

In the sampling locality downstream of the river (T3) the macroinvertebrate structure changed in favor of semi tolerant and tolerant groups. The richness of taxa (family) is significantly lower in comparison with two other localities. Macroinvertebrate fauna in this locality comprises from Diptera, Amphipoda, Molluscs and Hirudinea. The dominant taxa recorded in this part of the river course are Chironomidae, Simuliidae, Tabanidae and Hirudinidae, generally the most pollution tolerant groups (Armitage *et al.*, 1983). This community type is characteristic for degraded stream zones influenced by organic pollution. Regarding the EPT taxa, only a family was recorded while most sensitive stoneflies completely disappeared and even the presence of pollution tolerant Ephemeroptera and Trichoptera families was not recorded. According to Rosenberg and Resh (1993) changes in presence/absence, numbers, morphology, physiology or behavior of indicator organisms can indicate that the physical and/or chemical conditions are outside their preferred limits.

The composition of macroinvertebrate communities in first two sampling station in the upper course of the river Nerodime and the BI values indicate a healthy water ecosystem or a good ecological status along this part of the river course. Low EPT index and the value of BI in the third sampling site (T3) show poor water quality as a result of many anthropogenic activities in this area. Similar studies of the surface water bodies in Kosovo, using the

macroinvertebrate taxa as indicators of water quality (Gashi 1996,2006; Zhushi Etemi, 2005; Grapci, 2006 and Ibrahim, 2011) have indicated a good quality of waters in the upper stream of the investigated rivers in Kosovo, and significant decrease in water quality downstream the rivers due to many pressure/disturbance factors.

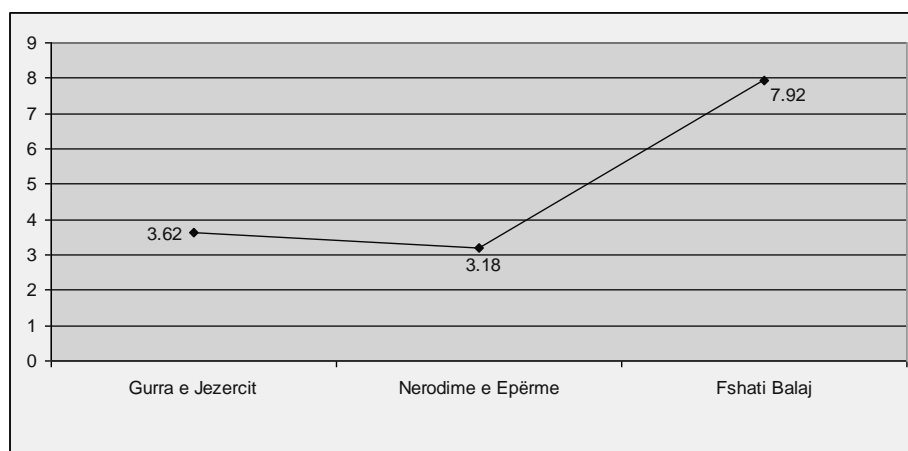


Figure 2. The graphic presentation of BI values in three sampling sites in the river Nerodime

4. Conclusions and discussion

The high value of EPT index and BI (biotic index) in first two sampling sites indicates a good water quality. In our study the most presented taxa /families in these sites were insect families sensitive to dissolved oxygen in the water. This composition changed significantly in the sampling locality T3, where most of the sensitive taxa disappeared due to the decrease of water quality as the result of changed environmental parameters. The macroinvertebrate community in T3 was dominated by tolerant organisms such as Chironomidae and Hirudinea which usually indicate poor water quality (Armitage et al., 1983)

Organic pollution as a result of discharge of untreated municipal wastewaters remains the main problem of the surface waters in Kosovo. From our investigation it can be concluded that in the near future the responsible authorities in the country should develop a Monitoring program for Surface water bodies which complies with the requirements of the WFD(2000) that should investigate Physicochemical, Hydro morphological and Biological quality elements.

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