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Biological assessment of water quality in Erzeni and Ishmi Rivers in Albania, using as biological indicators, different groups of macro invertebrates, during 2011 - 2012.

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Abstract: Erzeni and Ishmi Rivers flow in central Albania. The geographical position and geologic composition of Rivers basin have a specific study importance. The areas where the Rivers flows have been areas of many changes and developments lately, influencing the aquatic ecosystem in general and mainly impacting the water quality. For the biological assessment of Rivers water quality different groups of macro invertebrates are used. They are good indicators of biodiversity and habitat quality and their presence is closely connected with the general ecological status of the river ecosystem. (Lee N. 2003). Benthic macro invertebrates are determined as crucial elements and have a great importance in the biological assessment of water quality (Water Framework Directive - WFD). In this study the water quality results are given for two years of monitoring (2011 – 2012) in three sampling stations for each River in Albania. The paper presents the aquatic ecosystem situation based on data gathered on insect and invertebrate fauna. From the analyses of data is important to mention the presence of benthic sensitive organisms (Environmental Protection Agency- USA) in the sampling stations in Erzeni River, while this group of invertebrates is missing in monitoring stations in Ishmi River. Two other groups, benthic invertebrates with a medium tolerance toward pollution and tolerant taxons were present in both Rivers. Beside the classification of species according their tolerance, Biotic Index is calculated based on all the macro invertebrate groups found in each River.

Keywords: ETP, TV, water quality, BI index.

I. INTRODUCTION

Erzeni River flows in an area with sandy – clay deposits and this occurrence shows a close connection between habitat and benthic indicators and widely between hydrology and biodiversity. Ishmi River in the northern part flows in the hilly part of the country with flysh formations and is composed by main contributors which are: Tirana, Terkuza and Zeza streams (Saraçi R., 1996). Benthic invertebrates have a double role of a direct consume (respiratory and alimentary) and fragmentation of particle in substances simple to assimilate from the bacteria component taking in consideration the transferring process and elaboration of organic material present in running waters. Macro invertebrates are good indicators of water quality in particular and of environmental conditions in general. Their life cycle is closely connected to the aquatic ecosystem changes, which are reflected in variations of individual density level, species abundance or different values of quality indexes. The analyses of macro invertebrates assemblages is also time and cost efficient compared to chemical and physical assessments of water quality (Bode et al, 1996), which provide little insight into the temporal variation of conditions.
This study provides data on benthic invertebrates' population level as indicators of water quality in Rivers, Erzeni and Ishmi, comparing the water quality in respective monitoring stations, as well. Benthic invertebrates' communities have been analyzed based on their sensitiveness level. Biotic Index values are calculated based on individual density and tolerant value per each taxon identified in the samples. The relations between the determinate values and water bio-classification have been also studied for each of the Rivers.

II. METHODS AND MATERIALS

The sampling method of aquatic macro invertebrates is based on the methods according to Campaioli *et al.* (1994); Dowing & Rigler (1984); Lenat (1988); Barbour *et al,* 1999; Bailey *et al,* 2001; Bode *et al,* 1997). Benthic invertebrates were taken from the river bottom (40 – 60 cm) with a kick - net in order to gain sufficient samples from larger depths of water. The net is held upright on the stream bed by one individual, while the stream bottom upstream

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of the net is physically disrupted by a second individual. Kicking and turning over rocks and logs with the feet and hands dislodges organisms which are washed into the net by the current. The samples were collected from areas of differing current speed. In very small streams or in sandy areas lacking riffles, kicks are taken from root mats, snags or bank areas. All types of benthic macro invertebrates were collected by this sampling device, but method emphasizes species that live in fast flowing water. This technique gives consistent results (Horning & Pollard, 1978; Armitage, 1978). It was used to gather good results during the investigations in three monitoring stations per each River: Ishmi River, Rinas – station one, Zeze – Fushe-Kruje – station two and Gjuricaj – station three; Erzeni River, Mullet – station one, Damjan - Fortuzaj – station two and Shijak – station three. The monitoring stations are selected based on geographic expansion of the Rivers flow and the relations between the river stations and surrounding urban areas. Also the villages have a considerable number of inhabitants. The kick - net method takes the quantitative aspect into account, if the necessary experience is present (Pollard, 1981). In addition sampling plots were taken to be representative whereas within a station were taken three randomly samples, according a seasonal calendar during the period 2011 - 2012. Monitoring for both Rivers has been carried out regularly in a parallel manner. The field work is organized in daily expeditions, one for each season. To take one sampling plot are needed 30 sec and per each field trip are taken 3 of them in different stations. All benthic macro invertebrates are kept in 95% ETOH. Before mailing the jars are completely filled with alcohol to reduce damage to the specimen. They then are carefully packed with enough packing material to prevent breakage. Lab sheets and all the associated material is conserved in the laboratory. For the identification of benthic invertebrates are used different publications as Wallace and Wallace (2003), Edington & Hildrew (2005), Hickin (1967), Macan (1994), Hynes H.B.N (1993), Tachet et al. (1980) Cao et al. (1997), Parker and Salansky, (1998).

III. RESULTS AND DISCUSSION

During the monitoring period 2011 - 2012, for Erzeni River, in each of the stations, Mullet, Damjan-Fortuzaj and Shijak, a total number of 4448 individuals were collected. From these individuals, 1018 were found in the first monitoring station, 1140 in the second and 2290 in the third station; meanwhile for Ishmi River in each station, Rinas, Zeze and Gjuricaj, are collected a total number of 4740 individuals. From these individuals 1669 are found in the first monitoring station, 2270 in the second and 801 in the third station.
According to the Environmental Protection Agency- USA the benthic invertebrates are classified in three major categories based on the tolerance level of different invertebrate groups (Table: 1).

Table: 1. Aquatic biological indicators based on their tolerance level (Environmental Protection Agency- USA)

Benthos Sensitive	Medium Benthos Tolerant	Benthos Tolerant
Insecta/Plecoptera	*Insecta/Odonata*	*Insecta/Diptera/Chironomidae*
Insecta/Ephemeroptera	*Arthropoda/Decapoda*	*Annelidae*
Insecta/Coleoptera	*Crustacea/Amphipoda*	*Annelidae/Hirudidae*
Insecta/Megaloptera	*Insecta/Trichoptera*	*Molusca/Gastropoda*
Insecta/Diptera/Athericidae	*Arthropoda/Isopoda*	
Molusca/Bivalvia	*Insecta/Diptera/Tipulidae*	

Based on the above classification the macro invertebrate groups identified in the samples in Ishmi and Erzeni Rivers are used to evaluate the overall ecological conditions of the benthic fauna and water quality as well (Table: 2).

Table: 2. Aquatic biological indicators in Erzeni and Ishmi River

Benthos sensitive taxons	Erzeni River (%)	Ishmi River (%)
Ephemeroptera	54.75	7.93
Medium benthos tolerant taxons		
Trichoptera *Odonata*	20.65	0.15
Benthos tolerant taxons		
Chironomidae *Ceratopogonidae* *Olighocheta* *Hirudidae* *Gastropoda*	24.60	91.91

Based on the above results Erzeni River appears to be in better water quality conditions than Ishmi River. Benthos sensitive group has higher percentage in Erzeni River, which is a significant difference in water quality compared to Ishmi River. Medium tolerant taxons are in higher percentage as well, in Erzeni River. Meanwhile, tolerant species

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toward pollution are in higher percentage in Ishmi River. The macro invertebrate fauna, classified according Environmental Protection Agency- USA, implies significant variations between the two rivers, showing in the same time different water quality level. Erzeni River water has a better quality compared to the water quality in Ishmi River, which appears to be much polluted.

The classification of the water in both Rivers (Erzeni and Ishmi) is carried out based on Stroud Water Research Centre method. Biotic index according to this method takes into account the density and the tolerance value of all the macro invertebrates groups identified in the samples. S.W.R.C BI [**Biotic Index = (TV x D): Density]** is based in detailed information of benthic communities identified in the monitoring stations and provides for a more exact bio classification of River water quality (Table: 3).

Table: 3. Bio-classification of River water based on biotic index value according the Stroud Water Research Centre

BI value (S.W.R.C)	**< 3.75**	**3.76 - 5.0**	**5.1 - 6.5**	**6.6 - 10.0**
Water quality	Very good	Good	Medium	Poor

Biotic Index value is calculated for each monitoring station in Rivers, Erzeni and Ishmi. The respective BI values and water bio classification are presented in the following tables:

Table: 4. Biotic Index value and biological classification of water in three monitoring sites of Erzeni River (Stroud Water Research Center)

STATION	S.W.R.C - BI	BIO-CLASSIFICATION
Mullet	4.02	Good
Damjan - Fortuzaj	3.41	Very good
Shijak	3.97	Good

From the table above the River water quality in the third station is classified in the same bio – class based in both indexes. While the second and the first stations are classified in different bio – classes based on few differences in indexes values.

Table: 5. Biotic Index value and biological classification of water in three monitoring sites of Ishmi River (Stroud Water Research Centre)

STATION	S.W.R.C - BI	BIO-CLASSIFICATION
Rinas – Lana Bridge	6.83	Poor
Zeze – Fushe-Kruja	5.73	Medium
Gjuricaj - Sukth	7.33	Poor

S.W.R.C. Biotic Index value classifies the water of Ishmi River in “poor” bio-class in the first and the third monitoring stations and in “medium” bio-class the water of the second monitoring station. The biological indicators identified in the samples show a high level of pollution in the river water.

Comparing the water quality in both Rivers, based on the Biotic Index values, is obvious the great difference in values and respective bio-classes. Erzeni River water is still in good conditions, with slight impact pollution, while Ishmi River water is strongly polluted and is in bad environmental conditions.

IV. CONCLUSIONS AND RECOMMENDATIONS

- During the monitoring period 2011 - 2012, in both Rivers (in respective stations), are identified a total number of 4448 in Erzeni River and a total number of 4740 individuals in Ishmi River.
- According to the Environmental Protection Agency- USA the benthic invertebrates’ classification, Erzeni River has higher percentage of benthos sensitive group and significant difference value compared to Ishmi River benthos sensitive taxons percentage. Medium tolerant taxons are also, in higher percentage in Erzeni River.
- Species tolerant toward pollution are in higher percentage in Ishmi River. The macro invertebrate fauna, classified according Environmental Protection Agency- USA, implies significant variations between the two rivers, showing in the same time different water quality level. Erzeni River water has a better quality compared to the water quality in Ishmi River, which appears to be much polluted.
- Comparing the water quality in both Rivers, based on the Biotic Index values, is obvious the great difference in values and respective bio-classes. Erzeni River water is still in good conditions, with slight impact pollution, while Ishmi River water is strongly polluted and is in bad environmental conditions.
- Future monitoring in more sampling stations along both rivers.
- Action Plan preparation for Ishmi River, in order to rehabilitate the ecosystem and to improve the water quality.

- Chemical and microbiological analyses for both rivers, for comparing the results and having a better overall water quality conditions.

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