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Research Article

Evaluation of Ecological Parameters of the Benthic Fauna of Shkumbini River during Year 2010

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Abstract: Biological monitoring is a useful mean of detecting anthropogenic impacts to the aquatic community. River ecosystems are essential parts of human life in many ways, which need to be more recognized. During our survey Shkumbini River (Albania) was considered as important and adequate water course for the evaluation of ecological parameters of macro invertebrates. During our investigation based on the collection of samples in 5 different stations we identified out of 1125 specimens, 27 species. Class Insecta, order Ephemeroptera was present with 4 species**,** order Trichoptera with 6 species, order Diptera with 7 species and order Plecoptera with 3 species. The group of insects known as EPT (Ephemeroptera - Plecoptera - Trichoptera) constitutes 91.3% of the total number of individuals. We note that the species of EPT-group have although the highest value of Dominance and Constants in ecological analyses.

Keyword: Water Quality, Shkumbin River, Macro invertebrate, EPT.

1. INTRODUCTION

Shkumbini river lies in the central part of Albania and due to its geographic location faces both types of climate i.e. Mediterranean and Continental one. Due to that fact it is predictable that the diversity of the species has to be considerably high. Functional freshwater ecosystems are essential parts of human life in many ways which need to be more

recognized[1,2]. Being part of aquatic environments the water livings have special affections of living conditions in the environment where they live[3]. The macro invertebrates are benthic livings that have conditioned their living in the river bottom and most of them have a life under water in larvae period lasting relatively long (2 until 5 years) and they are a ideal bio indicators of environmental water quality where they live[4]. On the other hand they also possess a vital position in the food chain of aquatic systems and therefore can be used to make estimates of ecosystem health[5]. Analysis of macro invertebrate assemblages is efficient in assessing the biodiversity of river, and also determines the physical-chemical parameters of water quality[6]. Greater taxonomic resolution is needed for various indices of biological assessment dealing with toxicology and to evaluate the specific ecology and conservation of different organisms. The large number of species also gives us a specific ecological assessment and inform about the necessity of preservation of various organisms.

The rivers of Albania were subject of several approaches with intention of determining the level of diversity of macro invertebrates, and their use in assessing of water quality[7-9]. Following these studies it is worthy to mention that in Vjosa river were identified for the first time 7 species of Ephemeroptera, 5 species of Trichoptera and 5 species of Plecoptera. The purpose of current approach is to provide a contribution in presenting of benthic macro invertebrate diversity of Shkumbin River and analyzing some ecological data in dissemination of species in the entire length of river.

EXPERIMENTS DESIGN AND SETUP

The material is being collected according to methods suggested from some author[3,5,6,10-12]. The collection of the benthic macro invertebrates was realized by using the kick-net with holes of 0.5 mm. The material was placed in a 300 ml bottle adding ethylic alcohol 70%. In the laboratory the samples was poured into a large watch glass. Macro invertebrates were removed randomly from the detritus and gravel and placed in a smaller watch glass for identification under a dissecting microscope. Organism in orders EPT was identified at least to the family and genera level. Other organisms were identified to the order or family[13-15,]. The data collected were used to detect three different ecological parameters: Dominance (d), Constant (F), and Percentage of Similarity Index (PSC), where:

1- *Dominance* (d), d = *ai* / **Σ** *ai*: where *ai* is the number of individuals of a species and **Σ** *ai* is the total number of individuals of all species[16,17]. Based on the calculated values, the species were categorized in the following categories:

- **Eudominant taxon *(Ed)*** *where...* $d \geq 10.0\%$
- ***Dominant taxon*** ***(D)*** *where...* $5.0 \leq d < 9.9\%$
- ***Subdominant taxon*** ***(Sd)*** *where...* $2.0 \leq d < 4.9\%$
- ***Recedente taxon*** ***(R)*** *where...* $1.0 \leq d < 1.9\%$
- ***Subrecedente taxon*** ***(Sr)*** *where...* $d < 1.0\%$

2- *Constant* (F), F **= 100 x *b* / *a*** where ***a*** is the total number of samples and ***b*** is the number of samples where are identified the species[16,17]. Based on the calculated values, species were categorized in the following categories:

- **Euconstant takson (Ec)** *where...* $75.0 \leq F < 100\%$

- **Constant takson (C)** *where...* *50.0≤F<74.9%*
- **Accessories takson (As)** *where...* *25.0≤F<49.9%*
- **Accidental takson (Ac)** *where...* *F<24.9%*

3- Percentage of Similarity Index (PSC)[3], where's PCS = **100-0.5 Σ | a - b |**, where ***a*** and **b** are respective percentages from total samples ***A*** and ***B*** where these species are present.

STUDY AREA

Shkumbini River flows in central part of Albania **(Figure 1**). It has a length 195m^3 / s. It's average flow is 61m³/sec, with a flowing module from 25,21l sec/km² to 27,3l sec/km² and flowing coefficient varying from 0,59 [Rrogozhinë] to 0,73 [Qukës].Shkumbini is one of the most erosive rivers of Albania. Its solid flow varies from 36 kg/sec [Murrash] to 180 kg/sec [Rrogozhinë], flowing module from 806 ton/km² [Murrash] to 2460 ton/km² [Rrogozhinë]. At both sides of Shkumbini River there are located three urban regions and industrial zone[18]**.**

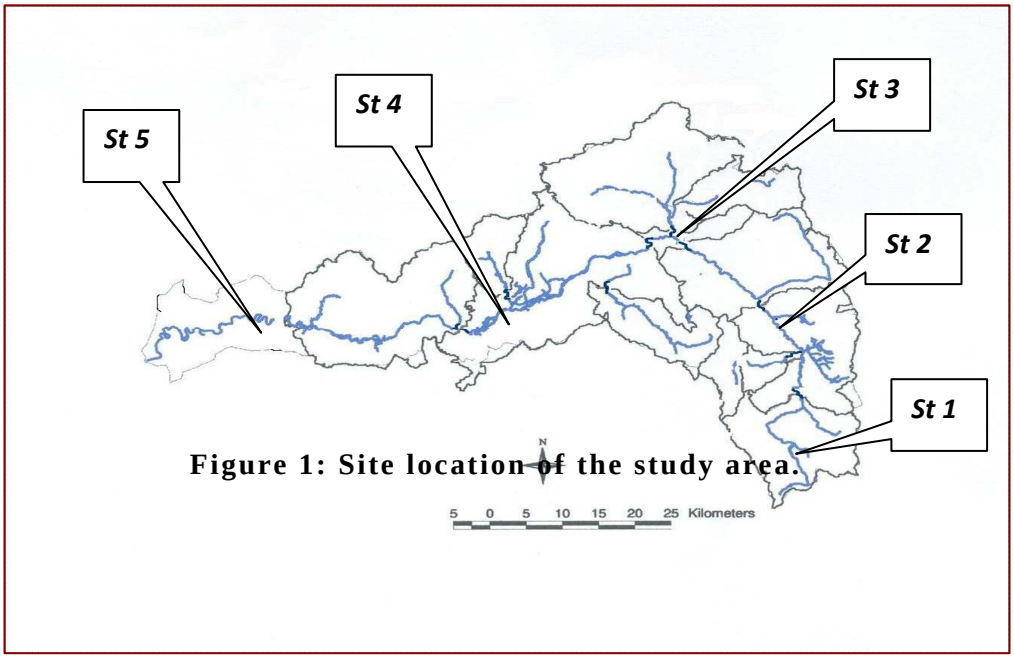

Figure 1: Site location of the study area.

This study included five sampling stations in entire River. The river stations (Figure.1) and their respective codes are named as following: station 1: Urban area *Golik–Proptisht*; station 2: Urban area *Lingajca-Qukes*; station 3: Urban area *Librazhd*; station 4: Urban and industrial area *Paper bridge*; station 5: Urban area *Peqin bridge*.

RESULTS AND DISCUSION

Statistical analysis of macro invertebrates: At the five stations were collected a total number of 1125 individuals. All individuals belonging to 12 orders and 27 species, where most of organisms, about 98% were Arthropods (mainly insects), and 2% of them were Molluscs and Nematodes. Most individuals 45.5% (512 individuals) belonged to the first

station, then comes the fifth station with 21.2% (239 individuals), fourth station with 16.9% (190 individuals), third station with 9.9% (111 individuals), and finally the second station with 6.5% (73 individuals) (**Fig. 2**). Also the first station has a greater numbers of species, 15, then comes the second station with 9 species, third station with 11 species, fourth station with 10 species and finally the fifth station with 7 species (**Fig. 2**).

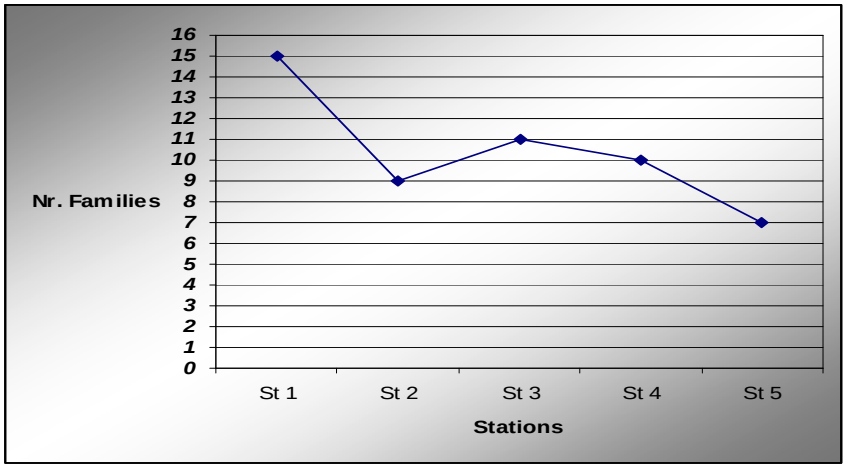

Figure 2: Distribution of taxons according to stations

From 12 orders found in the Shkumbin river we noticed that order Ephemeroptera (Mayflies) in comparison with the other 11 orders has 58.2% of total organisms (655/1125 *organisms*).After it comes the order Trichoptera (*Caddisflies*) with 30.6% (344/1125 organisms), then order Diptera (*Trueflies*) with 5.2% (59/1125 organism), Order Plecoptera (*Stoneflies*) with 2.6% (29/1125 individuals) follow by other orders with a lower percentage.Order Ephemeroptera is represented by 4 species and the dominant family is Oligoneuriidae. (68.1%). Order Trichoptera is represented by 6 species and the dominant family is Hydropsychidae (94.8%). Order Diptera represented by 7 species and the dominant family is Chironomidae (78.0%), and order Plecoptera is represented by 3 species and the dominant family is Perlodidae (44.8%) (**Fig. 3**).

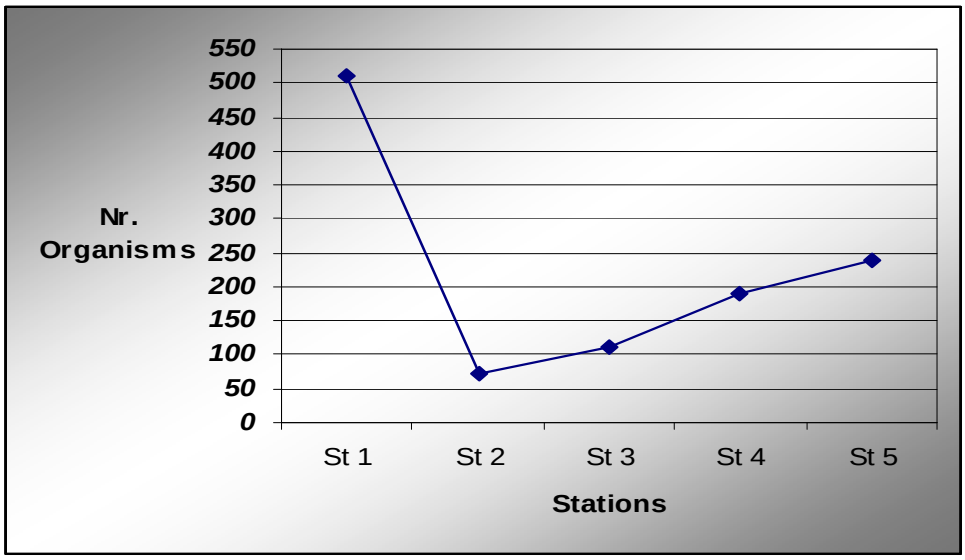

Figure 3: Distribution of organisms according 5 stations.

All other orders presented with 1 species and with a small number of individuals.

Ecological analysis of macro invertebrates

1 - *Dominance* (d), d = *ai* / **Σ** *ai*: Where *ai* is the number of individuals of a taxon and **Σ** *ai* is the total number of individuals of all species[16.17].

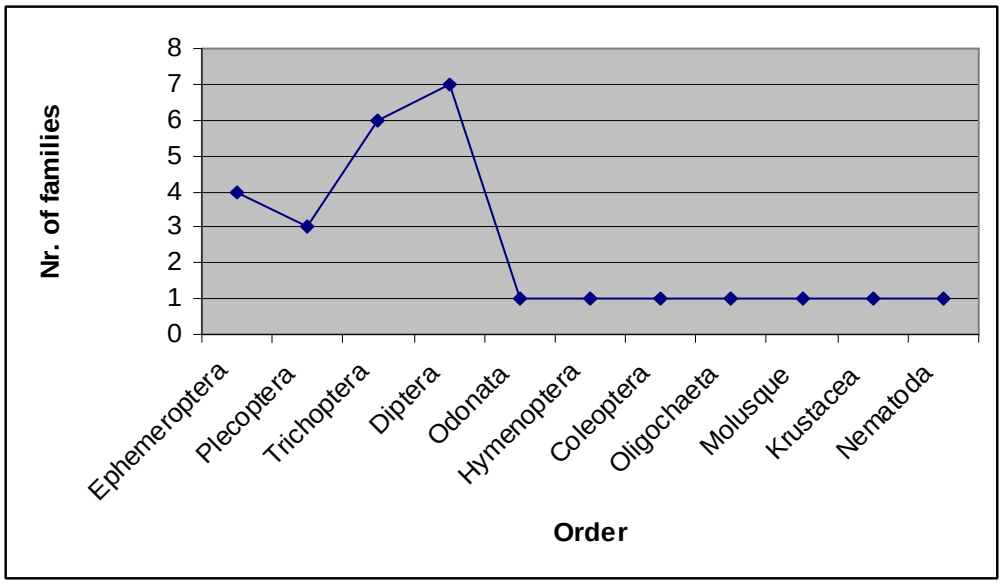

Figure 4: Distribution of species number according to each order.

Dominance calculations show that 3 species are Eudominant (Eu), 1 specie is Subdominant (Sd), 3 species are Recedente (R) and 20 species are Subrecedente (Sr) (**Table 1**). We notice that the Eudominant, Subdominant and Recedente species belong to the insect group.

2- *Constant* (F), F **= 100 x *b*/*a*** where *a* is the total number of samples and ***b*** is the number of samples where the species is present [16,17]. Constant calculations show that: 3 species are Euconstant (Ec), 2 species are Constant (C), 8 species are Accessories (As) and 14 species are Accidental (Ac) (**Table 2**). It is obvious that Euconstant and Constant species are part of the group of insects.

3 - Percentage of Similarity Index (PSC)[3], where: **PSC = 100- 0.5 Σ |a - b|**, where ***a*** and **b** are respective percentages from total samples ***A*** and ***B*** where these species are present. Absolute values of differences were collected and presented in a table (**Table 3**).

This index evaluates not simply the presence or absence of species but based on quality assessment reports to take between two samples in analysis.

In the table below we noted that the species represent a higher level of PSC between stations 4 and 5 (77.2%), then come station 1and 3 (69.7%), station 2 and 5 (39.2), station 3 and 4 (32.0%), station 3 and 5 (25.1%), station 2 and 4 (22.2%), station 1 and 4 (18.9%), station 2 and 3 (14.2%), station 1 and 5 (13.2%) and smallest values of PSC seen between stations 1 and 2 (10.4%).

High similarity between two last stations 4 and 5, can be explained by the fact, that both these stations belong to the lower area of the river which is under the influence of the same geological and climatic factors.

Table-1: Classification of species according to Dominances values (d).

Eudominante (Eu)	Dominante (D)	Subdominante (Sd)	Recedente (R)	Subrecedente (Sr)
D≥10.0%;	5.0≤d<9.9%;	2.0≤d<4.9%;	1.0≤d<1.9%;	d <1.0%;
Oligoneuriidae	-	*Chironomidae*	*Heptagenidae*	*Ephemerellidae*
Baetidae	-	-	*Perlidae*	*Leuctridae*
Hydropsychidae	-	-	*Perlodidae*	*Brachycentridae*
-	-	-	-	*Philopotamidae*
-	-	-	-	*Glossosomatidae*
-	-	-	-	*Beraeidae*
-	-	-	-	*Goeridae*
-	-	-	-	*Gomphidae*
-	-	-	-	*Simuliidae*
-	-	-	-	*Tabanidae*
-	-	-	-	*Empididae*
-	-	-	-	*Ceratopogonidae*
-	-	-	-	*Tipulidae*
-	-	-	-	*Limoniidae*
-	-	-	-	*Ditiscidae*
-	-	-	-	*Haplotaxide*
-	-	-	-	*Limnaeidae*
-	-	-	-	*Gammaridae*
-	-	-	-	*Gordiace*
-	-	-	-	*Agriotypidae*

Table-2: Classification of species according to Constant values (F).

Euconstante (Ec) 75.0≤F<100%	Constante (C) 50.0≤F<74.9%	Assessor (As) 25.0≤F<49.9%	Accidental(Ac) F<24.9%;
Baetidae	*Perlodidae*	*Oligoneuriidae*	*Leuctridae*
Chironomidae	*Philopotamidae*	*Heptagenidae*	*Brachycentridae*
-	-	*Ephemerellidae*	*Glossosomatidae*
-	-	*Perlidae*	*Beraeidae*
-	-	*Gomphidae*	*Goeridae*
-	-	*Haplotaxide*	*Simulidae*
-	-	*Gammaridae*	*Tabanidae*
-	-	-	*Ceratopogonidae*
-	-	-	*Tipulidae*
-	-	-	*Limoniidae*
-	-	-	*Ditiscidae*
-	-	-	*Limnaeidae*
-	-	-	*Agriotypidae*

Table-3: Comparison of Similarity Index values for each pair of stations.

	ST.1	**ST.2**	**ST.3**	**ST.4**	**ST.5**
ST.1		10.4	67.9	18.9	13.2
ST.2	10.4		14.2	22.2	39.2
ST.3	67.9	14.2		32.0	25.1
ST.4	18.9	22.2	32.0		77.2
ST.5	13.2	39.2	25.1	77.2	

CONCLUSIONS

Based on the data it is concluded that from insects groups the largest number of species (7 species) belongs to Order Diptera (*Trueflies*), order Trichoptera (*Caddisflies*) is represented with 6 species, order Ephemeroptera (*Mayflies*) is represented with 4 species, and Plecoptera (*Stoneflies*) with 3 species. Group EPT (Ephemeroptera - Plecoptera - Trichoptera) constitutes 91.3% of the total number of individuals.

The highest values of dominance (**Eu**) belongs to Oligoneuriidae, Baetidae, and Hydropsychidae families, while the highest values of Constant (**Ec**) belongs to Baetidae, Hydropsychidae and Chironomidae families.

Referring to ***PSC***, we reach the conclusion that highest values of similarity between species are between station 4 and 5 (77.2%) and between station 1 and 3 (69.7%).

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