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Systematic Data of Benthic Macroinvertebrate of Stream "Zalli I Qarrishtes" In National Park of Shebenik-Jabllanica, Albania

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Abstract: Systematical knowledge of the macro invertebrate biodiversity in streams and rivers in Albanian territory are still incomplete. Even though the last decade in some main river as, Shkumbini, Vjosa, Osumi, Devolli and Mati are undertaken some comprehensive research studies of macro invertebrates, if we talk about streams and tributary that feed those main rivers the data on macro invertebrates are almost absent. This study was focused in a specific tributary of Shkumbini River, "Zalli i Qarrishtës". "Zalli i Qarrishtës", sources on the National Park of the Shebeniku Mountain. Sampling was carried out at 1642 m altitude, during the summer 2012. This sampling site has very specific habitat characteristics. Data from this study shows a different picture of macro invertebrate biodiversity composition of "Zalli i Qarrishtes" in comparison with the first station of Shkumbini River studied from us. The total 610 individuals of macro invertebrates collected in this sampling station belong to 7 orders, 19 families and 9 geniuses (*Heptagenia, Electrogena, Baetis, Perlodes, Dictyogenus, Isogenus, Isoperla, Protoneura. Rhiacophila*). The high value of diversity of macro invertebrates in this tributary looks that is directly connected with the lowest impact of human activities and with the natural specific condition in this national park.

***Keywords**: Macro invertebrate, Shebenik Mountain, stream, impact.*

Introduction

During the 20[th] century, increasing industrialization, population growth, overexploitation of natural resources and different types of pollutions have greatly impacted many European freshwater ecosystems, and also endangering the species inhabiting them (Brittain & Sartori, 2003). Ecologists who evaluate environmental quality using the benthos often consider the following characteristics of a benthic sample to be important indicators of stream, river or lake quality (Voshell & McDonald, 2002). Highly sensitive organisms, confronted with habitat alteration, as benthic macro invertebrates species are among the first to disappear. Therefore, they are important indicators of freshwater health and widely used in bio-monitoring programs over the world (Elliott *et al*., 1988; Sartori & Brittain, 2015). The knowledge of the mayfly biodiversity in the Balkan Peninsula is still far from being complete. Moreover, many taxa lack appropriate morphological descriptions for the larval and/or adult stages (Vilenica *et al*., 2014). Studies on distribution and biodiversity are of crucial importance in determining the conservation status of certain species and in investigating factors that influence that diversity (De Silva & Medellín 2001). In the last decade in Albania are undertaken some general study with the focus macro invertebrates in the main rivers as Shkumbin, Osumi, Devolli *etc*., (Paparisto *et al*., 2009; Keci *et al*., 2008) but still not complete in their tributary. In comparison with the number of species recorded in the neighbouring countries, i.e. 68 in Slovenia, 106 in Italy, and 93 in Hungary (Bauernfeind & Soldán, 2012), it can be obvious that the Albanian macro invertebrate fauna has been underestimated to date.

Materials and Methods

Sampling and laboratory methods

This study is based on the material collected at the stream "Zalli i Qarrishtës" in the National Park of Shebenik –Jabllanica, Albania, during a frequent expedition organized on summer 2012. This stream is included directly in the territory of Shebeniku National Park, one of 798 existing protected areas in Albania. The stream "Zalli i Qarrishtës" sources nearby the top of the Shebeniku Mountain

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and flows directly to Rapuni River a branch of Shkumbini River (Figure 1). In our case, the place where is situated the sampling station of our study there is not under human impact.

Macro invertebrates were sampled during summer season 2012. The first sampling station was situated in the source of the stream, The material was collected according to methods suggested from Campaioli et al, (1994), Bauernfeind and Humpesch (2012), Rundle et al, (2002), Bode et al, (1996), Bode et al, (1997), Dowing et al, (1984). The collection of the benthic macro invertebrates was realized by using the kick-net with holes of 0.5 mm. Organisms were taken from the river bottom (400 – 600 mm) with a net in order to gain sufficient samples from larger depths of water. All types of benthic macro invertebrates were collected by this sampling device. The material was placed in bottles adding 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 (Tachet et al, 1980).

Figure 1. Map and the photo of the station; Locality position; N: 41.260455 E: 20.457483)

Data analysis

All recorded specimens of "Zalli i Qarrishtes" were included in the watershed Shkumbini River macro invertebrates list. An analysis of data was realized using these parameters:

a) *Shannon-Weaver (H) and Simpson indices (D):* Species diversity and similarity with respect to the macro invertebrate composition and abundance were determined by both this parameter (formula 1, 2). Diversity within the benthic macro invertebrate community was described and statistically analyses using the Simpson's diversity index ("D"), calculated:

$$D = 1 - \sum_{i=1}^{s} (Pi)^2 \qquad \text{Eq. 2}$$

Where "p" is the proportion of individuals in the "i" taxon of the community and "s" is the total number of taxa in the community. This index places relatively little weight on rare species and more weight on common species (Krebs, 1994). Its values range from 0, indicating a low level of diversity, to a maximum of 1-1/s.

Shannon-Weaver (H) was calculated:

$$H = -\sum_{i=1}^{s} (p_i)(\log_2 p_i) \qquad \text{Eq. 2}$$

Where "p" is the proportion of individuals in the "i" taxon of the community and "s" is the total number of taxa in the community. As the number and distribution of taxa (biotic diversity) within the community increases, so does the value of "H" (Gerritsen *et al*., 1998).

b) 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 (Fritz 1975; Schwerdtfeger, 1975). Based on the calculated values, the species were categorized in the following categories: Eudominant taxon - Ed (d≥10.0%); Dominant taxon -D (5.0≤d<9.9%); Subdominant taxon -Sd (2.0≤d<4.9%); Recedente taxon- R (1.0≤d<1.9%); Subrecedente taxon - Sr(d <1.0%).

Results and Discussion

The total 610 individuals of macro invertebrate collected in this sampling of stream belong to 7 orders, 19 families and 9 genera (*Heptagenia, Electrogena, Baetis, Perlodes, Dictyogenus, Isogenus, Isoperla, Protoneura. Rhiacophila*) (Table 1). The group of insect is better represented on the collected samples (80%), while the EPT group is the best represented group (77.7%) among insects.

The percentage of EPT- group shows directly the performance of water quality in this aquatic body, because all the representatives of those three families represent lowest tolerance values from organic pollution. The family Perlodidae (Plecoptera, specie *Isogenus*) seems to be with the most dominant value between insect (Eudominant, 17.5%). This family is rigorously constricted with clean water quality. From all the data, 8 taxon of macro invertebrates belong Eudominant and Dominant family, 3 taxon represent subdominant, 2 taxon recedente and 11 taxon subrecedente. The crab Gammarrus (Amphipode) seems also with high value of dominance (19.3%) related that with clean and cold freshwater.

According to Table 2 and Table 3, the results shown a high considerable value of species diversity based on Shannon-Weaver (H) index (H=3.37036) and Simpson index (D=0.877227).It is clear in this stream we have a high range of biodiversity of. As results both indices are in accordance with each other expressing a high degree of species diversity.

Table. 1 Classification of taxons according to values of Dominance

Class	Order	Family	*Species*	Nu. oforgan.	Dominance	
			Heptagenia	47	7.7%	*(D)*
		Heptagenidae	*Electrogena*	2	0.3%	*(Sr)*
	Ephemeroptera	Baetidae	*Baetis*	81	13.3%	*(Ed)*
			Perlodes	38	6.2%	*(D)*
			Dictyogenus	73	12.0%	*(Ed)*
			Isogenus	107	17.5%	*(Ed)*
		Perlodidae	*Isoperla*	61	10.0%	*(Ed)*
		Nemuridae	*Protoneura*	12	2.0%	*(Sd)*
		Chloroperlidae		6	1.0%	*(R)*
	Plecoptera	Capnidae		2	0.3%	*(Sr)*
		Rhyacophilidae	*Rhiacophila*	12	2.0%	*(Sd)*
		Philopotamidae		10	1.6%	*(R)*
Insecta	Trichoptera	Hydroptilidae		2	0.3%	*(Sr)*
		Glossosomatidae		3	0.5%	*(Sr)*
		Chironomidae		24	3.9%	*(Sd)*
		Simulidae		3	0.5%	*(Sr)*
		Tipulidae		2	0.3%	*(Sr)*
		Empididae/ Sf.Atalantinae		3	0.5%	*(Sr)*
		Tabanidae		1	0.2%	*(Sr)*
	Diptera	Dolichopodidae		1	0.2%	*(Sr)*
	Coleoptera	Haliplidae		1	0.2%	*(Sr)*
Crustacea	Amphipoda	Gammaridae		118	19.3%	*(Ed)*
Hydrozoa	Anthoatecata	Hydridae	*Hydra*	1	0.2%	*(Sr)*

Table 2. The calculation of Shannon-Weaver (H) index of "Zalli i Qarrishtës" stream

Order	Family	*Genus*	Nu. Of organ.	P_i	$Log_2 P_i$	$P_i * Log_2 P_i$
		Heptagenia	47	0.077049	-3.69808	-0.28493
	Heptagenidae	*Electrogena*	2	0.003279	-8.25267	-0.02706
Ephemeroptera	Baetidae	*Baetis*	81	0.132787	-2.91282	-0.38678
		Perlodes	38	0.062295	-4.00474	-0.24948
		Dictyogenus	73	0.119672	-3.06284	-0.36654
		Isogenus	107	0.17541	-2.5112	-0.44049
	Perlodidae	*Isoperla*	61	0.1	-3.32193	-0.33219
	Nemuridae	*Protoneura*	12	0.019672	-5.6677	-0.1115
	Chloroperlidae		6	0.009836	-6.6677	-0.06558
Plecoptera	Capnidae		2	0.003279	-8.25267	-0.02706
	Rhyacophilidae	*Rhiacophila*	12	0.019672	-5.6677	-0.1115
	Philopotamidae		10	0.016393	-5.93074	-0.09723
Trichoptera	Hydroptilidae		2	0.003279	-8.25267	-0.02706
	Glossosomatidae		3	0.004918	-7.6677	-0.03771
	Chironomidae		24	0.039344	-4.6677	-0.18365
Diptera	Simulidae		3	0.004918	-7.6677	-0.03771

	Tipulidae		2	0.003279	-8.25267	-0.02706
	Empididae / Sf.Atalantinae		3	0.004918	-7.6677	-0.03771
	Tabanidae		1	0.001639	-9.25267	-0.01517
	Dolichopodidae		1	0.001639	-9.25267	-0.01517
Coleoptera	Haliplidae		1	0.001639	-9.25267	-0.01517
Amphipoda	Gammaridae		118	0.193443	-2.37002	-0.45846
Anthoatecata	Hydridae	*Hydra*	1	0.001639	-9.25267	-0.01517
	TOTAL		**610**			
	$H = -\sum_{i=1}^{s}(p_i)(log_2 p_i)$					**3.37036**

Table 3. The calculation of Simpson index (D) of "Zalli i Qarrishtës" stream

Taxon	**Family**	***Genus***	**Nu. oforgan.**	**P_i**	**$(P_i)^2$**
		Heptagenia	47	0.077049	0.005937
	Heptagenidae	*Electrogena*	2	0.003279	0.000011
Ephemeroptera	Baetidae	*Baetis*	81	0.132787	0.017632
		Perlodes	38	0.062295	0.003881
		Dictyogenus	73	0.119672	0.014321
		Isogenus	107	0.17541	0.030769
	Perlodidae	*Isoperla*	61	0.1	0.010000
	Nemuridae	*Protoneura*	12	0.019672	0.000387
	Chloroperlidae		6	0.009836	0.000097
Plecoptera	Capnidae		2	0.003279	0.000011
	Rhyacophilidae	*Rhiacophila*	12	0.019672	0.000387
	Philopotamidae		10	0.016393	0.000269
Trichoptera	Hydroptilidae		2	0.003279	0.000011
	Glossosomatidae		3	0.004918	0.000024
	Chironomidae		24	0.039344	0.001548
	Simulidae		3	0.004918	0.000024
	Tipulidae		2	0.003279	0.000011
	Empididae / Sf.Atalantinae		3	0.004918	0.000024
	Tabanidae		1	0.001639	0.000003
Diptera	Dolichopodidae		1	0.001639	0.000003
Coleoptera	Haliplidae		1	0.001639	0.000003
Amphipoda	Gammaridae		118	0.193443	0.037420
Anthoatecata	Hydridae	*Hydra*	1	0.001639	0.000003
	Total		610		0.122773
	$D = 1 - \sum_{i=1}^{s}(Pi)^2$				**0.877227**

Conclusions

- In total 610 individuals of macro invertebrate collected in this stream belong to 7 orders, 19 families.
- The group of insect represents with high percentage (80%), while the group EPT has the dominance 77.7%.
- The family Perlodidae (specie *Isogenus*) seems to be with the most dominant value between insect (Ed=17.5%).
- From the data, 8 taxon of macro invertebrates belong classification Eudominant and Dominant, 3 taxon represent subdominant, 2 taxon recedente and 11 taxon subrecedente.
- The crab Gammarrus (Amphipode) seems to be with high value of dominance (19.3%).
- Based on Shannon-Weaver (H) index (H=3.37036) and Simpson index (D=0.877227) this stream express a high degree of species diversity.

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