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The Composition and Abundance of the Macroinvertebrate Fauna in the Leqinat Lake, National Park Bjeshkët e Nemuna, Kosovo

Astrit Bilalli[1], Halil Ibrahimi[2], Linda Grapci-Kotori[2], Milaim Musliu[1*], Donard Geci[2], Agim Gashi[2]

[1] Faculty of Agribusiness, University of Peja "Haxhi Zeka", Street "UÇK" 30000 Pejë, Kosovo

[2] Department of Biology, Faculty of Mathematics and Natural Sciences, University of Prishtina, Mother Teresa street p.n., 10000 Prishtina, Kosovo

* Corresponding author's e-mail: milaim.musliu@unhz.eu

ABSTRACT

During August and September 2018 we collected the macroinvertebrate fauna in the Leqinat Lake, Kosovo. The Leqinat lake (great lake) is a mountain lake found in the National Park "Bjeshkët e Nemuna" in western Kosovo, shared between Kosovo and Montenegro. Macrozoobenthos specimens were collected with *D*-frame net of 30×20 cm (600 cm^2) diameter. Samples were taken from all available habitats represented with more than 5% of total habitat area on the sampling stretch (multi-habitat sampling procedure). Sampling in riffle section of the lake was done by identifying the riffle segments, disturbing the substratum with the feet while holding the net downstream with the mouth facing upstream. The macrozoobenthos structure during this investigation includes: 2 classes (Bivalvia and Gastropoda), 2 subclasses (Hirudinea and Oligochaeta), 6 orders (Ephemeroptera, Plecoptera, Trichoptera, Diptera, Coleoptera and Odonata), 15 families, 6 genera and 86 specimens. The larger number of families and individuals belongs to the Odonata order (4 families and 47 specimens) followed by Tirchoptera (2 families and 10 specimens), Plecoptera (2 families and 6 specimens), Bivalvia (2 families with 5 specimens) Diptera (1 family with 12 specimens), Ephemeroptera and Hirudinea (1 family with 3 specimens) and Oligochaeta (1 family with only 1 specimens). This investigation is a contribution in knowing the macroinvertebrate fauna and their ecological patterns in alpine lakes in Kosovo.

Keywords: macroinvertebrate, composition, abundance, Leqinat Lake, National Park "Bjeshkët e Nemuna".

INTRODUCTION

Benthic (bottom-dwelling) macro (large enough to see with the naked eye) invertebrates are aquatic organisms that are generally small (will be retained by a 200 – to 500 µm [0.01 – to 0.02 inch] mesh) but large enough to be easily collected. Macroinvertebrates inhabit bottom substrates of streams and lakes for at least part of their life cycles and inhabit all types of aquatic habitats. In this group are included insects, but also worms, crayfish, snails, and freshwater clams.

There are several advantages in using macroinvertebrates as bioindicators of freshwater ecosystems because first of al they can be found in most aquatic habitats. They are affected by the physical and chemical conditions of the stream and they generally have limited mobility, so they cannot escape pollution events.There are a large number of different macroinvertebrate species, some are more or less tolerant of pollution, and the presence or absence of certain species or groups of species reflects environmental conditions, which indicates good or poor water quality. Since benthic macroinvertebrates retain (bioaccumulate) toxic substances, chemical analysis will detect toxins in them when levels may be undetectable in the water resource. Small order streams often do not support fish, but do support extensive macroinvertebrate communities. They are small enough to be easily collected and identified. Sampling of macroinvertebrates is easy, requires few people and minimal equipment (e.g., nets, buckets, trays), and does not adversely affect other organisms.

The basic principle behind the study of macroinvertebrates is that some are more sensitive to pollution than others. Therefore, if a stream site is inhabited by organisms that can tolerate pollution and the more pollution sensitive organisms are missing a pollution problem is likely. For example, stonefly nymphs belonging aquatic insects that are very sensitive to most pollutants cannot survive if a stream's dissolved oxygen falls below a certain level. If a bio-survey shows that no stoneflies are present in a stream that used to support them, a hypothesis might be that dissolved oxygen has fallen to a point that keeps stoneflies from reproducing or has killed them outright.

The numbers of indices based on the benthic macroinvertebrate communities is probably about five times that of any other groups, with about fifty indices currently existing, and the number is still growing. Biotic index systems have been developed which give numerical scores to specific "indicator" organisms at a particular taxonomic level (Armitage et al., 1983). Such organisms have specific requirements in terms of physical and chemical conditions. Changes in presence/absence, numbers, morphology, physiology or behaviour of these organisms can indicate that the physical and/or chemical conditions are outside their preferred limits (Rosenberg and Resh, 1993). Presence of numerous families of highly tolerant organisms usually indicates poor water quality (Hynes, 1998).

MATERIALS AND METHODS

Benthic invertebrate sampling

Macrozoobenthos specimens were collected with *D*-frame net of 30×20 cm (600 cm^2) diameter. Samples were taken from all available habitats represented with more than 5% of total habitat area on the sampling stretch (multi-habitat sampling procedure).

Sampling in riffle section of the lake was done by identifying the riffle segments, disturbing the substratum with the feet while holding the net downstream with the mouth facing upstream. Vigorously the substratum was moved about by digging the feet well into the cobbles and boulders. Several times the boulders and cobbles were turned and rubbed by hand in order to dislodge the organisms. The process was continued until we sampled a total of about five meters of riffle habitat. The net was stopped and rinsed several times in order to remove fine particles.

Once the macroinvertebrate samples were collected they were transferred to a plastic sorting stray where animals are picked with forceps and placed into a jar of ethanol. The collected material was fixed in 70% alcohol. Sampling protocol and procedures followed Bode et al. (1991, 1996) and Barbour et al. (1998). The physico-chemical parameters were measured with a HACH HQ30d portable multi-meter.

Study area

Sampling was carried out in Leqinat lake, during August and September 2018. Leqinat lake (great lake) is a mountain lake found in National Park "Bjeshkët e Nemuna" in western Kosovo, shared between Kosovo and Montenegro (Figure 1). Lake Leqinat is at an elevation of 1,800 m above the village of Kuqishte, Peja municipality (N 42.668608; E 20.090833; 1861 m).

Benthic invertebrate sorting and identification

The procedures for sorting and identification of macroinvertebrate samples are in line with the standard EN ISO 10870-2012. Samples collected in field were thoroughly rinsed over a sieve in order to remove fine sediments associated with the sample and also the initial alcohol. Water was used to wash the samples finely and they were transferred into the new preservative material. During the identification procedure the samples were put into a white laboratory tray from where they were taken into the identification desk. The macroinvertebrate material was sorted into groups for further identification. Macroinvertebrates prepared for taxa identification were identified by using an Olympus SZX 16 binocular stereomicroscope. The sorted material was after identification stored into plastic 5 ml vials with 80% ethanol with all necessary labelled information such as: locality data, sampling date, collector names, systematic information etc.

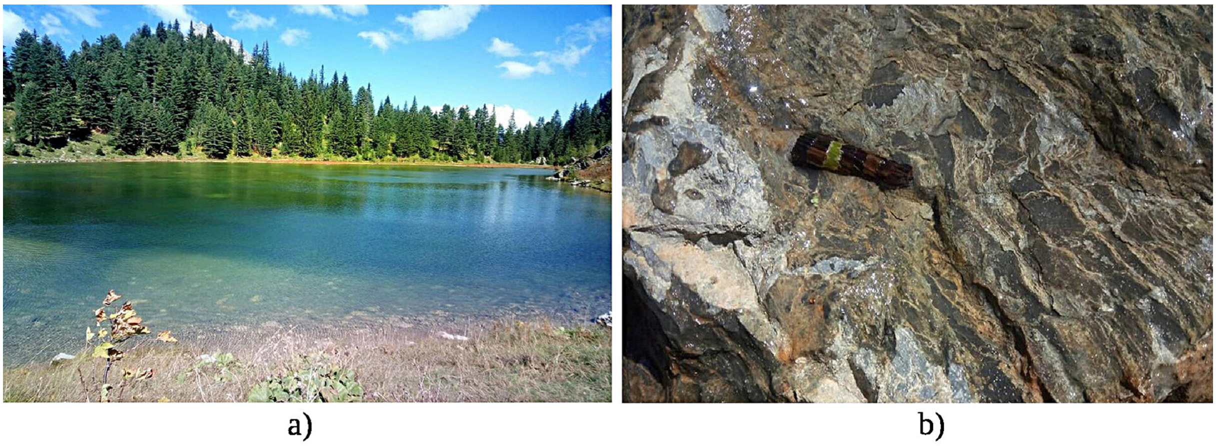

Figure 1. a) Leqinat Lake; b) caddisfly larva

Taxonomic identification was done consistently among samples. Two levels of identification are usually suggested/used: family and genus/species (Plafkin et al., 1989). Genus/species provides more accurate information on ecological/environmental relationships and sensitivity to impairment. Family level provides a higher degree of precision among samples and taxonomists, requires less expertise to perform, and accelerates assessment results. In either case, only those taxonomic keys that have been peer-reviewed and are available to other taxonomists should be used. The following literature was used for identifying macroinvertebrate specimens: Waringer & Graf, 1997; Elliot et al., 1988; Dall et al., 1990; Hynes, 1977; Studemann et al., 1992; Tachet et al., 1980; Bouchard R.W., 2004; Campaioli et al., 1994; Consiglio, 1980; Waringer et al., 2010, 2015.

RESULTS AND DISCUSSION

The data of the macrozoobenthos structure are presented in Table 1 (data for taxon and number of individuals). We found 2 classes, 2 subclasses, 5 orders, 15 families, 6 genera and 86 individuals.

The Ephemeroptera order is represented with 1 family (Caenidae) and 1 genus (Ceanis) Tirchoptera: 2 families (Limnephilidae and Phryganeidae) and 2 genera (*Limnephilus* and *Oligotricha*); Diptera: 1 family (Chironomidae) and 1 genus (*Chironomus*), Odonata:

Table 1. Data of macrozoobenthos structure in Liqenat lake

Taxa	Specimens	Taxa	Specimens
Ephemeroptera		Diptera	
Fam:. Caenidae		Fam.: Chironomidae	
Caenis sp.	3	*Chironomus* sp.	12
Plecoptera		Coleoptera	
Fam.: Perlidae	2	Fam.: Dytiscidae	3
Fam.: Perlodidae	1	Bivalvia	
Trichoptera		Fam.: Unionidae	
Fam.: Limnephiliidae		*Unio* sp.	4
Limnephilus sp.	8	Gastropoda	
Fam.: Phryganeidae		Fam.: Physidae	1
Oligotricha sp.	1	Hirudinea	
Odonata		Fam.: Erpobdellidae	3
Fam.: Gommphidae	13	Oligochaeta	
Fam.: Libellulidae	16	Fam.: Lumbriculidae	
Fam.: Lestidae	15	*Lumbricus* sp.	1
Fam.: Aeshnidae	3		

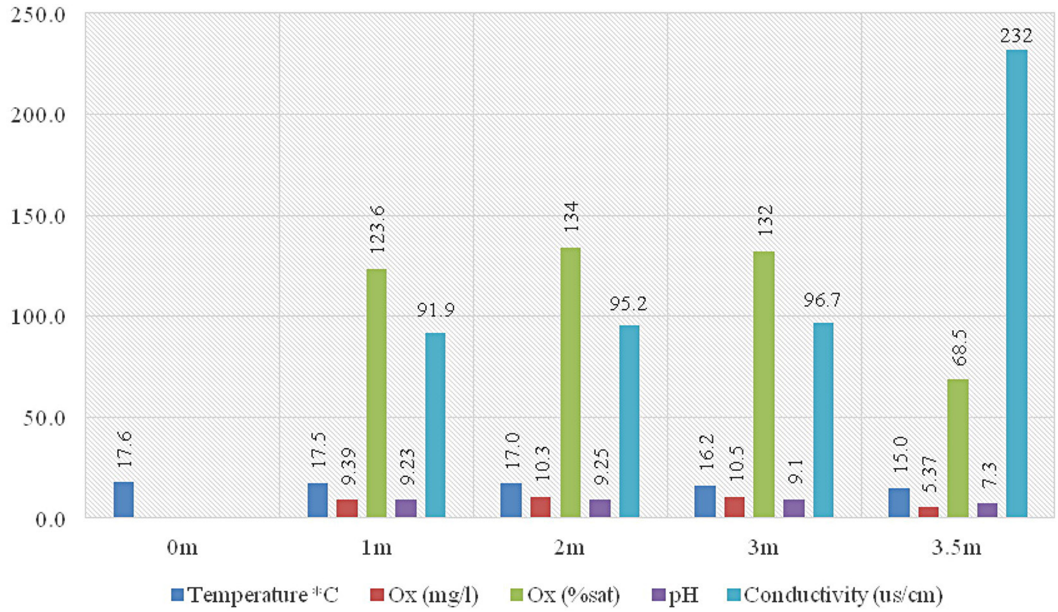

Figure 2. Physicochimical paramters of the Leqinat lake

4 families (Gomphidae, Libellulidae, Lestidae and Aeshnidae), Coleptera: 1 family (Dytisscidae), Bivalvia: 1 family (Unionidae) and 1 genus (*Unio*), Gastropoda: 1 family (Physidae), Hirudinidae: 1 family (Erpobdellidae) and Oligochaeta: 1 family (Lumbriculidae) and 1 genus (*Lumbricus*)

The results of the current study indicated that water temperature was between 17.6°C (surface water) and 15.0°C (in the 3.5 m depth) (Figure 2). The difference in water temperature is related to many environmental factors such as exposure to direct sunlight, and temperature inlet water and shading (Bartram & Balance, 1996). The temperature directly affects the amount of dissolved oxygen, the solubility of minerals and some solids. The oxygen concentration values were 9.3 mg/l (1 m), 10.3 mg/l (2 m), 10.5 mg/l (3 m) and 5.37 mg/l (3.5). The pH values were between 7.3 (3.5 m) and 9.23 (1 m) while conductivity values were 232 µs/cm (max. value in the 3.5 m water depth) and 91 µs/cm (min. value in the 1 m water depth). This study is in line with other recent similar investigations on freshwater ecosystems in Kosovo during the last decades (Dauti et al., 2007; Gashi 1993, 2006; Ibrahimi, 2007; Ibrahimi et al., 2007, 2019, 2021; Musliu et al., 2018; Shukriu 1979).

As in other similar studies in high altitude lakes in the area, it is obvious that there is no significant richness of macroinvertebrate fauna, conditioned by physico-chemical characteristics of the site, geographical conditions and biotic factors. The composition of macroinvertebrates in the Leqinat lake is typical for this kind of high-altitude lakes, with a significant dominance of aquatic insects. The most abundant orders are Odonata and Diptera, since they have favorable conditions for development, especially in their larval stages.

This study contributes in knowing the composition of macroinvertebrates in high altitude lakes in natural and pristine conditions, as is the case with Leqinat lake, in light of recent developments in Kosovo and the region, where freshwater ecosystems of all types and segments are heavily degraded, primarily because of pollution.

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