

Water quality assessment of Vasileva Lake based on diatoms influences by tourism, fishing and recreation

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Abstract

Surface waters in recent years are under the great influence of industrial and anthropogenic factors. Vasileva Lake has been impacted by anthropogenic factors. It has been exploited by people for recreation, vacation and fishing, which exposed Vasileva Lake to occurrence of pollution. Purpose of this work was to evaluate the status of water quality in this artificial lake, using algae-diatoms as indicators of organic and inorganic pollution determination. In order to evaluate the status, the samples were taken in three different points in the spring season then analyzed and processed in the laboratory. Also OMNIDIA program is used for diatom counting, diatom inventories management, and diatom indices calculation for water quality assessment. According to the results 152 diatoms are found, they were distributed to 15 genuses. The water quality in the Vasileva Lake belongs the class II and III.

Keywords: Quality, Vasileva Lake, Diatoms, Pollution, Parameter

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Introduction

Population growth, increased economic activity and intensification of land use practices all lead to increased water demand, and an increasing degradation of the resource (Taylor *et al.*, 2007a).

At the present many water resources are polluted human activities contribute to salinity in surface waters include the discharge of municipal and industrial effluent; irrigation return water; urban storm-water runoff; surface mobilisation of pollutants from mining and industrial operations and seepage from waste disposal sites, mining and industrial operations (Van Niekerk *et al.*, 2009).

Biological indicators as organisms (or populations) whose occurrence reflects the environmental conditions (Kovacs, 1992) biological indicators (bioindicators) may be defined as particular species or communities, which, by their presence, provide information on the surrounding physical and/or chemical environment at a particular site. Freshwater algae are considered as bio indicators in relation to water chemistry – otherwise referred to as ‘water quality’. The basis of individual species as bioindicators lies in their preference for (or tolerance of) particular habitats, plus their ability to grow and out-compete other algae under particular conditions of water quality.

Algae are widely present in freshwater environments, such as lakes and rivers, where they are typically present as micro-organisms. Although relatively inconspicuous, they have a major importance in the freshwater environment, both in terms of fundamental ecology and in relation to human use of natural resources. Algal

bioindicators from an environmental perspective, dealing initially with general aspects of algae as bioindicators and then specifically with algae in the four main freshwater systems – lakes, wetlands, rivers and estuaries. Diatoms have been used extensively in water quality monitoring (Round, 1991). They exist in a wide range of ecological conditions, colonizing almost all suitable habitats; they can thus provide multiple indicators of environmental change (Stevenson and Pan, 1999). The purpose of this study was to evaluate the water quality of the Vasileva Lake based on diatoms.

Material and methods

Study area

Vasileva Lake it is located in the northwestern part of the municipality of Fushë Kosova, located in the valley between Gospoje peak (817 m) northeast and Bregu i Sukes (701 m) in the southwest. The lake area is located at an altitude of 690 m. In the morphological aspect, the area of Vasileva Lake is a hilly and mountainous relief sunk in the northwest of the village of Vasileva. This lake was formed around the 80s for the effect of overburdening (sterile clay mass) by the Kosovo Energy Corporation, respectively from the coal mine in Bardh i Madh. The climate is continental with mountain climate elements. Average annual rainfall is 650 mm (Hydro meteorological Station of Prishtina). The lake has an area of 19.65 hectares. The lake is supply by water from some streams that feed from rain and snow atmospheric rainfall (Fig. 1).

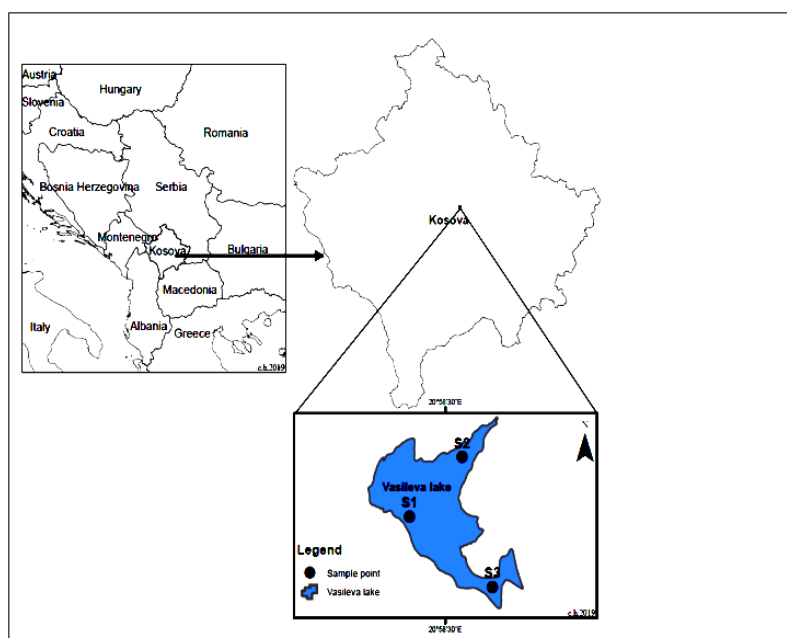


Figure 1: Location of investigated area.

The samples were taken, in stones or other substrates conforming to standard (British Standard, 2003). The material was taken algae populations that develop on stones or other substrates present in the Vasileva Lake. The samples taken are placed in glass bottles, while conservation and fixation is done in 4% formalin. Preparations are prepared in the lab in the following steps: Initially, we had 3 samples collected from different localities (S1, S2, and S3) from which we received 5 ml of contents and put them in the tubes. After the material was placed in the tubes we waited a few minutes until the algalogic material was precipitation and then we removed only the upper part of the water and leave part algae precipitation. Then all the finite samples in the test tubes were added from 10 ml of H_2O_2 . All the tubes were then placed in the water bath at $90^\circ C$ for 2-3 hours.

Then samples that have been richer organic matter as needed for dissolved carbonate added 1M HCl 37%. After the end of this stage it took the test tubes and put in the centrifuge for 3-4 minutes. Then it removed liquid part of H_2O_2 and HCl, and then added the test tube from 4ml of distilled water, centrifuged 4 times with distilled water until the samples were thoroughly cleaned. Thereafter, one or two formaldehyde points were added to ensure the preservation. With this material were prepared microscopic preparations, algae. Observation of the preparations is done by optical microscope. Determination of species was made based on the keys for determination by the authors (Zabelina *et al.*, 1951; Hustedt, 1953; Lange-Bertalot, 1993, 1997, 2001). After the identification the species, these results were entered into the OMNIDA

software version 6.0.6, (Lecointe, 2017) and then water quality is determined.

Results and discussion

A total of 152 diatoms belonging to 15 genera are distributed among 5 families Naviculacees, Araphidees, Nitzschiacees, Monoraphidees, Centrophycidees were recorded in all the diatom samples collected. Among the species observed, species with higher abundances were *Achnanthydium sp.*, *Neidium lineare*, *Cyclotella meneghiniana*, *Cocconeis placentula var. lineata*. Species with medium abundance were *Cocconeis placentula var. lineata*, *Cyclotella meneghiniana*, *Navicula cryptotenella*, *Navicula splendicula*, *Neidium lineare*, *Navicula viridula*. Species with small abundances *Amphora aequalis*, *Amphora macedoniensis*, *Amphora normanii*, *Cyclotella ocellata*, *Cymbella excisa*,

Cymbella lanceolata, *Cymbella tumida*, *Diatoma vulgare*, *Geissleria decussis*, *Melosira sp.*, *Meridion circulare*, *Navicula angusta*, *Navicula lanceolata*, *Navicula oblonga*, *Navicula oligotrappenta*, *Navicula subrhynchocephala*, *Navicula tripunctata*, *Synedra ulna*, *Nitzschia dissipata*, *Nitzschia gracilis*, *Nitzschia palea*, *Pinnularia microstauron*, *Nitzschia acicularis*

Genus *Achnanthydium* are living in rivers, streams, and springs if they inhabit clean and polluted waters, including those affected by acid mine drainage (Ponader and Potapova, 2007). While on the other hand, a small number of genus *Nitzschia* have been found, it turns out to the water in the Vasileva lake does not have a great load of pollution (Lowe 1974; Chohnoky 1968; Patrick 1977) (Table 1).

Table 1: Results of diatoms in Vasileve Lake.

No.	Code	Abundance	%	Extended name	Genus
1	ADCS	20	13.2	<i>Achnanthydium sp.</i>	ACHD
2	AAEQ	2	1.3	<i>Amphora aequalis</i> Krammer	AMPH
3	AMCD	2	1.3	<i>Amphora macedoniensis</i> Nagumo	AMPH
4	ANOR	2	1.3	<i>Amphora normanii</i> Rabenhorst	AMPH
5	CPLM	14	9.2	<i>Cocconeis placentula var. lineata</i> (Ehr.)Van Heurck f. anormale	COCO
6	CMEN	14	9.2	<i>Cyclotella meneghiniana</i> Kützing	CYCL
7	COCE	4	2.6	<i>Cyclotella ocellata</i> Pantocsek	CYCL
8	CAEX	2	1.3	<i>Cymbella excisa</i> Kützing	CYMB
9	CLAN	2	1.3	<i>Cymbella lanceolata</i> Agardh	CYMB
10	CTBO	5	3.3	<i>Cymbella tumida</i> (Brebisson)Van Heurck var. borealis (Grunow) Cleve	CYMB
11	DVUL	6	3.9	<i>Diatoma vulgare</i> Bory	DIAT
12	GDEC	4	2.6	<i>Geissleria decussis</i> (Ostrup) Lange-Bertalot & Metzeltin	GEIS
13	MELS	5	3.3	<i>Melosira sp.</i>	MELO
14	MCCO	2	1.3	<i>Meridion circulare</i> (Greville) C.A. Agardh var. constrictum (Ralfs) Van Heurck	MERI
15	NAAN	2	1.3	<i>Navicula angusta</i> Grunow	NAVI
16	NCTE	7	4.6	<i>Navicula cryptotenella</i> Lange-Bertalot	NAVI
17	NLAN	4	2.6	<i>Navicula lanceolata</i> (Agardh) Ehrenberg	NAVI

No.	Code	Abundance	%	Extended name	Genus
18	NOBA	2	1.3	<i>Navicula oblonga</i> Kützing var. acuminata Grunow	NAVI
19	NOLI	1	0.7	<i>Navicula oligotraphenta</i> Lange-Bertalot & Hofmann	NAVI
20	NSPD	10	6.6	<i>Navicula splendidula</i> Van Landingham	NAVI
21	NSYO	1	0.7	<i>Navicula subrhynchocephala</i> Hustedt f. robusta Manguin	NAVI
22	NTPA	1	0.7	<i>Navicula tripunctata</i> (O.F.Müller) Bory var. arctica Patrick & Freese	NAVI
23	NVIA	10	6.6	<i>Navicula viridula</i> (Kütz.)Ehr. var. abbreviata Grunow in Cleve	NAVI
24	NAAO	1	0.7	<i>Nitzschia acicularis</i> (Kützing) W.M.Smith var. adelos Hohn & Hellerman	NITZ
25	NDBN	3	2.0	<i>Nitzschia dissipata</i> var. borneensis Hustedt in Schmidt & al	NIDI
26	NELI	15	9.9	<i>Neidium lineare</i> Oestrup	NEID
27	NGBV	1	0.7	<i>Nitzschia gracilis</i> Hantzsch f. brevis Manguin	NITZ
28	NPAL	3	2.0	<i>Nitzschia palea</i> (Kützing) W.Smith	NITZ
29	PMBD	1	0.7	<i>Pinnularia microstauron</i> var. brebissonii(Kütz.)Mayer f. diminuta Hustedt	PINU
30	SULN	6	3.9	<i>Synedra ulna</i> (Nitzsch.)Ehr.	SYNE

Based on index results, IPS, IDG, Rott SI, water class is II, ecological status is good. The trophic status belongs to the oligo- mesotrophic class. While on the other hand, based on the index IBD,

IPS, DESCY, SLA, EPID, Lobo, IDAP, TDIL, Hurl, Rott TI, water classes is III, the ecological status is moderate, the trophic status belongs to that mesotrophic class (Table 2 and Fig. 2).

Table 2: Water class, ecological status, trophic status.

Water quality class	Ecological status	IPS, CEE, IBD, IDG, DESCY, SLA, IDAP, EPID, CEE, WAT, TDI, IDP, SHE	Trophic status
I	High	17-20	Oligotrophic
II	Good	13-16	Oligo-mesotrophic
III	Moderate	9-12	Mesotrophic
IV	Poor	5-8	Eutrophic
V	Bad	1-4	Hypertrophic

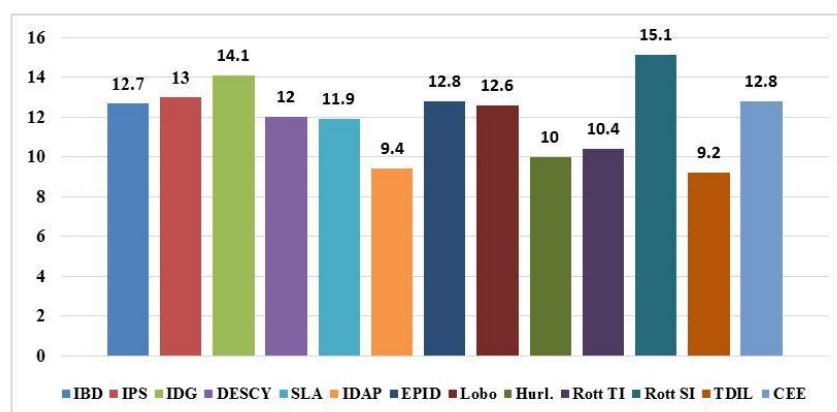


Figure 2: Results of indices conducted by Omnidia software.

Conclusions and recommendations

The study undertaken in this work was an attempt to relate the presence diatoms species during this work it was found 15 geniuses, and a total of 152 diatoms. The water quality in Vasileva Lake belongs in the class II and III. Diatom indices are very promising tools for ecosystem health assessment of lakes, rivers. This lake should be protected because it is of great importance for citizens for recreation, tourism and fishing.

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