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Review article

THE WATERS' ANALYSIS OF THE RIVERS FLOWING INTO OHRID LAKE

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Abstract

Water is one of the main existential conditions of life on our planet. It knows no borders, so it is a problem that belongs to all of us and we must all take care of it together.
The permanent human being is only used to take things from nature and not to contribute to it. However, human selfishness in relation to nature and the living environment, which is used without control and without care, can destroy entire ecosystems. All this comes back to people and is seen in their lives and health. We must leave the healthiest and most beneficial environment to future generations.
The purpose of this paper was to analyze the physical-chemical parameters, such as pH, temperature, sulfates, chlorides, conductivity and suspending substances. Water samples were taken at different locations of the Sateska River, the Ezerka River and the Velgozda River and a lake shore where the water of this river flows into Lake Ohrid.
A clean-living environment must be guaranteed for every citizen. Everyone is obliged to protect the environment and nature, that is, to protect the land, air and water.

Keywords: Ohrid; Lake; Environmental pollution; Protection mass.

1. Introduction

Water is an essential need for life and none of the living creatures could exist without it. But, in the meantime, water can cause some diseases and even death.

The individual and economic need for water increases along with social development, the improvement of living conditions and the increase in the number of inhabitants on our planet. The human being is only used to taking things from nature so as not to contribute to it. However, human selfishness in relation to nature and the living environment, which is exploited without control and without any care, can destroy entire ecosystems. All this comes back to people and is seen in their lives and health.

Water is one of the main existential conditions of life on our planet. It knows no borders, so it is a problem that belongs to all of us and we must take care of it together.

The water of Lake Ohrid is an aquatic ecosystem of special importance. This lake is located in the eastern western part of Europe. Albania and North Macedonia are the only two countries on the shores of the lake. It is characterized by a rich biodiversity that comes directly as a result of its ancient ages, approximately two to three million years of existence.

Its maximum depth reaches 295 m.

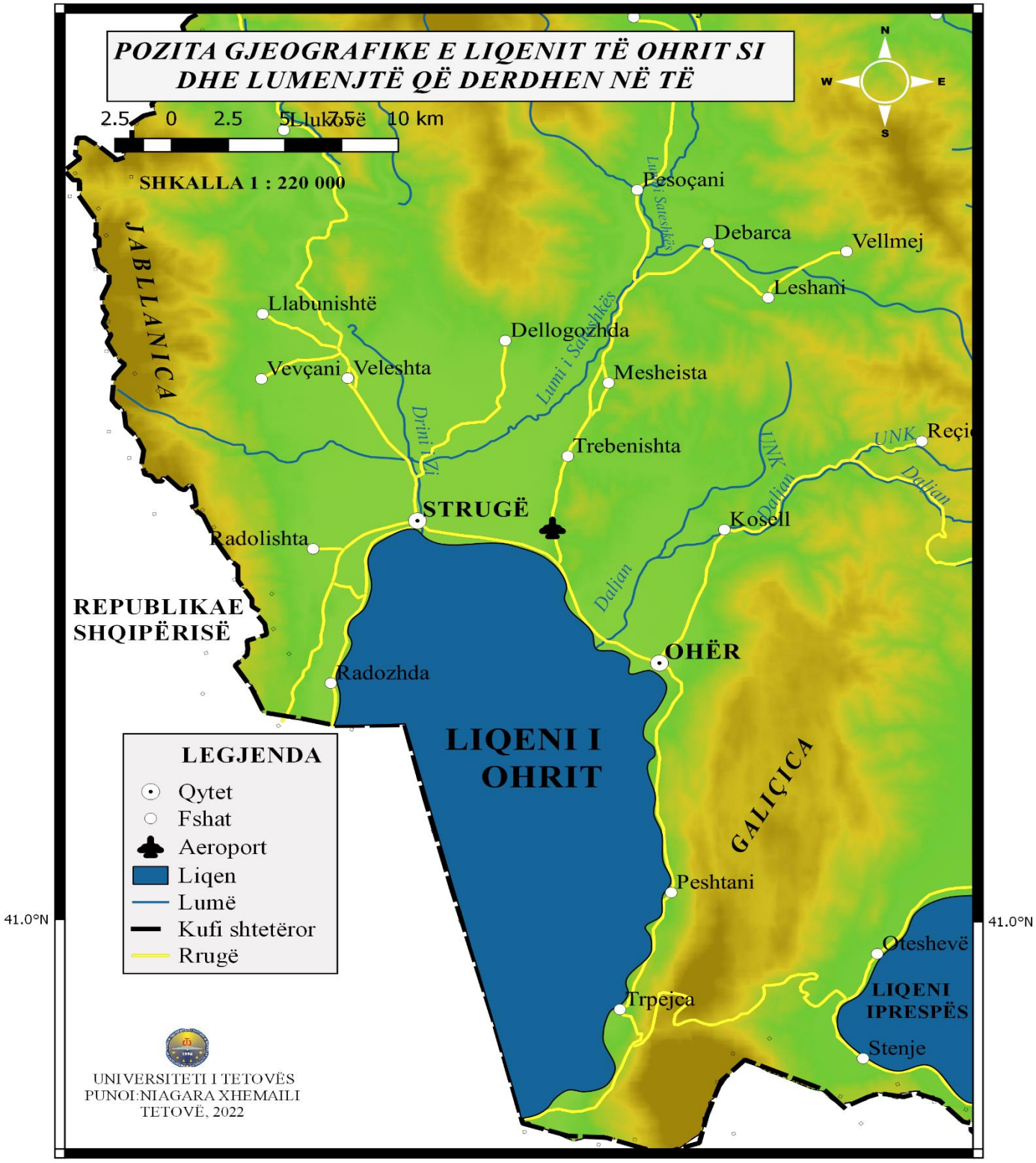
There is a flowing surface stream which is the Black Drin River.

Its water comes mainly from various water sources within itself as well as from several other rivers that flow over it. There are about 40 such local streams and small rivers. Most of them are dry rivers, which usually come to life during the rainy seasons or during the snowmelt period.

The rivers Sateska, Ezerka and Vellgozda (Koselska) are tributaries of Lake Ohrid and it flows through agricultural and urban areas. It carries a large load of alluvial sediments, which are deposited in the littoral area of Lake Ohrid at the mouth of the river.


Fig 1. Well-maintained parts of Lake Ohrid
(Photos taken by author herself, Merime Mustafi)


Fig 2. Well-maintained parts of Lake Ohrid
(Photos taken by author herself, Merime Mustafi)



Map 1. The geographical position of Lake Ohrid as well as the rivers that flow into it

2. Socio - Juridical Aspects for Protection of Living Environment

Protection of the living environment is one of the most important areas of our time and it is more than logical that society pays special attention to this area in the Republic of North Macedonia.
This is stated in act 8 of the Constitution of the Republic of North Macedonia, where the regulation and space of humanity and the protection and advancement of the living environment and nature and respect for the norms of international law, is generally accepted and expressed as one of the fundamental sums of the Constitution. of Republic of North Macedonia.
A clean-living environment must be guaranteed to every citizen. Everyone is obliged to protect the environment and nature, that is, to protect the land, air and water.
Of course, the regulation of the living environment and the protection of nature must be regulated by other special laws that must be in accordance with international norms and the Constitution of the Republic of North Macedonia.
But in a country, international laws and conventions are not always respected, such as the change of the Sateska River bed in 1962. Before this year, this river flowed into the Black Drin River and for no reason its bed was diverted and now flows into Lake Ohrid, even if such a thing is not allowed by the International Convention and by the law for the protection of Lake Ohrid, Prespa and Dojran.

3. Experimental Engagement

Material Gathering and Working Methods

The collection of material was done during one year, an ecological year. This is because in natural processes there is no possible way to predict the exact timing of the ecological cycle.
Water samples of Sateska, Ezerka and Vellgozda rivers were taken for analysis. There were places from which the samples were taken. Three of them on the banks of the river basin itself (S1, S2, S3, V1, V2, V3, E1, E2, E3) and one of these places was at the point where the Sateska, Ezerka and Velgozda rivers flow. Lake Ohrid, loading the lake with various types of nutrients. This should not happen because Lake Ohrid has its own special values as a very special water ecosystem and since 1980 it has been declared under the protection of UNESCO together with the city of Ohrid itself.
The determination of the analyzed parameters was done using a pH-meter (WTN-Multilab 540). Water conductivity was done using SEBA model F1 conductivity meter. Sulfates are determined by gravimetric methods, chlorides by standard titrimetric methods[1].

Experimental Results

Achieved results are given in tabular and graphic form. Tables represent the achieved experimental results of physical parameters and result of control pollution parameters in the studied samples as well as concentration of the nitrites, nitrates, ammonia, phosphates, dissolved oxygen, biological expense oxygen for five days, chemical expense oxygen in these same.

[1] *Ruthner 1975*

Table 1. Physico – chemical parameters in spring season

Samples	ºC	pH	Tupidity □s/cm	Cl^- mg/l	SO_4^{2-} mg/l	Suspended Materials mg/l
S_1	9.2	6.22	550	12.8	273.8	1.9374
S_2	9.0	6.74	557	10.9	372.5	1.7958
S_3	9.1	6.32	555	11.7	109.3	1.487
E_1	8.9	6.54	530	7.92	318.5	1.2423
E_2	8.4	4.95	524	17.02	267.3	1.0323
E_3	8.2	6.27	532	10.61	158.3	0.8753
V_1	8.2	6.6	303	13.52	291.7	0.8210
V_2	8.1	6.63	305	9.24	235.1	0.8013
V_3	8.3	6.4	306	10.84	100.4	0.7921
S_4	8.9	6.21	559	14.3	185.3	1.2453
E_4	8.1	6.19	527	8.21	164.2	0.7428
V_4	8.2	6.54	306	11.15	181.4	0.7831

Table 2. Physico – chemical parameters in summer season.

V_2	15.8	7.6	205	9.58	497.5	0.6231
V_3	15.6	7.7	200	11.72	369.7	0.6201
S_4	15.4	8.0	279	15.32	498.5	0.9754
E_4	18.4	7.8	200	12.78	65.8	0.6093
V_4	15.8	7.9	198	12.75	421.1	0.5943

Table 3. Physico – chemical parameters in autumn season

S_1	3.5	7.61	575	6.9	185.7	1.1241
S_2	4.1	7.63	587	12.78	172.8	1.2310
S_3	3.9	7.67	572	21.3	92.9	0.9783
E_1	4.1	7.65	587	7.3	219.5	0.8432
E_2	4.3	7.65	610	6.87	160.5	0.7943
E_3	4.2	7.56	623	6.39	88.5	0.7013
V_1	3.9	7.8	372	8.88	301.7	0.7623
V_2	3.7	7.78	374	7.1	143.6	0.6103
V_3	3.6	7.86	380	10.65	72.4	0.6023
S_4	4.1	7.6	584	9.94	108.5	0.8342
E_4	4.0	7.84	614	7.3	136.2	0.5235
V_4	3.7	7.8	369	9.54	174.1	0.5943

Graphic charts from 1 – 5 represent the same results.

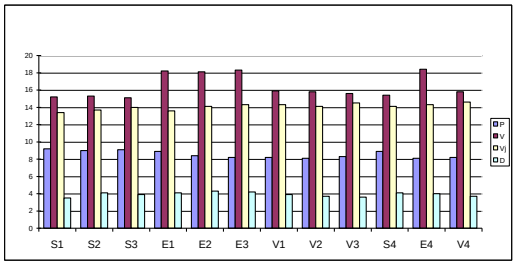


Fig 3. Temperature

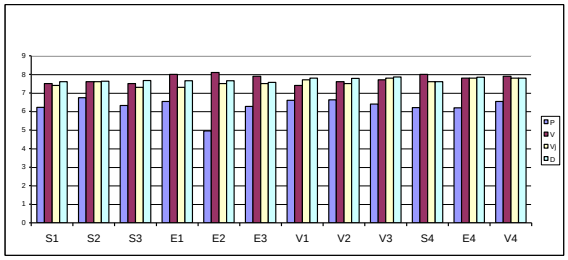


Fig 4. pH Value

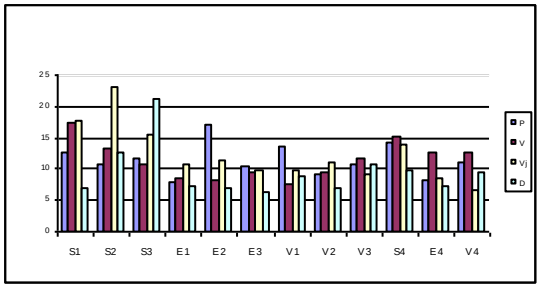


Fig 5. Conductivity of water (μs/cm)

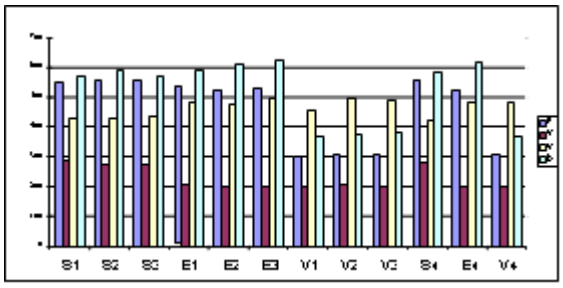


Fig 6. Chlorides (mg/l)

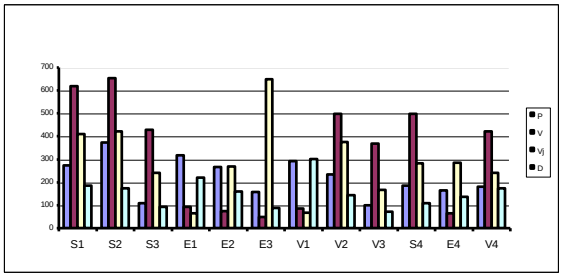


Fig 7. Sulphates (mg/l)

**The data is taken by Institute of Hydrobiology – Ohrid*

4. Discussion and conclusions

Temperature

Temperature is a physical parameter of certain importance for the existence of aquatic ecosystems. If the temperature is not suitable, many aerobic organisms can survive. Water temperature is the main characteristic that affects water quality, it can be a catalyst, activator, stimulator, controller or killer of life in that ecosystem. According to Kostovski, the water temperature, as in many other lakes, has a guiding role in the vertical migration of zooplankton. The water temperature is usually higher than 4°C. According to Forel and Hitchinson, Lake Ohrid is part of the group of tropical or subtropical lakes. Remembering that Lake Ohrid is located in the southern part of the Central European lakes, the temperatures were expected to be higher, but

the fact is that it is at an altitude of 693.17 m and is limited by massive high mountains, which are the reasons that reduce the Mediterranean climate. This is also confirmed by our results. The water temperature on the shore of the purification lake of the Velgozhda River is about 4.0-18.4 oC. (Tab. 1, Fig . 3).
In river water ecosystems we have temperature changes. The minimum temperature in the analyzed rivers is about 3.5°C (S1) (Tab. 4, Fig . 3), and the maximum value in summer is 18.3°C (E3). (Tab. 2, Fig . 3)

pH - Value

Other parameters depending on biological activity in aquatic ecosystems is the pH value.
From the results achieved during this research, the pH value is 6.66 surface. On the shore of the lake, in the vicinity of the river purification, the pH values do not differ from the river purification, but the change depending on the time period we are 6.19 (E4) spring, 8.1 (E2) summer (Tab.., Fig . 4.).

Conductivity

Chemically pure water is water with high resistance, according to this the higher the conductivity, the more polluted the water will be. This phenomenon cannot be accurately verified in natural waters such as rivers and lakes.
From our results in Tab. 1 and Graph 3, the conductivity changes are the result of temperature changes, which also bring changes in the pH value. The highest conductivity was recorded near the Ezerka river clearing 614 μs/cm) (Tab. 4, Fig . 5), and the lowest value of conductivity is found at the sample site E2 198 μs/cm (Tab. 2, Fig . 5).

Chloride and sulphates

Chloride and sulfates are the main anions of natural waters. They do not always come from minerals, they can come from waste water, water from industry, etc. Sulfates are indicators that are commonly found in water as a result of soil. Other sources of sulfates are wastewater. If the concentration of sulfates is above the specified value, its presence makes the water more aggressive [5].
In our study, the number of chlorides on the shore of the lake is in the values of 6.75 - 15.32 mg/l (Tab. 2, and 3 Fig . 6). Along the river bed, the results show that the number of chlorides is from 6.90 mg/l Tab. 4. Fig . 6.) at 23.08 mg/l (Tab. 3., Fig . 6).
The number of sulfates on the shore of the lake is from 136.2 mg/l (Tab. 4, Fig . 7) to 498.5 mg/l (Tab. 2, Fig . 7). In rivers, these values vary from 49.8 (Tab.2, Fig .7) to 654 mg/l (Tab.2, Fig .7)

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