



## EVALUATION OF THE QUALITY OF SKADAR LAKE WATERS THROUGH THE DETERMINATION OF DISSOLVED OXYGEN AND BIOLOGICAL OXYGEN DEMAND

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### ABSTRACT

*Dissolved oxygen is the form of oxygen in water bodies available to aquatic plants and animals. The concentration of dissolved oxygen (DO) at 25°C under atmospheric pressure is 8.32 mg/l. The levels of dissolved oxygen arise from the interaction between the oxygen produced by photosynthesis, oxygen consumed by aerobic bacteria and the exchange of oxygen with atmosphere. Biological Demand of Oxygen (BOD) is the measure of the amount of oxygen needed by bacteria to oxidize the organic matter present in water sample over a period of 5 days. A healthy ecosystem has optimal values of dissolved oxygen. Lake Skadar situated on the Montenegro-Albanian border is one of the most interesting of Balkan lake Skadar lake has a number of intriguing feature such as the fishery associated with the cryptodepressions, the tremendous fluctuations in water level and probable fluctuations in nutrient input. The low abundance of the phytoplankton, the extensive areas of macrophytes suggest that the lake might be treated as if it were a littoral environment. During the study period (May-November 2014) was determined the levels of DO and NBO in six stations distributed in western and eastern shore of Skadar lake. The standart chemical method used to determine the amount of DO in water samples is the Winkler method. Based on the results the DO values ranged from 8.67-1.32 mg/l good sign of healthy waters. NBO ranged from 0.5-1.76 mg/l showing a low effect of urban pollutants toward the water of Shkodra Lake.*

**Keywords:** Water Dissolved Oxygen, Biological Oxygen Demand, Shkodra Lake.

### Introduction

Oxygen is important to all life. Dissolved oxygen is the form of oxygen in water that is freely available to aquatic plants and animals. Dissolved oxygen is vital to fish and other aquatic life and for the prevention of odors. Oxygen is transferred from the atmosphere into surface waters, as well as being produced by aquatic plants, algae and phytoplankton as a by product of photosynthesis. Oxygen in water is measured as dissolved oxygen. A high percentage is conducive to supporting aquatic flora and fauna, such as algae, plant, fish and mollusks and invertebrates. A low percentage or depleted of dissolved oxygen indicates a negative impact on a body of water, which results in a abundance of worms and fly larvae. Aquatic life uses oxygen that is dissolved in the water. If more oxygen is consumed than is produced, dissolved oxygen declines and some sensitive animals may move away, waken and die. One the best indicators of the health of body water, such as stream like rivers ecosystem is the dissolved oxygen parameter. Dissolved oxygen can range from 0-18 mg/l. Most natural water systems require 5-6 mg/l to support a diverse population. Oxygen enters the water either by direct absorption by the atmosphere or by plant photosynthesis. The oxygen is used by plants and animals for respiration and by the aerobic bacteria which consume oxygen during the process of decomposition. When organic matter such as animal waste or improperly treated wastewater enters a body of water causing the dissolved oxygen to decrease as the plant material dies off and is decomposed through the decomposition through the action of aerobic bacteria. The factors that affect

dissolved oxygen levels are: water temperature, aquatic plant populations, stream flow, altitude atmospheric pressure, human activities, water discharge, organic waste.

The biological oxygen demand (BOD) is an important measure of water quality. It is a measure of the amount of oxygen (in milligram per liter) needed by bacteria and other microorganisms to oxidize the organic matter present in a water sample over a period of 5 days. BOD directly affects the amount of dissolved oxygen in rivers and streams. The more rapidly oxygen is depleted in the stream, the greater the BOD. This means less oxygen is available (Palanna, 2009)

Skadar lake is the largest lake on the Balkan Peninsula. The drainage area of the lake is about 5500 km<sup>2</sup> (4470 km<sup>2</sup> in Montenegro and 1030 km<sup>2</sup> in Albania). Stratification and water circulation are important for the chemistry and biology of a lake. Factors that affect water quality of a lake and its basin can be classified as natural and human made. The dissolved oxygen content in the lake water has remained mostly above 8.5mg/l. that implies that the water is abundant with oxygen (Anonymous, 2005).

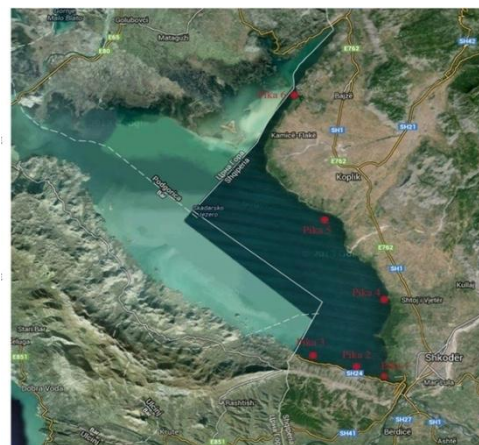


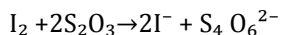
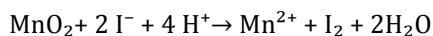
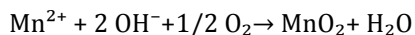
Figure 1. View of sampling points (Google Maps)

Table 1. Geographical position of sampling points

Sampling	Latitude	Longitude
S1	42° 3' 14" N	19° 28' 54" E
S2	42° 3' 37" N	19° 26' 58" E
S3	42° 4' 19" N	19° 23' 53" E
S4	42° 12' 0.7" N	19° 47' 65" E
S5	42° 18' 73" N	19° 41' 50" E
S6	42° 27' 23" N	19° 39' 35" E

**Material and Methods**

The Winkler method is used to estimate dissolved oxygen. This method is based on the fact that the DO oxidizes Mn<sup>2+</sup> to a higher oxidation state under acidic conditions; the oxidized manganese then liberates iodine from potassium iodide. The amount of iodine liberated is equivalent to the oxygen dissolved originally present. The iodine liberated is estimated by titration with sodium thiosulphate solution. The samples are collected away from the shore in the distance 50 cm from the of water surface. To obtain correct values the water samples are fixed immediately in the field itself. The fixing is made by adding to the sample, solution of MnSO<sub>4</sub>, alkaline iodide-azide and concentrated sulphuric acid. The titration with thiosulphate solution was made suddenly in laboratory.



Biochemical oxygen demand(BOD) is determined by measuring the dissolved oxygen level in a aliquot of the water sample maintained in a incubator at 20 ° C for 5 days in a closed BOD bottle, without allowing air to enter. During this time the bacterial decomposition get completed. Measuring the dissolved oxygen in the water sample before and after incubation would indicate the amount of oxygen used for stabilizing the water (Gopalan, 2008).

$$BOD(mg/l) = DO(b) - DO(a)$$

$$DO(b) = DO \text{ before}$$

incubation

$$DO(a) = DO \text{ after}$$

incubation

**Results**

The samples are collected from may -november 2014. The six sampling points are distributed three in western and three in eastern shore line of Skadar lake (Figure1). In the field water temperature was measured directly through waterproof Tester HI 98130 Combo (Hanna Instrument).

Water temperature as a very important parameter that affects the values of dissolved oxygen by influencing the life of creatures of water bodies. The observed temperature values are given in table 2. Maximum values were observed in july and minimum values in may and november (Fig nr 2). Figure 3 shows the differences in mean temperature values between the sampling points (stations). It has been observed that stations 4 and 5 on the east side of the lake have higher temperature values that the other stations.

Table 2 . The values of the temperature during 2014

Stations	Temperature					
	St 1	St 2	St 3	St 4	St 5	St 6
May	21	21.2	20.5	23	21.7	21.2
June	25.2	27	27.6	26.8	26	11.2
July	26.6	27.8	27.9	29.8	30.9	31.9
September	27.4	26.6	27.7	29.4	29.2	11.8
October	21.7	22.7	22.6	20.6	21.3	21.8
November	15.2	15.1	15.6	17.1	17.6	12.4

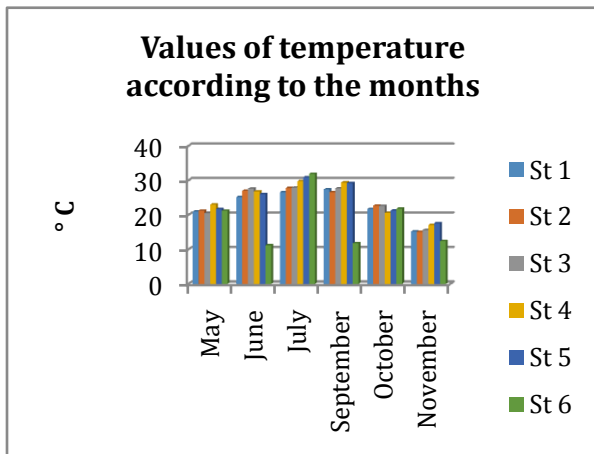


Figure 2.Values of temperature according to the months

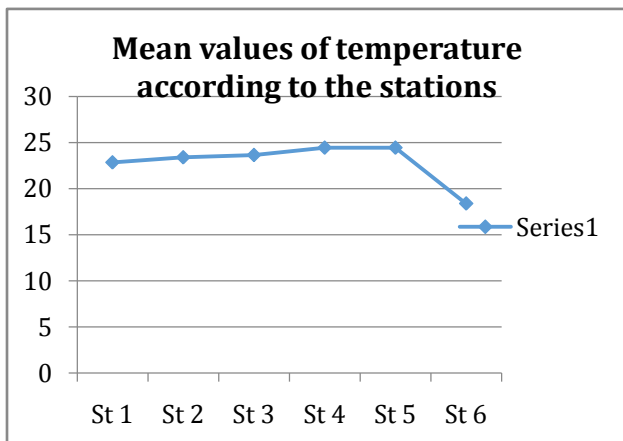


Figure 3. Mean values of temperature according to the stations

Dissolved oxygen content is one of the principal characteristics of water quality by influencing chemical processes and eutrophication of water (Cullaj, A 2010). Results for dissolved oxygen parameter are given in Table 3

Table 3. Values of dissolved oxygen content during 2014

	Dissolved Oxygen Content during 2014					
	St 1	St 2	St 3	St 4	St 5	St 6
May	12.7	13	11.7	10.75	10	8.65
June	8.85	7.8	7.25	8.25	7.85	9.95
July	8.1	8.6	7.75	8.4	9	8.6
September	9.8	11	9.7	10.2	10.5	9
October	7.9	6.9	7.6	9.95	10.5	10.55
November	12.65	9.45	8.95	9.8	9.05	8.2

During the period of the studie the amount of dissolved oxygen in Skadar lake is remained inside the interval from 8.67 to 11.32 mg / lThe highest values .are found in may and november (Fig. 4). The rise of the temperature in

June and July, indce the fall of dissolved oxygen values and the lowest value of dissolved oxygen is observed in July. With the fall of the temperatures, dissolved oxygen values start to increase and reach the maximum value in november. Important, is the fact that oxygen values remain above 7 mg / l.

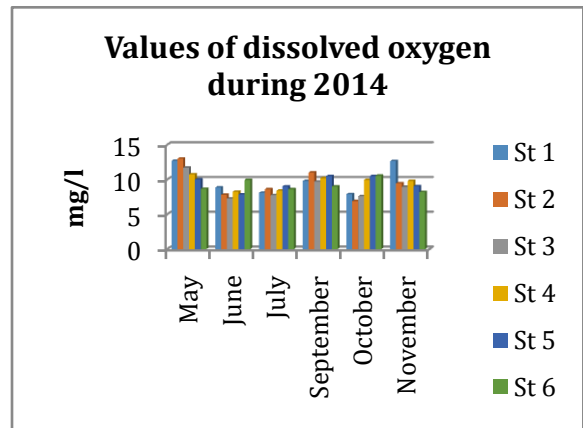


Figure 4. Values of dissolved oxygen during 2014

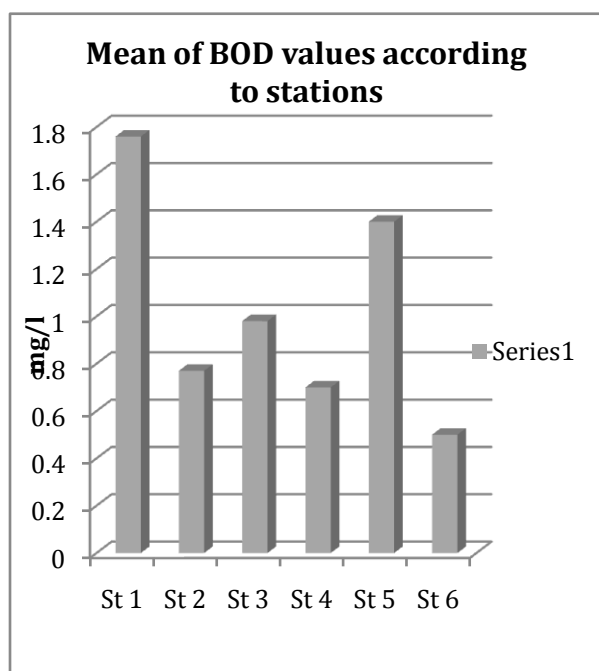
Biological Oxygen Demand (BOD) is a valid parameter to determine the level of water pollution from organic substances that are decomposed by bacteria. High BOD values demonstrate that lake or river waters have low dissolved oxygen content reducing biodiversity and microbiological quality. (Official Environmental Report, 2012). Table 4 shows the results of the mean value of BOD

The BOD parameter has not reported significant fluctuations. The highest BOD value was observed in the stacion 6 situated in eastern shore line. The lowest BOD values was observed in the stacion 1 situated in vestern shore line. The BOD values were inside the interval 0.5-1.76 mg/l.

This values appear to be within acceptable limits to categorize the water quality of Skadar lake as clean water to moderate one.

Table 3. Values of BOD according to the stations

Stations	S1	S2	S3	S4	S5	S6
BOD	1.76	0.77	0.98	0.7	1.4	0.5



**Figure 5. Mean of BOD values according to stations**

### Discussion

The temperature values are normal according to the months of monitorin in six stations. Based on several studies Skadar lake is a subtropical shallow lake (Petrovic & Beeton 1981) . Stratification does not occur. The dissolved oxygen values obtained during this study period demonstrate that the water of Skadar lake is abundant in oxygen. It remain a suitable ecosystem for the life of flora and fauna. The BOD values indicate the presence of oxygen in water very important for different kinds of aquatic organisms

### Conclusions

The fluctuations of the temperature values appear normal during the study period

Skadar lake has dissolved oxygen values inside the interval 8.67-11.32 mg/l maintaining the ecological diversity of species.

The BOD values within appropriate limits indicate that lake waters are not affected by various pollutants that can discharged occasionally to the lake.

The Shkodra Lake is a sustainable ecosystem with considerable natural potentials and a continuous water purification capacity

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