



Will the Functioning of the Wastewater Treatment Garanty Improvement in the Albanian Side of Lake Ohrid?#

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Received May 06, 2009; Accepted August 17, 2009

Abstract: Ohrid Lake is one of the most important lakes in the world and especially in Balkan Peninsula. This importance is based on its biological and tourist values. Ohrid Lake is tectonic from the origin. It is extremely oligotrophic lake; meanwhile based on the biological values it is called the “live fossil museum”. These big demographic movements that have happened these two last decades from one side are followed by the increase of the inhabitant’s number and from the other side by the levels’ increase of different kind of pollutions in the littoral of Ohrid Lake. The number of the inhabitants is multiplied these two last decades, and it’s thought that it will increase up to 75000 by the year 2015. But this number is going to double during every summer time. The measuring of the microbiological level pollution and mostly the coliform one in the Albanian littoral is very important during the summer time. The negative impact of the wastewater discharging into the lake without any preliminary treatment has been an important study object this last decade. This impact is present and around 200 m far from the shore. The purpose of this paper is to present the data coming out from the measure of seasonal coliform pollution level in the littoral of the Albanian Ohrid Lake. The comparison of the data is important especially in the border where the negative impact wastewater discharging is not present. The question is what is going to happen in the future next to Pogradec city and not so far from the border after the functioning of the Wastewater treatment plant?

Keywords: Ohrid Lake, Albanian littoral, coliform pollution, wastewater treatment plant, water quality.

Introduction

Ohrid Lake has a surface of 358,176 km², and 111.4 km² of that is situated in the Albanian part. Its length is 87.521 km. Ohrid Lake is tectonic from the origin point of view and around two million years old Pano *et al.* (1984). Based on the throphic level Ohrid Lake is oligotrophic extreme lake, Ocevski and Allen (1978). This lake has been the study object for some decades from the last century, by many authors. From the biological point of view is called “Museum of the fossil alive. As a result of demographic changes, Ohrid Lake is facing with some ecological problems these two last decades, especially in the Albanian part. These changes have happen on all Albanian shore lake but they are more evidently next to the Pogradec city. The discharge of wastewater into the lake has a negative impact on the water quality of this ecosystem Mali (2008). Ohrid Lake has many biological, tourist and economical values. Based on these values the study of coliform pollution is very important. The functioning with full capacity of the wastewater treatment plant in Albanian part will have the positive impact on water quality especially next to Pogradec city because the wastewater is the main source of the coliform pollution in the littoral of this region. But is the discharge of wastewater the only source of the coliform pollution water in the Albanian littoral? The answer of this question is the aim of this study. The determination of the sampling stations was carried out in certain way that we can analyze the impact of the discharge of wastewater and different remains into the lake not only in the region next to the main Hotel but and in the two others that are about three 3 km far from the place where discharge the main wastewater collectors. The determination of the level pollutions in the sample stations where there is no discharge of the wastewater help us to understand that wastewaters discharge is the main source of the coliform pollution but not only one. Along the littoral between the Albanian-Macedonian border and Guri i Kuq region discharge four streams that have their impact in

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#This study has been presented at 24-25 April 2009-Alblakes'09, Pogradec- Albania.

the level of coliform pollution lake. Analyzing the change on time of the level pollution in sampling stations point out that in different sites along the Albanian littoral there are causes different of the coliform pollutions.



Figure 1. Map of Ohrid and Prespa Lakes

Materials and Methods

The coordinates of sampling stations are as following: Station 1; Latitude $40^{\circ} 90' 61''$; Longitude $20^{\circ} 73' 44''$; Station 2; Latitude $40^{\circ} 90' 71''$; Longitude $20^{\circ} 65' 20''$; Station 3; Latitude $40^{\circ} 92' 78''$; Longitude $20^{\circ} 64' 06''$

Sampling stations are determined with GPS ALAN MAP 500 device. The first station is next to the Albanian Macedonian border, around 100 m far from the Albanian custom of Tushemisht. The second one is next to main hotel of the city called. The third station is in the front of the residence of the Guri i Kuq mine. The collecting of the samples was carried out with the sterile bottles with a volume of 300 ml; meanwhile their transportation was realized on portable fridge which provided temperatures lower than 5°C . The analyses are carried out in Hydrobiological Ohrid Institute and in the Elbasan University according to MPN and MP techniques based on the APHA (1988). The technique with a filter membrane in the Standard TTC-NutriDisk (10434164) with Tripheniltetrazoliumchloride link by Whatman Scheilder and Schuell is used for the determining of heretrophic bacteria. The determining of the total coliforms was carried out with same technique of the filter membrane respectively in the EndoNutriDisk (10434162) link by Whatman Scheilder & Schuell. The study was carried out in two periods of time. The first period is spring-summer 1998 and the second one is spring-summer 2008

Results and Discussions

The Table 2 and figure 2 display the data of the total coliforms bacteria of the station 1. The comperation of the values registered during the spring of 1998 with those registered on the spring of 2008 shows the fact that the level of the coliform pollution is increased around from 15 to 20 times more. The main source of the coliform pollution in this station has not been and still is not the discharge of the wastewater into the lake, but different kind of organic remains discharged next to the first station during the spring of the year 2008. Comparing the results registered in the summer of 1998

with those taken in the summer of 2008 we can point out the fact that the higher level of coliform pollution is registered on June 2008, meanwhile the results registered on July and August are almost the same on both two periods of study.

Table 1. Physico-chemical and bacteriological data

Date	Stations	Temperature (°C)	pH	Bact. heterotrof /100 ml	Bact.coliform total/ 100 ml
31.03.1998	1	12	7.90	5000	0
	2	10	7.50	400000	12000
	3	10	7.80	80000	4000
02.04.1998	1	11.5	7.37	158400	800
	2	10	7.18	266500	7500
	3	8.5	7.74	44800	200
03.05.1998	1	13.5	7.60	55600	1200
	2	12	7.20	173000	40000
	3	11	7.50	74000	9600
24.06.1998	1	23	8.50	8000	2800
	2	23	8.50	86000	46000
	3	25	8.50	110000	9300
30.07.1998	1	26	7.0	25000	21000
	2	27	7.50	73000	46000
	3	26	8.50	12500	9300
31.08.1998	1	21	8.0	51000	21000
	2	26	8.50	680000	46000
	3	25	8.50	27000	7500
23.03.2008	1	11	8.0	43000	15800
	2	9	7.50	85000	23000
	3	9	7.80	74000	32000
26.04.2008	1	13	7.90	64000	18000
	2	11	7.40	143000	26000
	3	11	7.60	83000	27000
25.05.2008	1	19	7.50	31680	19200
	2	22	7.80	57600	33600
	3	22	7.50	88600	33000
23.06.2008	1	20	8.0	64300	20400
	2	22	8.0	223000	36700
	3	23	8.0	124000	36000
24.07.2008	1	24	7.5	68700	21300
	2	26	8.0	198000	56300
	3	27	8.0	163000	44000
30.08.2008	1	23	8.0	43000	20800
	2	26	8.0	123000	43000
	3	26	8.0	145000	20400

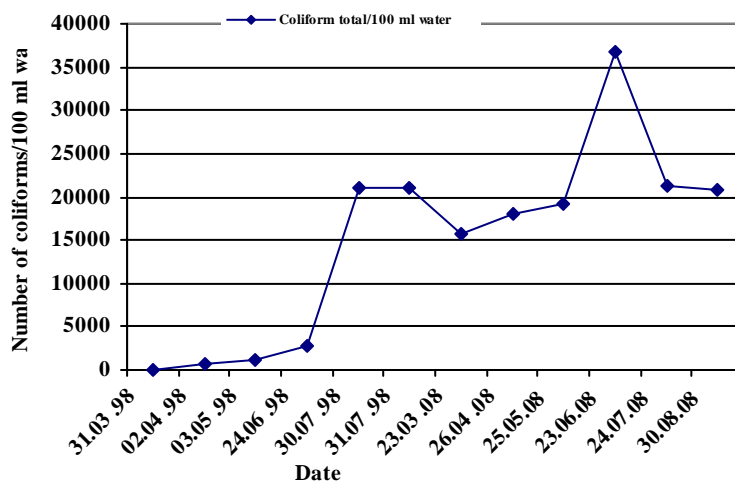


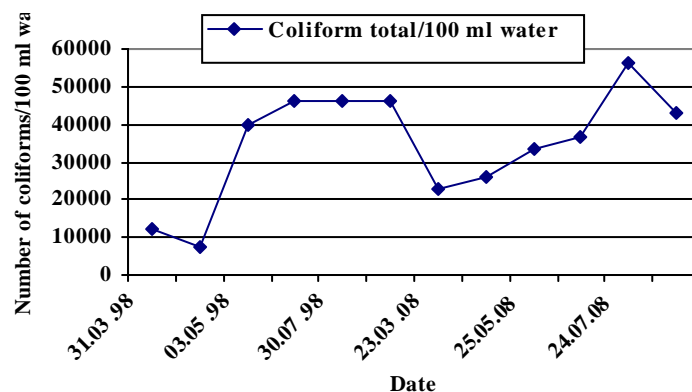
Figure 2. Coliforms data of the station 1 based on the date

Table 2. Coliforms data of the station 1

Date	31.3	02.4	03.5	24.6	30.7	31.7	23.3	26.4	25.5	23.6	24.7	30.8
	1998	1998	1998	1998	1998	1998	2008	2008	2008	2008	2008	2008
Tot. coliform / 100 ml water	0	800	1200	2800	21000	21000	15800	18000	19200	36700	21300	20800

Table 3. Coliforms data of the station 2

Date	31.03	02.04	03.05	24.06	30.07	31.07	23.03	26.04	25.05	23.06	24.07	30.08
	1998	1998	1998	1998	1998	1998	2008	2008	2008	2008	2008	2008
Total.coliform /100 ml water	12000	7500	40000	46000	46000	46000	23000	26000	33600	36700	56300	43000

**Figure 3.** Coliforms data of the station 2 based on the date

In Table 3 and figure 3 are presented the data of total coliform bacteria registered in station 2. The comparison of the values in two periods of study shows that the higher results are registered on July 2008. High temperature is a factor that makes possible for coliform bacteria to live some weeks in the water and they can also proliferate in the presence of organic remains (McCoy 1971; Hazen et al. 1990). The lower values are registered during May and June 2008. Comparing these values with those registered in the same period of time in 1998 shows that the last ones are higher. The decrease of these values is as a result of a good control of the other pollution sources. The main cause of this pollution in station 2 is again the discharge of the wastewater without a preliminary treatment.

Table 4. Coliforms data of the station 3

Date	31.03	02.04	03.05	24.06	30.07	31.07	23.03	26.04	25.05	23.06	24.7	30.08
	1998	1998	1998	1998	1998	1998	2008	2008	2008	2008	2008	2008
Total.coliform / 100 ml water	4000	200	9600	9300	9300	7500	32000	27000	33000	36000	44000	20400

The data of the coliform total of the station 3 based on the sampling dates are presented in table 4 and figure 4. The comparison of the data shows that during the second period of the study there is a notable tendency of the increase of the coliform pollution compared to the coliform pollution level in 1998. The main cause of this pollution is the discharge of the wastewater. There is also another cause of this pollution, which is the polluted area around station 3.

The registered values in both study periods except those of spring 1998 are higher than the European Community standards (EEC, 1996). Some results are approximate to those registered in Kariba Lake in Zimbabwe, 40400 coliforms bacteria / 100 ml water (Magazda & Dholmo, 1996), and with those registered in the Albanian littoral of Belshi Lake during June-July 2005, 46000/ coliforms bacteria / 100 ml water (Mali, 2000). Comparing these results with those registered in summer 1997 in the Macedonian littoral of Ohrid Lake 2400/100 ml they are several times higher (Novevska & Lokoska, 1998). The higher results of coliforms bacteria are registered in the different sources of wastewater in USA are 150000 / 100 ml water (Bond & Straub, 1988). During the study period, the

stream waters that were discharged in the inhabited area along the littoral of the lake had a high amount of organic and inorganic remains.

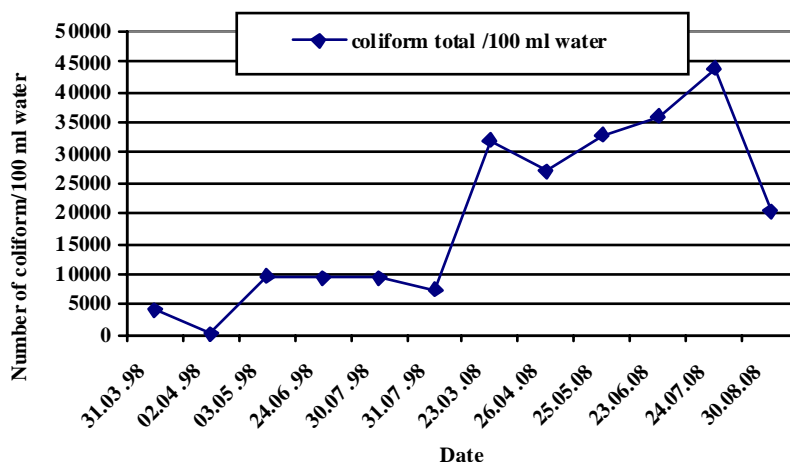


Figure 4. Coliforms data of the station 3 based on the date

Conclusions

- There is a tendency of the increase of the coliform pollution level in the area next to the Albanian Macedonian border although there is no discharge of the wastewater.
- The same tendency is also present in station 3 with different pollution sources.
- The functioning of the wastewater treatment plant will have a positive impact on the water quality in the Albanian part of Ohrid Lake next to the center of Pogradec city but not in the areas next to stations 2 and 3.
- The guaranty of the permanent high water quality in the Albanian side of Ohrid Lake needs the control of the other pollution sources including stream waters and different remains along the lakeshore.

References

- APHA (1988) Standard Methods for the Examination of Water and Wastewater. 20th Edn. American Public Health Association, Washington, DC
- Authros Group AAS, (1984) Hidrobiologjia e Shqipërisë., Tiranë.
- Bound R.G, Straub CP, (Eds) (1980) Handbook for Environmental Control, III: Water Supply and Treatment. CRS Press, Florida.
- EEC (1996) Directive 2006/7/E of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC. Official Journal of European Union, ANNEX L, PP. 46, ANNEX V, pp. 51.
- Hazen TC, Toranzos A, (1990) *Drinking Water Microbiology*, Springer-Verlag, pp.32–53, New York.
- Magadza CHD., Dhlomo EJ, (1996) Lakes and reservoirs. Research and management; “Wet season incidence of coliform bacteria in Lake Kariba in shore waters in Kariba town area” University of Zimbabwe, Kariba Zimbabwe
- Mali S, (2000) Studies On Bacteriological and Physics-Chemical Parameters of Albanian Part of Littoral of Ohrid Lake; “UNIEL. Scientific Bulletin Elbasan Albania. pp: 49-57.
- McCoy JH, (1971). Sewage pollution of natural waters. In Microbiological Aspects of pollution. Academic Press, London.
- Novevska V, Lokoska L, (1998) Pelagial and littoral water quality of Lake Ohrid from microbiological point of view. 27th Annual Conference of Yugoslav Water pollution Control Society “Water Pollution Control’98”, Conference Proceedings, p; 357-364. Yugoslavia.
- Oceviski, BT, Allen H, (1978) Phytoplankton production, physico-chemical conditions and nutrient relationships in Lake Ohrid, Yugoslavia. *Verh. Internat. Verein. Limnol.*, 20, 1078-1084.