



Response of the Human Impacts to Microbiological Water Quality in the Region of Belshi Lakes (Central Albania)

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Received March 17, 2009; Accepted April 17, 2009

Abstract: Belshi lakes are situated at the central part of Albania, about 20 km on the south west side of Elbasan city. The lakes are typically of caustic type and from the hydrological and ecosystem point of view they are important water bodies. The purpose of this paper is to present the data coming out from the measure of seasonal coliform pollution level of the littoral Belshi Lake. This data is presented for the first time of this kind for Belshi Lake. This lake is very important in the economical development of the Belshi town, because of its tourist values and the use of it for fishing. The number of inhabitants in the surrounding lakes zone is increased in the last years, following by increase of the number of buildings, restaurants and coffee-bars. Coliform pollution is the main source to the biological pollution of this lake. Preliminary data of this paper point out the fact that in some stations of the littoral of this lake the coliform pollution level is very high. The lack of the management of the water and wastewater system is the main cause of the coliform pollution to this lake.

Keywords: Belshi Lake, bacteria, coliform pollution, heterotrophic bacteria, water quality

Introduction

Albania is rich in water resources, including rivers, groundwater, lakes, lagoons and seas. Overall its resources exceed by far its consumption, although locally water shortage and conflicts among users may occur in the dry season. The hydrographic basin of Albania covers 43,305 km², of which 28,748 km² lie within its boundaries (Pano *et al.*, 1984). Since 1990, the monitoring of water is much less frequent, and in particular the quality of the water resources is not well known.

Belshi Lake is one of the 85 Belshi lakes that are situated in the area called Dumre in the district of Elbasan. It's a carstic lake. It is positioned in the height of 160 m above the sea level and has a surface about 29.6 ha and a deepness of 7 metres. Around it is situated Belshi town which has a population around 4 thousand habitants. The lake gives to the town great pictorial views and touristic values. This lake is used by its habitants and tourists for fishing, swimming and irrigation. The number increasing of habitats in the town by the new comers, who come from villages around these two last decades, is followed by a number increase of private and public buildings. But this process is also followed by major damage of the vegetation around the lakeshore. These changes have a negative impact in the quality of the water lake because the wastewater and other remains discharge into the lake in the conditions of a total absence of a managing system of treatment. The studies started with the purpose to collect some data regarding to the coliform pollution level which affects the quality of the lake water. The increase of this pollution level without doubt has its own negative impact in the health of the surrounding habitants and in the economical development of the town. In the mean time other studies are being planned and carried out to observe the negative impact of the different kinds of pollutions in the phytoplankton & zooplankton of this ecosystem.

Materials and Methods

This study was carried out during the period May 2007- July 2008 in the laboratory of microbiology in the University of Elbasan.

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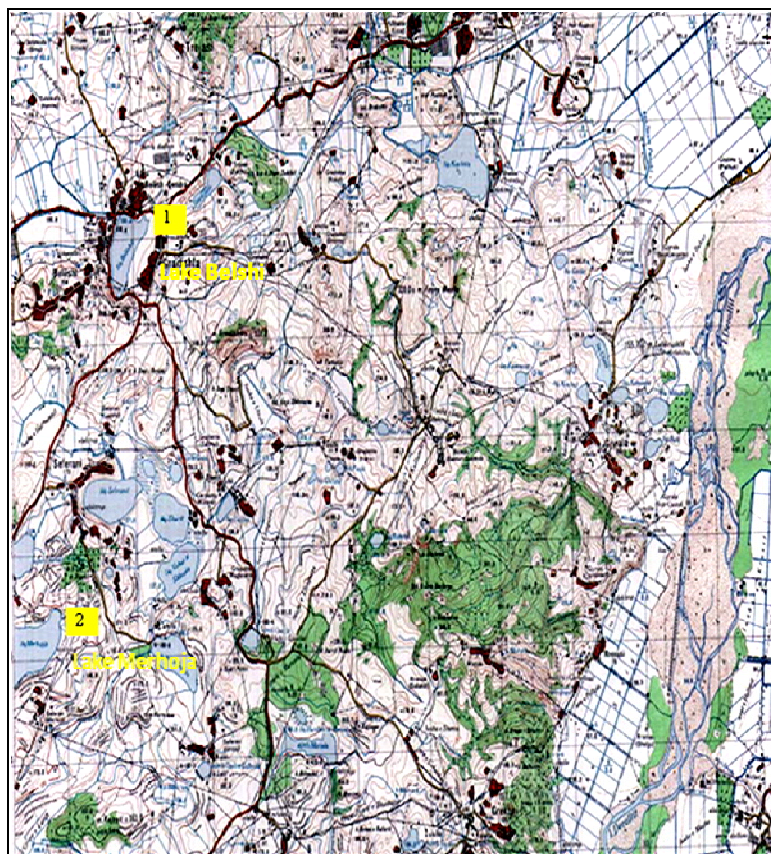


Figure 1. Map of the Belshi Lakes region

The coordinates of sampling stations are as following:

Station 1; Height 160 m; N: 40°58' 871''; E: 019° 53' 684''

Station 2; Height: 160 m; N: 40°58'803''; E: 019°53'425''

Station 3; Height: 160 m; North 40°58'803''; East 019° 53'425''

Station 4; Height 160 m; N: 40°. 58'. 758'; E: 019°.53'. 508''

The study is focused on the determining of the coliform level in the surface water of the lake littoral. The determining of the four sample stations is made so, that it can enable the measuring of the pollution level next to the spots where the immediate outpouring of the wastewater is fulfilled and also far from certain spots such as in the lake littoral and in the depths of the lake. *The first sample station* was determined next to a restaurant in the entrance of the town. *The second station* is in the centre of town, where the density of buildings is higher. *The third station* was determined in the exit of the town, where there are no public or private buildings. *Station four* is determined in the interior of the lake about 100m far from its shore in order to define the effect of this pollution even far from the lake littoral. The sample stations are determined with the help of the G.P.S ALAN MAP 500 device. The oxygen level, pH and temperature have been determined with the W.T.W, pH/cont 340 I device. Collecting the water samples is achieved with sterile bottles with a volume around 300 ml. The samples were transported by portable fridges which provided temperatures lower than 5°C. The spread of the water samples was, in a few cases, done 2-3 h after the taking of the samples in the determined medium. The work method was based on the standard methods for the examination of the surface and polluted waters (APHA, 1988). The method of spread with coverage and in the surface in the MPA medium and the technique with a filter membrane in the Standard TTC-NutriDisk (10434164) link by Whatman Scheilder and Schuell is used for the determining of heterotrophic bacteria. The determining of the total coliforms was carried out with the technique of the filter membrane in the EndoNutriDisk (10434162) by Whatman Scheilder & Schuell (Hazen et al., 1990). The calculation of the results was based on the rate of dilution and the volume of the sample used before the spread.

Results and Discussions

Physic-chemical and microbiological data during the study period May 2007-July 2008 for the analyzed points given in Table 1.

Table 1: Physic - chemical and bacteriological data

Number of samples	Date	Stations	T(°C)	pH	O ₂ mg/l	bact/heterotrofs /100ml water	bact/coliforms total/100ml water
1	09.05.07	1	23.5	8.20	8.75	230000	12500
2		2	24	8.20	8.65	280000	8320
3		3	23	7.85	8.82	94000	4320
4	20.07.07	1	29	8.30	8.62	427000	26500
5		2	28	8.20	8.32	326000	43000
6		3	28	8.20	8.73	134000	13200
7	19.10.07	1	19	8.10	8.55	237000	17500
8		2	18	8.10	8.34	265000	21400
9		3	18	8.20	8.67	196000	6700
10	16.02.08	1	8	7.50	8.64	84000	2170
11		2	7.5	7.50	8.56	79000	3420
12		3	7	7.50	8.87	80500	1500
13	31.03.08	1	15.5	8.10	8.48	86000	5270
14		2	14.5	8.10	8.35	102000	5800
15		3	15	7.85	8.65	48000	7750
16	16.05.08	1	24.4	8.30	8.52	124600	7760
17		2	21.5	8.30	8.45	438000	53760
18		3	25	8.30	8.72	67000	5600
19	27.07.08	1	31	8.20	8.25	235000	24600
20		2	30	7.90	8.15	437000	64300
21		3	29	7.50	8.55	124500	18300

The maximal temperature was registered on July 2008(31° C) and the minimal one on February 2008 (7° C). The maximal amount of oxygen soluble in 100 ml water is 8.82 mg (May 2007) whereas the minimal amount is 8.15 mg (July 2007). These values are alike with the oligosaprobial waters. (Hutter, 1988; Bound et al., 1980; Magadzla et al., 1996). The oxygen values are collected from the littoral of the lake during the time of the study are not so changeable from each-other, meanwhile the ones collected from different deepness's show that the lake is going towards a high atrophic state. The values of the pH don't display big changes. They are around the normal values for oligosaprobial lakes. Private houses achieve the wastewater management with the antiseptic wastewater holes, while the cafeterias and restaurants that are positioned near the lakeshore discharge the wastewater in the lake in the absence of their full treatment.

In station one there has been found a great amount of remains of different organic and inorganic materials, meanwhile the cafeterias outpour them directly into the lake. The number of coliform bacteria for 100ml water in this station reaches between the values 3420 bacteria / 100ml water and 63400 coliform bacteria / 100ml water. The lowest values have been received during winter (16.02.08), whereas the highest ones have been received during the summer, 63400 coliform bacteria /

100ml water (27.07.08). The maximal number of heterotrophic bacteria is 427000 for 100 ml water. These values are acceptable for an oligotrophic lake.

Table 2. Microbiological data of the station 1

<i>Data</i>	<i>Heterotrofs/100 ml water</i>	<i>Coliforms total/100 ml water</i>
09.05.07	230000	12500
20.07.07	427000	26500
19.10.07	237000	17500
16.02.08	84000	2170
31.03.08	86000	5270
16.05.08	124600	7760
27.07.08	235000	24600

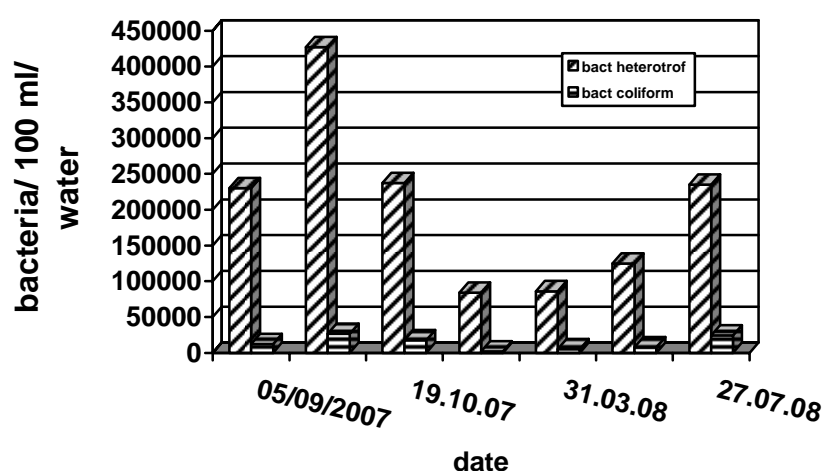


Figure 2. The number of bacteria and coliforms of station 1

The results registered at the station 2 shows higher values compared to the other two stations.

Table 3. Microbiological data of the station 2

<i>Date</i>	<i>Heterotrof/100 ml water</i>	<i>Coliform/100ml water</i>
09.05.07	280000	8320
20.07.07	326000	43000
19.10.07	265000	21400
16.02.08	79000	3420
31.03.08	102000	5800
16.05.08	438000	53760
27.07.08	437000	64300

The results at the station 4 shows that the sequences of this pollution is seen about 100 m far from it's source. There are similar data referred for other water bodies, where the human interventions are of considering level (Magazda *et al.*, 1996). In this case are registered the following data: 40400 coliforms bacteria / 100 ml water and with those registered in the Albanian littoral of Ohrid lake some years before (Mali, 1998), (46000 coliforms bacteria / 100 ml water). Comparing these data with those registered by other authors in summer 1997 (Novevska *et al.*, 1997) 2400 / 100 ml water in the Macedonian littoral zone of Ohrid Lake and with international standards (EEC, 1996) for the

superficial water (1000 bacteria coliform/100 ml water) our results have figured out in some cases higher values. The lowest values are registered in the station 3 (1500 coliform bacteria/ 100 ml water, February 2008). These results are similarly to those registered by Novevska (1997) of 2400 / 100 ml / water in summer 1997 and with international standards for the superficial water. High temperature is a factor which makes possible to coliforms bacteria to rest some weeks in the water, (McCoy 1971). The higher values of coliforms bacteria registered in the different sources of wastewater in USA are 150000 / 100 ml water (Bond & Straub 1988). The main sources of coliform pollution in this Lake are wastewater and different remain that discharge in the lake without any preliminary treatment.

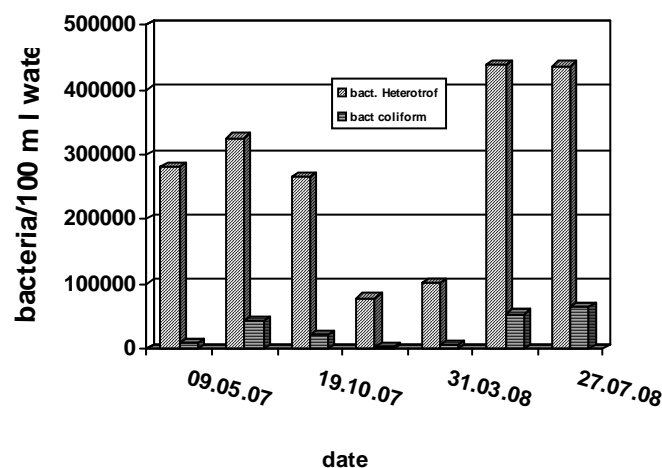


Figure 3. The number of heterotrophic bacteria and coliforms of the station 2

Table 4. Microbiological data of the station 3

Date	Heterotrofs/100ml water	Coliforms total/100ml water
09.05.07	94000	4320
20.07.07	134000	13200
19.10.07	196000	6700
16.02.08	80500	1500
31.03.08	48000	7750
16.05.08	67000	5600
27.07.08	124500	18300

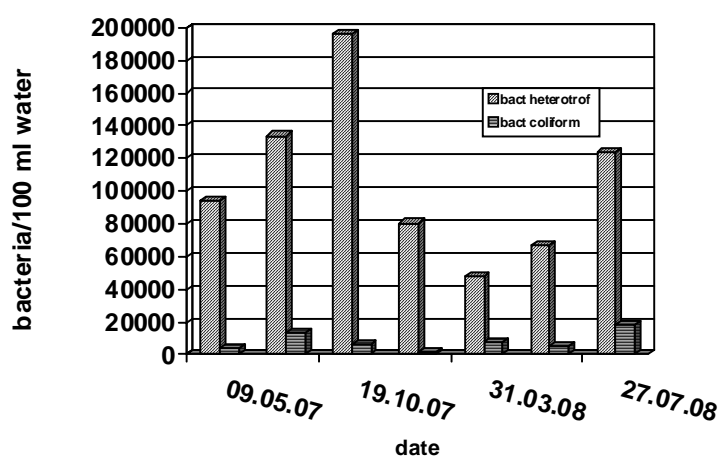


Figure 4. The number of bacteria and coliforms of the station 3

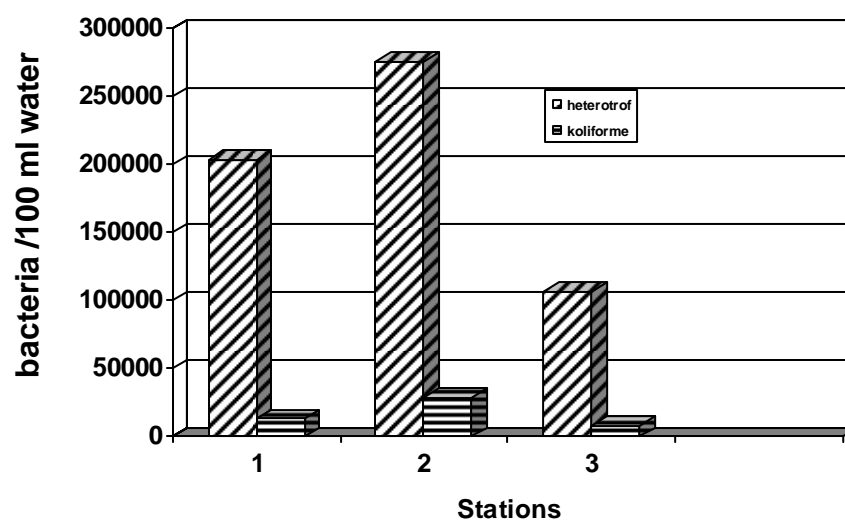
Table 5. Microbiological data for the station 4

Date	Depth(m)	Temp ($^{\circ}$ C)	pH	Parameters		
				O ₂ mg/l	Bact. Heterotrof/100ml	Bact. coliform/100 ml
16.05.08	1	21.2	8.30	8.6	115200	2800
	2	20.2	-	8.72	-	-
	3	19.6	-	7.72	-	-
	4	17.4	-	4.14	-	-
	5	14.6	-	0.5	-	-
	6	10.9	-	0.16	-	-
	7	9.9	-	0.14	-	-
27.07.08	1	29	8.20	8.46	165300	3400
	2	22.5	-	7.90	-	-
	3	20.6	-	7.47	-	-
	4	18.2	-	3.65	-	-
	5	15.2	-	0.46	-	-
	6	11.6	-	0.13	-	-
	7	10.2	-	0.12	-	-

The values registered at the station 4 point out the fact that the polluted littoral has a negative impact in the open part of the lake. In such a case we do not have to deal with big natural lakes, but with a typical small water bodies. To that fact, we found out that the human and other types of impacts are also sequences for the pelagic zone (See table 5). Compared results point out that station number 2 is more polluted from the coliform point of view.

Table 6. Average values of heterotrophic and coliform bacteria for various stations

Stations	1	2	3
Heterotrofs/100ml water	203371	275285	106857
Coliforms/100ml water	13760	28571	8195

**Figure 5.** Comparative data according to different stations

Conclusions

- The high level of coliform pollution shows the presence of a high faecal pollution of Belshi Lake.
- The main causes of this pollution are the discharging of the wastewater and different organics remains into the lake, without any preliminary treatment.
- The highest results are registered in station number 2 during the summer 2008, and they have the tendency of increasing by the time.
- In these circumstances the water of Belshi Lake cannot be used for different public and private purposes like swimming, fishing etc.
- In small water bodies the human impacts that are directed to the littoral zone shortly after will be reflected to the open part of water.

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