

# Impact of human activity on the water quality of lake Mullinjëza, Belsh, Albania.

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**Abstract.** Anthropogenic activities heavily influence lake ecosystems. This is due to population growth and the development of the industry and agriculture sectors. These activities include the intensified use of fishery resources, sewage discharge, polluting materials & substances, etc. The main aim of this study is to present an overview of the human impact on the pollution of the waters of Lake Mullinjëz. The many historical, cultural, ethnographic, architectural, and natural values that this city inherited from the past constitute a considerable potential for tourism. The objectives were to assess the lake water's quality and propose measures for minimization and mitigation of impacts on the environment and the development of tourism in Belsh. Another important influential factor is the urban waste management near the lake which was through away along the shore of this lake. Sampling sites were selected to measure the impacts of potential sources of pollution, such as sewage discharge and urban waste. The results show that the quality of the water lake is very polluted. The most critical parameters of the water quality of Lake Mullinjëza are SS, PO4<sup>3-</sup>, NO2<sup>-</sup>, NO3<sup>-</sup>, and NH4<sup>+</sup>. The most pronounced increase is observed in nitrites, nitrates, ammonium, TSS, TDS, and phosphates.

## 1 Introduction

Anthropogenic activities such as urban and industrial agricultural activities, increasing consumption of water resources and natural processes such as precipitation inputs, erosion, and weathering of crustal materials degrade surface waters and impact their use for agricultural, recreation, or other purposes [1, 2]. The area of Belshi is very little studied in relation to the quality of lake waters and the treatment of the pollution of these lakes by human activities. This area offers special natural values. Also, the area of Belshi, because of its landscape and water resources, has a great potential to develop natural, lake, and agrotourism. Due to its excellent and favorable geographical position, including 90 karst lakes, makes this area even more preferred for tourists [3]. The study zone was selected Mullinjëza Lake. The Mullinjëza Lake is a freshwater pond located in the village of Shkëndij, 675m north of the center of the city of Belsh [4]. It has an area of 76.75m<sup>2</sup> /7.67 ha (2.6 ha on the small part and 5 ha on the other side of the lake) with a maximum depth of 10-12m in winter, while in summer it has gone up to 4-5m deep or until drying, of the small part of the lake. This happens because during the summer, the temperatures are high, as well as from the use of water that the residents of the area use to irrigate the land and the agricultural products. The consequence of geodynamic processes has acted and continues to operate in the region, dictating the development of erosion and fluvial activity in this area.

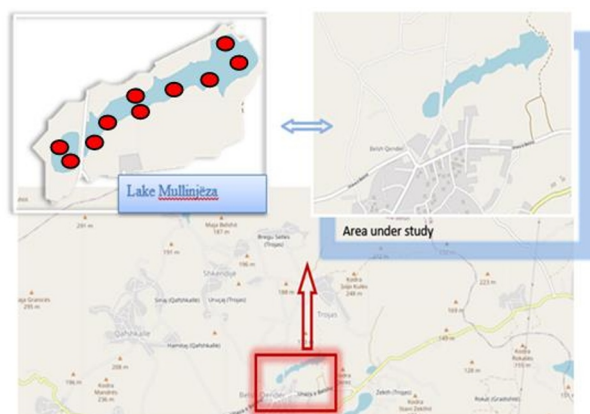
[5]. The lake faces a high risk of water pollution because of humans and so many sources, as in Mullenjëza Lake. The most polluting of them is the discharge of sewage and urban waste. These problems started to be more frequent during the period 2015-2016 and have followed until now. The citizens of the area are faced with the same problems in this lake. Population growth and pollution caused by toxic sewage, and surface water runoff from municipal and agricultural sources have increased the pollution in water quality and also limited the growth of water microorganisms [6]. Monitoring programs including surface water quality management and frequent water samplings at many sites and determination of a large number of physicochemical parameters are usually conducted resulting in a large data matrix, which needs a complex data interpretation [7]. The hydrographic basin of Albania covers 43,305 km<sup>2</sup>, of which 28,748 km<sup>2</sup> lies within its boundaries [8]. Belshi Lake, close to Belshi town, 30 km southwest of Elbasani, will be taken as the most representative of many lakes located in the Dumrea region [9].

## 2 Materials and Methods

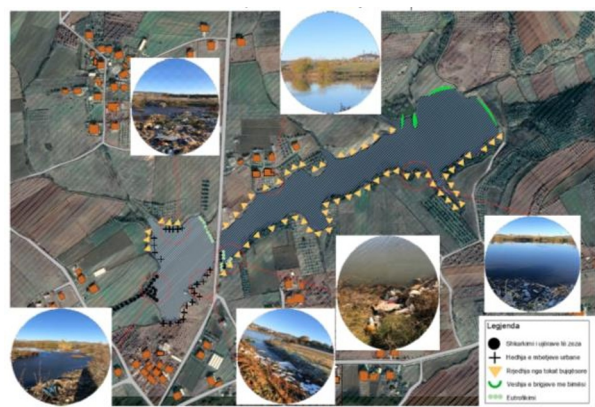
The assessment of the environmental situation of Mullinjëze Lake in relation to the water quality was carried out by determining the content of physicochemical parameters using water samples. The field survey was carried out during the months of March 2022 and June 2022. Sampling for assessment of the water

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quality of this lake is done in such a way as to present its changes in those two months. Thus, various environmental approaches for the assessment of water quality are frequently used [10, 11]. Water samples were collected in the morning with polyethylene bottles, (500 ml) and were transported to the laboratory by refrigeration at 4 grades before sending to the laboratory. All the samples are collected in one day in March and in one day in June. The following pollution indicator parameters were analyzed, such as pH, EC, SS TDS, Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, NO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, CaCO<sub>3</sub>, CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>, Ca<sub>2</sub><sup>+</sup>, Mg<sub>2</sub><sup>+</sup>. In Mullinjėza Lake was collected 10 samples and is done the average for each parameter per month. The results are compared between them to see the level of pollution and the EU standards. Total-N and Total-P were analyzed using digestion Kjeldahl [12]. The selection of sampling sites was based on the monitoring objective. Since the objective of the monitoring focuses on a specific problem of this lake, which is the discharge of sewage, pollutants from runoff of agricultural lands, and dumping of waste mainly on the shores, it was considered appropriate to take samples in these most problematic areas. Measurements and sampling were carried out as in Figure No. 1.



**Fig. 1.** Sampling locations of Mullinjėza Lake, Belsh



**Fig. 2.** Mullinjėza Lake monitoring plan about human impact

The assessment of the quality of the water environment of the lake is done by comparing the results achieved with national and international standards. A monitoring plan was done in the study zone to evidence the problems which are caused by human activity

(wastewater discharge, urban waste, agricultural land runoff, erosion of lake bank, eutrophication, etc).

### 3 Results and Discussion

The results of the analyzed samples demonstrate that the water of Mullinjėza Lake is polluted. The values of the parameters of both average months of samples (M1 & M2) had an increase in values in almost all parameters except for pH and EC which has a normal value. The most pronounced increase was observed in nitrites, nitrates, ammonium, TSS, TDS, and phosphates. The very high content of suspended solids, is a result of soil erosion, the slope of the territory, and intensive agriculture. High ammonium values in the stations were very high as a result of liquid urban discharges. The obtained TDS results are many times higher compared to the rates of urban liquid discharges. These very high values are related to the increase in the number of fertilizers, the increase of the load of soluble salts, the discharge of sewage, the rotting of plants, and the erosion of the shores of the lake.

This high content of TDS causes the inhibition of photosynthesis, the decrease of the oxygen content in the waters, and consequently abnormal development of aquatic fauna and flora, also affecting human health. Average values of nitrite in stations presented high levels, so they range from 0.53 mg/l in March to 0.62 mg/l in June 2022, Table no.1.

**Table 1.** The results of the samples during March and June 2022

No	Param.	Unit	Measured results		
			M1	M2	Stdv
1	pH	-	7.83	8.19	0.233
2	Cond.	μS/cm	559	462	67.536
3	TSS	mg/l	20.33	18.67	1.144
4	TDS	mg/l	363.35	335.3	18.834
5	PO43-	mg/l	0.73	0.68	0.0343
6	PO43-	mg/l	1.2	1.15	0.033
7	NO2-	mg/l	0.57	0.43	0.089
8	NO2-	mg/l	0.62	0.53	0.052
9	NO3-	mg/l	0.78	0.56	0.144
10	NO3-	mg/l	4.9	5.57	0.462
11	NH4+	mg/l	2.58	2.34	0.168
12	NH4+	mg/l	3.35	2.87	0.322
13	Cl-	mg/l	24.11	22.64	1.038
14	SO42-	mg/l	27.61	26.96	0.413
15	CaCO3	mg/l	225	211	9.845
16	CO32-	mg/l	7.6	9	0.971
17	HCO3-	mg/l	274.5	240.8	21.481
18	Ca2+	mg/l	58.75	49.98	6.001
19	Mg2+	mg/l	17.98	15.55	1.562

This situation is caused by the discharge of sewage from the village of Shkendij, where the lake is bounded, as well as from the villages around it, such as the village of Hyse and the center of the town of Belshit. Comparing the results of nitrates with the norms of the

EU Directive, [13] we come to the conclusion that the water quality was in bad condition, presented in table 2.

**Table 2.** The results of the samples during March and June 2022 compared with the standards.

No	Param	Measured results		Standards		
		M1	M2	Acc. EU	Niva	Acc. UNECE
1	pH	7.83	8.19	Basic	Class I	
2	Cond.	559	462	2500µS/cm Decision No. 379, 25.05.2016		-
3	TSS	20.33	18.7	Eu dc. no.78		Cl.V
4	TDS	363.3	335	35 mg/l VKM no.177,31.03.05		-
5	PO <sub>4</sub> <sup>3-</sup>	0.73	0.68	>5 Bad cond.		-
6	PO <sub>4</sub> <sup>3-</sup>	1.20	1.15	>5 Bad cond.		-
7	NO <sub>2</sub> <sup>-</sup>	0.57	0.43	>3 Bad cond.		-
8	NO <sub>2</sub> <sup>-</sup>	0.62	0.53	>3 Bad cond.		
9	NO <sub>3</sub> <sup>-</sup>	0.78	0.56	< 0.8 high cond		Cl. I
10	NO <sub>3</sub> <sup>-</sup>	4.90	5.57	< 0.3 Poor cond		Cl. II
11	NH <sub>4</sub> <sup>+</sup>	2.58	2.34	>1.5 Bad cond		Cl.IV
12	NH <sub>4</sub> <sup>+</sup>	3.35	2.87	>1.5		Cl.IV
13	Cl <sup>-</sup>	24.11	22.7			
14	SO <sub>4</sub> <sup>2-</sup>	27.61	27			
15	CaCO <sub>3</sub>	225	211			Cl. II
16	CO <sub>3</sub> <sup>2-</sup>	7.6	9			
17	HCO <sub>3</sub> <sup>-</sup>	274.5	241			
18	Ca <sup>2+</sup>	58.75	49.9			
19	Mg <sup>2+</sup>	17.98	15.6			

Results have demonstrated the value of water temperatures with different tendencies during the time of study. The main sources of pollutants were runoff from agricultural lands, the pouring of untreated water waste into them, urban waste, etc. Also, the lake had the premises for eutrophication, ammonia was a problem for the biological systems in this lake. The pollution of the water and fauna is serious and severe. Rainwater brought into the lake quantities of residues of agricultural chemicals such as pesticides and herbicides thrown around the former warehouse. A lot of polluted water with various materials such as waste from cattle slaughter and other waste was discharged into the lake. Based on the above map, figure no.2, a significant number of houses have been informally and unplanned built. As a result, many buildings that are located around Belshi Lake (around the town), or in other villages that are near the lakes, discharge their urban waters into the lakes. Another problem is the reduction of aquatic fauna as a result of indiscriminate fishing. Being that during the summer the climate is dry and with little rainfall, the water of the lake is also used for irrigation, thus reducing its level.

#### 4 Conclusions

The values of the parameters of both average months of samples (M1 & M2) have an increase in almost all

parameters except for pH and EC which has a normal value. The most pronounced increase is observed in nitrites, nitrates, ammonium, TSS, TDS, and phosphates. To prevent the problems is necessary for strong protective measures should be taken as soon as possible to improve water quality. Management of the shores of the Mullinjëza Lake along its entire length, through the removal of solid urban waste, and the planting of shore plants such as beech and pine, to protect the waters from soil erosion. The regular monitoring of water quality should be of sufficient priority to increase the necessary information and public awareness for the protection of aquatic ecosystems, use of pesticides, herbicides, wastewater discharge, etc.

As an area with numerous landscape environmental values and a potential for the development of lake, rural and natural tourism, the area of Belsh is positioned in the region as one of the most attractive areas for future tourist development. Therefore, it is very important to make investments in the area for the development of tourism.

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