

Water Quality Assessment of Karaidemir Dam Lake (Tekirdağ, Turkey): In terms of Agricultural Irrigation and Drinking Water Supply

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Abstract – Tekirdağ Province is located in the Thrace part of Marmara Region and the region can be declared as an agriculture and industry city. Karaidemir Dam Lake, which is being used for agricultural irrigation and drinking water supply and flood protection, is located in the Tekirdağ Province of Turkey. In this study, water quality of Karaidemir Dam Lake was evaluated in terms of agricultural irrigation and drinking water supply. For this purpose, water samples were collected from 3 stations selected on the reservoir in spring season of 2018 and total of 16 physical, chemical and biological water quality parameters were measured. According to detected data, Karaidemir Dam Lake has moderate salty water (C2) in terms of total concentration of soluble salts and the water of reservoir can be used for irrigation except stenohaline plants. Karaidemir Dam Lake has I. – II. Class water quality in terms of temperature, dissolved oxygen, oxygen saturation, pH, TDS, nitrate, sulphate, fluorine, EC and phosphate parameters; and III. – IV. Class water quality in terms of BOD, FC and nitrite parameters in general. It was also determined that any investigated parameters except turbidity have not exceeded the drinking water limits..

Keywords – Agricultural water supply, Drinking water supply, Karaidemir Dam Lake, Water quality, Tekirdağ

I. INTRODUCTION

Contamination of freshwater resources of the world is a matter of serious global concern. As it is known that lentic ecosystems like lakes and reservoirs are among the most vulnerable freshwater bodies to contamination due to their roles in carrying off point pollution sources like municipal and industrial wastewater and non-point pollution sources like run-off from agricultural areas in their drainage basins [1]. It is required to assess a large number of physicochemical water quality data for an effective contamination control. Water quality assessment is also useful and necessary for an effective management of freshwater resources [2]. Permanent monitoring of freshwater ecosystems is known as one of the most effective and cheap protection methods [3, 4]. Because it is easier to protect an unpolluted aquatic habitat than clean or rehabilitate a polluted freshwater ecosystem.

The Ergene River is the most important river basin of the Thrace Region and it is known to be exposed to a great industrial pressure [5]. Karaidemir Dam Lake, which is located on the southern section of Ergene River Basin, is one of the most important reservoirs of Tekirdağ Province and it was constructed between the dates of 1975 – 1983 by DSİ on the Poğaçı Stream to provide irrigation and drinking water and flood protection. The volume of the Karaidemir Dam Lake at normal water elevation is 120 hm³ and the lake area at the normal water level is 16 km² [6]. But as many freshwater ecosystems, this reservoir is being effected from agricultural and domestic pressure.

The aim of this study was to evaluate the water quality of Karaidemir Dam Lake by determining some limnologic parameters and evaluate the data in terms of agricultural irrigation and drinking water supply according to Turkish

Regulations Water Quality Classes and drinking water limits specified by Turkish Standards.

II. MATERIALS AND METHOD

A. Study Area and Collection of Samples

Karaidemir Dam Lake and selected stations on the reservoir are given in Figure 1. Water samples were collected in spring season of 2018, when the precipitation and surface runoff have increased significantly in the region, and one water sample was taken from each selected stations on the dam lake.

B. Physicochemical and Microbiological Analysis

Temperature, dissolved oxygen, oxygen saturation, pH, EC, TDS and salinity parameters were determined by using “Hach Lange HQ40D Multiparameter” device during the field studies; turbidity parameter was determined by using “Hach Lange 2100Q Portable Turbiditymeter” device during the field studies; nitrate, nitrite, phosphate, sulphate, fluorine and COD parameters were determined by using “Hach Lange DR3900 Spectrophotometer” device during the laboratory studies; BOD parameter was determined by using “Hach Lange BOD Trak II” device during the laboratory studies.

Microbiological analysis was carried out using membrane filtration technique. All water samples were filtered with membrane filtration technique and the membrane filter was placed in coliform chromogenic m-FC Agar. All growth mediums were left to incubate for 24 hours at 44.5 ± 0.2 °C and counted by automatic colony counter.

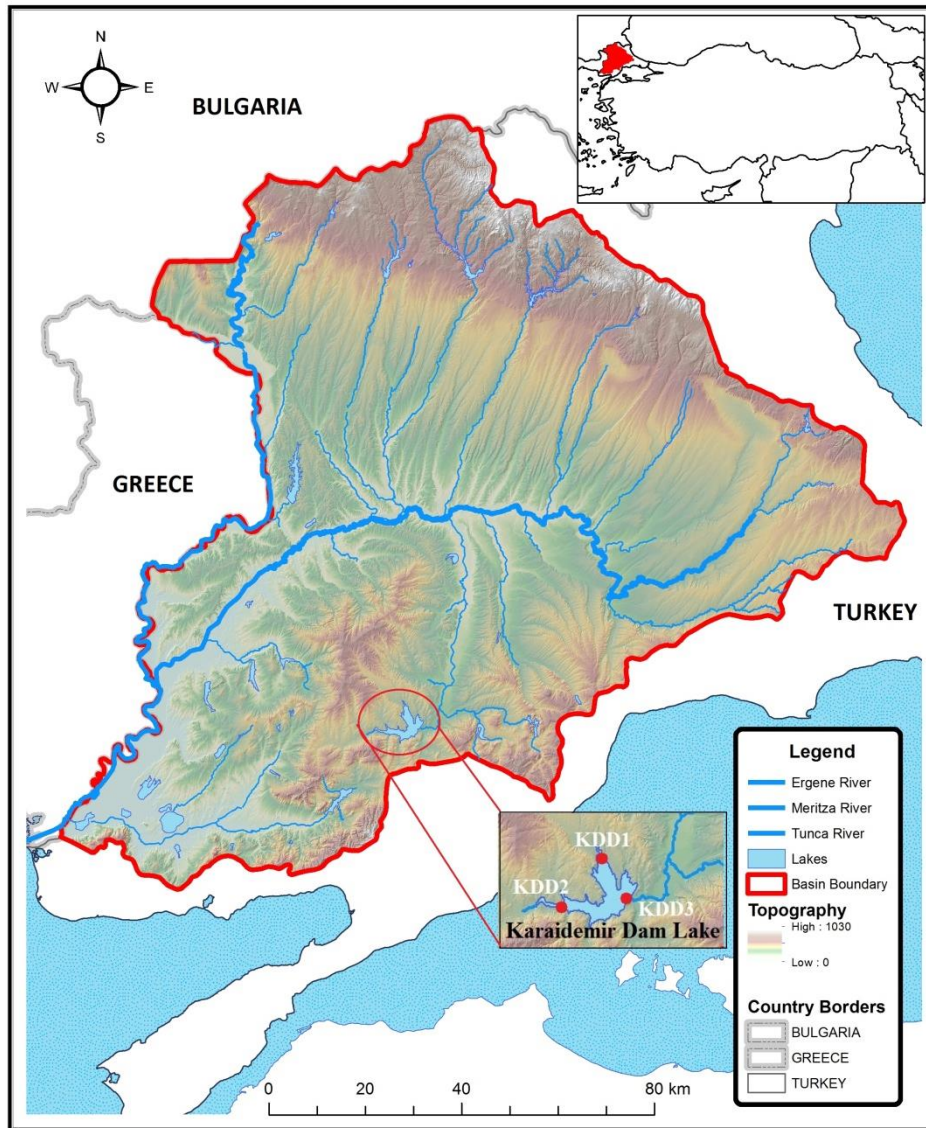


Fig. 1. Ergene River Basin, Karaidemir Dam Lake and selected stations

III. RESULTS

The detected water quality parameters of temperature, dissolved oxygen (DO), oxygen saturation (%O₂), pH, electrical conductivity (EC), total dissolved solids (TDS), salinity, turbidity, nitrate (NO₃), nitrite (NO₂), phosphate (PO₄), sulfate (SO₄), fluorine (F), biological oxygen demand (BOD), chemical oxygen demand (COD) and fecal coliform (FC) in Karaidemir Dam Lake and some national – international limit values are given in Table 1.

According to the Water Pollution Control Regulation criteria in Turkey [7, 8], Karaidemir Dam Lake has I. Class water quality in terms of temperature, dissolved oxygen, oxygen saturation, pH, TDS, nitrate, sulphate and fluorine parameters; II. Class water quality in terms of EC, phosphate [9] (KDD1 is I. Class) and COD parameters; III. Class water quality in terms of BOD (KDD1 is II. Class) and FC parameters. It was also determined that KDD1 has III. Class, KDD2 and KDD3 have IV. Class water quality in terms of nitrite parameter. It was also determined that any investigated parameters except turbidity parameter in any stations did not exceed the drinking water limits [10 – 12].

IV. DISCUSSION

In a study performed in dam lakes of Edirne Province in Ergene River Basin, water quality of Sultanköy (İpsala District), Altınyazı (Uzunköprü District), Süloğlu (Süloğlu District), and Kadıköy (Keşan District) Dam Lakes were investigated. According to the results of this study, as similar to the present study, the investigated reservoirs were found to be as highly contaminated by nitrite parameter in general [13].

In addition to the quite high organic content, the water of Karaidemir Dam Lake was also detected as slightly salty. Electrical conductivity is a measure of ability of water to pass an electrical current and it is affected by the presence of dissolved solids. Discharges to water may change the EC levels. Sewage water and especially irrigation practices are known as significantly effective factors on this parameter [14, 15]. According to detected data, Karaidemir Dam Lake has moderate salty water (C2) in terms of total concentration of soluble salts (electrical conductivity parameter) and the water of the reservoir can be used for irrigation except stenohaline plants.

Table 1. Results of detected parameters and some limit values

Limit Values and the Results of Present Study		Parameters															
		Temp. (C°)	DO (mg/L)	%O ₂	pH	EC (mS/cm)	^a TDS (mg/L)	Salinity (‰)	Tur (NTU)	NO ₃ (mg/L)	NO ₂ (mg/L)	^b PO ₄ (mg/L)	SO ₄ (mg/L)	F (mg/L)	COD (mg/L)	BOD (mg/L)	FC (cfu/100mL)
*Turkish Regulations Water Quality Classes [8]	I. Class	25	8	90	6.5-8.5	400	500	-	-	5	0.002	0.02	200	1	25	4	10
	II. Class	25	6	70	6.5-8.5	1000	1500	-	-	10	0.01	0.16	200	1.5	50	8	200
	III. Class	30	3	40	6.0-9.0	3000	5000	-	-	20	0.05	0.65	400	2	70	20	2000
	IV. Class	>30	<3	<40	Out of 6.0-9.0	>3000	>5000	-	-	>20	>0.05	>0.65	>400	>2	>70	>20	>2000
Drinking Water Standards	TS266 [10]	-	-	-	6.5-9.5	2500	-	-	5	50	0.5	-	250	1.5	-	-	-
	EC [11]	-	-	-	6.5-9.5	2500	-	-	-	50	0.5	-	250	1.5	-	-	-
	WHO [12]	-	-	-	-	-	-	-	-	50	0.2	-	-	1.5	-	-	-
Karaidemir Dam Lake	KDD1	21.6 I. Class	11.6 I. Class	133 I. Class	7.71 I. Class	611 II. Class	297 I. Class	0.30	5.08	0.455 I. Class	III. Class	0.013 I. Class	108.0 I. Class	0.316 I. Class	38.2 II. Class	7.6 II. Class	III. Class
	KDD2	17.7 I. Class	11.1 I. Class	117 I. Class	8.24 I. Class	594 II. Class	288 I. Class	0.29	4.90	1.970 I. Class	IV. Class	0.051 II. Class	100.0 I. Class	0.288 I. Class	26.3 II. Class	9.0 III. Class	266 III. Class
	KDD3	19.9 I. Class	12.7 I. Class	136 I. Class	8.31 I. Class	563 II. Class	273 I. Class	0.27	6.95	2.030 I. Class	IV. Class	0.066 II. Class	98.9 I. Class	0.273 I. Class	36.8 II. Class	9.1 III. Class	212 III. Class

^aTurkish Regulations. 2004 [7]; ^bUslu and Türkman. 1987 [9]; *III. – IV. Class water qualities are given in bold; TS266 – Turkish Standards Institute; EC – European Communities; WHO – World Health Organization

V. CONCLUSION

In this study, water quality of Karaidemir Dam Lake located in the Tekirdağ Province was evaluated by investigating some psychochemical and microbiological water quality parameters. According to data observed, organic contents in water of almost all the stations were detected in quite high levels. The reservoir has moderate salty water (C2) in terms of total concentration of soluble salts and the water of reservoir is suitable for irrigation except stenohaline plants. It was also determined that any investigated parameters except turbidity have not exceeded the drinking water limits.

As a result of this study, it can be concluded that Karaidemir Dam Lake is being affected from agricultural activities, it has especially III. – IV. Class water quality in terms of nitrite parameter. In order to provide the sustainability of this reservoir, organic contents originated from agricultural and domestic applications have to be reduced.

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