Determination of the Water Quality and Phytoplankton Composition in the coastal region of Lake Terkos (Istanbul, Turkey)

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ABSTRACT

1.Purpose: It is known that, the essential substance for the survival of all organisms on the earth is water. Unfortunately only 1% of earth's water is available in the form of freshwater, which is used for drinking and potable needs (De, 2003). Due to excessive population growth, over urbanisation, integrated industry and uncontrolled use of natural resources lead to water pollution problems in Turkey, as well as in the rest of the world and also day by day providing to usable freshwater is getting more hard (Fedra, 2005). For evaluating the water quality in aquatic systems, physical, chemical and biological parameters are examined usually together. Phytoplankton, which are the primary producers in the food chain in waters, are used as indicator organisms of water pollution investigations (Reynolds, 1998). Taxonomic studies on algal flora are very important in re-evaluation of the use and stability of aquatic systems. Phytoplankton are one of the four biological elements suggested for assessing the ecological status and potential of surface waters according to the EU Water Framework Directive introduced in 2000 (Padisak et al, 2006; Katsiapi et al, 2016). As it is known, phytoplankton constitutes the group that reacts most rapidly to changes in aquatic system. Therefore, determination of phytoplankton composition and density has a great importance for determine and monitor the trophic structure, productivity, nutrient level, water quality and pollution of lakes. In this study, the changes on the physicochemical parameters and phytoplankton composition in the water of the coastal region of Lake Terkos which is used as a drinking water source in Istanbul, were determined.

2.Methods: A total of 3 stations were selected from Terkos Lake in Balaban Village settlement area and samples were taken between August 2018 and May 2019 from the surface seasonally by using Nansen bottles. Temperature, pH, dissolved oxygen, salinity and electrical conductivity measurements of water samples were measured by WTW Multi 340i/set multiparameter in the study area. Nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N) and orthophosphate (PO_4-P) concentrations were determined according to standard analysis methods (Greenberg, 1985). Samples were fixed with lugol's iodine for phytoplankton identification and phytoplankton density was calculated according to Lund et. al (1958). Taxonomic identification of phytoplankton were done in reference to several comprehensive reviews. Algabase cite was used for checking all the recorded species (Guiry and Guiry, 2018). Chlorophyll- *a* concentrations were estimated according to the Parsons and Strickland (1963)'s methodology.

2.1.Study Area: Terkos Dam Lake is situated in the European side of Istanbul, at a latitude of 40º 19' north and 28º 32' east. The lake has a surface area of 25 km^2 and maximum depth of 11.5 m (Demirtaş, 2011). Terkos Dam was built between the Marmara Sea and the Black Sea, in order to provide drinking water to Istanbul Metropolitan. There are many streams feeding the lake and the stream with the highest inflow is Istranca Stream located in the west. Although the connection between the dam and the Black Sea was terminated in 1881; the water from wells drilled closer to the sea is pumped to Lake Terkos, to meet the increasing need for water because of the drought in recent times. The average annual flow to Lake Terkos is 196 million m^3 and it is used as a recreation, fishery and hunting area (Yilmaz and Gulecal, 2012). Existence between the European and Asian

flora geographically of Lake Terkos has led to the emergence of an extremely rich wetland vegetation containing local and rare plant species. More than 50 hydrophyte have been identified in the shallow waters of the lake and in the swamps on the lake, including rare distributed species in Turkey such as *Stratioles aloides* and *Vallisneria spiralis.* Common recorded species in the coastal area of the lake are *Phragmites australis*, *Typha* sp. and *Schoenoplectus lacustris.* Terkos Lake is also rich in freshwater fauna. Economically valuable fish species such as *Cyprinus* sp., *Proterorhinus* sp., *Chalcalburnus* sp., *Abramis* sp., *Blicca* sp., *Tinca* sp., *Scardinius* sp., *Rhodeus* sp., *Gobius* sp., *Esox* sp., *Silurus* sp. and *Lucioperca* sp. live in the lake (Baylan and Karadeniz, 2006).

3.Results: The phytoplankton composition of Lake Terkos constituted of Bacillariophyta, Charophyta, Chlorophyta, Cyanobacteria, Cryptophyta, Euglenozoa and Miozoa divison members. Measured minimum and maximum values of some physicochemical parameters were as follows: Temperature (6.6-28.1°C); dissolved oxygen (4.21- 8.13 mg/L); pH (5.92- 7.34) and electrical conductivity (244- 331 µS/cm). During the study period, no salinity concentrations were measured in all sampling points (Table 1).

Table 1. Some measured physochemical parameters and chl- *a* and phytoplankton density of Lake Terkos.

PARAMETERS	Stations	Summer 2018	Autmn 2018	Winter 2018
Temperature (°C)	St. 1	27.2	19.7	6.6
	St. 2	27.0	19.5	7.9
	St. 3	28.1	19.6	8.2
Dissolved Oxygen (mg/L)	St. 1	4.21	8.13	6.74
	St. 2	4.58	5.57	6.51
	St. 3	4.36	5.33	6.01
pH	St. 1	7.10	7.34	5.97
	St. 2	7.34	6.96	6.63
	St. 3	7.26	7.05	5.92
Electrical Conductivity (µS/cm)	St. 1	305	244	318
	St. 2	303	312	329
	St. 3	304	311	331
Salinity (%o)	St. 1	0.0	0.0	0.0
	St. 2	0.0	0.0	0.0
	St. 3	0.0	0.0	0.0

4.Conclusions: Previously, a few limnological investigations were carried out on zooplankton (Güher et. al, 2004), waterborne fungi (Asan et al., 2003), phytoplankton composition (Temel, 2005), total metal levels in crayfish (Kurun et al., 2010) and parazites on Tench Fish (Demirtaş, 2011) in Terkos Lake. Phytoplankton compositon of the lake and its feeding streams including some physicochemical parameters were investigated by Yilmaz and Gulecal (2012) in an earier study. Before the presented study, the water pollution level of Lake Terkos, was investigated by determining the phytoplankton distribution, some physicochemical parameters, nutrients and heavy metal concentrations by Yilmaz et al., 2013. In this study, it is aimed to determine the pollution load which is brought by the Balaban Village settlement area, located on the coast of Terkos Dam Lake. There was no significant change in phytoplankton composition compared to our previous study. However, it was determined that nutrient concentrations increased in summer. It is considered that, the reason for nutrient increases in summer, orginated from the increase in population in Balaban Village due to the intensive use of the public as a recreation area. As a result, Terkos Lake, which is one of the important sources of drinking water to the Istanbul Metropolitan area, will contribute to the prevention of pollution and taking necessary measures to improve the water quality.

Keywords: Phytoplankton, water quality, water pollution, Terkos Lake.

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