Relationship between phytoplankton composition and bacterial load dynamics in Buyukcekmece Dam Lake (Istanbul, Turkey), a drinking water resource

N.Yilmaz[1*], C.H. Yardimci[1], R.E. Yardimci[2] and M.Elhag[3]

[1*]Department of Freshwater Resources and Managment, Istanbul University Faculty of Aquatic Sciences, Ordu St. No:8, 34134, Laleli, Istanbul, Turkey.
[2]Department of Aquaculture and Fish Diseases, Istanbul University Faculty of Aquatic Sciences, Ordu St. No:8, 34134, Laleli, Istanbul, Turkey.
[3]King Abdulazziz University, Faculty of Meteorology, Environment and Arid Land Agriculture, Department of Hydrology and Water Resources Management, Jeddah, Saudi Arabia.

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Presenting author email: nyilmaz@istanbul.edu.tr

Buyukcekmece Dam Lake is located in the south of the Thrace Peninsula, 50 km away from the city center of Istanbul and near to Sea of Marmara. Buyukcekmece Dam Lake, situated close to industrial, agricultural and residential areas, is the most suffering reservoir in Istanbul affected by anthropogenic pollution, due to it is exposed to the effects of the use of pesticides and artificial fertilizers originating from agricultural activities (Yilmaz, 2019). BDL, which is feeding by many creeks, was built on Karasu River, which has an important amount of water flow, by ISKI (Water and Sewerage Administrative Center of Istanbul) in 1985.

In this study, the relationship between phytoplankton communities and bacteriological load of Buyukcekmece Dam Lake and its 8 influent streams (Karasu, İzzettin, Eskice, Ahlat, Beylikçayı, Çekmece, Çakmaklı and Tahtaköprü) were investigated. For this purpose, sampling studies were carried out seasonally between May 2017 and February 2018 from 9 sampling points (Figure 1). Samples were collected by using Nansen bottles and fixed with Lugol's iodine solution for phytoplankton identification and counting. Phytoplankton counting was made with a Nikon TMS inverted microscope at a magnification of 400 according to Lund *et al* (1958). Taxonomic identification of phytoplankton was done in reference to the literature including several comprehensive reviews on the subject. Water samples were collected in triplicates into sterile bottles by using membrane filtration technique to determinate the total heterotrophic aerobic bacteria (THAB), total and fecal coliform (Goldreich *et al*, 1955). After incubation, the diluted plates containing countable bacterial colonies were calculated and reported as colony forming units (CFU/ml).

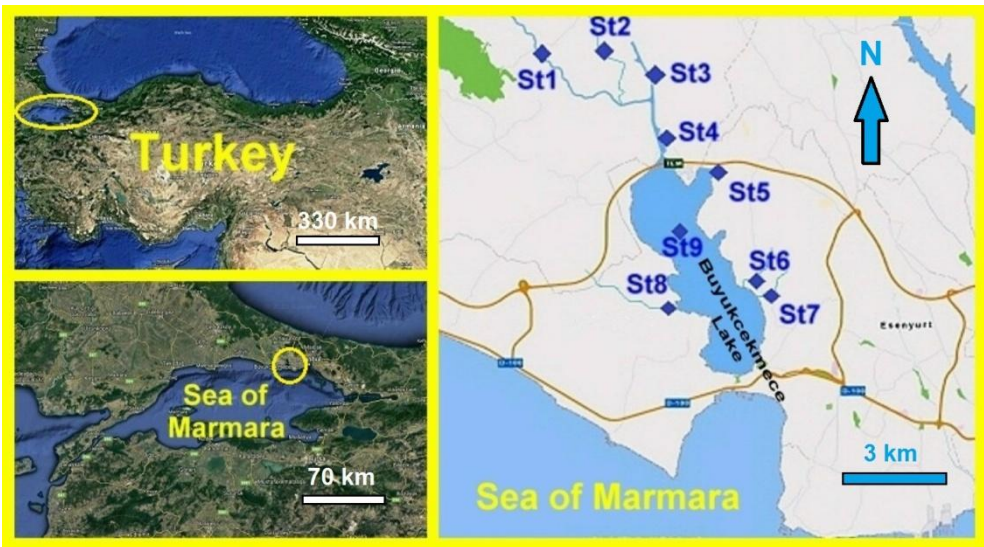

Figure 1. Map of Buyukcekmece Dam Lake and sampling stations.

Recorded dominant/subdominant and important species of phytoplankton and bacteriological load (cfu/ml) were given in Table 1 according to the sampling sites. Phytoplankton community of Buyukcekmece Dam Lake and its influent streams, constituted of 63 taxa belonging to 8 divisions (Yilmaz, 2019). Minimum and maximum load of total heterotrophic aerobic bacteria, total and fecal coliform were determined as $1x10^2$- $1330x10^2$, $1x10^2$- $378x10^2$ and $9x10^2$- $551x10^2$ cfu/ml respectively. Phytoplanktonic and bacterial organisms used as bioindicators in waters and they mainly show changes according to sampling points, flow rate and nutrient salts

concentrations. The maximum nutrient concentrations were measured in parallel to the stations where the bacteriological load detected in highest density. Maximum bacteriological load was determined at Çekmece Stream (st.6) which is passing through the agricultural areas and has a low flow. Also, the water bloom-forming cyanobacterium *Aphanizomenon flosaquae* Ralfs ex Bornet et Flahault was recorded as dominant. While minimum bacteriological load was determined at st.9, which is located in the middle of the lake, *Anabaena spiroides* Klebahn of Cyanobacteria was found the dominants species. When chlorophyll- *a* concentrations were measured in minimum at Çekmece Stream (st.6), bacteriological load was count in highest numbers. It was noted that, the load amount of heterotrophic aerobic bacteria increases when the phytoplankton diversity shows decreases. Since phytoplankton and bacteria both use the nutrient salts in the aquatic environment, they have antagonistic effect on each other. Consequently, Buyukcekmece Dam is the second largest drinking water sources of Istanbul Metropolitan, continuing limnological studies on monitoring and protection of the water of the lake and its feeding streams have great importance.

Table 1. Recorded dominant/subdominant and important species of phytoplankton and bacteriologic load (D:dominant, SD: subdominant, I: important species, THAB: Total heterotrophic aerobic bacteria, TC: Total coliform, FC: Fecal coliform).

SAMPLING STATIONS	**PHYTOPLANKTON**		**BACTERIOLOGICAL LOAD** ($x10^2$cfu/ml)		
	Divisio / Taxa Numbers	**Species**	**THAB** Min.-Max.	**TC** Min.-Max.	**FC** Min.-Max.
1. Karasu Stream	7 / 23	*Nitzschia acicularis* (D)	424 - 780	81 - 306	188 - 500
2. İzzettin Stream	5 / 12	*Anabaena spiroides* (D)	137 - 324	1 - 42	33 - 73
3. Eskice Stream	7 / 38	*Anabaena affinis* (D) *Merismopedia glauca* (SD)	151 - 264	4 -38	84 - 132
4. Ahlat Stream	6 / 17	*Cyclotella meneghiniana* (I) *Nitzschia acicularis* (I) *Crytomonas ovata* (I) *Euglena acus* (I) *Euglena viridis* (I)	159 - 589	25 - 378	83 - 448
5. Beylikçayı Stream	7 / 33	*Oscillatoria tenuis* (D) *Sphaerocystis* sp. (SD)	58 - 536	1 - 5	56 - 77
6. Çekmece Stream	5 / 15	*Aphanizomenon flosaquae* (D) *Aulocoseira italica* (SD)	239 - 1330	50 - 240	109 - 551
7. Çakmaklı Stream	5 / 14	*Nitzschia acicularis* (D) *Merismopedia glauca* (SD)	1 - 534	14 - 72	75 - 412
8. Tahtaköprü Stream	7 / 33	*Cyclotella meneghiniana* (I) *Scenedesmus quadricauda* (I) *Cryptomonas ovata* (I) *Euglena viridis* (I)	110 - 436	2 - 68	18 - 236
9. Buyukcekmece Dam	7 / 26	*Anabaena spiroides* (D) *Aphanizomenon flosaquae* (SD) *Oscillatoria tenuis* (SD)	17 - 189	1 - 22	9 - 58

References

Lund W.G., Kipling C., Le Cren E.D. (1958) The inverted microscope method of estimating algal numbers and the statiscal basis of estimations by counting, *Hydrobiologia*, 11 143-170.

Goldreich E.E., Kabler P., Jeter H., Clark H. (1955) A Delayed Incubation Membrane Filter Test for Coliform Bacteria in Water, *American Journal of Public Health*, 45, 1462-1474.

Yilmaz N. (2019) Water Quality Assessment Based on the Phytoplankton Composition of Buyukcekmece Dam Lake and its Influent Streams (Istanbul), Turkey, *Desalination and Water Treatment*, 159, 3-12.

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