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Evaluation of the Relationship between Epiphytic Diatoms and Water Quality Parameters in the Büyükçekmece Reservoir

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ABSTRACT

Objective: In this study carried out in Büyükçekmece Reservoir, the composition, distribution, seasonal changes of epiphytic diatoms that live on the surfaces of plants, and the effects of environmental parameters on these organisms were investigated, and it was aimed to reveal the water quality of the reservoir.

Materials and Methods: In order to determine the seasonal changes of epiphytic diatom species in Büyükçekmece Reservoir, water and material samples were collected from five stations in 2019. In the study, water temperature, salinity, conductivity, dissolved oxygen, and pH values, which are among the basic ecological variables, were measured. Epiphytic diatom samples were obtained from *Phragmites* sp. species. Also, Spearman's rank correlation, Shannon–Weaver diversity index, Cluster (Bray–Curtis and Euclidean Distance), and ordination analysis (DCA and CCA) were applied in the study.

Results: 66 epiphytic diatom species were identified in this study, and 36 of these species are new records for the reservoir. Most epiphytic diatom species were obtained in August, and the lowest number was obtained in November. According to the pH values, it was determined that the reservoir is alkaline. In addition, it was determined that the main factors affecting the distribution of epiphytic diatom species in the reservoir are temperature and conductivity, and it was revealed that ecological variables affect species distribution.

Conclusion: According to conductivity and DO values, it was determined that the reservoir was of very good and of good quality, and in terms of DO values, the reservoir was mainly oligotrophic. However, station 5 was mesotrophic during the August sampling period, station 4 was mesotrophic, and station 5 was eutrophic in November. Also, Büyükçekmece Reservoir was found in poor and moderate status according to *H'* classification.

Keywords: Epiphytic diatom, Bacillariophyceae, Correlation, Water quality, Istanbul, Turkey

INTRODUCTION

Diatoms (Bacillariophyceae) are among the unicellular, microscopic groups of algae with high distribution in freshwaters. Their existence on Earth, dating back 185 million years ago, has been proven by the fossil records (1). Diatoms are responsible for almost 20-25% of the oxygen produced on Earth in aquatic ecosystems (2). Diatoms constitute the vast majority of benthic algae species in freshwater and seas (3,4), and they are distributed in almost all habitats. Due to their high tolerance range against environmental factors, they

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in field sampling. They also thank Elif Yilmaz for her support in preparing diatom frustules. In addition, the authors thank TÜBİTAK (BİDEB–2237, Project No: 1129B371901423) for their contribution to the implementation of ordination analysis.

REFERENCES

1. Medlin LK, Kooistra WHCF, Gersonde R, Sims PA, Wellbrock U. Is the origin of diatoms related to the end-Permian mass extinction? Nova Hedwigia 1997; 65: 1-11.
2. Round FE, Crawford RM, Mann DG. Biology of diatoms, the diatoms: Biology and morphology of the genera. Sandgren CD, editor. Cambridge: Cambridge University Press; 1990. 746 p.
3. Ács É, Szabó K, Tóth B, Kiss KT. Investigation of benthic algal communities, especially diatoms of some Hungarian streams in connection with reference conditions of the Water Framework Directives. Acta Bot Hung 2004; 46 (3-4): 255-78.
4. Soininen J, Paavola R, Muotka T. Benthic diatom communities in boreal streams: community structure in relation to environmental and spatial gradients, Ecography 2004; 27(3): 330-42.
5. Cumming BF, Wilson SE, Hall RI, Smol JP. Diatoms from British Columbia (Canada) Lakes and their relationship to salinity, nutrients and other limnological variables. Bibliotecha Diatomalogica 1995. 207 p.
6. Battarbee RW, Charles DF, Dixit SS, Renberg I. Diatoms as indicators of surface water acidity. Stoermer EF, Smol JP, editors. The Diatoms: Applications for the enviromental and earth sciences. Cambridge: Cambridge University Press; 1999. pp. 98-121.
7. John J. Bioassessment on health of aquatic systems by the use of diatoms. Ambasht RS, Ambasht NK, editors. Modern Trends in Applied Aquatic Ecology. New York, USA: Kluwer Academic Publications; 2003. pp. 1-20.
8. Taylor JC, Harding WR, Archibald CGM. An illustrated guide to some common diatom species from South Africa. Gezina, South Africa: Water Research Commission; 2007. Report No: 282/07.
9. Bozarth A, Maier UG, Zauner S. Diatoms in biotechnology: modern tools and applications. Appl Microbiol Biotechnol 2009; 82: 195-201.
10. Official Journal of the European Communities. Directive 2000/60/EC of the European Parliament and of the Council, establishing a framework for community action in the field of water policy. The European Parliament and the Council of the European Union 2000; 327: 1-73.
11. Official Gazette of the Republic of Turkey. Water pollution control regulations. Official Gazette of the Republic of Turkey 2004; No: 25687.
12. Official Gazette of the Republic of Turkey. Surface water quality management regulation. Official Gazette of the Republic of Turkey 2016; No: 29797.
13. Stener-Kovács C, Buczkó K, Hajnal É, Padisák J. Epiphytic, littoral diatoms as bioindicators of shallow lake trophic status: Trophic Diatom Index for Lakes (TDIL) developed in Hungary. Hydrobiologia 2007; 589: 141-54.
14. Dalkıran N, Zünbülgil B, Karacaoğlu D, Dere Ş. Uluabat gölü epifitik diyatomelerinin uzun dönemdeki değişimleri. LimnoFish 2016; 2(3): 153-63.
15. Sanal M, Demir N. Use of the epiphytic diatoms to estimate the ecological status of Lake Mogan. Appl Ecol Environ Sci 2018; 16(3): 3529-43.
16. Solak CN, Çetin T, Karaaslan Y, Kaleli A, Yılmaz E, Duran M, Kıvanç G, Kimençe, T, Aynur-Koyunoğlu, Ş., Çankaya, B.F., Yılmaz-Aşık, D. Common diatoms of phytobenthos in Gediz River Basin. Turkish Journal of Water Science & Management 2019; 3(2): 58-70.
17. Temel M. Büyükçekmece Gölü Bentik Alg Florası, Süleyman Demirel Univ. Eğirdir Su Ürün. Fak. Derg. 1996-1997; 5: 173-90.
18. Temel M. Büyükçekmece Gölü bentik alg florası, Kısım II: Epilitik ve epifitik alg toplulukları. In: X. National Fisheries Symposium, Adana: 22-24 September 1999; 877-86.
19. Temel M. The phytoplankton of Lake Büyükçekmece, İstanbul, Turkey, Pak J Bot 2002; 34(1): 81-92.
20. Aktan-Turan Y, Aykulu G, Albay M, Okgerman H, Akçaalan R, Gürevin C, Dorak Z. Büyükçekmece Gölü'nde aşırı artış gösteren fitoplankterlerin gelişimini kontrol eden faktörlerin araştırılması. TÜBİTAK, Ankara. 2006. Report No: 103Y127.
21. Aktan Y, Gürevin C, Dorak Z. The effect of environmental factors on the growth and size structure of two dominant phytoplankton species in Büyükçekmece Reservoir (İstanbul, Turkey). Turk J Biol 2009; 33: 335-40.
22. Gulecal Y, Temel M. Water quality and phytoplankton diversity in Büyükçekmece Watershed, Turkey. J Water Resource Prot 2014; 6: 55-61.
23. Yilmaz N. Water quality assessment based on the phytoplankton composition of Buyukcekmece Dam Lake and its influent streams (Istanbul), Turkey. Desalin Water Treat 2019; 159: 3-12.
24. Balkis-Ozdelice N, Solak CN, Durmus T. The use of phytoplankton communities to determination of the ecological status of Büyükçekmece Dam-Lake and the investigation of water quality problems. TÜBİTAK, Ankara; 2020. Report No: 118Y347.
25. Demir N, Atay D. Kurtboğazı ve Çamlıdere Baraj Göllerinin Fitoplanktonu. In: X. National Fisheries Symposium, 1999; p. 577-87.
26. Directorate General for State Hydraulic Works (DSİ). Büyükçekmece Barajı ve tesisleri ikmal inşaatı aylık iş durumu. DSİ papers, Istanbul; 1985.
27. İSKİ. "Büyükçekmece Barajı son 14 gün içindeki mevcut su hacimleri" https://www.iski.istanbul/web/tr-TR/baraj-doluluk, Last Accessed Date: 03 May 2021.
28. İSKİ. "Baraj Doluluk Oranları - Mevcut Su Miktarının Barajlara Göre Dağılımı". http://www.iski.istanbul/web/tr-TR/baraj-doluluk, Last Accessed Date: 11 November 2019.
29. Winter JG, Duthie HC. Epilithic diatoms as indicators of stream total N and total P concentration. J North Am Benthol Soc 2000; 19(1): 32-49.
30. Hendey NI. A revised check-list of British marine diatoms. J Mar Biolog Assoc UK 1974; 54(2): 277-300.
31. Battarbee RW, Cameron NG, Golding P, Brooks SJ, Switsur R, Harkness D, McGovern A. Evidence for holocene climate variability from the sediments of a Scottish remote mountain lake. J Quat Sci 2001; 16(4): 339-46.
32. Hustedt F. Heft 10: Bacillariophyta (Diatomeae). Pascher A. editor. Die Süsswasser-Flora Mitteleuropas. Jena, Germany: Verlag von Gustav Fischer; 1930. 466 p.
33. Patrick R, Reimer CW. The diatoms of the United States, Exclusive of Alaska and Hawaii. Philadelphia. Philadelphia, USA: Wiley; 1966. 688 p.
34. Patrick R, Reimer CW. The diatoms of the United States Vol.2, Part 1. Philadelphia, USA: Wiley; 1975.
35. Krammer K, Lange-Bertalot N. Süßwasserflora von Mitteleuropa Bacillariophyceae 3. Teil: Centrales, Fragilariaceae, Eunotiaceae. Stuttgart, Germany: Gustav Fischer Verlag; 1991.
36. Krammer K, Lange-Bertalot N. Süßwasserflora von Mitteleuropa Bacillariophyceae 4. Teil: Achnanthaceae, Kritische Ergänzungen zu *Navicula* (Lineolatae) und *Gomphonema* Gesamtliteraturverzeichnis Teil 1-4. Stuttgart, Germany: Gustav Fischer Verlag; 1991.
37. Krammer K, Lange-Bertalot N. Süßwasserflora von Mitteleuropa Bacillariophyceae 1. Teil: Naviculaceae. Berlin, Germany: Gustav Fischer Verlag; 1997.