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Evaulation of Water Quality By Using Trophic Diatom Index: Exaple of Porsuk Dam Lake

Cem TOKATLI

Trakya Üniversitsi, İpsala Meslek Yüksek Okulu, Laboratuvar Teknolojisi Programı, Edirne / 22400

*Corresponding author:
E-mail: tokatlicem@gmail.com

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Abstract

Diatoms are commonly used as bioindicator organisms for evaluating especially freshwater quality. Trophic Diaton Index (TDI) provides information about trophic levels of the aquatic ecosystem. In this study, the epipelic diatoms were collected from Porsuk Dam Lake in autumn season of 2009. As a result, total of 25 diatom taxa were identified and the water quality of Porsuk Dam Lake in terms of trophic levels was determined according to these 25 taxa by calculating TDI. It was determined that, *Stephanodiscus agassizensis* Hakansson & Kling, *Epithemia sorex* Kützing and *Aulacoseira granulata* (Ehrenberg) Simonsen were the most dominant taxa and Porsuk Dam Lake has mesotrophic state according to TDI.

Keywords: Porsuk Dam Lake, Biyomonitoring, Trophic Diaton Index

INTRODUCTION

Pollution of freshwater resources has become one of the most important problems of mankind and as it is known, continuous monitoring of the quality of aquatic ecosystems is one of the best protection techniques. New methods of environmental monitoring especially by using biological organisms are the most popular topic for the scientific community in recent years. Diatoms, that can be found in every surface water at any time are an important part of water quality monitoring organisms [1]. They have been used in a number of countries as indicators of water pollution [2, 3, 4, 5, 6, 7].

The aim of this study was to evaluate the water quality of Porsuk Dam Lake with Trophic Diatom Index by using epipelic diatom composition.

MATERIAL AND METHOD

Study Area

Porsuk Dam Lake, which exposed to significant organic and inorganic pollution, is located in the 25 km southwest of Eskişehir province. Length of Reservoir is 16 km, volume of reservoir is 457 million m^3 and surface area of reservoir is 27.20 million m^2 [8] (Figure 1). Epipelic diatom samples were collected in autumn season of 2009 from the middle of Porsuk Dam Lake, where it was thought to be best represent the trophic levels of system.

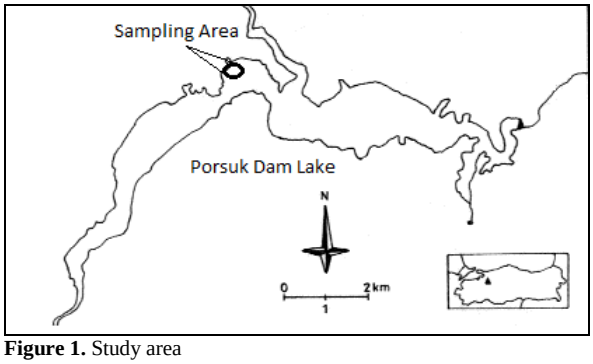

Figure 1. Study area

Sampling and Analysis

Epipelic diatom samples were collected by 2 cm diameter - 1 m long glass tube from sediment. They were cleaned with acid (98% H2SO4 and 35%HNO3) and mounted on microscope for observation with a magnification of 1000X. Slides were prepared and 156 valves enumerated to determine the relation and abundance of each taxa [9, 10]. Diatoms were identified according to Cox [11], Krammer and Lange-Bertalot [12, 13, 14, 15] and Taylor [16] and then TDI index were calculated.

Calculating TDI

Trophic diatom index (TDI) was calculated by using the following Formula [17]:

$$TDI = (WMS \times 25) - 25$$
$$WMS = \Sigma A_j \times S_j \times V_j \ / A_j \times V_j$$

Where WMS is the weighed mean sensitivity of the taxa present in the sample. A_j is the abundance or proportion of valves of species j present in the sample, S_j is the nutrient sensitivity (1 – 5) of species and V_j its indicator value (1 – 3).

RESULTS AND DISCUSSION

Abundance (A), nutrient sensitivity (S) and indicator values (V) of of all identified diatom taxa were given in Table 1.

A total of 25 diatom species representing 16 genera were observed in this study and *Stephanodiscus agassizensis* Hakansson & Kling, *Epithemia sorex* Kützing and *Aulacoseira granulata* (Ehrenberg) Simonsen were the most dominant taxa (Figure 2).

Epithemia sorex is a cosmopolitan taxon that can be found in both lentic and lotic waters. *Stephanodiscus agassizensis, Aulacoseira ambigua, Aulacoseira granulata, Aulacoseira muzzanensis* and *Cyclotella meneghiniana* are common in eutrophic characterized waters. *Cocconeis placentula* and *Cyclotella ocellata* that were quite dominant in Porsuk Dam Lake are also common in mesotrophic – eutrophic characterized waters. *Nitzschia palea* that was also quite dominant in Porsuk Dam Lake has eutrophic character and can be found even in the extreme polluted waters [16].

A few taxa have TDI sensitivity values of zero. These include a few taxa that are relatively rare in freshwaters and whose ecological preferences are not well defined, along with planktonic taxa, which are routinely excluded from calculations [18]. According to calculated TDI value (56.74), Porsuk Dam Lake was mesotrophic state. In a study performed on water quality monitoring of Upper Porsuk Stream based on diatom indices, TDI value of the station before dam input (121.3) was reported extremely higher that the upstream stations close to source (39 – 44.5) [19]. If we compare this study with the present study, it can be understood that, water quality of Porsuk Dam Lake is significantly higher and trophic levels of Porsuk Dam Lake is significantly lower than the input of dam water. In another study performed on water quality of Porsuk Stream Basin, it was reported that, the water quality of Porsuk Stream was decreasing before input of reservoir [IV. class] and increasing after output of reservoir [II. class] [20]. The results of these studies support the Trophic Diatom Index data and show that, diatoms can be used for biomonitoring of water quality in the Porsuk Stream Basin. Diatoms have been used in a number of studies in Turkey [21, 22, 23], but using diatoms for evaluating water quality is a new topic. These studies demonstrate the applicability of diatom indices and can help in establishing database in Turkey.

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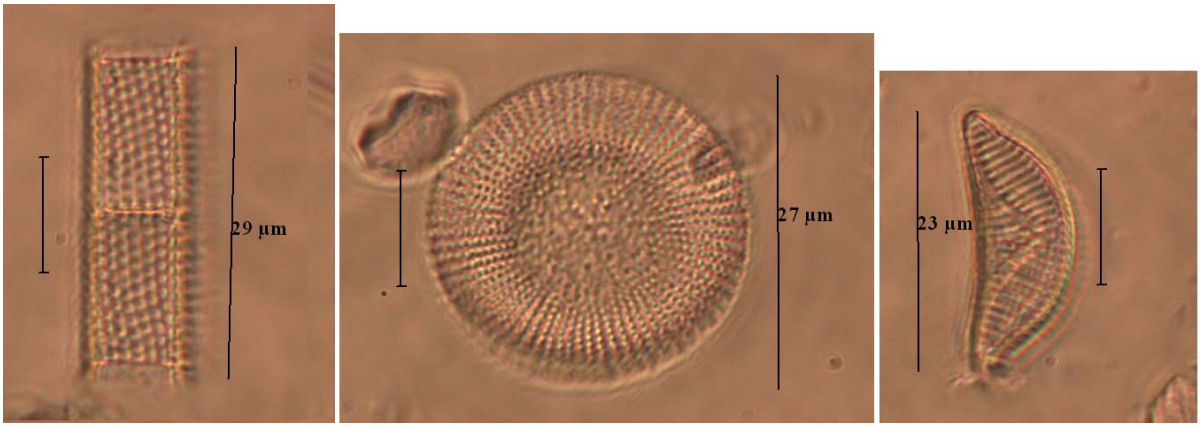

Figure 2. Most dominant taxa (*A. granulate, S. agassizensis, E. sorex;* respectively)

Table 1. The data used in calculation of TDI

Species	A	S	V	A.S.V	A.V
Aulacoseira ambigua (Grunow) Simonsen	8	0	0	0	0
Aulacoseira granulata (Ehrenberg) Simonsen	17	0	0	0	0
Aulacoseira muzzanensis (Meister) Krammer	3	0	0	0	0
Cocconeis pediculus Ehrenberg	8	4	2	64	16
Cocconeis placentula Ehrenberg	7	3	2	42	14
Craticula cuspidata (Kützing) D.G.Mann	1	5	1	5	1
Cyclotella meneghiniana Kützing	5	0	0	0	0
Cyclotella ocellata Pantocsek	9	0	0	0	0
Cymatopleura elliptica (Brebisson) W.Smith	1	4	1	4	1
Cymatopleura solea (Brebisson) W.Smith	2	4	1	8	2
Cymbella ventricosa Agardh	2	2	1	4	2
Encyonema caespitosum Kützing	1	2	1	2	1
Epithemia sorex Kützing	22	3	2	132	44
Fragilaria capucina var. rumpens (Kützing) Lange-Bertalot	2	2	2	8	4
Fragilaria ulna var. acus (Kützing) Lange-Bertalot	6	2	1	12	6
Gomphonema parvulum Kützing	2	5	3	30	6
Gomphonema truncatum Ehrenberg	3	3	1	9	3
Navicula radiosa Kützing	1	4	1	4	1
Navicula tripunctata (O.F.Müller) Bory	1	4	2	8	2
Nitzschia dissipata (Kützing) Grunow	2	5	2	20	4
Nitzschia palea (Kützing) W.Smith	9	5	1	45	9
Rhopalodia gibba (Ehrenberg) O Müller	8	1	1	8	8
Stephanodiscus agassizensis Hakansson & Kling	34	0	0	0	0
Surirella brebissonii Krammer & Lange-Bertalot	1	3	1	3	1
Tryblionella hungarica (Grunow) D.G.Mann	1	4	1	4	1
TOTAL	**156**			**412**	**126**

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