

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/257840793>

# Phytoplankton composition of İkizcetepeler Reservoir, Balıkesir–Turkey.

Article · January 2012

---

CITATIONS  
5

READS  
138

2 authors, including:



**Tuğba Ongun Sevindik**  
Sakarya University

83 PUBLICATIONS 773 CITATIONS

SEE PROFILE

## Phytoplankton composition of İikizcetepeler reservoir, Balıkesir-Turkey

Tuğba ONGUN SEVİNDİK\* & Kemal ÇELİK\*\*

\*Sakarya University, Faculty of Arts and Science, Department of Biology,  
54187 Adapazarı-Sakarya-Turkey Corresponding Author:  
tsevindik@sakarya.edu.tr

\*\*Balıkesir University, Faculty of Arts and Science, Department of Biology,  
10145 Balıkesir-Turkey

### Abstract

Phytoplankton composition of İikizcetepeler reservoir was studied between February 2007 and January 2009. Samples were taken from 3 sampling stations. A total of 174 taxa belonging to 7 divisions have been identified, including *Ochrophyta* (70 taxa), *Chlorophyta* (50 taxa), *Cyanobacteria* (15 taxa), *Euglenozoa* (14 taxa), *Charophyta* (13 taxa), *Myzozoa* (8 taxa) and *Cryptophyta* (4 taxa). Most of the species are characterized by their widespread presence, although some taxa are rarely found in Turkey. Base on measured physicochemical parameters and species composition results, İikizcetepeler reservoir could be a mesotrophic reservoir.

**Key Words:** İikizcetepeler reservoir, phytoplankton, composition, Balıkesir, Turkey

## İkizcetepeler (Balıkesir-Türkiye) barajının fitoplankton kompozisyonu

### Özet

Şubat 2007 ile Ocak 2009 tarihleri arasında İkizcetepeler barajının fitoplankton topluluğu çalışılmıştır. Su örnekleri 3 farklı istasyondan aylık olarak alınmıştır. *Ochrophyta* (70 takson), *Chlorophyta* (50 takson), *Cyanobacteria* (15 takson), *Euglenozoa* (14 takson), *Charophyta* (13 takson), *Myxozoa* (8 takson) ve *Cryptophyta* (4 takson) divizyonlarına ait olmak üzere toplam 174 takson teşhis edilmiştir. Teşhis edilen birçok tür Türkiye’de geniş bir yayılım alanına sahipken bazı taksonlar nadir olarak bulunmaktadır. Ölçülen fizikokimyasal parametreler ve tür kompozisyonu baz alınarak İkizcetepeler barajı mezotrofik olarak sınıflandırılabilir.

**Bulduru Sözcükleri:** İkizcetepeler barajı, fitoplankton, tür kompozisyonu, Balıkesir, Türkiye

### Introduction

Phytoplankton are primary producers of aquatic systems. Since their composition and distribution are effected by short and long term environmental changes (1), the seasonal distribution and the effects of environmental gradients on phytoplankton dynamics are commonly investigated world-wide (2-4). Similar studies were performed (1, 5) however algal flora studies has not been completed in Turkey. In recent years, new records were found for Turkish algal flora (6-9).

Turkey has many natural lakes however reservoir construction for different purposes was increased at last twelve years. Therefore some taxonomical and ecological studies have been carried out on the phytoplankton of reservoirs in Turkey. Some of them are: Kurtboğazı reservoir (Ankara) (10), Çubuk-I reservoir (Ankara) (11), Altınapa reservoir (Konya) (12), Bayındır reservoir (Ankara) (13), Tercan reservoir (Erzincan) (14), Suat Uğurlu reservoir (Samsun) (15), Demirköprü reservoir (Manisa) (16), Hasan Uğurlu reservoir (Samsun) (17), Sarıyar reservoir (Ankara-Eskişehir) (18), Ömerli reservoir (İstanbul) (19), Demirdöven reservoir (Erzurum) (20), Derbent reservoir (Samsun) (21). The current work presents mainly the phytoplankton

composition aspect of the İkizcetepeler reservoir; other data, particularly quantitative data, will be published later.

## Materials and Methods

### Study Area

İkizcetepeler reservoir is located between the longitudes of 27° 94' 16'' E and at latitudes of 39° 47' 48''N in the province of Balıkesir, Turkey (Figure 1). It is 175 m above the sea level. It is fed by Kille, Akçaköy, Taşköy, Kocaçay, Bağırsak and Kozludere streams. It was constructed in 1992 for the purpose of irrigation, flood prevention and domestic utilization. The total length of the reservoir is approximately 294 m. The reservoir has a surface area of 9.60 km<sup>2</sup> with a maximum depth of 47 m, an annual mean water capacity of 112.20 hm<sup>3</sup> and a total volume of 164.560 hm<sup>3</sup> (22).

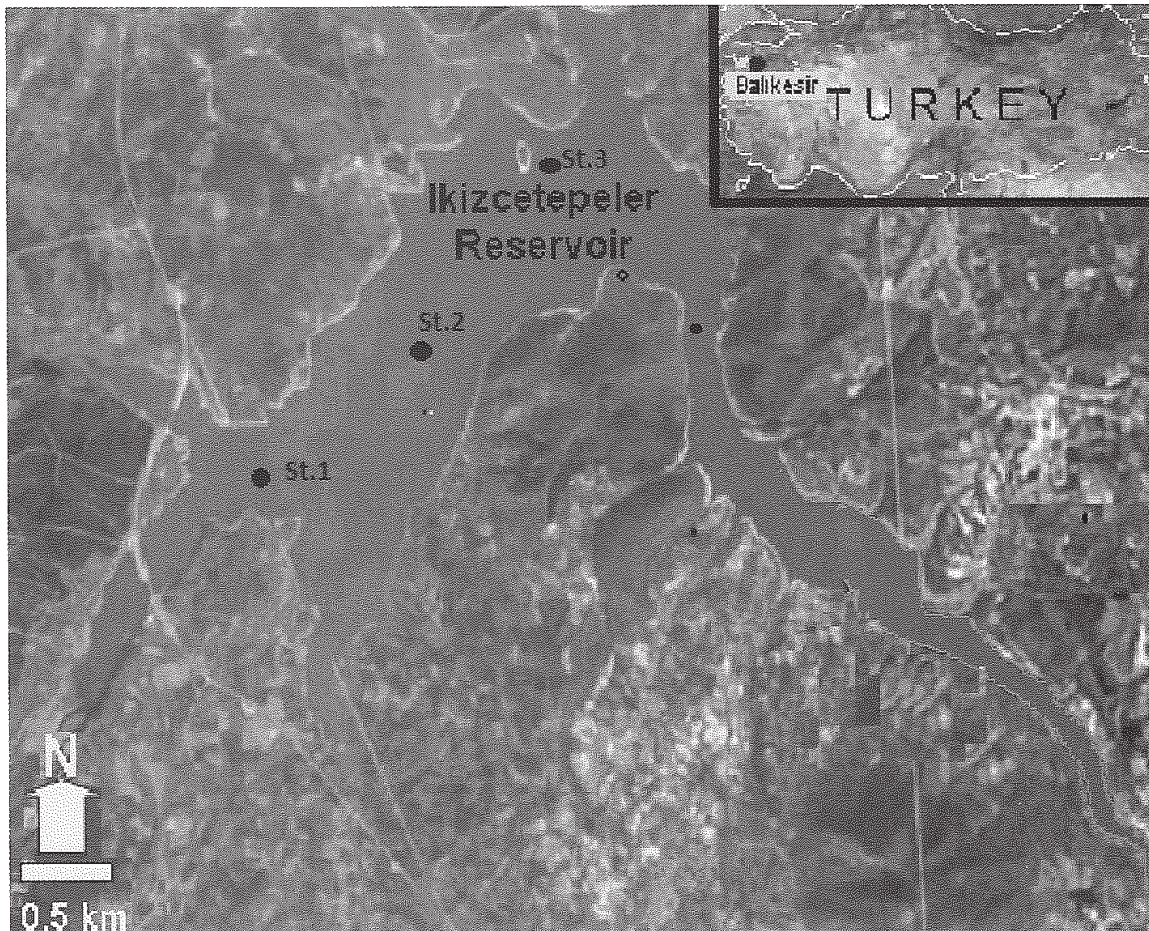


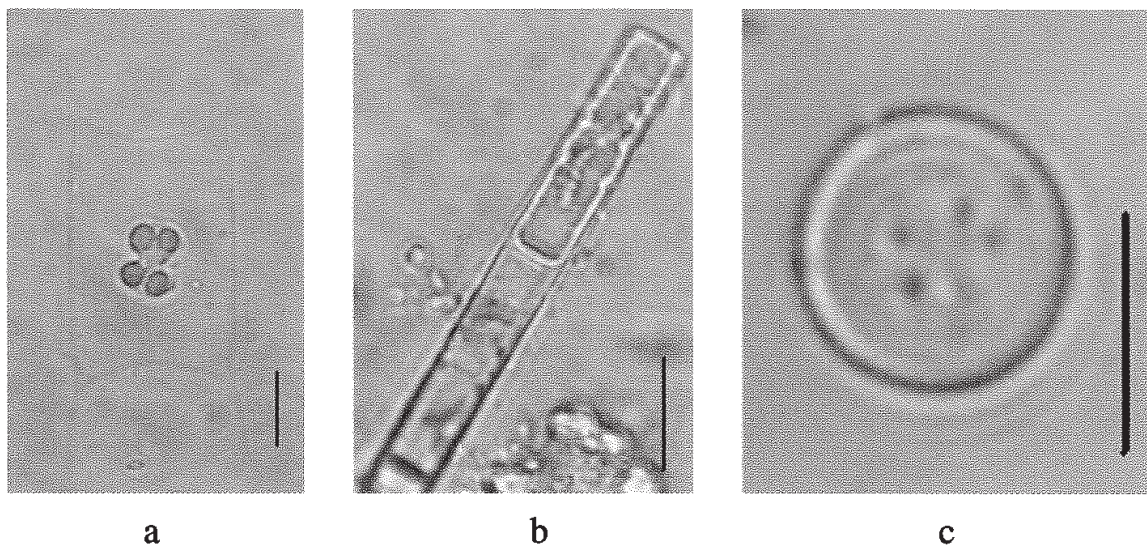
Figure 1. Map of the İkizcetepeler reservoir showing the position of sampling stations

### Phytoplankton analysis

The samples were monthly taken from three stations of the reservoir between February 2007 and January 2009 vertically with 10 m intervals using plankton net (55  $\mu\text{m}$  mesh size). In the field, phytoplankton samples were placed in 250 mL dark bottles and fixed with the mixture of Lugol's and formaldehyde solution. Identification of samples was performed on a compound microscope, equipped with water immersion lenses and a phase contrast attachment. (23). Diatoms were also analyzed using permanent preparations where the samples were digested with acid (24). Diatom samples were identified with compound microscope. Identification of phytoplankton was done according to taxonomic keys of Round et al., (25); Sims, (26); Kramer & Lange-Bertalot, (27, 28); Huber – Pestalozzi, (29-35); John et al., (36) and Komarek & Anagnostidis, (37). Some of the phytoplankton species were photographed with a Canon Digital Ixus 75 camera attached to an Olympus BX 51 microscope (Figures 2 - 4).

### Physical and chemical analyses

Conductivity, total dissolved solid, pH and water temperature were measured monthly using a YSI 6600 multi probe. Water transparency was determined monthly using a Sechi disk during the sampling. Chemical analyzes were done according to standard methods at Balıkesir University Basic Sciences Research Center (23). Chl-a was determined via extraction with 90 % acetone spectrophotometrically (38).



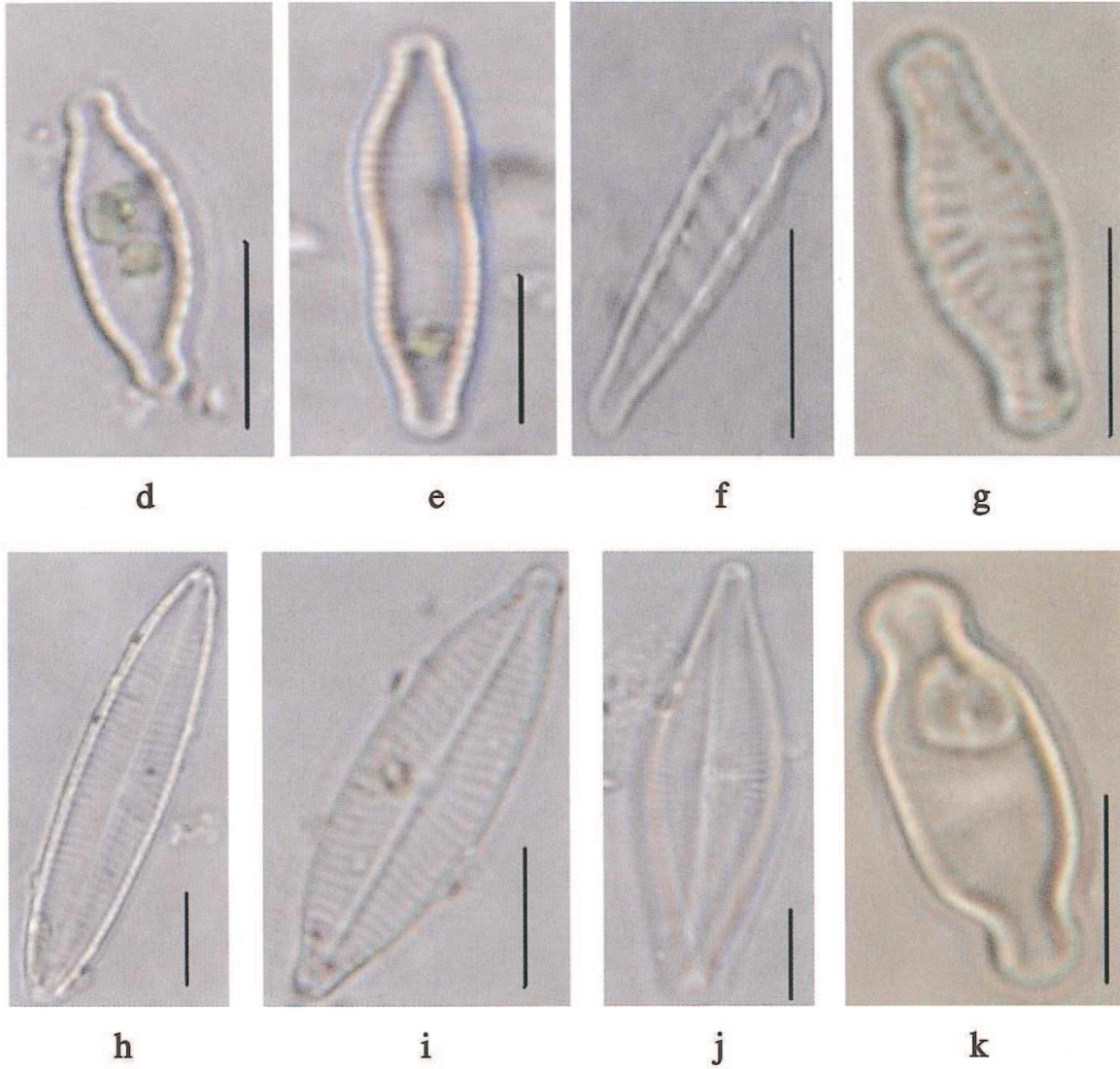


Figure 2. a. *Acanthoceras zachariasii*, b. *Melosira italica* subsp. *subarctica*, c. *Cyclotella ocellata*, d. *Fagilaria capucina* var. *capitellata*, e. *Fragilaria* sp., f. *Meridion circulare* var. *constricta*, g. *Hippodonta capitata*, h. *Navicula tripunctata*, i. *N. rostellata*, j. *N. trivialis*, k. *Placoneis elginensis* (Scale 10µm)

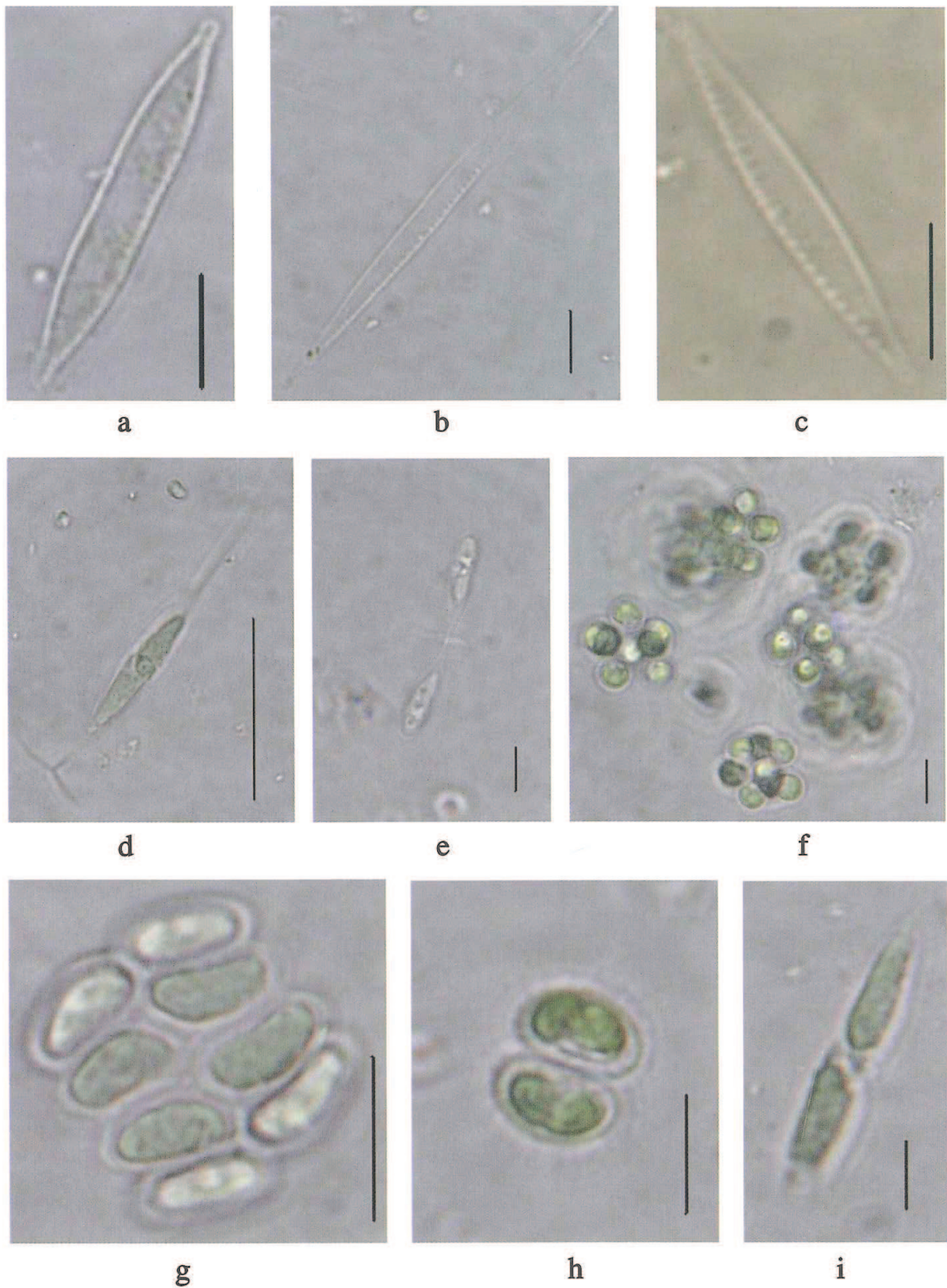


Figure 3. a. *Nitzschia capitellata*, b. *N. gracilis*, c. *N. paleacea*, d. *Ankyra judai*, e. *Paradoxia multiseta*, f. *Sphaerocystis planctonica*, g. *Scenedesmus disciformis*, h. *S. subspicatus*, i. *Elakatothrix gelatinosa* (Scale 10 $\mu$ m)

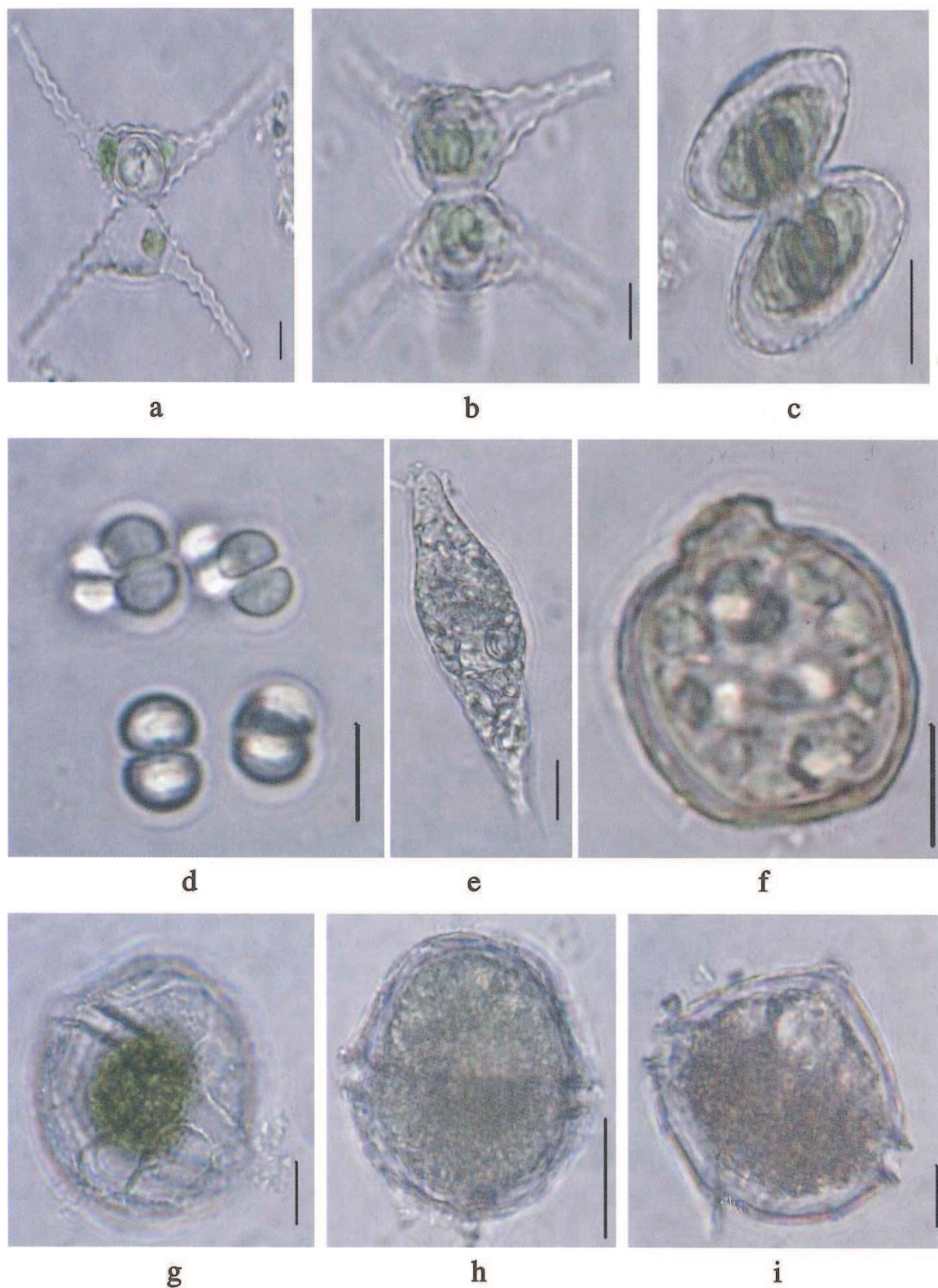


Figure 4. a. *Staurastrum chaetoceras*, b. *S. cyclacanthum*, c. *S. punctulatum*, d. *Chroococcus limneticus*, e. *Euglena clavata*, f. *Trachelomonas similis*, g. *Peridinium cinctum*, h. *Peridinium* sp., i. *Diplopsalis acuta* (Scale 10 $\mu$ m)

## Results and Discussion

The average concentrations, standard deviations, maximums and minimums of measured physico-chemical variables are listed in Table 1. İkizcetepeler reservoir is a man-made lake with an annual mean chlorophyll a concentration of  $4.2 \mu\text{g l}^{-1}$  and Secchi disk depth of 160 cm. Rast and Holland (39) give the boundary values of chlorophyll a and a Secchi disk depth for the trophic classification of lakes. According to these values, İkizcetepeler is a mesotrophic lake.

A total of 174 phytoplanktonic taxa were identified. *Ochrophyta* comprised 40 % (70 taxa) of the total taxa and were dominant in the phytoplankton. The remaining divisions were as follows: *Chlorophyta* 29 % (50 taxa), *Cyanobacteria* 9 % (15 taxa), *Euglenozoa* 8 % (14 taxa), *Charophyta* 7 % (13 taxa), *Myzozoa* 5 % (8 taxa) and *Cryptophyta* 2 % (4 taxa) (Figure 5). A list of phytoplankton is given in Table 2. Of these, 18 taxa which were determined as new records for Turkish freshwater algae was published (8) and were marked (\*\*) on Table 2.

Table 1. Physicochemical variables of İkizcetepeler reservoir waters.

Analyses	İkizcetepeler Reservoir		
	Min.	Max.	Mean±S.D.
pH	4.10	11.80	9.64±0.30
Total Dissolved Substance ( $\text{g l}^{-1}$ )	0.231	0.291	0.25±0.01
Temperature ( $^{\circ}\text{C}$ )	4.4	6.8	13.99±6.69
Conductivity (mS/cm)	0.244	0.405	0.33±0.05
Secchi Disc (cm)	70.0	340	160±66
SRP ( $\text{mg l}^{-1}$ )	0.060	0.644	0.24±0.08
$\text{SO}_4$ ( $\text{mg l}^{-1}$ )	18.28	38.39	30.76±5.59
$\text{NH}_4\text{-N}$ ( $\text{mg l}^{-1}$ )	0.018	0.339	0.098±0.078
$\text{NO}_3\text{-N}$ ( $\text{mg l}^{-1}$ )	0.735	2.600	2.03±0.55
$\text{NO}_2\text{-N}$ ( $\text{mg l}^{-1}$ )	0.013	0.111	0.049±0.023
Total nitrogen ( $\text{mg l}^{-1}$ )	2.27	13.40	4.97 ±2.66
Chl-a ( $\mu\text{g l}^{-1}$ )	0.6	18.5	4.21±2.56

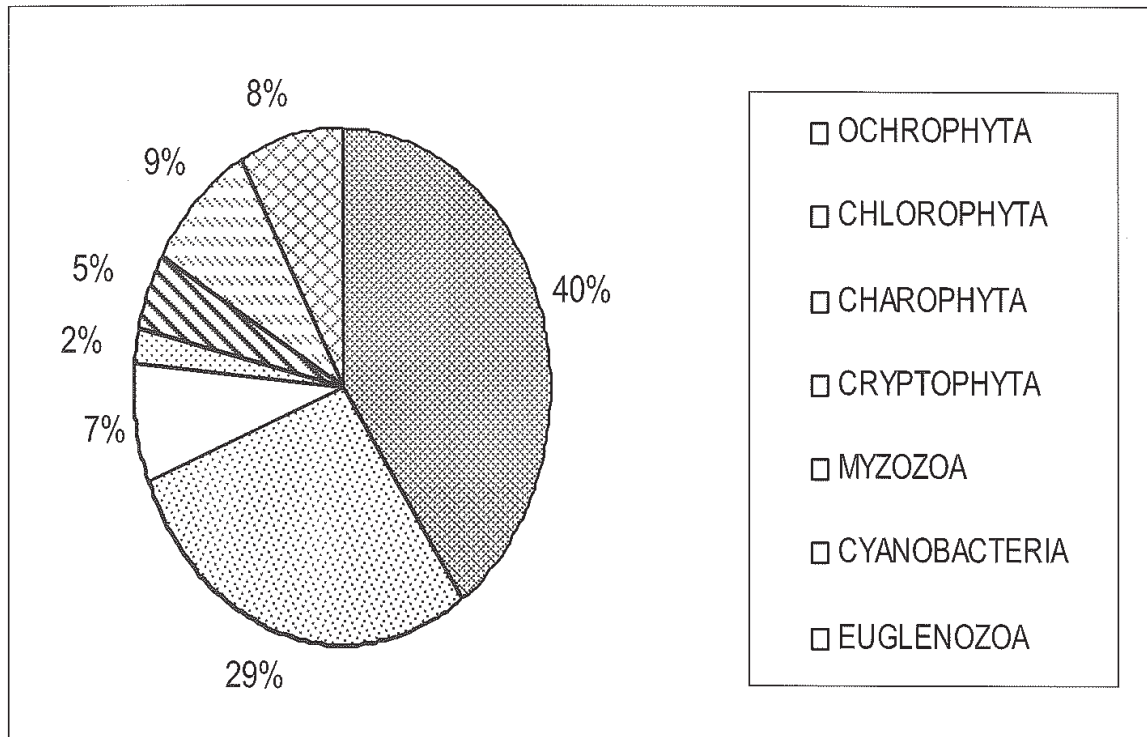


Figure 5. The phytoplankton composition of İkizcetepeler reservoir

Table 2. List of phytoplankton of İkizcetepeler reservoir (\*\* New records for Turkish freshwater algae)

#### OCHROPHYTA

##### BACILLARIOPHYCEAE

###### Aulacoseirales

*Aulacoseira granulata* (Ehrenberg) Simonsen

###### Chaetocerotales

*Acanthoceras zachariasii* (Brun) Simonsen

###### Meloseirales

*Melosira italica* (Ehr.) Kützing subsp. *subarctica*

O.F. Müller

*M. lineata* (Dillwyn) Agardh

###### Thalassiosirales

*Cyclotella meneghiniana* Kützing

*C. ocellata* Pantocsek

*Stephanodiscus neoastraea* Håkansson & Hickel \*\*

###### Achnanthes

*Cocconeis placentula* Ehrenberg

###### Bacillariales

*Amphora* sp.

*A. ovalis* (Kützing) Kützing

*Hantzschia amphioxys* (Ehrenberg) Grunow

*Navicula veneta* Kützing

*N. tripunctata* (O.F. Müller) Bory

*N. trivialis* Lange-Bertalot

*Neidium binodis* (Ehrenberg) Hustedt

*N. productum* (W. Smith) Cleve

*Pinnularia viridis* (Nitzsch) Ehrenberg var. *sudetica* (Hilse) Hustedt

*Sellaphora pupula* (Kützing) Mereschkovsky

###### Surirellales

*Cymatopleura solea* (Brébisson) W. Smith

*Surirella brebissonii* Kram. & Lange-Bert. var. *kuetzingii* Kram. & Lange-Bert.

*S. ovalis* Brébisson

###### Fragilariales

*Diatoma mesodon* (Ehrenberg) Kützing

*D. moniliformis* Kützing

*D. vulgaris* Bory de Saint-Vincent

*D. tenuis* C. Agardh

*Fragilaria* sp.

*F. berlinensis* (Lemmermann) Lange-Bertalot

*Fragilaria capucina* Desmazières

*Nitzschia acicularis* (Kützing) W. Smith

*N. amphibia* Grunow

*N. capitellata* Hustedt

*N. gracilis* Hantzsch

*N. palea* (Kützing) W. Smith

*N. paleacea* Grunow

*N. recta* Hantzsch

*N. sigmoidea* (Nitzsch) W. Smith

*Tryblionella calida* (Grunow in Cleve & Grun.)

D.G. Mann

### Cymbellales

*Cymbella affinis* Kützing

*C. amphicephala* Näegeli

*C. cistula* (Hemprich & Ehrenberg) O. Kirchner

*C. lanceolata* (Ehrenberg) Kirchner

*Encyonema silesiacum* (Bleisch) D.G. Mann

*Gomphonema augur* Ehrenberg

*G. minutum* (C. Agardh) C. Agardh

*G. olivaceum* (Hornemann) Brébisson

*G. parvulum* (Kützing) Kützing

*Placoneis elginensis* (Gregory) E.J. Cox

### Naviculales

*Craticula accomoda* (Hustedt) D.G. Mann

*Gyrosigma spencerii* (J.W. Bailey ex Quekett)

Griffith & Henfrey

*G. wansbeckii* (Donkin) Cleve \*\*

*Hippodonta capitata* (Ehr.) Lange-Bert., Metzeltin &

Witkowski

*Luticola nivalis* (Ehrenberg) D.G. Mann

*Navicula* sp.

*N. capitatoradiata* Germain

*N. constans* Hustedt var. *symmetrica* Hustedt \*\*

*N. cryptonella* Lange-Bertalot

*N. gregaria* Donkin

*N. rhyncocephala* Kützing

*N. rostellata* Kützing

### Sphaeropleales

*Ankistrodesmus* sp.

*Coelastrum microporum* Nägeli

*C. astroideum* De Notaris

*Kirchneriella contorta* (Schmi.) Bohlin var. *elegans*

(Playf.) Kom.\*\*

*Monoraphidium arcuatum* (Korshikov) Hindák

*M. circinale* (Nygaard) Nygaard

*F. capucina* var. *capitellata* (Grunow) Lange-Bertalot

*F. capucina* var. *perminuta* (Grunow) Lange-Bertalot

*F. delicatissima* (W.Sm.) Lange-Bertalot

*F. lata* (Cleve-Euler) Renberg

*Meridion circulare* (Greville) C.A. Agardh var.

*constricta* (Ralfs) Van Heurck

*Synedrella parasitica* (W. Smith) Round & Maidana

*Ulnaria acus* (Kützing) M. Aboal

*U. ulna* (Nitzsch) P. Compère

### **CHRYSOPHYCEAE**

#### **Chromulinales**

*Volvochrysis polyochla* Schiller

### **SYNUROPHYCEAE**

#### **Synurales**

*Mallomonas acaroides* Perty

*M. alpina* Pascher & Ruttner \*\*

### **CHLOROPHYTA**

#### **CHLOROPHYCEAE**

#### **Chlorellales**

*Actinastrum hantzschii* Lagerheim var. *subtile* J.

Woloszynska\*\*

*Coronastrum ellipsoideum* Fott

*Franceia ovalis* (Francé) Lemmermann

*Golenkiniopsis solitaria* (Korshikov) Korshikov

*Lagerheimia ciliata* (Lagerheim) Chodat

*L. subsalsa* Lemmermann

*Micractinium pusillum* Fresenius

*Mucidosphaerium pulchellum* (H.C. Wood) C. Bock,

Proschold & Krienitz

*Oocystis borgei* J. Snow

*O. parva* W. West & G.S. West

#### **Chlorococcales**

*Ankyra judai* (G.M. Smith) Fott

*Paradoxia multiseta* Svirenko

*Treubaria triappendiculata* C. Bernard

*C. depressum* (Nägeli) P. Lundell var. *planctonicum* Rever.

*C. pygmaeum* W. Archer

*C. sphalerostichum* Nordstedt \*\*

*C. tenue* W. Archer \*\*

*Staurastrum cingulum* (West & G.S. West) G.M. Smith

*S. chaetoceras* (Schröder) G.M. Smith

*S. cyclacanthum* W. West & G.S. West

*S. punctulatum* Brébisson ex Ralfs

*M. contortum* (Thuret) Komárková-Legnerová  
*Pediastrum boryanum* (Turpin) Meneghini  
*P. duplex* Meyen var. *rugulosum* Raciborski  
*P. simplex* Meyen  
*P. simplex* var. *echinulatum* Wittrock  
*Pseudoschroederia robusta* (O. Korshikov) E. Heg.&  
 E. Schnepf  
*Scenedesmus acuminatus* (Lagerheim) Chodat  
*S. obliquus* (Turpin) Kützing  
*S. bicaudatus* Dudesenko  
*S. communis* E.H. Hegewald  
*S. disciformis* (Chodat) Fott & Komárek  
*S. ellipticus* Corda  
*S. opoliensis* P.G. Richter var. *mononensis* Chodat  
*S. planctonicus* (Korshikov) Fott \*\*  
*S. pseudodenticulatus* E. Hegewald  
*S. smithii* Teiling \*\*  
*S. subspicatus* Chodat  
*Tetraedron minimum* (A. Braun) Hansgirg  
*T. regulare* Kützing var. *torsum* Brunenthaler  
*T. trilobatum* (Reinsch) Hansgirg \*\*  
*T. tumidulum* (Reinsch) Hansgirg \*\*  
*Tetrastrum komarekii* Hindák  
*T. staurogeniaeforme* (Schröder) Lemmermann  
*T. triangulare* (Chodat) Komárek  
**Tetrasporales**  
*Sphaerocystis planctonica* (Korshikov) Bourelly  
**Volvocales**  
*Carteria multifilis* (Fresenius) O. Dill  
*Chlamydomonas microsphaera* Pasc. & Jahoda var.  
*acuta* Bourre.  
*Chlamydomonas* sp.  
*Eudorina cylindrica* Korshikov  
*E. elegans* Ehrenberg  
*Pandorina morum* (O.F. Müller) Bory de Saint-  
 Vincent

**CHAROPHYTA****KLEBSORMIDIOPHYCEAE****Klebsormidiales***Elakatothrix gelatinosa* Wille**ZYGNEMATOPHYCEAE****Zygnematales***Mougeotia* sp.**Desmidiiales***Closterium* sp.**CRYPTOPHYTA****CRYPTOPHYCEAE****Cryptomonadales***Cryptomonas caudata* J. Massart \*\**C. ovata* Ehrenberg*C. pyrenoidifera* Geitler*Plagioselmis nannoplanctica* (H. Skuja) G. Novar.,  
Lucas & Morrall**MYZOOZA****DINOPHYCEAE****Gymnodiniales***Gymnodinium varians* Maskell \*\***Gonyaulacales***Ceratium hirundinella* (O.F. Müller) Dujardin**Peridinales***Diplopsalis acuta* (Apstein) Entz*Peridiniopsis cunningtonii* Lemmermann*Peridinium* sp.*P. oculatum* (F. Stein) Bourrelly \*\**P. polonicum* (Woloszynska) Bourrelly \*\**P. cinctum* (O.F. Müller) Ehrenberg**CYANOBACTERIA****CYANOPHYCEAE****Chroococcales***Chroococcus limneticus* Lemmermann*C. turgidus* (Kützing) Nägeli*Gomphosphaeria aponina* Kützing*Microcystis aeruginosa* (Kützing) Kützing*M. robusta* (Clark) Nygaard**Nostocales***Anabaena spiroides* Klebahn*Aphanizomenon flos-aquae* (Linna.) Ralfs ex Bornet  
& Flahault**Oscillatoriales***Arthrospira gigantea* (Schmidle) Anagnostidis*Phormidium limosum* (Dillwyn) P.C. Silva*Planktothrix* sp.**Pseudanabaenales***Pseudanabaena catenata* Lauterborn*Spirulina subtilissima* (Kützing) Gomont**Synechococcales***Aphanocapsa holsatica* (Lemmermann) G. Cronberg  
& J. Kom.*Merismopedia minima* Beck

*Cosmarium berryense* Kouwets \*\*  
*C. bioculatum* Brebis. ex Ralfs var. *depressum*  
 (Scha.) Schmi.  
*Merismopedia tenuissima* Lemmermann

## EUGLENOZOA

### EUGLENOPHYCEAE

#### Euglenales

*Euglena clavata* Skuja  
*E. gracilis* Klebs  
*E. hemichromata* Skuja  
*Strombomonas fluviatilis* (Lemmermann) Deflandre  
*S. schauinslandii* (Lemmermann) Deflandre  
*S. verrucosa* (Daday) Deflan. var. *zmiewika* (Svir.)  
 Defla.  
*Trachelomonas* sp.  
*T. granulosa* Playfair  
*T. hispida* (Perty) F. Stein  
*T. scabrata* (Playfair) Deflandre \*\*  
*T. similis* A. Stokes  
*T. spiculifera* Palmer  
*T. volvocina* Ehrenberg  
*T. volzii* Lemmermann var. *intermedia* Playfair

The highest number of species was recorded in summer while the lowest species richness was found in winter during the study period. In 2008 the highest number of taxa (42) was recorded in June. *Ochromyxa* was the dominant phytoplankton group showing the greatest species richness (70 taxa) with large contribution of *Naviculales* (19 taxa) and *Fragilariales* (15 taxa). Species numbers of *Bacillariophyceae* were high in winter and spring during the study period and reached a maximum in February 2008 with 33 taxa. *Navicula* was dominant genus and it was represented with 10 taxa. *Ulnaria acus* (*Fragilaria acus*), *Fragilaria berolinensis*, *Nitzschia palea*, *N. amphibia*, *N. acicularis*, *N. paleacea*, *Diatoma moniliformis*, *Navicula capitatoradiata*, *Surirella brebissonii* var. *kuetzingii* were widely found in winter and spring. *N. palea*, *N. acicularis*, *U. acus* were known to have a broad distribution in Turkey (40, 41). *Ulnaria*, *Fragilaria* and *Nitzschia* species were known as indicators of the eutrophic lakes (42, 43). *Cyclotella meneghiniana*, *C. ocellata*, *Stephanodiscus neoastraea* were widespread taxa in winter and spring while *Aulacoseira granulata* and *Melosira italica* subsp. *subarctica* were widespread in autumn during the study in centric diatoms. *C. meneghiniana* and *C. ocellata* were densely recorded in

Kurtboğazi (10), Çubuk-I (11) and Keban (44) reservoirs, Beytepe and Alap ponds (45), Hafik (46) and Simenit (47) lakes. Round (48) stated that *Cyclotella* species are bioindicators of transient phase from oligotrophic to eutrophic conditions. *Stephanodiscus* species were accepted as members of eutrophic conditions (49). *A. granulata* was accepted as a member of eutrophic conditions however, it has a wide range of tolerance and could be seen in different environmental conditions (50). This species was densely recorded in Demirköprü (16), İkizgöl (51), Hasan Uğurlu (17) and Suat Uğurlu (52) reservoirs. Hutchinson (53) stated that *Cyclotella*, *Stephanodiscus*, *Aulacoseira*, *Melosira*, *Fragilaria* and *Ulnaria* species were widespread in plankton. This may be attributed to the movement of cells away from bottom due to strong wind-driven water turbulence. *Chrysophyceae* and *Synurophyceae* were represented with 3 species (*Volvochrysis polyochla*, *Mallomonas acaroides* and *Mallomonas alpina*). *V. polyochla* was only found in April 2007. It was reported that both *M. acaroides* and *M. alpina* were widespread in eutrophic lakes (54).

The second dominant group was *Chlorophyta* (50 taxa) with large contribution of *Sphaeropleales* (30 taxa). Species numbers of *Chlorophyta* were high in summer and reached a maximum in June 2008 with 35 taxa. High water temperature and sufficient light contributes to the development of *Chlorophyta* (55). *Sphaeropleales* were mostly consisted of *Pediastrum* and *Scenedesmus* species. *Scenedesmus* was dominant genus and it was represented with 11 taxa. *Scenedesmus* and *Pediastrum* species were found in oligomesotrophic reservoirs in Turkey (20, 56). *Sphaerocystis planctonica*, *Pediastrum simplex* and *P. simplex* var. *echinulatum* were widespread in summer at 2007 and 2008. *P. simplex* was also an important component of plankton in Hasan Uğurlu (17) and Suat Uğurlu (52) reservoirs. It is known that *Chlamydomonas*, *Eudorina* and *Pandorina* (*Volvocales*) species were mostly found in shallow and nutrient rich waters (53). They were not significant in İkizcetepeler reservoir.

Species richness of *Cyanobacteria* increased in summer and reached a maximum in August at 2007 and 2008 with 6 taxa. It is reported that *Cyanobacteria* species are important component of plankton in summer and early autumn at eutrophic and mesotrophic lakes (57). Smith (58) showed that low light intensity and high temperature favored *Cyanobacteria* in lakes. *Aphanizomenon flos-aquae* and *Aphanocapsa holsatica* were significant at

spring and summer months. *A. holsatica* was a planktonic species shown in mezotrophic lakes (59). It was also recorded in Çaygören reservoir (60). *A. flos-aquae* was recorded in Demirköprü reservoir (16), Tahtalı reservoir basin (61) and Marmara lake (62).

Species numbers of *Euglenozoa* were high at 2007 and 2008 in summer and autumn. *Trachelomonas* was the most dominant genus with 8 species of this phylum. Especially *Trachelomonas volvocina*, *T. hispida* and *T. volzii* var. *intermedia* were the most common taxa found in summer and autumn. Hutchinson (53) pointed out that *T. volvocina* is widespread in the open water of lakes. *T. volvocina* was recorded in Yedigöller, Abant (63), Gököy (64) and Uluabat (65) lakes. *T. hispida* was recorded in İkizgöl (51) Gököy (64), Gölcük (66) lakes and Tahtalı reservoir basin (61). *Trachelomonas* was generally found in nutrient rich water (67).

*Charophyta* was represented with 13 taxa and species richness of this phylum increased in summer at both years. *Cosmarium* was the most dominant genus with 6 species of this phylum. *Cosmarium* species were widespread in summer. *Desmidiaceae* species were accepted as characteristic species of oligotrophic lakes (53). However it is known that *Desmidiaceae* members are common in eutrophic and mesotrophic lakes rather than oligotrophic lakes in Turkey (68).

*Myxozoa* and *Cryptophyta* were represented by 8 and 4 taxa, respectively. *Myxozoa* was mostly found in late spring to autumn in 2007 and 2008. *Ceratium hirundinella*, *Peridinium cinctum*, *Peridiniopsis cunningtonii* and *Diplopsalis acuta* were widespread taxa during those periods. Rawson (49) stated that *C. hirundinella* prefers mesotrophic conditions. *P. cinctum* and *C. hirundinella* was known to have a broad distribution in Turkey (40, 41). *Cryptophyta* was represented with 4 species. In this phylum *Plagioselmis nannoplanctica*, *Cryptomonas ovata* and *C. caudata* were widespread in different times of the study period. *C. ovata* was accepted as characteristic species of eutrophic conditions (69). *P. nannoplanctica* was recorded in Gököy lake (64) and Çaygören reservoir (60).

In İkizcetepeler reservoir, most phytoplankton species are cosmopolitan (40, 41); however 18 species are new records for Turkish freshwater algae (8). This study contributed to determine the distribution of algae in Marmara region however algal composition studies should be maintained. Base on the chlorophyll a concentration, Secchi disk depth values, other physicochemical

parameters and species composition results, İkizcetepeler reservoir could be a mesotrophic reservoir. It should be monitored periodically because of its importance as a freshwater source of Balıkesir city centre.

### Acknowledgements

We would like to thank to Osman ONGUN for helping the fieldwork. The support for this research came from Balıkesir University Research Foundation (Project Number: 2007/18).

### References

1. YERLİ S.V., KIVRAK E., GÜRBÜZ H., MANAV E., MANGIT F., TÜRKECAN O., Phytoplankton Community, Nutrients and Chlorophyll a in Lake Mogan (Turkey); with Comparison Between Current and Old Data, *Turk. J. Fish. Aquat. Sci.*, 12, 95-104, 2012.
2. MUNAWAR M., MUNAWAR I.F., The seasonality of phytoplankton in the North American Great Lakes, a comparative synthesis, *Hydrobiologia*, 138, 85-115, 1986.
3. TEUBNER K., Phytoplankton, pelagic community and nutrients in a deep oligotrophic alpine lake: ratios as sensitive indicators of the use of P-resources (DRP:DOP:PP and TN:TP:SRSI), *Water Research*, 37, 1583-1592, 2003.
4. ARHONDITSIS G.B., WINDER M., BRETT M.T., SCHINDLER D.E., Patterns and mechanisms of phytoplankton variability in Lake Washington (USA), *Water Research*, 38, 4013- 4027, 2004.
5. ERSANLI E., GÖNÜLOL A., Study on the phytoplankton and seasonal variation of lake Simenit (Terme – Samsun, Turkey), *Turk. J. Fish. Aquat. Sci.*, 3, 29-39, 2003.
6. BAYKAL T., AKBULUT A., AÇIKGÖZ İ., UDOH A.U., YILDIZ K., ŞEN B., New records for the freshwater algae of Turkey, *Turk J Bot.*, 33, 141-152, 2009.
7. SEVİNDİK (ONGUN), T., ÇELİK, K., GÖNÜLOL, A., Twenty-four new records for the freshwater algae of Turkey, *Turk J Bot.*, 34, 249-259, 2010.
8. SEVİNDİK (ONGUN), T., ÇELİK, K., GÖNÜLOL, A., Twenty new records for Turkish freshwater algal flora from Çaygören and İkizcetepeler reservoirs (Balıkesir, Turkey), *Turk. J. Fish. Aquat. Sci.*, 11, 399 -406, 2011.

9. ÖZER (BAYKAL) T., ERKAYA (AÇIKGÖZ) İ., UDOH A.U., AKBULUT A., YILDIZ K., ŞEN B., New records for the freshwater algae of Turkey (Tigris basin), *Turk J Bot.*, 36, 747-760, 2012.
10. AYKULU, G., OBALI, O., Phytoplankton biomass in Kurtboğazi dam lake, *Commun. Fac. Sci. Univ. Ankara*, 24, 29-45, 1981.
11. GÖNÜLOL, A., AYKULU, G., Çubuk-I baraj gölü algleri üzerine araştırmalar, I-Fitoplankton kompozisyonu ve yoğunluğunun mevsimsel değişimi, *Doğa Bilim Derg.*, 8,3, 330-342, 1984.
12. YILDIZ, K., Altınapa baraj gölü alg toplulukları üzerinde araştırmalar, Kısım I: Fitoplankton topluluğu, *Doğa Bilim Derg.*, A2, 9, 2, 419-426, 1985.
13. GÖNÜLOL, A., Studies on the phytoplankton of Bayındır dam lake, *Commun. de la Fac. Sci. d'Ank, serie C Biologie*, 3, 21-38, 1985.
14. ALTUNER, Z., GÜRBÜZ, H., A study on the phytoplankton of the Tercan dam lake, Turkey, *Turk J Bot.*, 18, 443 – 450, 1994.
15. YAZICI, N., GÖNÜLOL, A., Suat Uğurlu baraj gölü (Çarşamba, Samsun – Türkiye) fitoplanktonu üzerinde floristik ve ekolojik bir araştırma, *E.Ü. Su Ürün. Derg.*, 11, 42-43, 71 – 93, 1994.
16. ŞIPAL (GEZERLER), U., BALIK, S., USTAOĞLU, M.R., Demirköprü baraj gölünün (Salihli-Manisa) fitoplanktonu, **II. Uluslar arası Su Ürünleri Sempozyumu**, İ. Ü. Su Ürün. Fak., İstanbul, 1996.
17. GÖNÜLOL, A., OBALI, O., A study on the phytoplankton of Hasan Uğurlu dam lake (Samsun – Turkey), *Turk J Biol.*, 22, 447 – 461, 1998.
18. ATICI, T., Sarıyar barajı planktonik algleri, Kısım II – *Chlorophyta*, **Eğirdir Su Ürün. Fak. Derg.**, 8, 128 – 151, 2003.
19. ALBAY, M., AKÇAALAN, R., Factors influencing the phytoplankton steady state assemblages in a drinking-water reservoir (Ömerli reservoir, Istanbul), *Hydrobiol.*, 502, 85-95, 2003.
20. KIVRAK, E., GÜRBÜZ, H., Seasonal variations in phytoplankton composition and physical-chemical features of Demirdöven reservoir, Erzurum, Turkey, *Biologia*, 60,1, 1 – 8, 2005.
21. TAŞ, B., GÖNÜLOL, A., Derbent baraj gölünün (Samsun, Türkiye) planktonik algleri, *J of Fish. Sci.*, 1, 3, 111 – 123, 2007.
22. DSİ., İkiztepeliler ve Çaygören II. Aşama Projesi Planlama Revizyon Raporu, DSİ, Ankara. 502, 85 – 95, 1987.
23. APHA (American Public Health Association), **Standard Methods for the Examination of Water and Wastewater**, 19th Edition, Washington, D.C., 1995.

24. BATTARBEE, R.W., Diatom analysis in: Berglund, B.E. (Ed.), *Handbook of Holocene Paleoecology and Paleohydrology*, Wiley & Sons, London, 527–570, 1986.
25. ROUND, F.E., CRAWFORD, R.M., MANN, D.G., *The Diatoms: Morphology and Biology of the Genera*, Cambridge University Press, Cambridge, 747p., 1990.
26. SIMS, P.A., *An Atlas of British Diatom*, Biopress Ltd., 601pp, 1996.
27. KRAMER, K., LANGE–BERTALOT, H., *Bacillariophyceae*. 1. *Naviculaceae* in: *Sü\_wasserflora von Mitteleuropa*, Stuttgart, New York, Gustav Fischer Verlag, 2/1, 876 pp, 1986.
28. KRAMER, K., LANGE-BERTALOT, H., *Bacillariophyceae*. 3. *Centrales, Fragilariaceae, Eunoticeae* in: *Sü\_wasserflora von Mitteleuropa*, Stuttgart, New York, Gustav Fischer Verlag, 2/3, 577p., 1991.
29. HUBER–PESTALOZZI, G., *Das Phytoplankton des Süßwassers*, (Die Binnengewässer, Band XVI). Teil 2. (i) Chrysophyceen, Farblose Flagellaten Heterokonten. E. Schweizerbart'sche Verlag-sbuchhandlung. Stuttgart, 1941.
30. HUBER–PESTALOZZI, G., *Das Phytoplankton des Süßwassers*, 3 Teil. Cryptophyceen,, Chloromonadien, Peridineen. In: A. Thienemann (Ed), *Die Binnengewässer*, E. Schweizerbart'sche Verlagsbuchhhandlung. Stuttgart, 1950.
31. HUBER–PESTALOZZI, G., *Das Phytoplankton des Süßwassers*, (Die Binnengewässer, Band XVI). Teil 5. Chlorophyceae, Ordnung: Volvocales. E. Schweizerbart'sche Verlagsbuchhandlung. Stuttgart, 1961.
32. HUBER–PESTALOZZI, G., *Das phytoplankton des süßwassers systematik und biologie*, 1. Teil, Blaualgen, E. Schweizerbarth'sche Verlagsbuchhandlung (Nagele u. Obermiller). Stuttgart, 1962.
33. HUBER–PESTALOZZI, G., *Das phytoplankton des süßwassers systematik und biologie*, 4. Teil, Euglenophycean, E. Schweizerbarth'sche Verlagsbuchhandlung (Nagele u. Obermiller). Stuttgart, 1969.
34. HUBER–PESTALOZZI, G., *Das phytoplankton des süßwassers systematik und biologie*, 8. Teil, 1.Halffe Conjugatophyceae Zygnematales und Desmidiales (excl. Zygnemataceae), E. Schweizerbarth'sche Verlagsbuchhandlung (Nagele u. Obermiller). Stuttgart., 1982.
35. HUBER–PESTALOZZI, G., *Das phytoplankton des süßwassers systematik und biologie*, 7. Teil, 1.Halffe Chlorophyceae (Grünalgen) Ordnung: Chlorococcales, E. Schweizerbarth'sche Verlagsbuchhandlung (Nagele u. Obermiller). Stuttgart., 1983.

36. JOHN, D.M., WHITTON, B.A., BROOK, A.J., *The Freshwater Algal Flora of the British Isles: An Identification Guide to Freshwater and Terrestrial Algae*, The Natural History Museum and The British Phycological Society, Cambridge University Press, 702 pp, 2003.
37. KOMÁREK, J., ANAGNOSTIDIS, K., *Cyanoprokaryota, 2. Teil/Part 2: Oscillatoriales, Süswasser Flora von Mitteleuropa (Freshwater Flora of Central Europe)*, 759 pp, 2008.
38. STRICKLAND J.D.H., PARSSONS T.R., *A Practical Handbook of Seawater Analysis*, 2<sup>nd</sup> Ed. Bull. Fish. Res. Board. Can., Canada. 311p., 1972.
39. RAST W., HOLLAND M., *Eutrophication of lakes and reservoirs: a framework for making management decisions*, *Ambio*, 17, 2-12, 1988.
40. GÖNÜLOL, A., ÖZTÜRK, M., ÖZTÜRK, M., *A check-list of the freshwater algae of Turkey*, *O.M.Ü. Fen Edb. Fak, Fen D.*, 7, 1, 8 – 46, 1996.
41. AYSEL, V., *Check-List of the Freshwater Algae of Turkey*, *J. Black Sea/Medit. Environ.*, 11, 1, 1 – 124, 2005.
42. REYNOLDS, C.S., *The ecology of freshwater phytoplankton*, Cambridge Univ. Press, Cambridge., 1984.
43. MOSS, B., *Ecology of freshwaters*, Third edition, Blackwell Science, Oxford., 2001.
44. ÇETİN, K., ŞEN, B., *Diatoms (*Bacillariophyta*) in the phytoplankton of Keban reservoir and their seasonal variations*, *Turk J Bot.*, 22, 25 – 34, 1998.
45. ÜNAL, Ş., *Beytepe ve Alap göletlerinde fitoplanktonun mevsimsel değişimi*, *Doğa Bilim Derg.*, 8, 1, 121-137, 1984.
46. KILINÇ, S., *A study in the seasonal variation of phytoplankton in Hafik lake (Sivas, Turkey)*, *Turk. J Bot*, 22, 35 – 41, 1998.
47. ERSANLI, E., GÖNÜLOL, A., *Study on the phytoplankton and seasonal variation of lake Simenit (Terme-Samsun, Turkey)*, *Turk. J. Fish. Aquat. Sci.*, 3, 29 – 39, 2003.
48. ROUND, F.E., *The phytoplankton of their water supply reservoir note Central Wales*, *Arch. F. Hydrobiol.*, 220-232, 1956.
49. RAWSON, D.S., *Algal indicators of trophic lake types*, *Limnology and Oceanography*, 4, 386-398, 1956.
50. ROUND, F.E., *The Ecology of the Algae*, Cambridge University Press, Cambridge, 1981.

51. ŞİPAL (GEZERLER), U., BALIK, S., USTAOĞLU, M.R., İkizgöl'ün (Bornova, İzmir) mikro ve makro alg florası, *Su Ürün. Derg.*, 13, 1-2, 183 – 190, 1996.
52. GÖNÜLOL, A., OBALI, O., Seasonal variations of phytoplankton in Suat Uğurlu (Samsun), *Turk J Bot.*, 22, 93 – 97, 1998.
53. HUTCHINSON, G.E., *A Treatise on Limnology*, Vol: II, introduction to lake biology and the limnoplankton, John Wiley and sons. inc., 115 pp, Newyork, London, Sydney, 1967.
54. SIVER, P.A., *The Biology of Mallomonas: Morphology, Taxonomy and Ecology*, Kluwer, Dordrecht, 230 p., 1991.
55. HAPPEY-WOOD C.M., Ecology of freshwater planktonic green algae, in: *Growth And Reproductive Strategies of Freshwater Phytoplankton* (Ed. by C. D. Sandgren), pp.103-133. Cambridge University Press, New York., 1988.
56. İŞBAKAN (TAŞ), B., GÖNÜLOL, A., TAŞ, E., A study on the seasonal variation of the phytoplankton of lake Cernek (Samsun-Turkey), *Turk. J. Fish. Aquat. Sci.*, 2, 121-128, 2002.
57. TRIFONOVA, I.S., Phytoplankton composition and biomass structure in relation to trophic gradient in some temperate and subarctic lakes of north-western Russia and the Prebaltic., *Hydrobiol.*, 370, 99 – 108, 1998.
58. SMITH V. H. Light and nutrient effects on the relative biomass of blue-green algae in lake phytoplankton, *Canadian Journal of Fisheries and Aquatic Sciences*, 43, 143-153, 1986.
59. SHEATH, R., STEINMAN, G.A., checklist of freshwater algae of the Northwest Territories, Canada, *Canadian J Bot.*, 60, 1964 – 1997, 1982.
60. SEVINDİK (ONGUN), T., Phytoplankton composition of Çaygören reservoir, Balıkesir-Turkey, *Turk. J. Fish. Aquat. Sci.*, 10, 295-304, 2010.
61. BALIK, S., ŞİPAL (GEZERLER), U., Tahtalı baraj havzasının (Gümüldür-İzmir) makro ve mikro alg florası, *II. Ulusal Ekoloji ve Çevre Kongr. Bildirileri*, Ankara, 483-492, 1995.
62. CİRİK (ALTINDAĞ), S., Manisa-Marmara gölü fitoplanktonu, I-Cyanophyta, *Doğa Bilim Derg.*, 6, 3, 67 – 81, 1982.
63. ATICI, T., OBALI, O., Yedigöller ve Abant gölü (Bolu) fitoplankton'unun mevsimsel değişimi ve klorofil-a değerlerinin karşılaştırılması, *E.Ü. Su Ürün. Derg.*, 19, 3-4, 381-389, 2002.
64. ÇELEKLI, A., ALBAY, M., DÜGEL, M., Phytoplankton (except *Bacillariophyceae*) flora of lake Gököy (Bolu), *Turk J Bot.*, 31, 49 – 65, 2007.

65. KARACAOĞLU, D., DERE, Ş., DALKIRAN, N., A taxonomic study on the phytoplankton of lake Uluabat (Bursa), **Turk. J Bot**, 28, 473-485, 2004.
66. CİRİK, S., CİRİK, Ş., Gölçük'ün (Bozdağ/İzmir) planktonik algleri, **İ.Ü. Su Ürün. Derg.**, 3, 1-2, 131-150, 1989.
67. YAMAGISHI, T., The *Euglenophyceae* from Brophet in the Central Plain of Thailand, **Gen Educ Rev Coll Agr & Vet Med Nihon Univ.**, 23, 39-51, 1987.
68. GÖNÜLOL, A., ÇOMAK, Ö., Bafra Balık gölleri (Balık gölü, Uzungöl) fitoplanktonu üzerinde floristic arařtırmalar III-*Chlorophyta*, **Doğa, Turk J Bot.**, 17, 227-236, 1993.
69. HUTCHINSON, G.E., **A Treatise on Limnology**, Vol: I, Geopraphy, Physics and Chemistry, John Wiley and sons. inc., Newyork, London, Sydney, 1957.