Turkish Journal of Fisheries and Aquatic Sciences 3: 29-39 (2003)

Study on the Phytoplankton and Seasonal Variation of Lake Simenit (Terme – Samsun, Turkey)

Elif Ersanlı[1,]*, Arif Gönülol[1]

[1]Ondokuz Mayıs University, Science and Arts Faculty, Department of Biology, 55139 Kurupelit, Samsun, Turkey

*Corresponding Author: Tel.: + 90. 362. 457 60 20 / 5430; Fax: +90. 362. 457 60 81;
E-mail: eliftez@omu.edu.tr

Received 30 May 2003
Accepted 11 December 2003

Abstract

The composition and seasonal variations of phytoplankton in Lake Simenit were studied between june 2000 to may 2001. 175 taxa belonging to the Cyanoprokaryota, Bacillariophyta, Chlorophyta, Cryptophyta, Dinophyta, Euglenophyta and Xanthophyta divisions were identified. In the phytoplankton species belonging to the genera of *Chaetoceros, Cyclotella, Cocconeis, Scenedesmus, Anabaena, Euglena, Trachelomonas* caused water blooms in certain months.

The Lake water was light alkaline and ıt was varied between hardness and very hardness water groups. The temperature and nutrient levels affected the composition and seasonal variations of phytoplankton.

Key Words: Algae, Phytoplankton, Seasonal variation, Lake Simenit

Introduction

In limnological studies, to determine of water quality in lake, stream, river and to identify of algae that composed of primer productivity and to obtain this continuity are well important. Studies showed that most of the algae were a great deal sensitive to the varying environment condition. That is to say, negative changes in algae composing the primary productivity effects all living creatures. Therefore algae that composed the first ring of food chain should be examined taxonomically and ecolocically. Also composition, quantity, seasonal variation of the algae and the factors that affected the seasonal variation should be examined.

Of the lakes in the Kızılırmak delta, located the west of Samsun, the Bafra Fish Lakes (Balık Gölü, Uzungöl) (Gönülol and Çomak, 1992a; 1992b; 1993a; 1993b), Lake Karaboğaz (Arslan, 1998) and Lake Cernek (İşbakan *et al.*, 1998) were examined in floristik composition and seasonal variations. The floristik composition and seasonal variations of Akgöl, of the lakes located in the Yeşilırmak delta and composing the Terme lagunal complex, were also examined (Şehirli, 1998). The main purpose of this study is to determine the phytoplankton composition and seasonal variations of the Lake Simenit (Figure 1).

Materials and Methods

Lake Simenit is located between 41°16’ north and 36°47’ east circle of latitudes in Gölyazı city of Terme district in Samsun. Also it is called Simenlik, Karasu or Arapsazı Lake. Its area is 80 hectare, maximum depth is 0.5-1.5 m. Its depth sometimes reaches 2 m in winter (Anonymous, 1995). Lake Simenit reaches the sea through a very narrow streat, called Karaboğa clearance, on its west end, and is linked to Akgöl through a channel on its south end. The lake is fed with groundwater and rain. Water resources feeding the lake dry entirely in summertime (Anonymous, 1989).

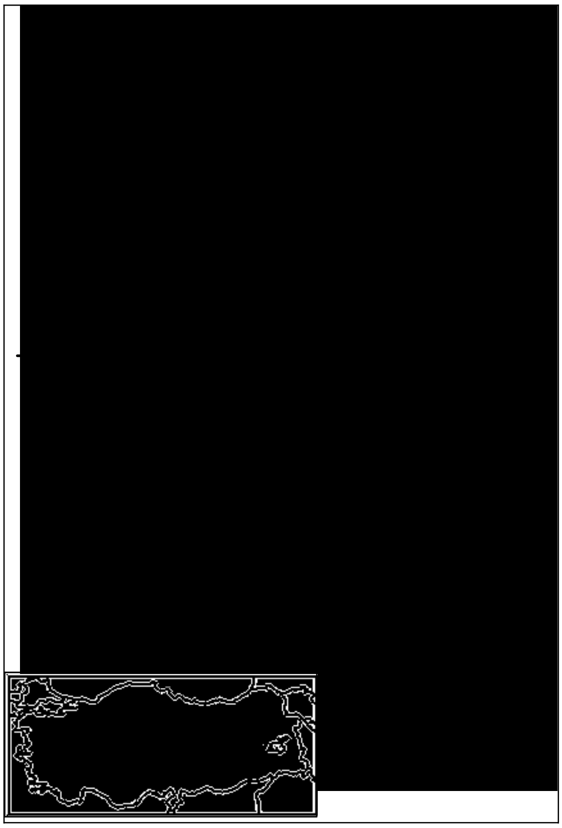

Figure 1. The geographical location of Lake Simenit and the sampling stations.

Four stations were chosen from the Lake Simenit to examine phytoplankton and its seasonal variation. The first station (st. 1) is located on the channel linking Akgöl to lake Simenit (41°17’28’’ N, 36°51’45’’ E). Both sides of the channel is coated with reeds. The second station (st. 2) is middle of the lake (41°18’00’’ N, 36°55’44’’ E) and is the deepest area of the lake. The depht is 0.5 m in summertime and it reaches 2 m in winter, when rainfall is much greater. The sediment is coated with sludge and mud. The third station (st. 3) is located in the area that first gets narrow and then enlarges northward (41° 18’19’’ N, 36° 55’0.8’’ E). The fourth station (st. 4) is opposite to the channel relates the lake to the Black Sea (41°18’50’’ N, 36°51’11’’ E). The strait is sometimes blocked with sand that is accumulated by waves. It is linked to the sea through a very narrow channel in winter, when rainfall is a great deal.

The samples were collected monthly from surface of st. 1, 3, 4 and from surface and 1 m depth of the st. 2 by using a 2 litres capacity Hydro-Bios water sampler. The algae were identified and counted using an inverted microscope according to the method of Lund *et al*. (1958). At the counting process, every colony and threadlike organism was considered to be an individual unit. The water samples were filtered using Whatman GF/A glass fibre filter paper with a pore size of 55 µm and the residue on the filter paper was used to identify all of the algae except Bacillariophyta. Bacillariphyta members were identified on permanent slides which had been prepared according to the method of Round (1953).

At the time of sampling, the water temperature and amount of dissolved oxygen were measured by using a model of YSI 51B oxygenmeter ; conductivity was measured by using PW 9529 model conductivity meter in all stations between september 2000 to may 2001. Other chemical analyses were performed according to the standart methods (Apha, Awwa, Wpcf, 1992) in st. 2 and 4.

The taxonomic idetification of algae Krammer, K. and Lange-Bertalot, H. 1986, 1991a, 1991b; 1999; Komarek *et al*., 1998; Huber Pestalozzi, 1969; 1972; 1983 were used. And also all the species are checked in algaebase cite (Guiry and Nic Dhonncha, 2003).

Results

Environmental Conditions

The water temperature, conductivity, and amount of the dissolved oxygen measuring in all stations are presented in Table 1., some chemical properties measuring in st. 2 and 4 are showed in Table 2-3.

Table 1. Temperature, conductivity and amount of dissolved oxygen (DO) at the sampling stations.

Dates of sampling	Station 1.			Station 2.			Station 3.			Station 4.		
	Temp. (°C)	Cond. (ms)	DO (mg/l)	Temp. (°C)	Cond. (ms)	DO (mg/l)	Temp. (°C)	Cond. (ms)	DO (mg/l)	Temp. (°C)	Cond. (ms)	DO (mg/l)
19 Sep. 2000	21.5	8.2	9.4	22.0	7.8	10.0	22.0	8.1	9.8	22.0	8.2	10.0
22 Oct. 2000	20.0	4.8	7.0	21.0	5.4	7.8	17.5	7.1	7.6	18.0	7.7	7.8
16 Nov. 2000	12.0	5.9	9.2	14.0	5.5	9.8	13.0	6.4	9.0	13.0	6.8	8.8
25 Dec. 2000	10.5	0.6	9.0	10.0	0.6	9.2	13.0	1.0	9.4	11.0	1.2	9.8
25 Jan. 2001	6.0	0.8	8.6	11.0	1.2	10.4	8.5	1.4	9.8	6.0	1.8	10.4
28 Feb. 2001	10.0	0.4	8.6	12.0	0.6	8.2	11.0	0.8	8.8	10.0	1.0	8.0
23 Mar. 2001	16.5	3.3	7.2	17.0	3.9	5.0	17.0	5.1	6.0	16.0	6.1	5.8
26 Apr. 2001	20.0	1.0	3.8	18.5	4.4	6.2	19.0	3.4	7.2	18.0	4.7	7.2
21 May.2001	25.0	0.4	5.0	24.5	4.6	5.4	24.0	4.8	5.2	24.5	4.4	3.6

Table 2. Some chemical analyses of the surface water of the lake at station 2.

Dates of sampling	Analises						
	pH	DO (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Chloride (mg/l)	Total hardness (FS°)
19 Sep. 2000	7.65	10.0	0.19	0.22	207.36	20.28	113.60
22 Oct. 2000	7.97	7.8	0.00	0.10	606.72	14.79	78.00
16 Nov. 2000	8.16	9.8	0.01	0.00	529.92	101.41	74.40
25 Dec. 2000	8.65	9.2	0.08	1.15	660.48	10.14	82.00
25 Jan. 2001	8.37	10.4	0.19	0.11	216.96	22.82	30.80
28 Feb. 2001	7.85	8.2	0.12	0.00	174.72	1.41	26.00
23 Mar. 2001	8.26	5.0	0.04	0.11	405.12	67.61	58.40
26 Apr. 2001	8.05	6.2	0.00	0.00	310.14	20.30	40.13
21 May. 2001	8.72	5.4	0.21	0.00	240.00	83.38	35.60

Table 3. Some chemical analyses of the surface water of the lake at station 4.

Analyses Months	pH	Dissolved oxygen (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Chloride (mg/l)	Total hardness (FS°)
19 Sep. 2000	7.86	10.0	0.00	0.00	211.20	5.60	94.00
22 Oct. 2000	8.10	7.8	0.00	0.00	737.28	19.72	94.00
16 Nov. 2000	8.39	8.8	0.00	0.00	618.24	121.69	84.80
25 Dec. 2000	8.56	9.8	0.10	1.13	491.52	16.34	60.80
25 Jan. 2001	8.51	10.4	0.01	0.00	385.92	34.65	50.00
28 Feb. 2001	7.80	8.0	0.03	0.36	205.44	2.25	29.60
23 Mar. 2001	8.30	5.8	0.00	0.14	520.32	104.23	78.80
26 Apr. 2001	8.10	7.2	0.00	0.00	380.90	40.12	50.21
21 May. 2001	8.50	3.6	0.17	0.00	301.44	70.70	44.40

The Composition of Phytoplankton

The phytoplankton of Lake Simenit consisted of 175 taxa belonging to Cyanoprokaryota, Bacillariophyta, Chlorophyta, Cryptophyta, Dinophyta, Euglenophyta and Xanthophyta divisions.

The list of recorded taxa are presented according to related literatures and alphabetical order in Table 4.

Seasonal Variations of Phytoplankton

The seasonal variations of phytoplankton in Lake Simenit were investigated by dividing them into 4 seasonal groups.

Summer Months

Bacillariophyta was dominant in june at all stations. *Cylotella glomerata* and *C. meneghiniana* were found to be dominant at st. 1, 3 and 4. 61% of the total 8275 cells/ml were *Navicula notha* at surface of st. 2.

In july, while Euglenophyta was found to be dominant at st. 1, 2 and 3, Cyanoprokaryota was dominant at st. 4. At st. 1, 17.2% of the total 3775 cells/ml was *Trachelomonas oblonga*. At the surface of st. 2, 17% of the total 4401 cells/ml and at 1m deep of st. 2, 16% of the total 4126 cells/ml were *T. curta*. 16.3% of the total 3675 cells/ml were *Phacus curvicauda* at st. 3, 18% of the total 2075 cells/ml were *Oscillatoria planctonica* in st. 4.

In august, Bacillariophyta was dominant at st. 1 and Euglenophyta was dominant at the other stations. *Cyclotella distinguenda* made up 24% of the total 2057 cells/ml at st. 1. *T. oblonga*, *T. verrucosa*, *T. curta* were dominant species 14.1-27.3% of the total organisms at st. 2, 3 and 4 in this months.

Melosira varians, *Gomphonema ventricosum*, *Colacium simplex*, *Euglena oblonga*, *Chroococcus pallidus, Scenedesmus obtusus* and *Tetraedron minimum* were the other organisms found in low numbers in the summer months.

Autumn Months

Bacillariophyta was dominant at all stations in september and october. *Nitzchia reversa* consisted of 18.4-27.5% of the total organisms at stations. *Chaetoceros constrictum* was the dominant organism, made up 11-47% of the total organisms at stations in october.

In november while *C. constrictum* was the dominant species at st. 2 and 3, *Nitzschia acicularis* var. *typica* was dominant at st. 4. In this month, *Colacium simplex* was 19% of 5400 cells/ml, dominant organism at st. 1.

In addition, *Navicula notha*, *Nitzschia acicularis* var. *typica*, *Chroococcus minor*, *Merismopodia punctata*, *Microcystis aeruginosa*, were rarely present in the autumn months.

Winter Months

In december, while Euglenophyta was the dominant at stations, Cyanoprokaryota was subdominant. *Colacium simplex* made up 12-54.5% of the total organisms. *Microcystis aeruginosa* was 6.9-13.5% of the total organisms at st. 1, surface of st. 2 and st. 3. At 1 m deep of st. 2 and st. 4, 5.5-7.5% at the total organisms were *Chroococcus. minor*.

In january, Euglenophyta was dominant. In this month, 16.9-36.6% of the total organisms consisted of *Colacium simplex*, 9.7-25.4% *Trachelomonas pulcherrima* var. *minor*. Also, *Scenedesmus ecornis* was 8.3% at st. 1, *S. communis* was 10.2% at st. 2 surface and 1 m, *Gomphonema truncatum* was 11.1% at st. 3, *M. aeruginosa* was 12.2% of the total organisms at st. 4.

In february, while Euglenophyta was dominant, at st. 1, 1 m deep of st. 2 and st. 4, Bacilariophyta was dominant at surface of st. 2, Chlorophyta was dominant at st. 3. *T. pulcherrima var. minor* was 16% of the total 4952 cells/ml at st. 1, 44.6% of 5602 cells/ml at 1m deep of st. 2, 17.8% of 1401 cells/ml at st. 4. At surface of st. 2, while *Fragilaria ulna* was dominant *Stichococcus subtilis* was subdominant organisms. At st. 3, *S. subtilis* was dominant, *F. ulna* was subdominant.

Aulacoseira perglabra, *Amphora commutata*, *A. ovalis*, *Cocconeis neodiminuta* and *Oscillatoria planctonica* were present in low numbers in the winter months.

Spring Months

In march, *Scenedesmus communis* was dominant organism made up 22-33.8% of the total organisms at the stations. At st. 2. and 4, *S. obtusus*, at st. 1 *F. ulna*, at st. 3, *Chroococcus dispersus* were subdominant organisms.

In april, as Chlorophyta was dominant again at st. 1, Cyanoprokaryota was dominant at the other stations. In this month *Microspora stagnorum* was 28% of 4320 cells/ml, 12% *S. communis* at st. 1. *Anabaena spiroides* was dominant organism at the other stations.

In may, *C. meneghiniana* at st. 1 and 4, *Euglena pisciformis* at surface of st. 2, *A. spiroides* at st. 3 were dominant organisms. On the other hand subdominant organisms were different species at stations (alternately of stations, *S. subtilis*, *T. dybowski*, *E. pisciformis*, *Coleochaete nitellarum*).

Amphora commutata, *Nitzschia reversa*, *Cocconeis placentula*, *Gyrosigma attenuatum*, *Peridinium cinctum*, *Trachelomonas curta* were the other organisms found in low numbers in the spring months.

Seasonal variations of the total organism numbers at phytoplankton are in Figure 2, seasonal variations of divisions of Bacillariophyta, Euglenophyta, Cyanoprokaryota and Chlorophyta are in Figure 3 and seasonal variations of some important species and genera are in Figure 4-6.

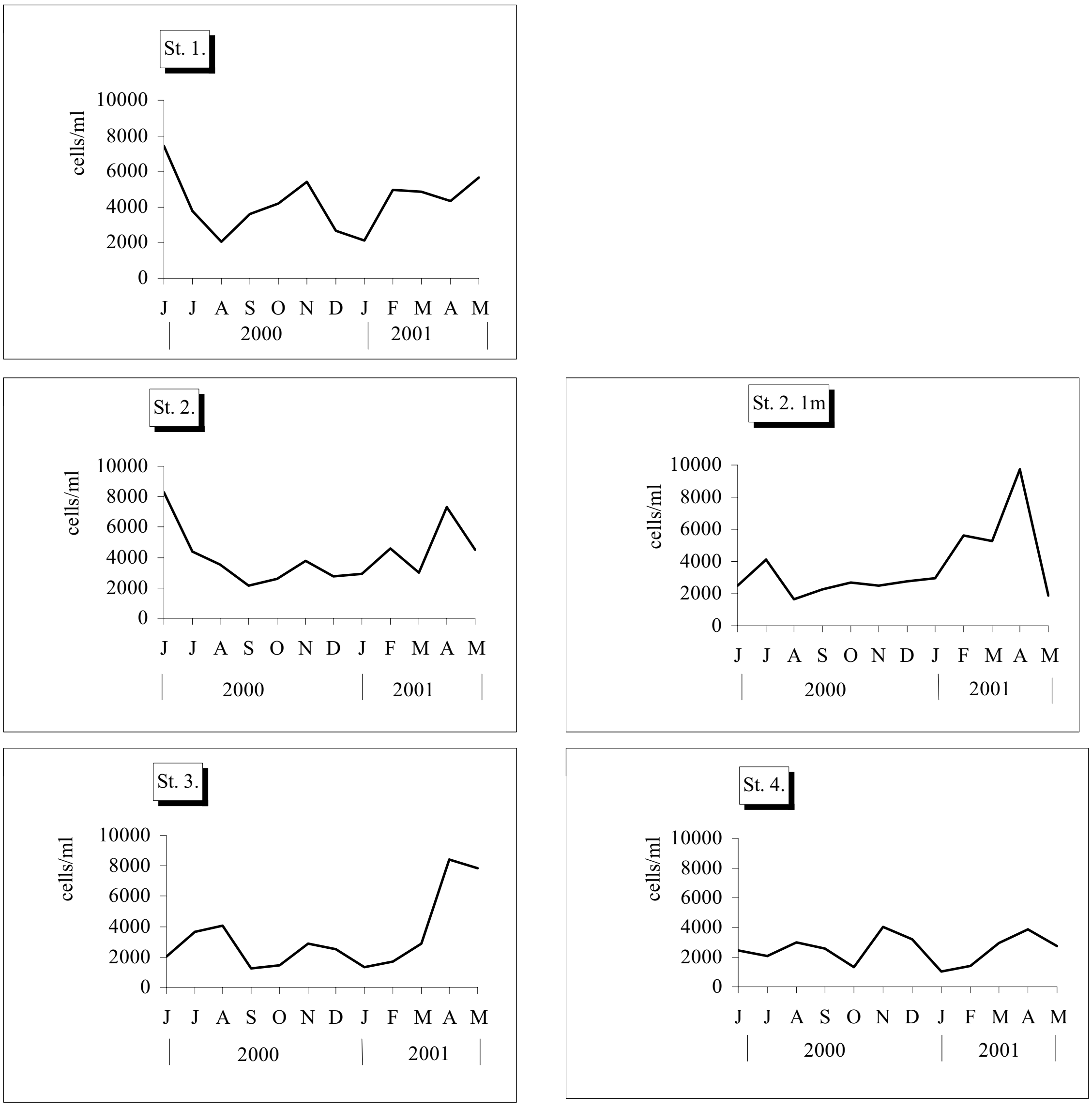

Figure 2. The seasonal variations of total cells/ml at stations.

Table 4. The list of recorded taxa.

Divisio : CYANOPROKARYOTA
Anabaena circinalis Robenh.
Anabaena flos-aquae (Lyngb.) Breb. ex Bornet & Flahault
Anabaena füellebornii Sch.
Anabaena ovalisporum Forti
Anabaena spiroides Kleb.
Anabaena zinserlingii Kossinskaja
Anabaenopsis arnoldii Aptekar
Anabaenopsis circularis (G.S.West) Wol et. Mill.
Anabaenopsis tanganyikae (G.S.West) Wol.
***Arthrospira major* (Kütz.) Crow**
Aphanizomenon aphanizomenoides (Forti) Hort.& Komarek
Aphanizomenon flos-aquae (Linn.)Ralfs ex Bornet & Flahault
Aphanothece microscopica Naeg.
***Chroococcus diminiatus* (Kütz.) Naeg.**
Chroococcus dispersus (Keissl) Lemm.
Chroococcus minor (Kütz.) Naeg.
Chroococcus pallidus (Naeg.) Naeg.
Cyanothece aeruginosa (Naeg.) Komarek
Merismopodia punctata Meyen
Microcystis aeruginosa (Kütz.) Kütz.
Microcystis flos-aquae (Wittr.) Kirch.
Oscillatoria planctonica Wol.
Synechococcus sigmoideus (Moore & Carter) Komarek
Trichormus catenula (Born.& Flah.) Komarek & Anagn..

Divisio : BACILLARIOPHYTA
Amphora commutata Grun.
***Amphora ovalis* (Kütz.) Kütz.**
***Amphora pediculus* (Kütz.) Grun.**
Aulacoseira perglabra (Oes.) Haw.
***Chaetoceros gracilis* Schütt.**
Chaetoceros vistulae Apstein.
Chaetoceros constrictum Gran.
Coccinodiscus fluviatilis Hust.
Cocconeis neodiminuta Kramm.
Cocconeis disculus (Schum.) Cl.
Cocconeis pediculus Ehr.
Cocconeis placentula Ehr.
Cyclotella glomerata H. Bachm.
Cyclotella meneghiniana Kütz.
Cyclotella distinguenda Hust.
Cymbella affinis Kütz.
Cymbella prostrata (Berk.) Cl.
Cymbella mesiana Choln.
Diatoma vulgaris Bory
Diploneis aculata Breb.
Epithemia argus (Ehr.) Kütz.
Epithemia smithii Carr.
Eunotia sudetica O.Müll.
Fragilaria berolinensis (Lemm.) Lang.-Bert.
Fragilaria brevistriata Grun.
Fragilaria dilatata (Brebisson) Lang.-Bert.
Fragilaria fasciculata (C. Ag.) Lange-Bert.
Fragilaria leptostauron (Ehr.) Hust. var. *martyi* (Heribaud) Lang.-Bert.
Fragilaria pulchella (Ralfs. ex. Kütz.) Lang.-Bert.
Fragilaria tenera (W. Sm.) Lang.-Bert.
Fragilaria ulna (Nitzsch) Lang.-Bert.
Fragilaria ulna var. *danica* Sipp.
Fragilaria virescens Ralfs.
Frustulia creuzburgensis (Krasske) Hust.
Gomphonema truncatum Ehr..
Gomphonema ventricosum Greg.
Gyrosigma attenuatum (Kütz.) Rabh.
Melosira arctica Dick.
Melosira lineata (Dillw.)Ag. var. *genuina* A. Cl.
Melosira varians C. Ag.
Meridion circulare (Grevill.) C. Ag.
Navicula capitata Ehr. var. *hungarica* (Grun.) Ross
Navicula cincta (Ehr.) Ralfs
Navicula cryptotenella Lang.-Bert.
Navicula gallica (W. Sm.) Lagerst. var. *laevissima* (Cl.) Lang.-Bert.
Navicula halophila (Grun.) Cl.
Navicula lateropunctata J. H. Wall.
Navicula notha Wall.
Navicula placentula (Ehr.)Kütz.
Navicula protracta (Grun.) Cl.
Navicula pupula Kütz.
Navicula rhynchocephala Kütz
Navicula secura R. M. Patr.
Navicula tripunctata (O. F. Müll.) Bory
Navicula tuscula (Ehr.) Grun.
Navicula veneta Kütz.
Navicula virudula var. *germanii* (Wall.) Lang-Bert.Patr.
Navicula vulpina Kütz.
Nitzschia acicularis (Kütz.) W. Sm.
Nitzschia acicularis var. *typica* A. Cl.
Nitzschia constricta (Kütz.) Ralfs.
Nitzschia longissima var. *closterium* (W. Sm.) V. H.
Nitzschia reversa W. Sm.
Rhizosolenia longiseta O. Zach var. *typica* A. Cl.
Rhoicosphenia abbreviata (G. Ag.) Lange-Bert.
Rhopalodia gibba (Ehr.) O. Müll.
Rhopalodia gibba (Ehr.) O. Müll var. *gibba*
Rhopalodia gibberula var. *producta* Grun.
Suriella angusta Kütz.
Suriella linearis W. Sm.
Tetracyclus glans (Ehr.) Mill.

Divisio : CHLOROPHYTA
Actinastrum aciculare Playf.
Actinastrum hantzschii Lang.
Characium limneticum Lemm.
Characium obtusum A. Braun
Characium orissicum Philip.
Chlamydomonas sp.
Coelastrum microporum Naeg.
Coleochaete nitellarum Jost
Cosmarium laeve Rabenhorst
Cosmarium sp.
Crucigenia tetrapedia (Kirch.) W. West & G. S. West
Eremosphaera oocystoides Presc.
Kirchneriella irregularis (G. M. Sm.) Korsh.
Microspora stagnorum (Kütz.) Lagerheim
Pediastrum duplex Meyen
Rhizoclonium heiroglyphicum (C.A.Ag.) Kütz.
Selenastrum gracile Reins.
Scenedesmus acuminatus (Lag.) Chad.
Scenedesmus arcuatus (Lemm.) Lemm.
Scenedesmus bijugus (Turp.) Kütz.
Scenedesmus communis E. H. Hegewald
Scenedesmus dimorphus (Turp.) Kütz.
Scenedesmus ecornis (Ehr.) Chod.
Scenedesmus obtusus Meyen
Scenedesmus opoliensis P. G. Richt.
Scenedesmus opoliensis var. *mononensis* Chod.
Scenedesmus perforatus Lemm.
Scenedesmus ralfsii Playf.
Scenedesmus vesiculosus (Prosk) Peterf.
Spirogyra weberii Kütz.
Stichococcus subtilis (Kütz.) Klercker
Tetraedron minimum (A. Braun) Hans.
Tetraedron muticum (A. Braun) Han.
Tetraedron trigonum (Naeg.) Hans.
Westella linearis G. M. Sm.

Divisio : CRYPTOPHYTA
Cryptomonas ovata Ehr.

Divisio : DINOPHYTA
Peridiniopsis penardiforme (Linde) Bourrelly
Peridinium cinctum (O F. Mull.) Ehr.
Peridinium umbonatum F. Stein
Peridinium sp.

Divisio : EUGLENOPHYTA
Colacium simplex Huber-Pestalozzi
Euglena clara Skuja
Euglena lepocincloides Drez.
Euglena oblonga F. Schmitz
Euglena oxyuris Schmarda
Euglena pisciformis G. A. Klebs
Euglena pseudoviridis Chad.
Euglena satelles Brasl. - Spect.
Euglena spathyrhyncha Skuja
Euglena stellata Mainx
Euglena tuberculata Swir.
Lepocinclis acuta Presc.
Lepocinclis fusiformis (H. J. Carter) Lemm.
Lepocinclis playfairiana Defl.
Lepocinclis radiata Chad.
Phacus caudatus Hueb.
Phacus curvicauda Swir.
Phacus longicauda (Ehr.) Duj.
Phacus nordstedtii Lemm.
Phacus onyx Pochm
Phacus circulatus Pochm.
Phacus sp.
Trachelomonas crebea Kell. var. *brevicollis* Presc.
Trachelomonas chlamydophora Nyg.
Trachelomonas curta A. M. Cunha
***Trachelomonas dubia* (Swir.) Defl. var. *minor* Defl.**
Trachelomonas dybowskii Drez.
Trachelomonas hispida (Perty.) F. Stein ex Defl.
Trachelomonas hispida var. *punctata* Lemm.
Trachelomonas intermedia P. A. Dang.
Trachelomonas lismorensis Playf.
Trachelomonas lismorensis var. *oblonga* Playf.
Trachelomonas oblonga Lemm.
Trachelomonas ovata Roll
Trachelomonas pulcherrima Playf. var. *minor* Playf.
Trachelomonas verrucosa A. Stokes
Trachelomonas volvocina Ehr.
Trachelomonas volvocina var. *papillata* Lemm.
Trachelomonas volvocina var. *punctata* Playf.

Divisio : XANTHOPHYTA
Characiopsis cylindrica (Lamb.) Lemm.

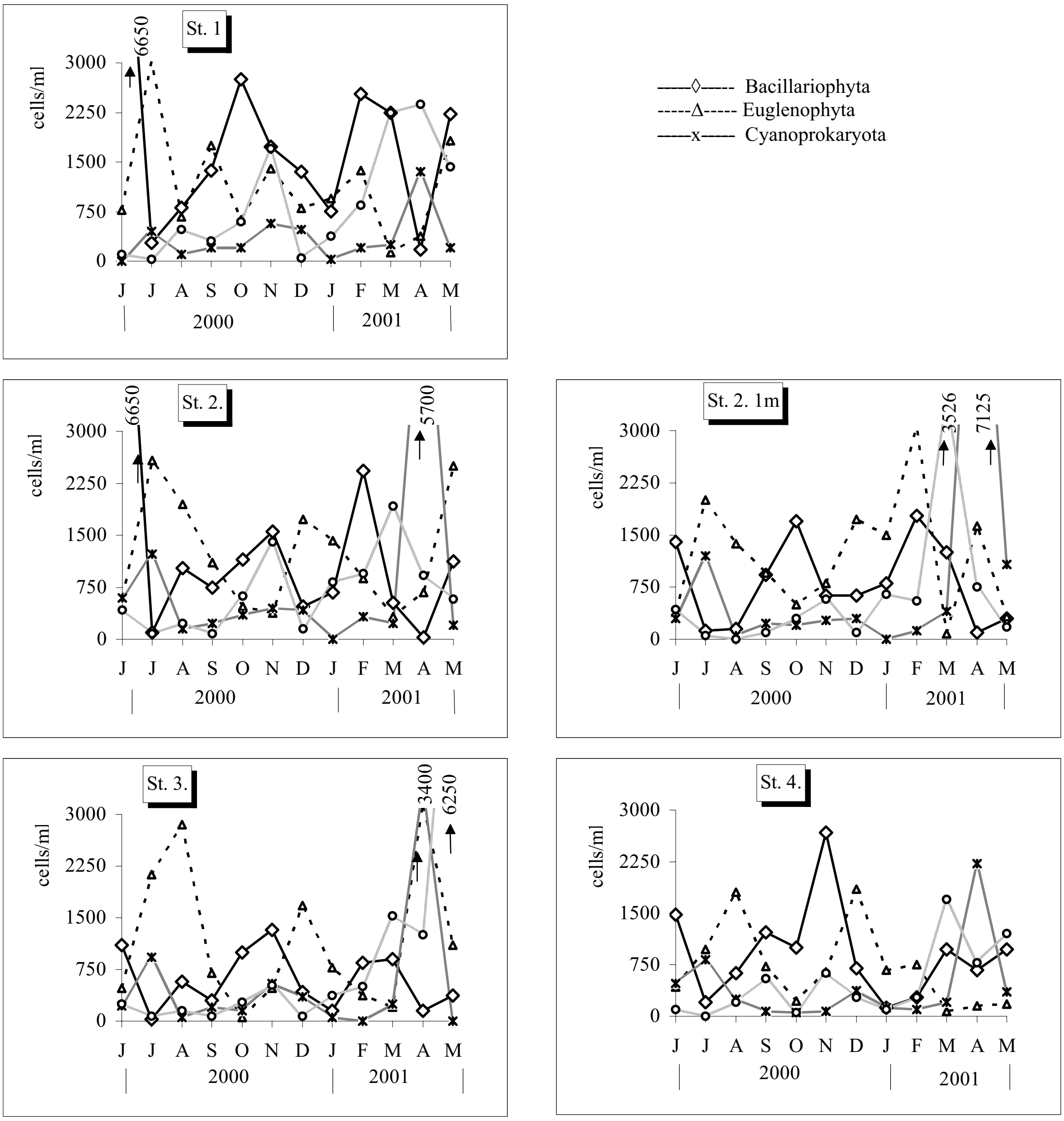

Figure 3. Seasonal variation of Bacillariophyta, Euglenophyta, Cyanoprokaryota and Chlorophyta at stations.

Discussion

In the phytoplankton of Lake Simenit, 175 taxa belonging to Cyanoprokaryota, Bacillariophyta, Euglenophyta, Chlorophyta, Dinophyta, Cryptophyta and Xanthophyta divisions were found. Of the 175 taxa determined, 71 belong to Bacilloriophyta, 39 Euglenophyta, 35 Chlorophyta, 24 Cyanoprokaryota, 4 Dinophyta, 1 Cryptophyta and 1 Xanthophyta divisions. According to the number of species Bacillariophyta-Euglenophyta type phytoplankton existed in Lake Simenit. Phycial factors and the amount of the nutrient affected seasonal variation in phytoplankton.

In the Lake, the water temperature varied between 6-25°C. The lowest temperature was determined at st. 1 and 4 in january and the highest temperature was determined at st. 1 in may. The conductivity of the lake water was measured between 0.4-8.2 ms and the amount of Cl was determined as 1.14-121.69 mg/l. It was observed that, closing to the st. 4, the conductivity and the amount of Cl increased. That the 4th station was near the Karaboğaz clearance, through which the lake reaches the sea, and therefore the freshwater involves with the seawater affects this circumstance.

The pH values varied between 7.65-8.75 in the lake. As the pH values showed, the lake was light

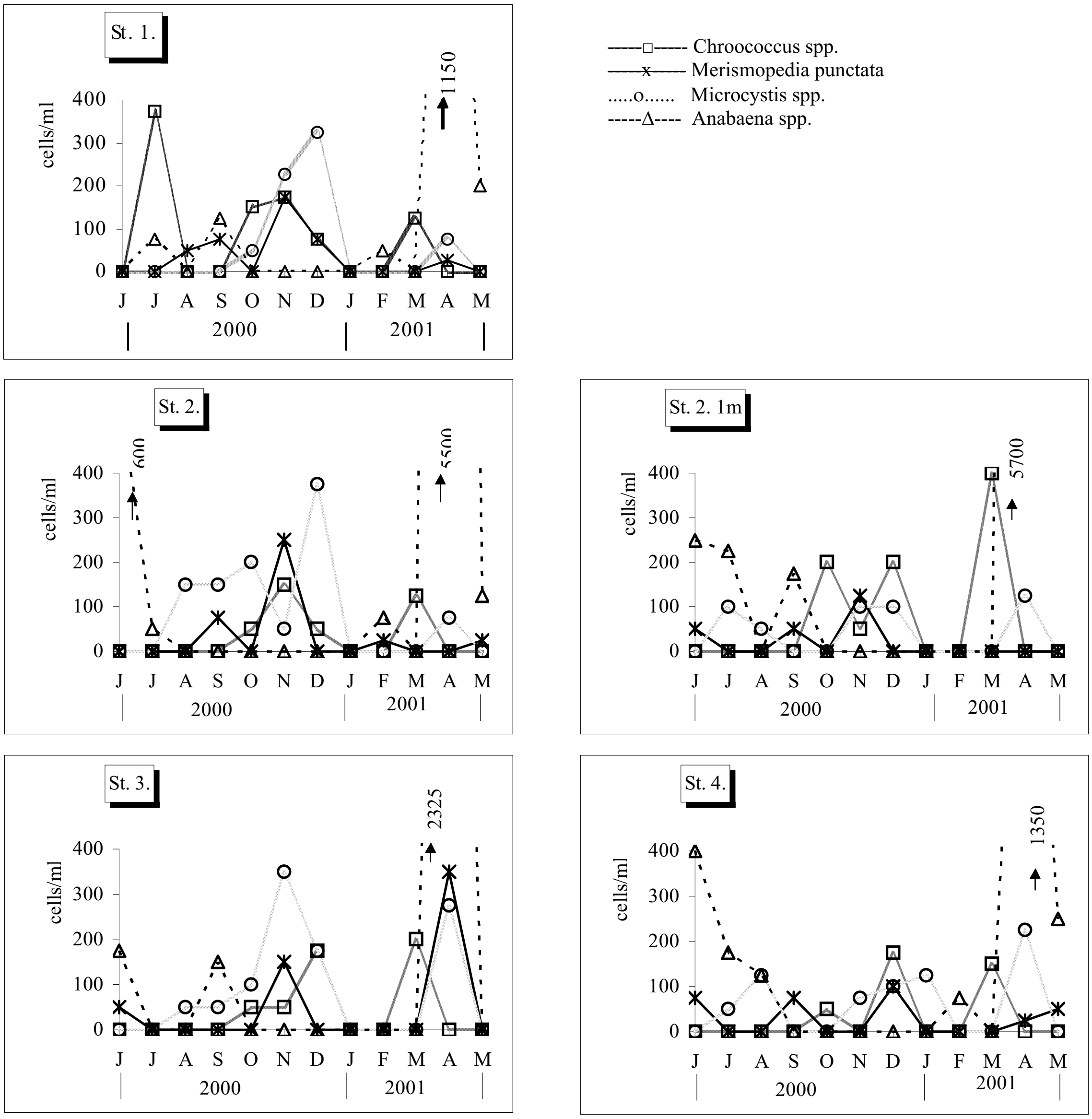

Figure 4. Seasonal variation of *Chroococcus* spp., *Merismopedia punctata*, *Microcystis* spp. and *Anabaena* spp. at stations.

alkaline. It had been determined that the pH values varied between 6-9 in unpoluted lakes (Şişli, 1999). Hardness values in the Lake Simenit varied between 34 – 113.6 FS^0. According to the these values, the lake water were in between hardness and very hardness water groups (Yaramaz, 1992). The dissolved oxygen values were measured between 3.6-10.4 mg/l. The amount of the dissolved oxygen was inversely proportional with temperature. It had been determined that, when the temperature increased, the amount of dissolved oxygen decreased. It has been thought that these lower values of the dissolved oxygen in may may be caused by increasing temperature and absence of wind or fractionation of bloomed threadlike algae in april (Tanyolaç, 1993). In lake water, nitrate values varied between 0.00-1.15 mg/l. And in Lake Karaboğaz (Arslan, 1998), which is similar to Lake Simenit in respect of being linked to the sea, the nitrate values were measured 0.00-0.10 mg/l. In this study, it has been determined the nitrat values can disappear in time on the surface of some overmuch salt lakes and can increased by organic pollution and flood waters. The amount of nitrite in lake varied between 0.00-0.21 mg/l. The higher values of the amount of nitrite in march may result from bloom of threadlike algae in april. The sulphate values, which had been determined to have been between a few mg/l and several hundred mg/l (Şengül and Türkman, 1991) were measured 207.36 and 737.28 mg/l in Lake Simenit.

In phytoplankton, the most widespread group of algae was Bacillariophyta that composes of 41% of the total taxa. Species of *Cyclotella*, were present in all seasons. *Cyclotella ocellata* was observed to be

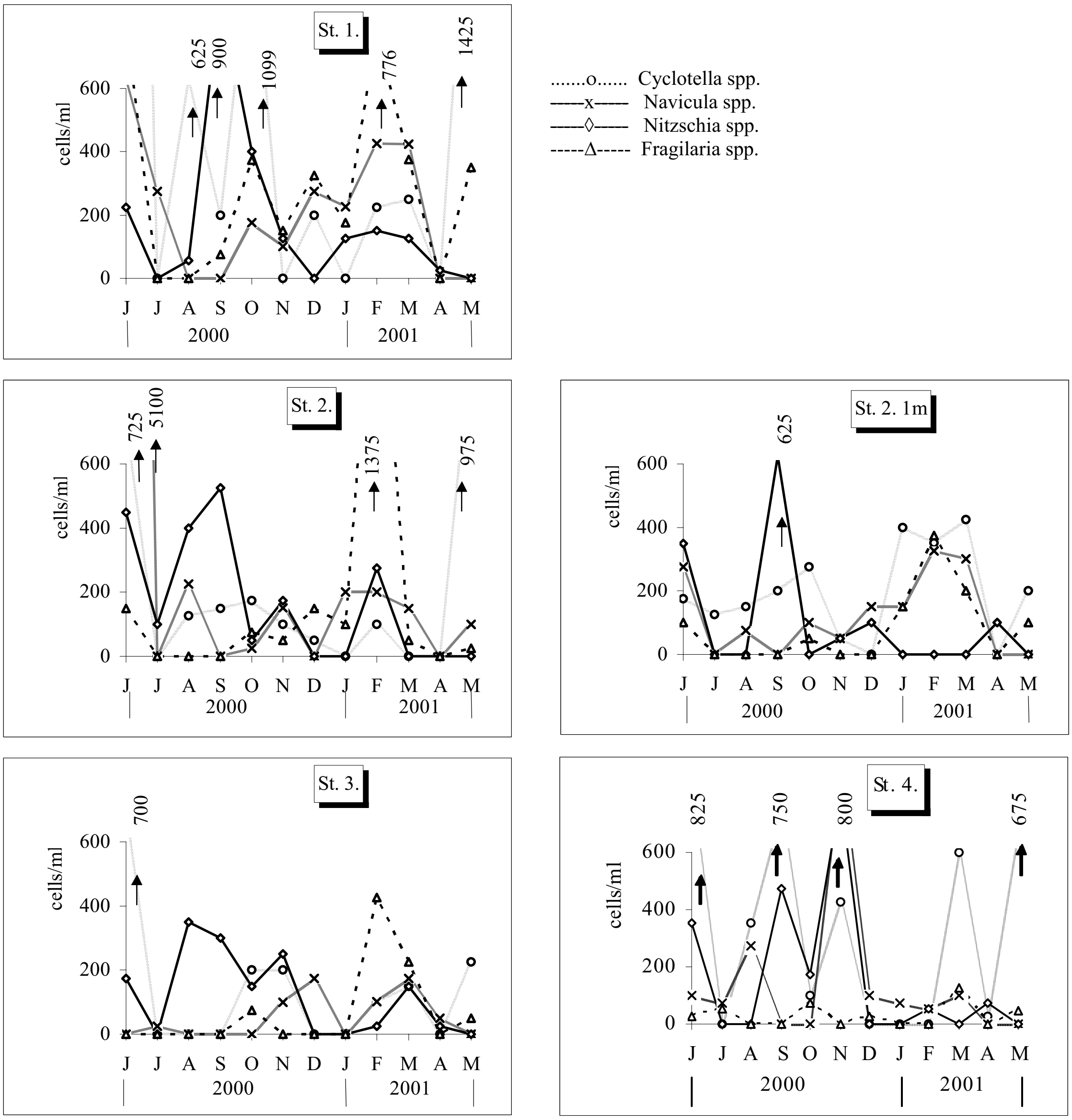

Figure 5. Seasonal variations of *Cyclotella* spp., *Navicula* spp., *Nitzschia* spp. and *Fragilaria* spp. at stations.

abundant in Akgöl (Şehirli, 1998) and Bafra Fish Lakes that have eutrophic feature (Gönülol and Çomak, 1992b; İşbakan *et al*., 1998). Whereas they have generally been identified as oligotrophic, *C. distinguenda*, *C. meneghiniana* and species of *Melosira*, which exist abundantly in the research area, also exist in eutrophic waters (Hutchinson, 1967). Species of *Cyclotella* were indicator species in transition to eutrophy (Round, 1956). In Lake Simenit *Chaetoceros* spp. that are characteristic to saline water were found abundantly. In Akgöl *Chaetoceros* spp. caused water blooms in august and september (Şehirli, 1998). It has been defined that only one species of *Chaetoceros* existed in Lake Cernek (İşbakan *et al*., 1998) .

The species of *Cocconeis*, *Navicula*, *Nitzschia*, *Fragilaria* were represented with a great number in phytoplankton. *Cocconeis placentula*, *Navicula notha* and *Fragilaria ulna* outnumbered in certain months.

Most of these species are benthic algae. Benthic algae were appeared in phytoplankton abundantly because of the phenomena of the Lake Simenit is shallow (1-2m), the deep is covered with aquatic plants, reeds, the wind and wave etc. This situation were also reported in Lake Mogan (Obalı, 1984), Afyon Karamık Lake (Gönülol and Obalı, 1986), the Bafra Fish Lakes (Gönülol and Çomak, 1992b), Lake Cernek (İşbakan *et al*., 1998) and Lake Karaboğaz (Arslan, 1998) researched lakes of Turkey.

Euglenophyta was subdominant group by 39 of taxa in algal flora. It has been defined that Euglenophyta members existed more abundantly in polluted water and water that is reach in the organic mass (Round, 1956). Of the Euglenophyta taxa 39

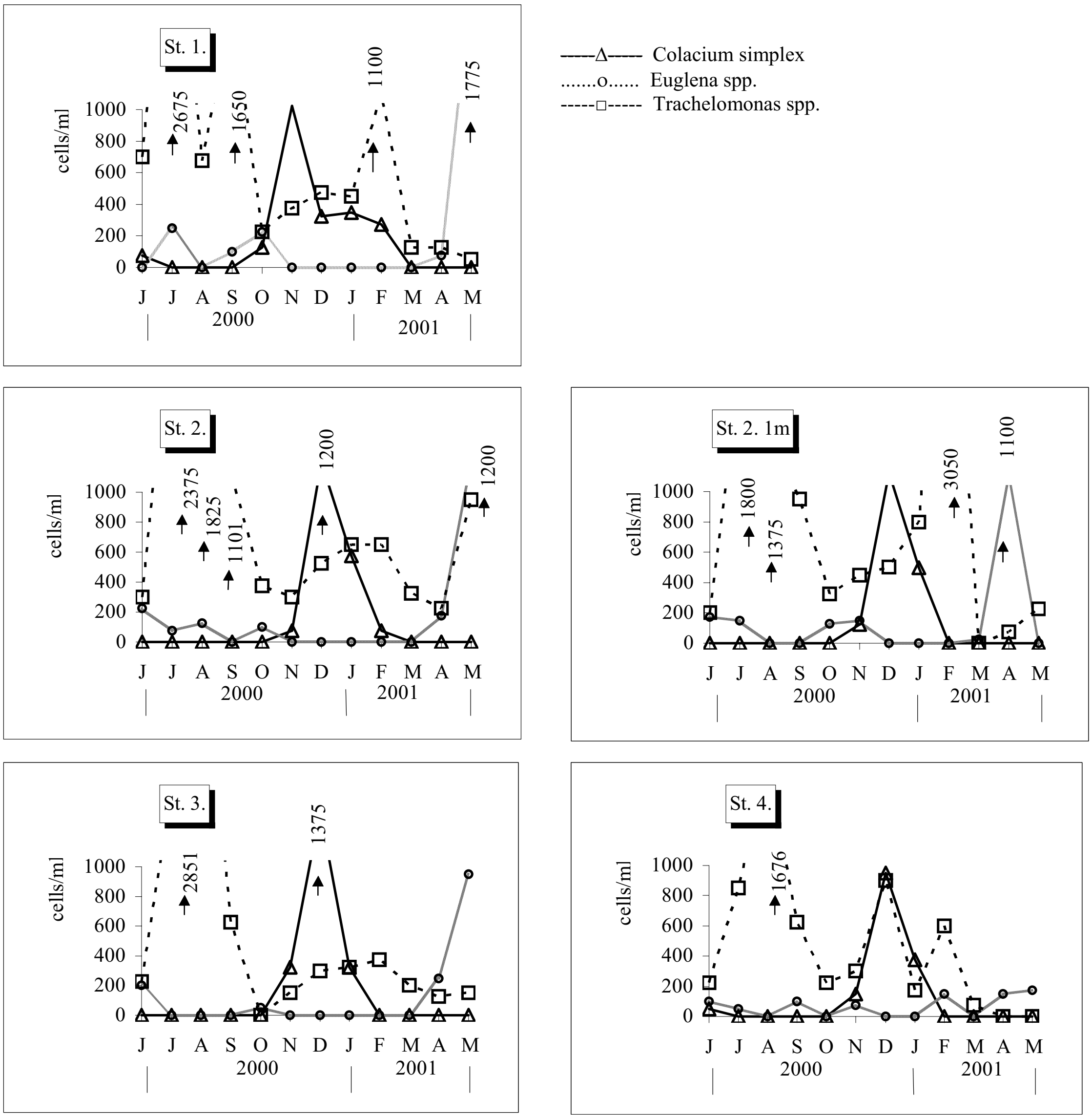

Figure 6. Seasonal variations of *Colacium simplex, Euglena* spp. and *Trachelomonas* spp. at stations.

were determined in Bafra Fish Lakes (Gönülol and Çomak, 1993a), 43 in Manisa Marmara Lakes (Cirik-Altındağ, 1983), 27 in Akgöl (Şehirli, 1998), 12 in Karaboğaz (Arslan, 1998) and 11 in Cernek Lake (İşbakan *et al*., 1998). That the numbers of taxa in these lakes are great is significantly caused by the lakes' being shallow the increasing quantity of organic mass, because of the existence of aquatic plants (Gönülol and Çomak, 1993a). *Colacium simplex, Euglena pisciformis, Trachelomonas volvocina, T. crebea* var. *brevicollis* outnumbered in some months in Lake Simenit.

In Lake Simenit, 33 species from Chlorophyta were found. Chlorophyta was the most widespread and dominant algae group in Akgöl (Şehirli, 1998). *Selenastrum gracile*, *Scenedesmus communis*, *S. ecornis* outnumbered in some months in Lake Simenit. *Pediastrum* was represented with only one species. It is expressed that similar these members of Chlorophyta are dominant in eutrophic waters (Jarnefeld, 1952; Hutchinson, 1967). Two species of *Cosmarium* were determined in Lake Simenit . This members that identified as Desmids were characteristic of oligotrophic lakes (Hutchinson, 1967). Desmids were found seldom and largely present in all seasons in Akgöl (Şehirli, 1998) and in Lake Cernek in summer (İşbakan *et al*., 1998). On the other hand they were not present or represented only one species in Lake Karaboğaz (Arslan, 1998). It was determined that members of this group developed less in hard water that had higher CO_2 and pH and alkaline was composed of bicarbonate in literature (Moss, 1973).

Twenty four taxa belonging to the Cyanoprokaryota in Lake Simenit has been determined. It was determined that members of

Cyanoprokaryota caused water bloom in Europe, North America and Anatolia's stagnant water (Prescott, 1973, Huber-Pestalozzi, 1968). In Lake Simenit, it was observed that particularly *Anabaena spiroides* and *Microcystis* spp. caused water blooms in summer months. In Akgöl *A. spiroides* in july and *Oscillatoria* spp. in Autumn caused water bloom (Şehirli, 1998). On the other hand in Lake Cernek *M. aeruginosa*, *A. affinis*, *A. spiroides* caused water bloom in summer (İşbakan *et al*. 1998). It was determined that Cyanoprokaryota was dominant in Lake Karaboğaz and *M. aeruginosa* had outnumbered in spring and summer months. It was determined that *Anabaena* spp. and *M. aeruginosa* also caused water bloom in autumn (Arslan, 1998).

Dinophyta were represented with 4 species. *Peridinium* spp. were composed of three of these. *Peridinium* spp. were shown seldom and sometimes present in along the year in Akgöl (Şehirli, 1998). It was determined that *P. cinctum* was widespread at lakes in Turkey studied (Gönülol and Çomak, 1992b). It had been pointed out that tis species can live in various habitats (Hutchinson, 1967). Peridiniales were represented with *P. cinctum* in Bafra Fish Lakes (Gönülol and Çomak, 1992b).

Only one species from Cryptophyta was found (*Cryptomonas ovata*). This species was found in few numbers in some months. In Akgöl *C. ovata* and *C. erosa* caused water bloom in october (Şehirli, 1998).

Xanthophyta was represented with *Characiopsis cylindrica*. This species that was tied the extremite of *Daphnia* with very short stipe (Prescott, 1973) and was determined as a new record for algal flora of Turkey in Bafra Fish Lakes (Gönülol and Çomak, 1992b). But it wasn't found in Akgöl (Şehirli, 1998).

Lake Simenit is a shallow lake and has a wide vegetation belt. Because of much suspended material the water transparency is less. The colour of the lake water varies between brown-green and yellow-green throughout the year. Surroundings of the channels are covered with reed and the deep of these channels are covered with aquatic plants. The sediment of the lake is composed of slime. Species of *Chaetoceros*, *Cyclotella*, *Cocconeis*, *Anabaena*, *Trachelomonas* and *Euglena* caused water bloom in certain months. According to these proporties Lake Simenit has eutrophic characteries.

References

Anonymous 1989. Türkiye Çevre Sorunları Vakfı. Türkiye'nin Sulak Alanları, Önder Matbaa, Ankara, 220 syf.

Anonymous 1995. Tarım Orman ve Köy İşleri Bakanlığı (Proje ve Uygulama Genel Müdürlüğü). Karadeniz ve Marmara Kıyılarında Deniz Ürünleri Yetiştiriciliğine Uygun Olabilecek Alanlar. 44p.

Apha, Awwa, Wpcf. 1992. Standart methods for the examination of water and wastewater. 18th edition. Washington D.C.USA.

Arslan, N. 1998. Karaboğaz Gölü fitoplanktonu ve mevsimsel değişimi üzerinde bir araştırma, Doktora Tezi, OMÜ Fen Bil. Enst., Samsun.

Cirik-Altındağ, S. 1983. Manisa- Marmara Gölü Fitoplanktonu II- Euglenophyta, Doğa Bilim Dergisi, A2, 8(1): 1-8.

Gönülol, A and Çomak, Ö. 1992a. Bafra Balık Gölleri (Balık Gölü, Uzungöl) fitoplanktonu üzerinde floristik araştırmalar I-Cyanophyta, Doğa-Tr. J. of Botany, 16: 223-245.

Gönülol, A. and Çomak, Ö. 1992b. Bafra Balık Gölleri (Balık Gölü, Uzungöl) fitoplanktonu üzerinde floristik araştırmalar IV-Bacillariophyta, Dinophyta, Xanhtophyta, OMÜ Fen dergisi, 4(1): 1-19.

Gönülol, A. and Çomak, Ö. 1993a. Bafra Balık Gölleri (Balık Gölü, Uzungöl) fitoplanktonu üzerinde floristik araştırmalar II-Euglenophyta, Doğa-Tr. J. of Botany, 17: 163-169.

Gönülol, A. and Çomak, Ö. 1993b. Bafra Balık Gölleri (Balık Gölü, Uzungöl) fitoplanktonu üzerinde floristik araştırmalar III-Chlorophyta, Doğa-Tr. J. of Botany, 17: 227-236.

Gönülol, A. and Obalı, O. 1986. Phytoplankton of Karamık Lake (Afyon), Turkey. Commun. Fac. Sci. Univ, Ank. ISSN 0256-7865, 128, Ser. C, 4: 105-128

Guiry, M.D. and Nic Dhonncha, E. 2003. AlgaeBase version 2.0 world-wide electronic publication, National University of Ireland, Galway. http: // www.algaebase.org.

Huber-Pestalozzi, G. 1968. Das Phytoplankton des Süsswassers Systematic und Biologie, I. Teil, Cyanophycean (Blaualgen), E. Schweizerbatrh' sche Verlagsbuchhandlung (Naegele u. Obermiller), Stuttgart, 606 p.

Huber-Pestalozzi, G.U.A. 1969. Das Phytoplankton des Susswassers, Systematik und Biologie, Part 4: Euglenophycean. E. Schweizerbarth'sche Verlagsbuchhandlug (Nagele u. Obermiller), Stuttgart, 606 p.

Huber-Pestalozzi, G.U.A. 1972. Das Phytoplankton des Susswassers, Systematik und Biologie, Part 6: Fott. Bohuslav: Chlorophyceae (Grunalgen), Ordnung Tetrasporales, E. Schweizerbarth'sche Verlagsbuchhandlug (Nagele u. Obermiller), Stuttgart, 116 p.

Huber-Pestalozzi, G.U.A. 1983. Das Phytoplankton des Susswassers, Systematik und Biologie, Part 7, Teil 1: Komarek, J. und B. Fott: Chlorophyceae (Grunalgen), Ordnunug Chlorococcales, E. Schweizerbarth'sche Verlagsbuchhandlug (Nagele u. Obermiller), Stuttgart, 1044 p.

Hutchinson, G.E. 1967. A Treatise on Limnology Vol: II. Introdouction To Lake Biology and the Limnoplankton, John Wiley and Sons. Inc., Newyork, London, Sydney, 115 p.

İşbakan, B., Gönülol, A. and Obalı, O. 1998. Cernek Gölü (Bafra-Samsun) fitoplanktonu XIV. Ulusal Biyoloji Kongresi, Samsun, 7-10 Eylül 1998, Cilt II, 240-253.

Jarnefeld, H. 1952. Plankton Alg Indicator Der Trophiegruppen Seen, Suomal, Tiedeakad, Tom, Anlls, Acad, Sci, Feen, ser, A, IV. Biol. 18pp, 29, 332, 380, 393, 394.

Krammer, K. and Lange-Bertalot, H. 1986. Süßwasserflora von Mitteleuropa. Bacillariophyceae, Band 2/1, 1. Teil: Naviculaceae. 1-876. Berlin: Spectrum Academicher Verlag.

Krammer, K. and Lange-Bertalot, H. 1991a. Süßwasserflora von Mitteleuropa. Bacillariophyceae, Band 2/3, 3.

Teil: Centrales, Fragillariaceae, Eunoticeae. 1-576. Stuttgart: Gustav Fischer Verlag.

Krammer, K. and Lange-Bertalot, H. 1991b. Süßwasserflora von Mitteleuropa. Bacillariophyceae, Band 2/4, 4. Teil: Achnanthaceae. Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema Gesamtliteraturverzeichnis. 1-436. Stuttgart: Gustav Fischer Verlag.

Krammer, K. and Lange-Bertalot, H. 1999. Süßwasserflora von Mitteleuropa. Bacillariophyceae, Band 2/2, 2. Teil: Bacillariaceae, Epithemiaceae, Surirellaceae. 1-610. Berlin: Spectrum Academicher Verlag.

Komarek, J., Eloranta, P. and Lhotsky, P. 1998. Cyanobacteria / Cyanophyta. Morphology, taxonomy, ecology. Proceedings of the 14th Symposium of the International Association for Cyanophyte Research (IAC), Lammi (Finland). J. Komarek, P. Eloranta and P. Lhotsky (Eds.). (Algological Studies, 94/ Archiv für Hydrobiologie, Supplementbande 129). 382 p.

Lund, J.W.G., Kipling, C.D. and Le Cren, E. 1958. The Inverted Microscope Method of Estimating Algal Numbers and Statistical Basis of Estimations by Coutung, Hydrobiol, 11: 143-170.

Moss, B. 1973. The influence of environmental factors on the distribution of freshwater algae: An experimental study. IV. Growth of test species in natural lake waters, and conclusion. J. Ecol., 61: 193-211.

Obalı, O. 1984. Mogan Gölü fitoplanktonunun mevsimsel değişimi, Doğa Bilim Dergisi, A2, 8(1): 91-104.

Prescott, G.W. 1973. Algae of the Western Great Lakes Area, (5 th Edition) W. M.C., Brown Dubique, lowa, 977 p.

Round, F.E. 1953. An investigation of two benthic algal communities in Malharm Tarn, Yorkshire. J. of Ecol., 41: 174-197.

Round, F.E. 1956. The Phytoplankton of there water supply reservoir note Central Wales. Arch. F. Hydrobiol. 220 – 232.

Şehirli, H. 1998. Akgöl (Terme-Samsun) fitoplanktonunun kompozisyonu ve mevsimsel değişimi üzerine bir araştırma, Yüksek Lisans Tezi, OMÜ Fen Bil. Enst., Samsun.

Şengül, F. and Türkman, A. 1991. Su ve Atık Su Analizleri, Dokuz Eylül Ü. Mühendislik ve Mimarlık Fak. Çevre Müh. Böl., Bornova İzmir, 157 p.

Şişli, M.N. 1999. Çevre Bilim Ekoloji, 2. Baskı, Gazi Büro Kitabevi Tic. Ltd. Sti. Ankara, 492 p.

Tanyolaç, J. 1993. Limnoloji, Tatlı Su Bilimi, Hatipoğlu Yayınevi Ankara 263 p.

Yaramaz, Ö. 1992. Su Kalitesi E. Ü. Su Ürünleri Yüksek Okulu Yayın No: 14 Bornova, İzmir, pp105