PHYTOPLANKTON COMPOSITION OF SAWA LAKE, IRAQ.

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ABSTRACT

The phytoplankton composition of Sawa Lake was studied monthly for 18 months, from October 1999 to March 2001. A phytoplankton net (20 μ) was used to collect phytoplankton samples. A total of 51 algal taxa was identified belong to diatoms (Bacillariophyceae), blue greens (Cyanophyceae), green algae (Chlorophyceae) and euglenoids (Euglenophyceae). Diatoms were dominated in species number (64.7%) and total cell number (68.6%) followed by blue greens (23.5%) and (15.5%), and the green (7.8%) and (14.5%) respectively. Bimodal seasonal peaks of chlorophyll-a and phytoplankton population were observed in the lake.

INTRODUCTION

The study of algae in aquatic ecosystems has a great importance since it is the base level in the food chain.

A total of 101 taxa including 56 taxa belonged to diatoms were reported in Dokan Lake (Shaban 1980). Whereas, the epiphytic algae in Al-Qadisia Lake were dominated by diatoms 65.6%, followed by green 21.3% and blue greens 11.5%(Kassim *et al*. 1997). Meanwhile, the phytoplankton total number showed two peaks namely in spring and autumn in Qadisia Lake and similar pattern with the Chlorophyll-a concentration which was ranged between 0.22- 68.5 μgl^{-1}, as a character of oligotrophic to Mesotrophic Lake (Kassim *et al*.1999).

In Therthar lake, the diatoms and the green algae were dominated at 35% and 37% respectively (Anon 1983). Whereas, in Habbania Lake the diatoms (65 taxa) and the blue-green algae (61 taxa), were identified (Al-Kaisi 1964).

The diurnal distribution of phytoplankton species in relation with the environmental parameters were studied in Razzazah Lake (Al-Saadi *et al*.1995). The trophical level of the lake is ranged to its algal composition was also reported (Hassan 1998).

The present study was on the phytoplankton composition in Sawa Lake, since very limited investigations based on short term periods were found (Maulood and Al-Mausawi 1989, Al-Handal 1994).

STUDY AREA

The study lake is located on the south-west of Samawa city about 30 km from center of the city, southern part of Iraq at 45° E and 31° 18¯ N (Fig. 1). The total surface area is about 10 Km^2 with average length and width of 5 and 2 Km respectively. Its depth is ranged between 3-5.5 m.

This lake is a unique in its characters in comparison with other lakes in Iraq, it is a saline and has no in or out let and surrounded by gypsum, which rise up six meters away from the surrounded area (Jamil 1977).

MATERIALS AND METHODS

Monthly water samples were collected from three sites in the lake represented the north (St.1), middle (St.2) and south (St.3), for 18 months starting Oct. 1999 (Fig.1).

The total cell number of phytoplankton was followed the modified McNabb method (Hinton and Maulood 1979). The chlorophyll-a concentration was determined according to the method reported by Parsons *et al.* (1984).

A plankton net (20μ) was used to collect algal samples from the same sites for qualitative study of phytoplankton. Several references were used for identification (Desikachary 1959, Patric and Reimer 1966, Prescott 1973, Hadi *et al.* 1984, Al-Handal 1994).

RESULTS

The environmental parameters were shown in table (1). The chlorophyll-a concentrations were found into two peaks (spring and autumn) in the three studied stations (Fig.2), and their mean values (for 18 months) were 1.47, 1.98 and 1.55μ l^{-1} in stations 1,2 and 3 respectively (Table 1and Fig.2).

The total cell number of phytoplankton was increased gradually during Feb.2000, and a major peak occurred at the beginning of Mar.2000, after a decline during summer season 2000, it was followed by another peak at autumn season (Nov.2000). The same peak appears at Nov.1999, and Mar.2001, in all three studied stations (Fig 2). The cell number was ranged between 1556-8685, 1650-8766, and 1659-8609 cell x 10^2 /l in station 1,2 and 3 respectively (Table 1, Fig 2).

The diatoms were the dominated group and found between 38.7-88%, 37.6-85.9% and 36.2-87.56% in stations 1,2 and 3 respectively and blue-green was ranged between 3.1-24.9 %, 5.2- 25.2% and 6.1- 26.8% in stations 1,2 and 3 respectively and green algae 6.7-35.9%, 6.9-37.3% and 7.4-3.7.0% in stations 1,2 and 3 respectively. Whereas, the Euglenoids were less than 0.6% of the total species numbers (table 1).

A total of 51 algal taxa was identified and dominated by diatoms (33 species), followed by blue green (12 taxa), greens (4 species), and 2 species of Euglenoids (Table 3). The most abundant phytoplankton species (which appeared along 18 months) were showed in table 3 in all three studied stations. Three filamentous green algae were also identified, namely *Chara* sp., *Cladophora crispate* and *Cladophora fracta var. lacustris*.

DISCUSSION

The phytoplankton composition in the studied lake was very limited based on short term data and that included only identification of some species (Maulood and Al-Mousawi 1989, Al-Handal 1994). Whereas, the present study was conducted for 18 months to study the phytoplankton in three sites qualitatively and quantitatively as well as measuring the chlorophyll-a concentration as other indicator for the biomass.

The environmental characters of the studied lake (Table1) were already discussed by Alkam *et al*. (2002). The lake is alkaline, very hard and oligohalin. Anions were higher in concentration than cations (Ca, Mg, Na, and K). Sulphate was the highest concentration followed by Cl^-, Na^+, Ca^+, Mg^+, and then K^+. The values of the studied nutrients were sufficient which may not limit the phytoplankton growth.

Two peaks of the chlorophyll-a values were found namely in spring and autumn. Similar finding was the case in the total cell numbers and a positive relation with chlorophyll-a values was found ($r = 0.75$ at $P \geq 0.05$). Similar results were found in different lakes in Iraq, such as Razazzah Lake (Hassan *et al*.2001), Al-Hammar marsh (Al-Mousawi *et al.* 1994), and Qadisia lake (Al-Lami *et al*. 1997).

In terms of total cell number, the present study indicated that it is oligotrophic lake and it has less number (as a mean of 18 months, 4669 x 10^2cell.l^{-1}) than other studied lakes, such as 75690 x 10^2cell.l^{-1} in Habbania lake (Al- Lami *et al*. 1998), and 20570 x 10^2 cell.l^{-1} in Razazzah lake (Hassan *et al.*2001).

The diatoms were the dominated group. Similar results were found in several lakes in Iraq, such as Habbania, Qadisia and Razazzah Lake (Al- Lami *et al*. 1998, Kassim *et al*. 1999, and Hassan *et al.*2001 respectively). As well as in Ringsjon lake in Sweden (Cronberg 1999). Whereas, different sequence in the second dominated group, which was blue – greens instead of greens. This may attribute to the fact that the blue-green may tolerate higher salinity in comparison with greens (Reynolds 1984). Temperature, light intensity, nutrients, competition and grazing are involved in the oscillation of the algal species composition, especially between blue-green and green algae (Hutchinson 1967, Fog *et al*. 1973). For that reason some variations between these two groups which existed in the present study. Similar conclusion was reached on several Iraqi aquatic ecosystems (Kassim and Al-Saadi 1994, Hassan 1997)

Several species were identified, belong to genera *Cyclotella*, *Nitzschia* and *Amphora* which prefer the mesohaline and alkaline water as indicated in table (3), many species were identified belonged to euplankton (such as, *Gomphosphaeria*, *Aulacosiera*, *Cyclotella*, and *Fragillaria*) which were not recorded before in the study of lake by Maulood and Al-Mausawi(1989).

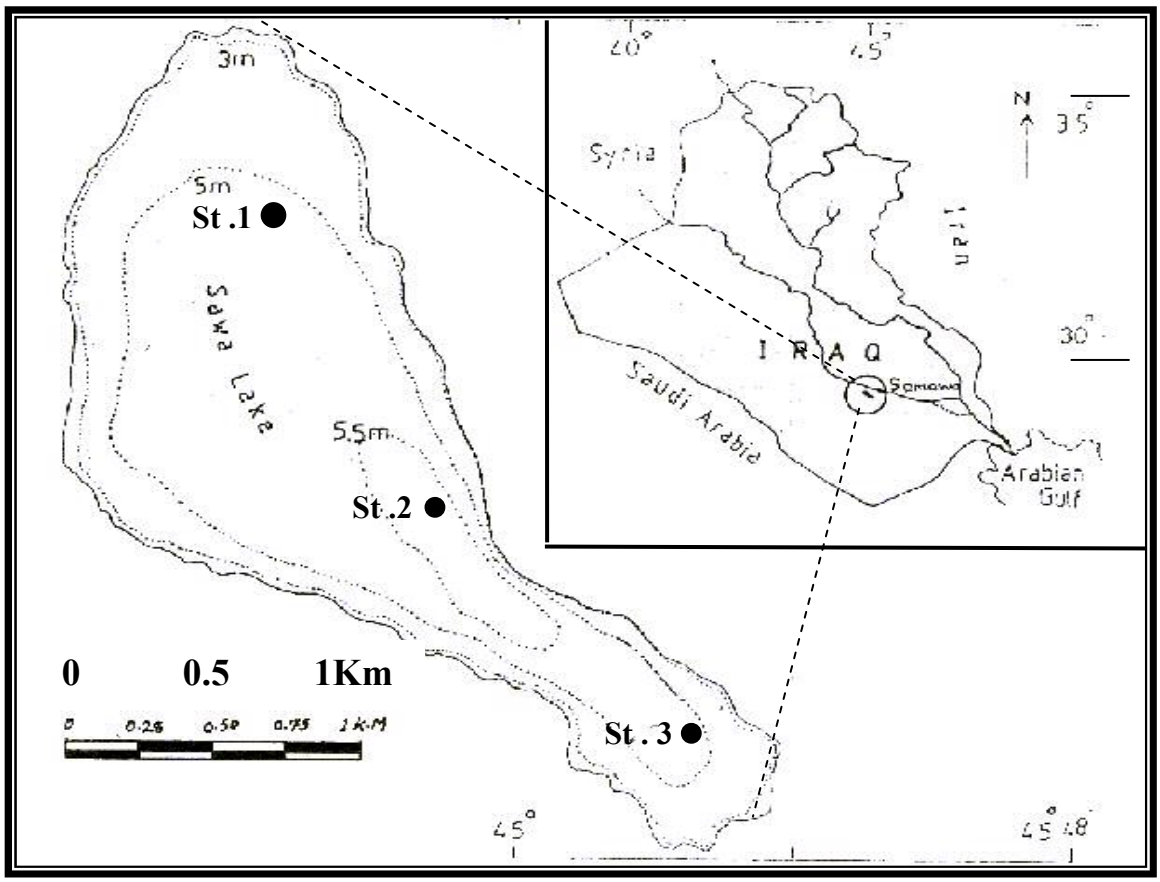

Fig 1: Map of the studied area.

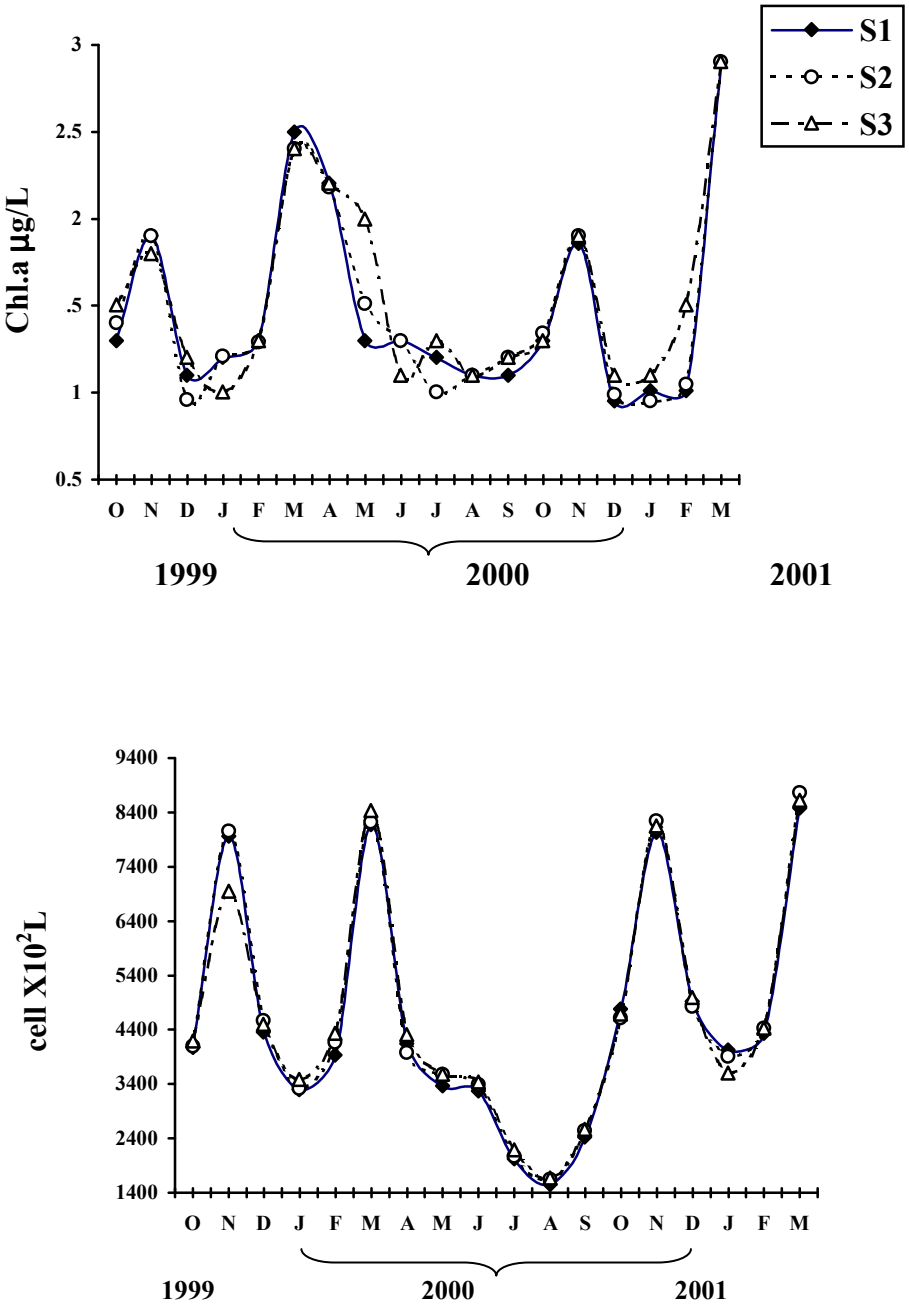

Fig (2): Seasonal variations of chlorophyll-a concentration and total cell numbers of phytoplankton at the studied stations in Sawa Lake.

Table 1: The range (mean±SD) of environmental characters of the studied stations in Sawa Lake during the study period (October 1999 – March 2001). The physico-chemical characters were already reported (Alkam *et al*. 2002).

Character	St.1	St.2	St.3
Temperature C° air	10- 41(23.57±9.97)	10.5-40(23.84±9.87)	10.5-40(24.19±9.73)
Water	9-38(20.4±9.15)	9-35.2(19.94±8.6)	9.3-35.5(20.25±8.63)
Electric conductivity ($\mu S.cm^{-1}$)	22.6-27.6(25.47±1.88)	22.1-27.5(25.29±2.5)	22.0-27.2 (24.38±1.78)
Salinity ‰	14.5-17.6 (16.17±1.19)	14.1-17.6(15.9±1.14)	14-17.4(15.5±1.14)
Dissolved Oxygen ($mg.l^{-1}$)	5.3-10.6(8±1.85)	5.2-10(8.1±1.9)	5.4-10(8.1±1.8)
pH	8-8.4(8.2±0.11)	8-8.4(8.2±0.12)	8-8.4(8.2±0.13)
Total Alkalinity ($mg.CaCO_3.l^{-1}$)	138-150(145±4.9)	140-151(146±4.12)	136-150(144±5.44)
Total Hardness ($mg.CaCO_3.l^{-1}$)	9033-11130(10198±717)	9010-11090(10109±726)	9000-11070(9846±68)
Calcium	1860-2330(1993±159)	1850-2310(1988±158)	1845-2300(1983±153)
Magnesium	1045-1470(1266±152)	1027-1478(1248±155)	954-1474(1241±169)
Sodium	2543-2743(2694±44)	2670-2736(2694±30)	2612-2730(2692±27)
Potassium $mg.l^{-1}$	175-180(178±1.5)	176-180(178±1.15)	176-180(178±1.15)
Chloride	4542-4752(4633±64)	5411-4745(4617±72)	4502-4741(4611±71)
Sulphate	4580-5923(4825±414)	4565-5927(4818±422)	4560-5900(4800±416)
Nitrate ($\mu mole.l^{-1}$)	16-21(20±1.57)	16-22(20±1.35)	16-22(20±1.75)
Phosphate ($\mu mole.l^{-1}$)	1.3-1.8(1.74±0.14)	1.4-1.8(1.73±011)	1.35-1.8(1.72±0.13)
Silicate ($\mu mole.l^{-1}$)	144-250(197±35)	146-251(198±33)	148-248(197±34)
Chlorophyll-a $\mu g.l^{-1}$	0.95-2.9(1.47±0.56)	0.95-2.9(1.48±0.56)	1-2.9(1.55±0.54)
Total Number of Phytoplankton ($Cellx10^2l^{-1}$)	1556-8685(4614±214)	1650-8766(4682±217)	1659-8609(4669±206)
Diatom (Bacillariophyceae)	38.7-88.0%	37.6-85.9%	36.2-87.56%
Blue greens (Cyanophyceae)	3.1-24.9%	5.2-25.2%	6.1-26.8%
Green algae (Chlorophyceae)	6.7-35.9%	6.9-37.3%	7.4-37.0%
Euglenoids (Euglenophyceae)	0.0-0.92%	0.0-0.7%	0.0-0.6%

Table 2: Number of identified species for each algal group and its percentage in the Sawa lake during study period.

Algae group	Identified species number	Percentage (%)
Cyanophyceae	12	23.5
Chlorophyceae	4	7.8
Euglenophyceae	2	4.0
Bacillariophyceae	33	64.7
Total	51	

Table 3: The identified algal taxa at the studied stations in Sawa Lake, and the number of months that each taxa appeared also indicated.

Species	**St.1**	**St.2**	**St.3**
Cyanophyceae	------	-----	------
Aphanothece clathrata W. Sm.	5	5	5
Chroococcus giganticus West	14	15	16
*C. turgidus (*Ktz.*)* Naeg.	13	14	16
*Gleocapsa aeruginosa (*Carm*)* Ktz.	16	16	16
G. punctata Nag.	18	18	18
Gomphosphaeria aponina Ktz.	18	18	18
Johannesbaptistia pellcida (*Dickie*) Taylor	18	18	18
*Microcoleus paludosus (*Ktz.*)* Gomont	17	18	18
Microcystis sp.	15	16	16
Merismopedia elegans A. Braun.	18	18	18
M. glauca (Ehr.) Naeg.	18	18	18
Oscillatoria sp.	4	4	4
Chlorophyceae			
Chlamydomonas saline Ehr.	5	5	5
Chlorella vulgaris Breb.	18	18	18
*Closterium microporm (*Naeg.*)* A. Braun	4	4	4
*Scenedesmus bijuga (*Turp.*)* Lager.	18	18	18
Euglenophyceae			
Euglena acus Ehr.	13	14	15
E. proxima Dang.	2	3	3
Bacillariophyceae			
Centrales			
Aulacosiera granulata var. *angustissima* Mueller	13	14	15
Coscinodiscus centrial Ehr.	15	15	15

Cyclotella meneghiniana *Ktz*.	16	15	15
*C. striata (*Ktz*.)* Grun.	15	15	15
Pennales			
Achnanthes hauckiana Grun.	18	18	18
A . lanceolata Hust.	18	18	18
A longipes Ag.	18	18	18
A . minutissima Grun.	18	18	18
*Amphora coffeaformis (*Ag*.)* Ktz.	14	15	16
Amphora sp.	18	18	18
Cocconeis placentula var. *euglupta (*Ehr*.)* Cl.	18	18	18
C. placentula var. *lineata* Ehr.	18	18	18
C. pediculus Ehr.	18	18	18
*Cymatopleura elliptica (*Breb*.)* W. Sm.	14	13	16
Cymbella helvetica Ktz.	12	13	14
C. tumida (Breb.) Van Heurck	13	12	14
Diatoma elongatum (Lyng*.)* Ag.	12	13	13
D. vulgare Bory.	12	12	11
Diploneis bombus Ehr**.**	11	12	11
D. ovalis (*Hils*) *Cleve*	10	11	12
*D. smithii (*Breb*)* Cleve	12	12	12
*Fragilaria tabulata (*Ag*.)* Ktz.	8	8	8
*F. ulna (*Ntz*.)* Ehr.	7	8	9
Gomphonema,olivaceum Cl.	12	13	13
Gyrosigma balticurn Ehr.	13	14	13
Mastogloia sp.	12	12	14
*Navicula crucigera (*W. Sm*.)* Cleve	13	14	16
N. pupule Ktz.	13	12	15
Nitzschia amphibia Grun.	14	14	14
N. punctata var. *coarctata (Coarcata)* Grun.	15	15	15
*N. sigmoidea (*Ehr*.)* W. Sm.	15	15	16
Surirrella ovata Ktz.	13	16	17
S. striatule	8	8	10

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تركيبة الهائمات النباتية لبحيرة ساوه، العراق

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الخلاصة

درست تركيبة الهائمات النباتية لبحيرة ساوه شهريا لمدة ثمانية عشر شهرا، من تشرين الثاني 1999 الى اذار 2001 . واستعمل لجمع عينات الهائمات النباتية شبكة الهائمات ذات حجم 20 مايكرون. شخصت في الدراسة الحالية 51 نوع عائد ه الى مجاميع الدايتومات (Bacillariophyceae) والطحالب الخضر المزرقة (Cyanophyceae) والطحالب الخضر (Chlorophyceae) والطحالب اليوغلينية (Euglenophyceae). وشكلت الدايتومات السيادة في عدد الانواع (64.7%) وكذلك في العدد الكلي (68.6%) وتلتها طحالب الخضر المزرقة (23.5%) في الانواع و(15.5%) في العدد الكلي ثم يليها الطحالب الخضر (7.8%) في الانواع و (14.5%) في العدد الكلي. لوحظ في الدراسة ذروتان للكلوروفيل_ أ والعدد الكلي للهائمات النباتية.