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ECOLOGICAL STUDIES ON WADI EL-RAIYAN LAKES II- DISTRIBUTION OF PHYTOPLANKTON AND CHLOROPHYLLA

By

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SUMMARY

The newly formed man-made Wadi El-Raiyan lakes are the immense reservoir for agriculture drainage water of El-Faiyoum Province. The present investigation was conducted to through some light on phytoplankton and their distribution in the lakes and their seasonal variation, population density and the species composition.

The present data revealed that the phytoplankton inhabiting the lakes are belonging to the following divisions Chlorophyceae, Cyanophyceae, Bacillariophyceae, Dinophyceae and Euglenophyceae. The Chlorophyta was dominant class in all seasons except in the Autumn when the Cyanophyta predominated. A total of 96 taxa of phytoplankton belonging to 53 genera and 26 families and five clases were recorded during this investigation. The result revealed a positive correlation between phytoplankton standing crop and chlorophyll a values. The peak of both chlorophyll a and phytoplankton density was observed in Autumn, while the minimum value for both of them was recorded in Spring.

MATERIAL AND METHODS

Standing Crop and Species Composition:

Samples for quantitative (standing Crop) and qualitative (species composition) analysis of the phytoplankton communities were collected by 1.51 Ruttner Sampler and preserved immediately in 4% neutralized formalin. In the laboratory the samples were poured into glass cylinders and lugol's solution (1+K1) was added until the sample changed to faint tea color. The phytoplankton organisms were allowed to settle, by gravitation, for 5 days. About 90% of the supernatant were then siphoned of , 0.1 ml of the residue were poured into Palmer and Mallony counting cell. The species composition and the number of phytoplankton cells were determined at high magnification (40 x & 100x). The standing crop (number of cells/m^3) was calculated.

The main references used for identification of phytoplankton organisms were: Prescott (1978); Bourrelly (1968); Kofoid and Swezy (1921); Hendey (1964) and Mills (1933-1935).

Chlorophylla and Phaeophytin:

A known volume of water samples was filtered in situ using syringe filtration system (Sartorious). This unit was equiped with a plastic holder (13 mm diameter) and glass microfiber fiter (GF/C Whatmann 13 mm diameter). Chlorophyll a was extracted by grinding the filters and the samples with 90% aqueous acetone. The extracts were clarified by centrifugation at 2000 rpm using centrifuge. The samples were measured fluorometrically using Turner III automatic fluorometer. The apparatus was calibrated by using an authertic standard of Chlorophyll a (Sigma Co.). The extract was then acidified by adding two drops of 4 N HCl and measured again.

The values of Chlorophyll a and Phaeophtin were calculated according to standard method (A.P.H.A.; 1985).

RESULTS

Distribution of the total Phytoplankton:

In general the phytoplankton recorded in Wadi El-Raiyan varied greatly from station to another and from season to another. The range, average, regional and seasonal variation of the total phytoplankton are given in Table (1) and Fig. (1).

The total phytoplankton crop reached its maximum value of 6225 x 10^5 cells/m^3, during Autumn, while its minimum value of 1065 x 10^5 cells/m^3 it was reached during Spring. The phytoplankton communities inhabiting Wadi El-Raiyan Lakes are represented by five classes; namely Chlorophyceae, Cyanophyceae, Bacillariophyceae, Dinophyceae and Euglenophyceae.

Chlorophyceae

The population density and percentage abundance of the Chlorophyceae (green algae) are given in Table (2) and Fig. (2). The green algae were always the most dominant group except in Autumn when the blue green algae occupied the first dominant position. This class is represented by 27 species belonging to 18 genera and 10 families. They dominated by *Sinuclearis tenuis; Closterium* sp.; *Oocystis borgei; O. crassa* and *O. pava Scenedesmus bijuga; S. denticulatus* and *S. quadricauda.* Also *Tetraedron minimum; Ankistrodesmus falcatus; Chodatela citriformis; C. ciliata; Dictyosphaerium pulchellum; Golankinia radiata; Staurasterum netator, Cosmarium granatum; Coelastrum microporum, C. sphaerium* and *Pediastrum simplex* were present. These species reached their maximum during Winter being 2199 x 10^5 cells /m^3 while they reached their minimum during the Spring being 699 x 10^5cells/m^3 .

Cyanophyceae:

The population density of blue-green and their percentage abundance are given in Table (3) and Fig. (3). Cyanophyceae always occupied the second predominant position, except in Autumn when they dominated over all the other classes and this was attributed to the blooming of *Aphanizemeneon* and *Merismopedia.*

Table (1): Seasonal variation of the total crop in Wadi El-Raiyan Lakes, No. of Cells X 10^5/m^3.

st.no.	Winter No.	Spring No.	Summer No.	Autumn No.
1	6657	730	1128	9403
2	3902	1256	3898	12161
3	4691	1119	3843	5767
4	2508	1381	3220	2415
5	5385	475	4446	2729
6	375	505	1617	1572
7	1521	1987	1486	9530
Average	3577	1065	2805	6225

Table (3): Population density of blue green algae and their percentage abundance to the total phytoplankton

No. of Units x 10^5 /m^3

st.no.	Winter		Spring		Summer		Autumn	
	No.	%	No.	%	No.	%	No.	%
1	1701	25.6	122	16.7	577	51.2	7420	78.9
2	2801	71.8	127	10.1	1650	42.3	7630	62.7
3	738	15.7	120	10.7	1654	43.0	2856	49.5
4	548	21.9	197	14.3	1668	51.8	443	18.3
5	2182	40.5	69	14.5	2908	65.4	685	25.1
6	134	35.7	48	9.5	685	42.4	1077	68.5
7	1217	80.0	935	47.0	546	36.7	8007	84.0
Average	1332	41.6	231	17.5	1384	47.5	4017	55.3

Table(2) Population density of Chlorophyceaee and their percentage abundance to the total phytoplankton

No. of cells X 10^5 /m^3

st.no.	Winter		Spring		Summer		Autumn	
	No.	%	No.	%	No.	%	No.	%
1	4926	74.0	582	79.7	533	47.3	1566	16.7
2	1091	28.0	1107	88.0	2136	54.8	3467	28.5
3	3947	84.0	985	88.0	2153	66.0	2115	36.7
4	1881	75.0	1153	83.5	1476	45.8	1460	60.5
5	3194	59.0	387	81.5	1504	33.8	1736	63.6
6	212	56.5	416	82.4	894	55.3	378	24.0
7	141	9.3	264	13.3	868	58.1	532	5.6
Average	2199	55.1	699	73.8	1366	51.6	1608	33.7

Table (4):Population density of Bacillariophyceae and their percentage abundance to the total phytoplankton

No. of Units x 10^5 /m^3

st.no.	Winter		Spring		Summer		Autumn	
	No.	%	No.	%	No.	%	No.	%
1	16	0.2	18	2.5	10	0.9	417	4.4
2	--	--	20	1.6	80	2.1	1064	8.7
3	2	0.0	12	1.1	--	--	820	14.2
4	44	1.8	17	1.2	56	1.7	504	20.9
5	8	0.1	9	1.9	26	0.6	296	10.8
6	27	7.2	40	7.9	28	1.7	117	7.4
7	155	10.2	786	39.6	36	2.4	991	10.4
Average	36	2.8	129	8.0	34	1.3	601	11.0

Table (5):Population density of Dinophyceae and their percentage abundance to the total phytoplankton

No. of cells x 10^5 /m^3

st.no.	Winter		Spring		Summer		Autumn	
	No.	%	No.	%	No.	%	No.	%
1	14	0.06	8	0.1	8	0.04	---	---
2	10	0.04	2	0.0	32	0.20	---	---
3	6	0.02	2	0.0	36	0.20	8	0.02
4	36	0.10	14	0.2	16	0.08	8	0.02
5	0	0.00	10	0.1	8	0.04	20	0.05
6	0	0.00	0	0.0	10	0.05	---	---
7	8	0.03	3	0.0	28	0.14	---	---
Average	11	0.04	6	0.07	20	0.1	5.1	0.01

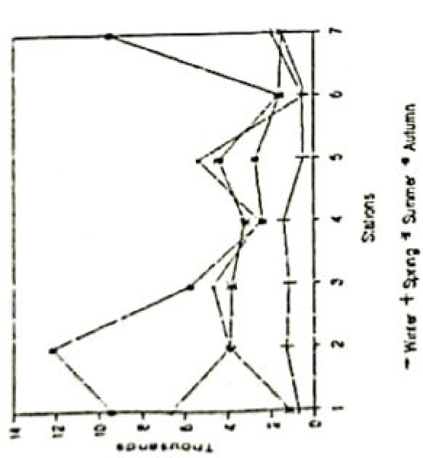

Fig (1): Changes of Total Phytoplankton No. of cells x10³/m³

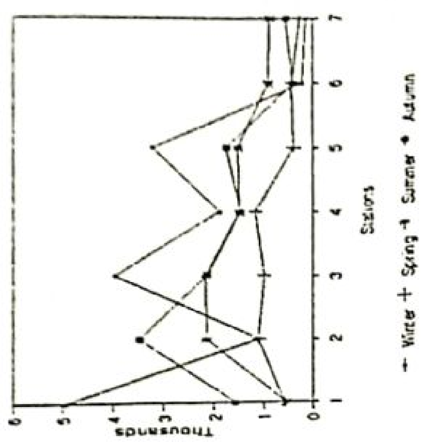

Fig (2): Changes of Chlorophyceae No. of cells x 10³/m³

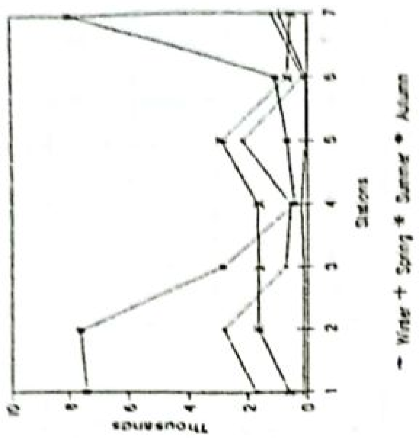

Fig (3): Changes of Blue Green Algae No. of Units x 10³/m³

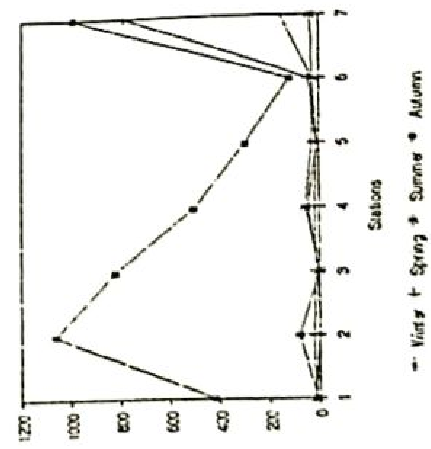

Fig (4): Changes of Bacillariophyceae No. of Cells x 10³/m³

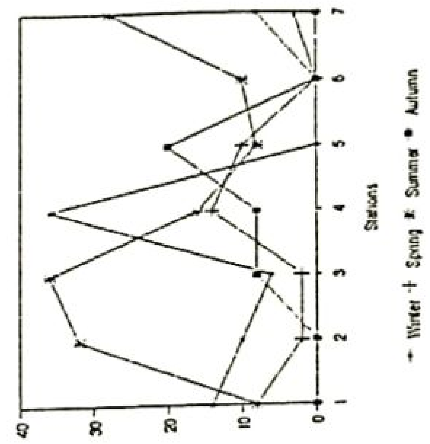

Fig (5): Changes of Dinophyceae No. of cells x 10³/m³

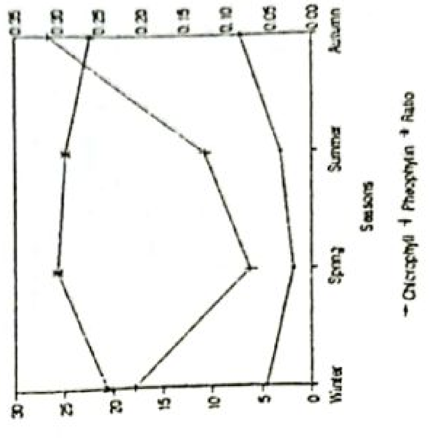

Fig (6): Changes of Chlorophyll, Phaeophytin and Chlorophyll Phaeophytin Ratio

Tabel (6) Changes of Chlorophyll and Phaeophytein (µg/L)

at Wadi El-Raiyan Lakes

st no	Winter			Spring			Summer			Autumn		
	Chlo	Phaeo	Ratio	Chlo	Phaeo	Ratio	Chlo	Phaeo	Ratio	Chlo	Phaeo	Ratio
1	6.5	25.0	0.3	2.1	7.7	0.27	3.4	11.7	0.29	8.8	29.4	0.30
2	6.0	20.9	0.3	2.0	4.9	0.41	3.2	10.3	0.31	13.8	51.6	0.27
3	6.1	21.4	0.3	2.0	6.5	0.31	3.5	10.9	0.32	7.2	23.9	0.30
4	4.9	16.8	0.3	2.1	6.6	0.31	4.3	15.3	0.28	4.1	18.0	0.23
5	3.9	15.8	0.3	1.1	4.1	0.26	3.5	12.5	0.28	4.5	18.7	0.24
6	1.4	10.4	0.1	1.3	5.4	0.24	1.5	5.4	0.28	2.5	12.0	0.21
7	2.8	14.40	0.2	2.2	7.8	0.28	2.4	8.5	0.28	9.0	32.9	0.27

The blue green algae were represented by 16 taxa belonging to 10 genera and 14 families. The blue green algae reached their maximum during the Autumn being 4017x 10^5 cells/m^3, while their minimum value were recorded during Spring being 231 x 10^5 cells/m^3. The dominant species were *Aphanizomenon issatschenkoi. Lyngbya limnetica; Merismopedia glauca; M. punctata; M. tenuissima. Microcytis flos-aquae; M. aeruginosa.* Also *Spirolina major* and *Oscillatoria tenuis; Phormidium molle* and *chroococus turgidus* were present.

Bacillariophyceae:

The Diatoms occupied the third predominance position. Members of this class were generally scarce except in Autumn when they reached their maximum. The population density and the percentage abundance of this class are given in Table (4) and Fig. (4).

The Bacillariophyceae are represented by 48 taxa belonging to 22 genera and 10 families. The dominant species were *Synedra ulna; Nitzschia palea; N. gracilis; Melosira granulate; M. granulata* var. *angustissima; Amphora ovalis; Rhopalodia gibba; Pleurosigma elongatum; Navicula cryptocephala; Cocconeis placentula.* Also, *Cyclotella menghiniana* and *Amphiprora paludosa* were present.

Dinophyceae:

Members of this class occupied the fouth predominance position. They were very rare and represented by 4 taxa belonging to one genera and one family. They dominated by *Peridiriium achromaticum* and *P. gatunese; P. paltinum; Ceratium hirudinella.* The population density and their seasonal fluctuation are given in Table (5) and Fig. (5).

Euglenophyceae:

This class was represented by one taxa namely *Phacus hispidula.* This species was recorded in the second lake (St. 7) during Summer with a population density of 8 x 10^5 cells/m^3.

Chlorophyll a and Phaeophtin Ratio:

The values of Chlorophyll a and phaeophytin in the first take were much higher than that recorded in the third lake being 5.5 and 2 µg/L.

Chlorophyll a concentration varied from a minimum of 1.8 µg/L during Spring to maximum of 7.1 µg/L during Autumn, while the Phaeophtyin varied from a minimum of 6.2 µg/L during Spring to a maximum of 26.6 µg/L during the Autumn.

The distribution of Chlorophyll a and phaeophytin ratio are given in Table (6) and Fig. (6).

DISCUSSION

During this survey a total of 96 taxa of phytoplankton belonging to 53 genera, 26 families and five classes were recorded. The phytoplankton peak was found in autumn (seasonal average value 6225 x 10^5) cells/m^3 while the minimum population density occurred in spring (average crop 1065 x 10^5 cells/m^3). A positive correlation was observed between phytoplankton crop and biomass as represented by chlorophyll a (r=0.99). In this connection, Brylinsky & Mann (1973) reported that algal production and biomass have been found to correlate well in a large number of fresh water bodies, and from this Golterman (1980) conducted that chlorophyll a can be used in general as a measure of algal productivity. The severe drop in phytolpankton crop as well as biomass recorded in the second lake (St. 6) can be attributed to the high flow rate of water at this site that consequently reduce growth and proliferation of phytoplankton cells. On the other hand, vigorous growth of phytoplankton and consequently high biomass occurred in autumn was mainly due to water circulation which is set up in a manner that brings up nutrients and other growth promoting substances from the rich bottom sediments to the water column. On the other hand, the secondary peak of phytoplankton was recorded in winter (average crop 3577 x 10^5 cells/m^3). This reveal that the seasonal cycles of phytophlankton did not exhibit the classical patterns for shallow temperate region, where the outburst of phytoplankton occurred in response to increase in nutrient concentrations during Winter/Spring.

The results of zooplankton communities in Wadi El-Raiyan reported by El-Shabrawy (1991) indicated that their standing crop was always associated with phytoplankton bloom periods. This leads to conclusion that the magnitude of grassing pressure of zooplankton on phytoplankton in Wadi El-Raiyan did not have iminical effect on algal outburst. This view is confirmed by a direct relation between zooplankton crop and both phytoplankton crop (r=0.97) and biomass as represented by chlorophyll a(r=0.98). The present investigation revealed that phytoplankton communities in Wadi El-Raiyan are represented by five main classes namely, Cyanophyceae, Chlorophyceae, Bacillariophyceae, Dinophyceae and Euglenophyceae. This agrees with Saleh et al. (1988) who recorded these classes in the lakes. On the other hand, Khalil (1984) recorded only 34 algal species belonging to three classes namely, Cyanophyceae, Chlorophyceae and Bacillariophyceae.

The green algae were always the most dominant group, except in autumn when the blue greens occupied the first predominance position. The highest density of green algae (average 2199 x 10^5 cells/m^3) was observed in winter, constituting 55.1% of the total phytoplankton crop, while the least value (average 699 x 10^5 cells/m^3) occurred in spring. The population density of the green algae was positively correlated with the water hardness, especially Ca^{+2} (r=0.67). The flourishing of green algae recorded in winter can be attributed to the obvious in crease in phosphate concentrations. This agrees with Peursall (1932) findings in some English Lakes. In the meantime, the standing crop of green algae had significantly decreased at the second lake (St. 6) and at the northem basin of the third lake (St. 7). This quantitative decrease in chlorophyceae can be attributed to the current that passes through the second lake to the third lake. This agree with Chandler (1973) who recorded the quantitative plankton decrease in streams as it flows downstream. This decrease was effective not only for total net plankton and various plankton groups but for the predominant individual phytoplankton as well. The quantitative decrease in the crop of green algae at the sites was not uniform but it depends on the season and the environmental conditions. Among the green algae 27 species belonging to 18 genera and 10 families. The one member of the green algae which represents most attention is *Binuclearia tenuis,* especially during spring and summer. Its population density during these season being 268 x 10^5 & 878 x 10^5

cells/m^3 and constituted 53.7 and 64.3% of the total green algal population. On the other hand, *Closterium* sp. (average 478 x 10^5 cells/m^3) and *Oocystis parva* (average 252 x 10^5 cells/m^3) dominated during winter and autumn, constituting 22 & 15.7% of the total green algal population. The major peak of this group was recorded in winter, while the minor peak occurred in autumn. The species composition of green algae indicated that most of the species are completely fresh water, while there are some other species of minor importance, especially desmids can tolerate moderate concentrations of salts. many desmids are distributed widely, but as a whole they are less cosmopolitan than most unicellular green algae (Hutchinson, 1967; Brook, (1981). The population density of green algae in the first lake was always much higher than in the second lake and the northem most basin of the third lake. In the meantime, the number of green algal species recorded in the first take was always high compared with the situation in the second and the northem regions of the third lake. Since salinity of Wadi El-Raiyan Lakes increased as going away from discharging point of the drain (El-Wadi Drain), however salinity iminical effect not only on population density of green algae but also in their species diversity.

Concerning the blue green algae in Wadi El-Raiyan Lakes, they are always occupied the second predominance position, except in autumn when they dominated. During this investigation 10 genera and 4 families were observed in the lakes. The outburst of blue-greens (average 4017x10^5 cells/m^3) was observed in autumn, forming 55.3% of the total phytoplankton population. The least density of this group (average 231 x 10^5 cells/m^3) occured in spring, constituting 17.5% of the total algal crop. In this connection, Saleh (1985) recorded 36 blue-green algal species in Wadi El-Raiyan Lakes. The obvious decrease in member of bluegreen algal species can be attributed to the increasing salinity of the lakes that consequently limited the growth and prolification of the most susceptible species. The blue green algae were densest when the organic matter was high. This view was confirmed by the positive relation between blue-greens crop and organophosphrus compounds in the waters (r=0.95). Tolerance to high salts concentration is a feature that enables some species of bluegreen algae to dominant in the saline lakes whether these are of the chloride, sulphate or carbonate type (Fogg et al., 1973). Singh (1961) mentions, for example, that *Anabaenopsis circular* is abundat in brine contaning 14-17% of salts from Sambrha salt lake in Rajasthan.

The results revealed a positive correlation between blue greens and HCO_3 (r=0.74). This may denote that these algae utilized carbon from bicarbonate ion. Ruttner (1953) and Prescott (1960) have corelated the higher bicarbonate contents of water with the formation of myxophyceae blooms and Rabinowith (1951) has shown that member of myxophyceae are physiologically cabable of utilising carbon dioxide from bicarbonate sources. In Wadi El-Raiyan Lakes the predominance of blue green was observed in autumn when TN/TP ration was 9.6. This contradicts Smith (1986) who reported that the blue-greens are not dominated if TN/TP ratio was below 10. On the other hand, the florishing of the blue green algae in winter contradicts the temperaure hypothesis which indicated that blue-greens are always dominant in summer, when temperature is over 24°C (Me Queen and Lean, 1987). The literature also contanins examples which contradicts temperature hypothesis. Winter blooms of blue-greens have been reported for a number of European lakes (Skulberg, 1980).

Among the most important blue-greens in Wadi El-Raiyan, *Aphanizomenon* dominated in autumn (average 1033 x 10^5 units/m^3) and summer (average 561 x 10^5 units/m^3), comprising 25.7 & 40.5 of the total green-algal population. This species is the common filamentous plankton forms in fresh water environments less well documented cases have been reported that the blooming of *Aphanizomenon* is usually associated with toxin production (Fogg et al., 1973). On the other hand, Microcysis dominated in winter (average 682 x 10^5 units/^{3}), while Merismopedia was dominated in spring (average 131 x 10^5 units/m^3). Microcystis is mentioned as an indicator of eutrophic nature (Swayer, 1966). This alga is known to produce the first death factor (FDF). The toxin is usually released from the cells of this alga by decomposition (Fogg et al., 1973). In general, the substances produced by blue-green algae are effective aganist other algae which might compete for light or nutrients, or predatory organisms, their survival value is clear (Frogg et al., 1973). On the other hand, Merismopedia is known to tolerate moderate levels of salinity and carbonate, sometimes it can flourish at high salinity, reaching to above 11% (Fogg et al., 1973).

Diatoms occupied the third predominance position in all investigated seasons two peaks of Bacillariophyceae occurred in autumn (average 601 x10^5 cells/m^3) and in spring (average 129 x 10^5 cells/m^3), comprising 11 and 8 % of the total phytoplankton, respectively. A total of 48 diatom taxa belonging to 22 genera and 10 families were recorded in Wadi El-Raiyan Lakes. In this connection, Saleh (1985) recorded 53 diatom species in Wadi El-Raiyan Lakes. As a rule, the spring diatom bloom is much larger than the autumn bloom, while during the present survey the rule was completely reversed. Some exceptions to this rule were also reported in different areas (Werner, 1977). During autumn pulse, diatoms dominated by Synedra ulna, while *Nitzschi gracilis* was leading species among diatomaceae during spring. The least diatoms crop (average 34 x 10^5 cells/m^3) was found in summar, forming 1.3% of the total phytoplankton population. This may be due to the indirect effect of high temperature in summer that may lower the viscosity of the water and thus increase the sinking rate of the plankton diatoms (Werner, 1977), also its well known that increase in temperature affect the diffusion rates of chemicals and lower their reproductive rate and metabolism. It is noteworthy that silica were consumed actively during diatoms pulses. However, a negative relation between diatoms crop and silica (r=0.6) was observed. in the meantime, concentrations of phosphate were lowered during growth of diatoms in general. The most important species among Diatomaceae was *Synedra ulna,* which dominated over the other diatoms in autumn (average 25 x 10^5 cells/m^3) and formed 45% of the total diatoms, respectively. This species is known to grow best in the presence of hogh nitrate concentrations (Werner, 1977). On the other hand, *Nitzschia gracilis* was the most dominant species among Diatomacease in spring (average 105 x 10^5 cells/m^3), constituting 81% of the total diatom population. *N. gracilis* only utilized nitrates as a source of nitrogen (Seenayya, 1972). He stated that this species could be regarded as avioding pollution. *Melosira granulata* dominated over the other species of Diatomaceae durign summer (average 14 x 10^5 cells/m^3), comprising 41.6% of the total diatom population. This species has its best development in warmer water (Werner, 1977), however its abundance occurred in summer when the water temperature reached the maximum value. In the meantime *M. granulata* is one of the typically eutrophicplankton species and is mentioned as indicator of eutrophic nature (Mathew, 1975).

Dinoflagellates were rarely occurred and represented by 4 taxa belonging to 2 genera and one family. Two pulses of Dinoflagellates were observed in summer (average 20 x 10^5 cells/m^3) and in winter (average 11 x 10^5 cells/m^3), comprising 0.1 and 0.04% of the total phytoplankton, respectively. Saleh (1985) recorded three species of dinoflagellates in Wadi El-Raiyan Lakes. The present data revealed a direct correlation between dinoflagellates crop and both salinity (r=0.93) and temperaute (r=0.65). This agree with the rule that temperature and salinity are the most important factors responsible for the outburst of dinoflagellates. *Ceratium hirudinella* was the most important species among dinoflagellates because it reveals the eutrophic nature of Wadi El-Raiyan. This species is considered as indcator of eutrophy (Mathew, 1975).

Euglenoids were represented by one taxa namely *Phacus hispidula.* This species was recorded in the 2nd take (st. 7) during summer, with a population density of 8 x 10^5 cells/m^3. Its noteworthy that Saleh (1985) recorded 7 species of Euglenophyceae in Wadi El-Raiyan Waters. This means that the species of this class had decreased by time as results of increasing salinity, as can be expected, increasing salinity of Wadi El-Raian Lakes will have deleterious effect on the fresh water planktonic organisms.

Chlorophyll a and phaeophytin a in Wadi El-Raiyan were not reported by any of the previous investigators, while the present study provided their seasonal variations in the first and second lakes as well as the northem most basin of the third lake. The highest values of Chlorophyll a and phaeophytin a being 7.1 & 26.6μg/L was recorded in autumn, while their least value of 1.8 & 6.2 μg/L occurred in spring. In general chlorophyll a and phaeophytin a were obviously decreased as moving away from the discharging point of El-Wadi Drain into the first lake reaching their minimum in the second lake (st. 6) and increased again in the northem region of the third lake. This agree with the seasonably and periodicity of phytoplankton communities. Chlorophyll a was positively correlated with phytoplankton standing crop (r= 0.99). The annual maximum of chlorophyll a fraction coincides with the peak of the autumn bloom of phytoplankton. Nutient concentrations appear to have little or no influence the chlorophyll a : phaeophytin ratio, which showed a narrow range of fluctuations and varied from 0.25, in winter to 0.29, in spring. On the other hand, phaeophytin showed a positive correlation with zooplankton crop (r=0.99). The highest crop of zooplankton (average 61867 organisms/m^3) was recorded in autumn, while the least crop (25324 organisms/m^3) occurred in spring (El-Shabrawy, 1991). The correlation between zooplankton and phaeophytin in Wadi El-Raiyan Lakes can be attributed to the grazing effect. In this connection, Lorenzen (1967) concluded that pheopigments in the water column are mainly fecal products of herbivorous zooplankton grazing on phytoplankton. Also, Glooschenko et al. (1972) observed a correlation between zooplankton abundance and phaeophytin content in Lake Ontario.

As has emerged from this survey, in spite of the considerable amount of nutrient discharged into Wadi El-Raiyan Lakes, the lakes (the 1st. & 2nd. lakes) can be considered as weakly eutrophied. The species composition of phytoplankton communities revealed the eutrophic nature of some taxa. On the other hand, although the third lake constitutes 66% of the total area of Wadi El-Raiyan Lakes, it was represented by one station at the northenmost region due to the difficulties in making a complete survey for this lake. Since the third lake may be ecologically more stable than eithr the first of the second lakes. To acheive these investigation a research station should be established near this lake.

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