EFFECT OF DISSOLVED NUTRIENTS ON THE DISTRIBUTION OF ALGAL FLORA IN SELECTED LAKES OF U.A.R.

II — LAKE — NASSER

By

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INTRODUCTION

The numerous studies, that have been made, on the effect of physical and chemical factors, singly or combined, on algal distribution in various localities were already mentioned in the first paper of this series (Nosseir & Abou-El-kheir, 1969). In that paper, the authors identified 85 species of the algal flora (Bacillariophyceae, Cyanophyceae and Chlorophyceae) present in Lake-Qarun, U.A.R. The Bacillariophyceae formed more than 90% of the algal population concerning the number of species, 77 species belonging to 26 genera appeared in the material. Also it has been noticed that the diatom species which are numerous and tolerant were of the marine and brackish types. Factors rather than salinity or together with salinity such as pH, nutrients (Ca, Mg, K, NO_3, PO_4) in some localities of the lake, low monovalent/divalent ratio in other localities seemed to be responsible for the abundance of diatom population. Also the poor population of Cyanophyceae and Chlorophyceae in Lake-Qarun was mainly due to the very low contents of phosphate and nitrate in the water.

Lake — Nasser, another lake in U.A.R., differs greatly from Lake — Qarun in many respects (Figure 1). After the construction of Aswan — High — Dam, it will impound behind it a lake called Lake — Nasser. Now this lake contains a huge mass of water about 50.000 milions m^3 covering an area of more than 4000 kilometres. However it is expected that the lake will extend 500 kilometres (350 kilometres in the Southern extermity of Egypt and 150 kilometres in the Sudau) and that the storge-water in the lake will reach 157,000 milions m^3 when the lake is completely filled. This means that the vater level of the lake behind the dam will

attain 188 m. above sea level. The width of the lake ranges between 1 and 20 kilometres, with an average of 8 kilometers. The lake when filled to capacity will take an elongated shape.

Accordingly, it was interesting to us to investigate the algal flora of lake — Nasser and the effect of dissolved nutrients present on their distribution especially lake — Nasser was recently formed after the construction of Aswan — High — Dam and its algal flora related to nutrients, is still unknown.

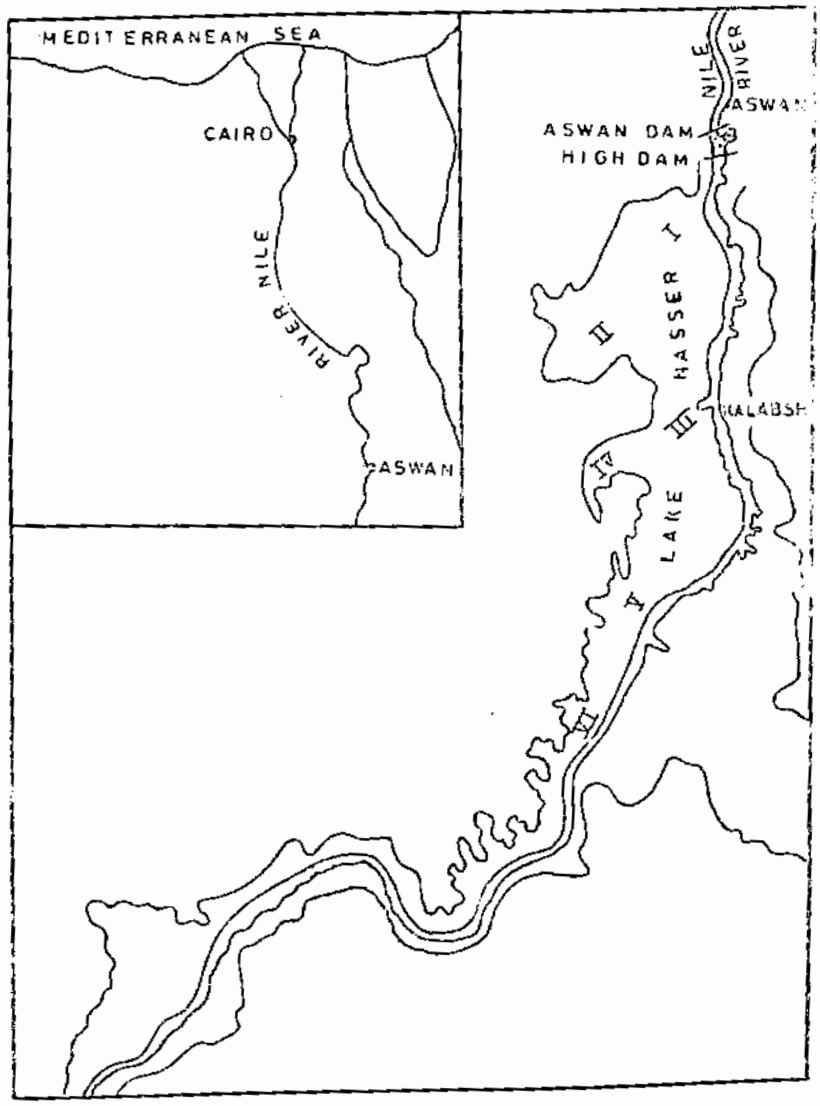
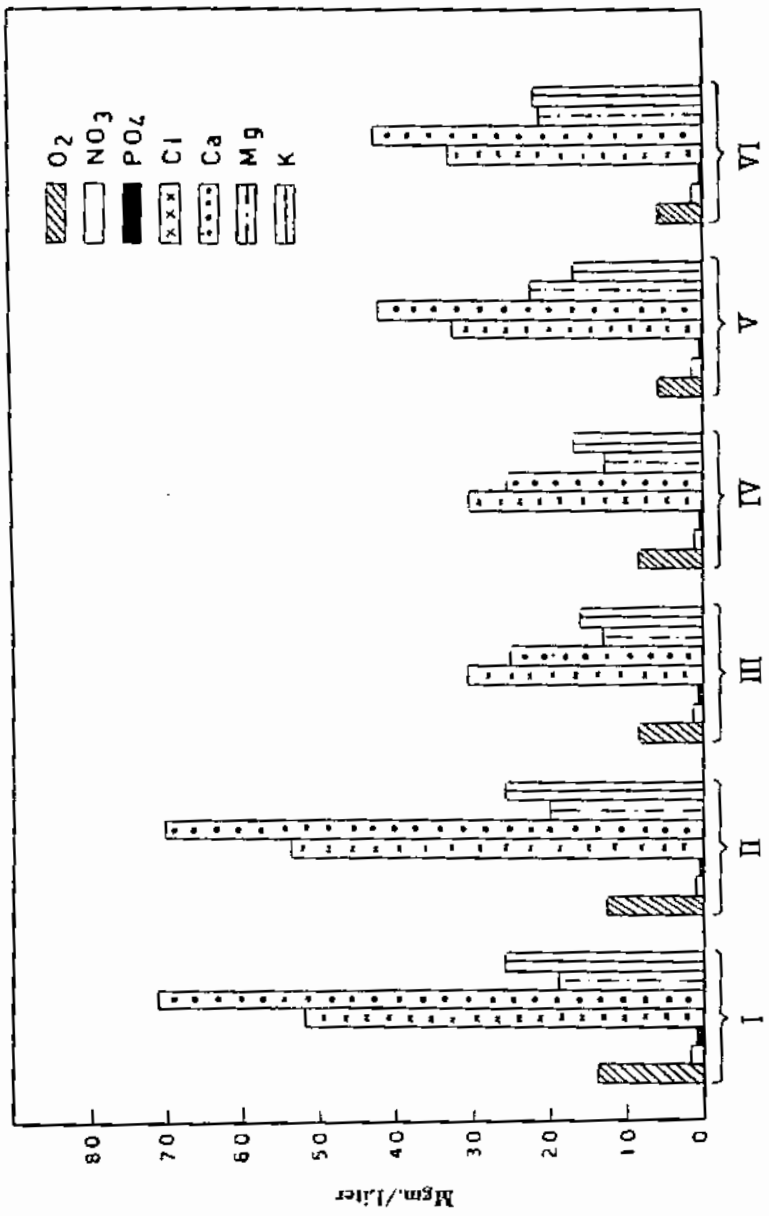


Fig. (1) Lake Nasser
The numbers indicate the sites chosen.



Fi. (2) : Dissolved nutrients of Lake Nasser water (means of duplicate samples taken from every site-Mgm./L.)

MATERIAL AND METHODS

The general procedure followed for clearing diatoms and identifying the algal flora present in the water samples as well the methods used for determining the various nutrients in the samples were as already described by Nosseir and Abou-Elkheir (1969).

Six sites were chosen at various localities and depths. Two samples were taken from every site. The scheme of sampling from the sites was as follows :

Site I : surface water.

Site II : surface water.

Site III : at depth of about 6 meters.

Site IV : at depth of about 6 meters.

Site V : at depth of about 9 meters.

Site VI : at depth of about 9 meters.

The data recorded in table (1) represent the conc. of the dissolved nutrient in every sample while the means of the duplicate samples taken from every site are represented by figure (2). All data are expressed in mgms./L. A full list of all algae identified in all the sites is compliled at the end of this paper. The time of sampling was during March (1969).

RESULTS AND DISCUSSION

It has been found that the ingradients of the samples were not only diatoms, but also blue-green and green algae. Approximately 66 species belonging to 31 genera have been identified. The greatest number of these algal groups were found in sites number 1, 4 and 5. The diatoms dominated over other classes of algae forming 50 species belonging to 14 genera concerning the number of species. The species which are numerous and tolerant in Lake — Nasser were of the fresh-water type (29 spp.), while the brackish and marine types were only 21 spp.

Chn (1942) found that the most favorable concentration of Ca, Mg, K, Na and silicate differ considerably for different algae. This might explain the great difference in the algal flora of lake-Qarun (Nosseir & Abou-El-kheir, 1969) from that of Lake — Nasser, since the concentration of the above mentioned dissolved nutrients varied greatly in both lakes. The outstanding difference in the constituents of water of both lakes was due to the chloride content. Here in Lake — Nasser the chloride content varies from 30.5 — 54.5 mgm./L. This explains the dominance of the fresh-water individuals in Lake — Nasser, (Kolbe, 1927).

Cyanophyceae and Chlorophyceae have been found in Lake — Nasser, but not so much in the number of their species, but in the relative abundance of the individual species. The rich population of Cyanophyceae and Chlorophyceae found in Lake — Nasser was accompenied by a very low level

TABLE 1

pH and Dissolved Nutrients of Samples taken from Lake Nasser (mgm./L.)

Site No.	Nutrients														pH	
	O_2		NO_3		PO_4		Cl		Ca		Mg		K			
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
I	14.0	15.0	1.6	1.6	0.6	0.5	52.0	52.5	70.0	72.0	20.0	18.0	26.0	26.0	5.9	5.8
II	13.0	12.0	1.0	1.0	0.4	0.3	55.0	53.0	72.0	68.0	19.0	21.0	25.0	26.0	5.8	6.0
III	8.8	8.0	1.2	1.2	0.2	0.2	31.0	30.0	26.0	24.0	14.0	12.0	16.0	16.5	6.4	6.5
IV	9.2	8.1	0.8	0.8	0.2	0.2	32.0	30.0	26.0	25.0	12.6	12.6	16.0	17.0	6.4	6.5
V	6.0	6.2	1.2	1.2	0.2	0.2	30.1	35.0	42.0	42.0	20.1	24.6	17.0	17.0	5.9	5.9
VI	7.0	5.0	1.6	1.6	0.2	0.2	30.0	36.0	42.5	42.5	20.1	22.5	22.0	22.0	6.1	6.1

1 and 2 = duplicate samples for each site

of PO_4 and NO_3 in the water (0.8 — 1.6 mg./L. No_3 and 0.20 — 0.55 mgm./L. PO_4). This was found to disagree with the findings of Atkins (1923) and Atkins & Harris (1924) who found a direct correlation between the amount of phosphate and the growth of fresh-water plankton. They suggested that the lack of phosphate rather than the lack of nitrate limits the plankton as a general rule in fresh-water.

On the other hand, Rich (1933) noticed that the blue-green algae were plentiful where the salinity was high as well as where it is low. This observation of Rich seems to be the case in the present study, since the blue-green algae was found in copious masses, Spirolena in particular. There-fore salinity which is varying from 30.5 — 54 mgm./L. seems to favour the abundance of the Cyanophyceae found in Lake — Nasser.

Also it has been noticed that, although the desmidaceae were completely absent from the plankton of Lake — Qarun (Nosseir & Abou-Elkheir. 1969) yet they are present in Lake-Nasser. Rich (1935) mentioned that the desmids in the tropics, a pH af about 7 is favourable for their development. However in Lake — Nasser the desmids were well represented by *Cosmarium* although the pH varies from 5.8 — 6.5. This may be due to some other factors rather than the pH.

The leading taxa representing the Bacillariophyceae are *Cymbella sp.*, *Nitzschia sp.* and *Navicula sp.*, and those representing Cyanophyceae are *Spirolena* and *Nostoc* while those representing Chlorophyceae are *Scenedesmus*, *Pediastrum*, *Englena* and *Ankistrodesmus*. Also *Spirolena* which is one of the leading genera of Cyanophyceae was found to be one of the most conspicuous genera having a well marked distribution. Factors affecting the kind of species that may be abundant rather than the total amount of the plankton have been already discussed by the authors in the first paper of this series (1969). Braarud (1935) stated that salinity, P and Ca content affect the kind of species that may be abundant rather than the total amount of the plankton. Also Gran (1929) noted that the abundance of the plankton is dependent on the nutrients present. Lund and Talling (1957) noted that there is no ultimate factor responsible for algal mass productivity and periodicity.

SUMMARY

66 species of algae (Bacillariophyceae and Chlorophyceae) belonging to 31 genera were identified in Lake-Nasser, diatoms being the dominant.

Diatom species which are numerous and tolerant were of the fresh-water type (29 sp.) while the brackish and the marine types were 21 sp.

The kind of species that appears abundant seems to be limited by interaction of various factors such as salinity, pH, Ca, Mg, K, PO_4 and NO_3.

Desmids appear and is well represented by *Cosmarium* and this is due to factors other than pH.

The rich population of Cyanophyceae and Chlorophyceae was accompanied by low phosphate and nitrate contents of the water, which indicates the effect of some other factors (probably low salinity) on their population.

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A LIST OF THE ALGAL FLORA FOUND IN LAKE-NASSER

Bacillariophyceae

1 —	Amphora ovalis v. affinis f. minor (Grun) H.V.H.	F.
2 —	Amphora salina W.Sm.	B
3 —	Cocconeis placentula Ehr.	
4 —	Cyclotella Kutzingiana Chauvin.	F.
5 —	Cymbella sp.	
6 —	Cymbella tamidula Grun.	F.
7 —	Encyonema caespitosum Kutz.	F.
8 —	Gomphonema micropus Kutz.	F.
9 —	Gomphonema montanum v. Gommutatum Grun.	F
10 —	Gomphonema parvulum Kutz.	F.
11 —	Hantzschia amphioxys (Ehr.) Grun.	F. & B.
12 —	Licmophora tenuis (Kutz) Grun.	F.
13 —	Melosira crenulata Kutz.	F.
14 —	Melosira crenulata v. tenuis Kutz.	F.
15 —	Melosira Dickiei (Thw.) Kutz.	F.

16 — Melosira granulata (Ehr.) Ralfs.	F.
17 — Navicula anglica Ralfs.	F.
18 — Navicula Bahusiensis Grun.	B.
19 — Navicula cryptocephola Kutz.	F. & B.
20 — Navicula forcipata Grev.	M.
21 — Navicula Hebes Ralfs.	F.
22 — Navicula lanceolata Kutz.	F.
23 — Navicula limosa Kutz.	F.
24 — Navicula peregrina (Ehr. ?) Kutz. v. Meniscus. Schum.	B.
25 — Navicula rhynchocephala Kutz.	B.
26 — Navicula viridula v. slesvicensis (Grun.) H.V.H.	F.
27 — Nitzschia circumsuta (Bail.) Grun.	B.
28 — Nitzschia dissipata (Kutz) Grun.	F. & B.
29 — Nitzschia fasciculata Grun.	M. & B.
30 — Nitzschia frustuleum (Kutz.) Grun.	B.
31 — Nitzschia linearis v. tenuis Grun.	F.
32 — Witzschia ohtusa W.Sm.	B.
33 — Nitzschia obtusa v. brevissima Grun.	B.
34 — Nitzschia obtusa v. nana Grun.	B.
35 — Nitzschia obtusa v. scalpelliformis H.V.H.	B.
36 — Nitzschia panduriformis Grun.	M.
37 — Nitzschia palea (Kutz) W.Sm.	F.
38 — Nitzschia palea v. debitis H.V.H.	F.
39 — Nitzschia palea v. tenuirostris H.V.H.	F.
40 — Nitzschia Sigma v. intercedens Grun.	B.
41 — Nitzschia thermalis (Kutz) Grun.	F.
42 — Nitzschia thermalis v. intermedia Grun.	F.
43 — Nitzschia vermicularis (Kutz) Grun.	F.
44 — Nitzschia vitrea v. recta Hantz.	F. & B.

45 — Pinnularia sp.

46 — Rhoicosphenia curvata v. marinum W.Sm. M.

47 — Synedra affinis Kutz M. & B.

48 — Synedra investicus W.sm. M.

49 — Synedra nitzschioides Grun. M.

50 — Willemoesia humilis (coscinodiscus humilis) (unkonwn)

Cyanophyceae

51 — Anabaena sp.

52 — Oscillatoria sp.

53 — Nostoc. sp.

54 — Spirolena sp.

Cyanophyceae

55 — Ankistrodesmus septatus Oettli

56 — Chlamydomonas sp.

57 — Chlorococcum sp.

58 — Cosmarium foveatum Schmidle

59 — Euglena oxyuris Schmarda

60 — Merismopedia convolata Breb.

61 — Pediastrum sp.

62 — Scenedesmus sp.

63 — Selenastrum sp.

64 — Spirogyra sp.

65 — Volvox sp.

66 — Zygnema sp.

N.B. : F = fresh B = Brackish M = Marine.