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CHANGES IN PHYSICO-CHEMICAL CHARACTERS AND PHYTOPLANKTON STRUCTURE OF EL-SALAM CANAL IN THE WEST OF SUEZ CANAL REGION

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Abstract

The changes in the phytoplankton size, species composition and physico-chemical characters of El-Salam Canal water (in the west of Suez Canal) compared with that of Nile water at Damietta region were studied during May 1999. Great variations in physico-chemical characters between El-Salam Canal water and Nile water were observed due to the disposal of Bahr Hadus drain water and/or seepege of El-Manzala lake water which may reach to El-Salam Canal water. pH; E.C; phosphate-P ; nitrate-N; chloride ; sulphate ; carabonate ; Magnesium ; Calcium ; Sodium and Potassium were represented with high values at all sites of El- Salam Canal which surpass those of Nile water .

The species composition of the main algal groups showed distinct variations. The dominance of algal groups at El-Salam Canal was in the following descending divisions: Cyanophyta/ or Chlorophyta > Bacillariophyta > Euglenophyta, on the other hand the dominance of algal groups at Nile water was in the following divisions: Bacillariophyta > Cyanophyta > Chlorophyta > Euglenophyta.

The values of pollution index at all sites of El-Salam Canal exceeded those of Nile water. Species diversity index was calculated.

Key words: BahrHadus, El-Salam Canal, Manzala Lake, Nile, phytoplankton, pollution,

Introduction

Many works have been carried out concerning the physical, chemical and biological aspects of the Nile ecosystem. Beam (1906) and Lucas(1908) were the pioneers who gave information about the Nile chemistry. The distribution and species composition of freshwater algal communities and their periodicity in different water supplies in Egypt in relation to physical and chemical characteristics of water, as well as in response to the impact of some environmental stresses was intensively studied (El-Nayal, 1935; Abdin, 1948; Talling, 1966; Golterman, 1975; El-Ayouty and Ibrahim, 1980; Shabana, 1989; Ahmed, 1983; Kobbia *et al,* 1990 and 1995) .

As far as the literature available no work was carried out on the algal distribution in El-Salam Canal water. Therefore, the main objective of the present investigation was to study the changes that might take place in the algal standing crop and physico-chemical characters of El-Salam Canal with those of the Nile water (main source). Sampling was carried out during May, 1999.

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Materials and Methods

Sampling sites: Samples of six sites belonging to the Nile water and El-Salam Canal (West to Suez-Canal near El-Cap region) were chosen to cover the investigated area (Fig.1).

Site (1): The main course of the River Nile at Damietta (near Farskur).
31° $24'$ N and 31° $47'$ E

Site (2): The main course of El-Salam Canal at El-Gamaliya .
31° $15'$ N and 31° $49'$ E

Site (3): The main course of El-Salam Canal (near El-Matariya) .
31° $10'$ N and 32° E

Site (4): The main course of El-Salam Canal (near San El-Hagar) .
31° N to 32° $5'$ E

Site (5): The main course of El-Salam Canal at (Mallahet Tel Sanhur)
31° $3'$ N and 32° $2'$ E

Site (6): The main course of El-Salam Canal at El-Sahara area (west to Suez Canal near El-Cap region) .
31° $1'$ N and 32° $18'$ E

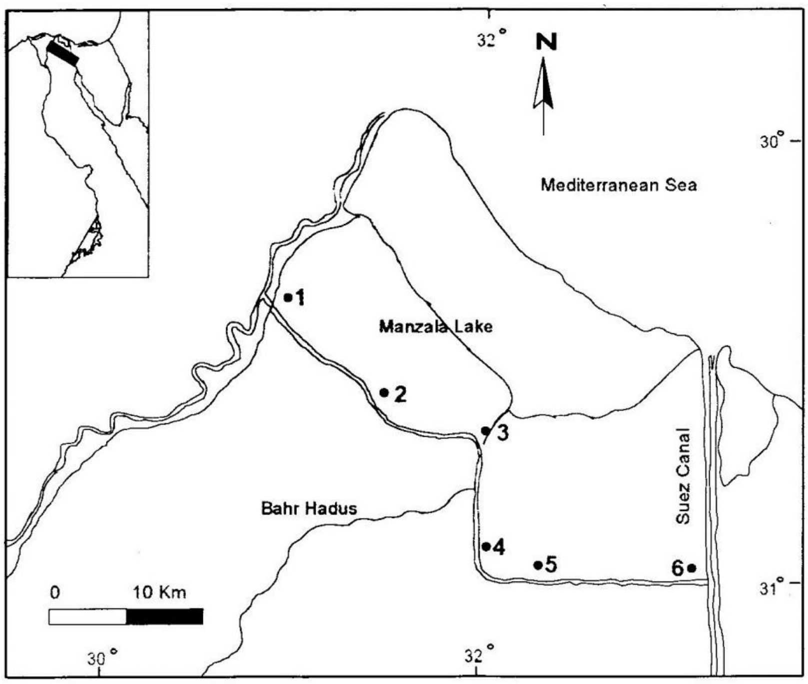


Fig.1 Location map of area surveyed
1- Nile water (Farskur), 2- El-Gamaliya, 3-El-Matariya, 4-San El-Hagar, 5-Mallahet Tel Sanhour, 6-El-Cap

Sampling: Subsurface water samples were collected from each site during May 1999. Four replicates were collected from areas surrounding each sampling site at different distances. These replicates were mixed together and again divided into four or more portions.

pH value was recorded using pH-Meter (HI model 8014). Water temperature and dissolved oxygen were measured in situ using DO_2 Meter (JENWAY) Model 9071. Water samples for physico-chemical studies were collected in polyethylene bottles of one-liter capacity and laboratory analysis started within a few hours from the time of collection.

Water analysis: Analysis of water including turbidity, electric conductivity, chloride, sulphate; carbonate; bicrbonate, phosphate-P, nitrate-N, Silicte-Si, major cations and chlorophyll "a" were determined according to the methods recommended by the Americam Public Health Association (1985). Aliquots of water samples were preserved for subsequent counting and identification of algae using Lugol's solution with acetic acid.

Identification and counting: Living and preserved cells were identified according to the systems proposed by Nygaard, (1976); Palmer (1980); Bourrelly (1981) and Prescott (1982). Diatoms were cleaned and identified according to Riley (1967). Centrifugation was carried out to concentrate the algal cells and counting was conducted by means of Sedgwick-Rafter cell. Any filamentous or massed colonial forms were counted as one cell. The results were, then expressed as counts per one liter (sample taken).

Statistical analysis: The appropriate statistic in Brillouin's index (Pilou, 1966) was used for quantitative analysis of species diversity of the phytoplankton. Pollution index (d) was analysed according to Shannon and Weaver (1963).

Results and Discussion

The results of some physico-chemical characters of the sampled water are given in Table 1. The pH values of water at all sites of studied water bodies are generally on the alkaline side, ranging between 8.1 at site 1 (River Nile near Farskur) and 8.8 at site 3 (El-Salam Canal near El-Matariya). This general tendency towards alkaline side could be mainly due to activation of photosynthetic process of dense phytoplankton populations at these sites. Such assumption seemed to be in conformity with findings of Samaan (1974); Kwaitkowski and Roff (1976) and Kobbia *et al.*,(1993).

The data in Table (2). Show that these alkaline water samples of Nile water (site 1) and El-Salam Canal (site 2) were dominated by Bacillariophyta followed by either Chlorophyta or Cyanophyta (Cyanobacteria). The dominancy of Bacillariophyta members over other phytoplankton groups in alkaline water at different transects of the Nile water was also documented by some other authors (Ramadan and Shehata, 1976; Ahmed *et al.* , 1986 a; Mohamed *et al.* , 1986; Kobbia *et al.* , 1990 and 1995) .

The water temperature did not show distinct variations between the different studied sites. The subsurface water temperature (Table 1) ranged between 26.2°C at site 6 (El-Salam Canal at El-Sahara region) and 28.1°C at site 5 (El-Salam Canal at Mallahet Tel Sanhur). At all sites, the trend of water temperature went almost parallel to figures of phytoplankton yield in studied sites. Thus it could be revealed that any increase or decrease in standing crop of phytopankton at all sites seemed to be correlated with the fluctuation in water temperature. This is in accordance with the results obtained by some other authors (Lund, 1965; Mahmoud, 1989 and Kobbia *et al.* ,1995).

Table 1. Average values of some physico-chemical characteristics of water at El-Salam Canal sites and Damietta branch of Nile water at Farskour , during May 1999.

Character \ Site	1 River Nile Damietta	2 El-Gamaliya	3 El-Mataryia	4 San El-Hagar	5 Mallahet Tel Sanhour	6 El-Cap
Temperature, °C	27.5	27.3	27.8	27	28.1	26.2
Turbidity , ntu	14.5	13	14	12.5	11.5	11
PH	8.1	8.2	8.8	8.2	8.6	8.5
E.C. m mohs cm^{-1}	0.41	0.62	0.77	1.54	2.21	1.62
Dissolved O_2 mgL^{-1}	3.4	4.6	7.8	3.7	2.8	4.2
Chloride mgL^{-1}	39.05	42.60	184.60	486.35	550.25	532.50
Sulphate mgL^{-1}	26	42	124	136	244	216
Carbonate mgL^{-1}	2.4	4.8	4.8	4.8	9.6	9.6
Bicarbonate mgL^{-1}	167.14	161.04	222.04	273.28	233.02	254.98
Phosphate-P mgL^{-1}	0.1	0.12	0.32	0.77	0.62	0.43
Nitrate-N mgL^{-1}	0.78	1.35	3.58	5.49	4.23	5.40
Silicate-Si mgL^{-1}	2.77	2.34	3.34	4.65	4.91	4.29
Magnesium mgL^{-1}	29.5	32	44	52.60	64.25	58.20
Calcium mgL^{-1}	12.5	14.56	17.25	27.20	30.15	37.20
Sodium mgL^{-1}	26.65	35.65	47.50	57.50	62.65	60.50
Potassium mgL^{-1}	5.42	6.80	8.46	9.36	12.75	19.50
Chlorophyll "a" μgL^{-1}	4.2	3.8	3.4	3.2	2.6	2.4

The results demonstrated in Table (1) revealed as well that the highest turbidity level was displayed at site 1 (Nile water near Farskur), since the absolute value was 14.5 ntu, whereas the lowest turbidity level (11 ntu) was recorded at site 6 (El-Salam Canal at El-Cap region). A part of some minor exceptions, the lower values of turbidity were always associated with a remarkable drop in total standing crop and the increase in turbidity went almost parallel to conspicuous increases in phytoplankton population at all the study sites. Such findings are consistent with those reported by some other authors (Misraand Yadov, 1978; Mooney, 1989; Kobbia *et al.* ,1993 and 1995).

Determination of the amount of dissolved oxygen in water at studied sites is undoubtedly of great importance since it is considered as one of the best parameters for evaluating pollution stress of aquatic habitats, unless it contains toxic substances (Lester,1975). As revealed from the results herein obtained (Table 1), the dissolved oxygen content of water of sites located in El-Salam Canal ranged between 2.8 mg L^{-1} at site 5 (Mallahet Tel Sanhur) and 7.8 mg L^{-1} at site 3 (El-Matariya), on the other hand, the absolute value of dissolved oxygen content of River Nile (site1) was 3.4 mg L^{-1}. However, O_2 concent-rations at all sites lay within the suitable range.

It is to be noted that El- Salam canal water showed always-higher values of electric conductivity (E.C.), compared with the Nile water (Table 1). Such variation in

E.C. may be attributed to high levels of nutrients, which reach to El-Salam Canal through Bahr-Hadus drain. The high nutrients of water at most sites of El-Salam Canal induced high eutrophication levels which in turn led to major alterations in community structure of phytoplankton. Such results are in harmony with the findings of Kobbia *et al.*, (1995).

Table 2. A list of recorded phytoplankton, their counts, species diversity index and pollution index in El – Salam Canal and Nile water during May (1999).

Algal taxa \ Site	1 River Nile Damietta	2 El-Gamaliya	3 El-Mataryia	4 San El-Hagar	5 Mallahet Tel Sanhour	6 El-Cap
Cyanophyta						
Anabaena constricta (Szafer) Geitler	12	8	6		4	2
A. variabilis Kütz.	6	6	4	2	4	6
Aphanocapsa elachista var. conferta West and West		6	2		4	2
Aphanothece clathrata G. S. West and West	4	12		12	2	6
Calothrix parietana (Naeg.) Thuret	16	12	8		4	4
Chroococcus limneticus var.distans G.M.Smith	10	16	20	8	10	8
Coelosphaerium dubium Grunow	8	8	4	6	8	8
C. kutzingianum Nage.	6			4	4	2
Cylindrospermum majus Kütz.		6		4	2	4
C. stagnale var. angustatum G. M. Smith	14	14	10	10		6
Glaucocystis duplex Prescott	12	6		4	4	4
Gloeocapsa aeruginosa (Garm.)		2		8	6	6
Gomphosphaeria lacustris var. compacta Lemm.	10	8		6	1	4
Lyngbya majusula Harv.			2	4	4	4
Microcystis aeruginosa Kütz.	8	16	10	4	8	8
Merismopedia elegans A. Braun		14	10	6	6	6
M. minima G. Beck	20	8	2		3	6
Nostoc microscopicum Garmichael					6	4
Oscillatoria lemnetica Lemm.		12	6	2	6	6
Phormidium autumnale (C.A.Ag.) Gomont	10	8	12	6	6	4
Spirulina major Kütz.			8		6	4
Tolypothrix tenuis Kütz.					2	4
Chlorophyta						
Actinastrum gracilimum G.M.Smith	4	2	8			4
Ankistrodesmus convolutus Corda	6		4	6		
Ankistrodesmus falcatus var. acicularis (A. Broun) G. S. West	8	4	10		2	4
Ankistrodesmus spiralis (Turner) Lemm.	4		10	8	10	
Botryococcus braunii Kütz.	4		4	6	4	
Chlorella vulgaris Beyerink		4	12	14	10	6
Closterium strigosum Breb	4		6	2		4
Coelastrum microporum Naeg.			10	6	2	

Table (2). Cont.

Algal taxa / Site	1 River Nile Damietta	2 El-Gamaliya	3 El-Mataryia	4 San El-Hagar	5 Mallahet Tel Sanhour	6 El-Cap
Dictyosphaerium chrenbergianum Naeg.	2		8			4
Eremosphaera viridis De Bary	2		1	2		
Gloeocystis planctonica (West and West) Lemm.	1	1	2		6	2
Hormidium klebsii G. M. Smith		6	4	2		2
Kirchneriella lunaris (Kirch) Moebius	2		8	12	4	
Micractinium pusillum Fresenius			6	4		2
Oocystis lacustris Chodat	2	1	8			
Pediastrum boryanum (Turp) Meneghini			4	4		2
P. simplex var. duodenarium (Bailey)	4	1	6		8	
Scendesmus abundans (Kirchin) Chodat		4	1	2		4
S. dimorphus (Turp) Kütz.	8	4	4		12	2
S. obliquus (Turp) Kütz.		4	8	6		4
S.quadricauda (Turp)	10	8	1		8	4
Selenastrum gracile (Reinsch)			4	6	1	2
Sorastrum spinulosum Naegeli	4	1	2	4		8
Spirogyra varians (Hass) Kütz.			4	2		
Staurastrum gracile Ralfs	6	1	2	2	1	
Stigcoclonium tenue (C. A. Ag) Kütz.	1	1	6	8		4
Tetraedron limneticum Borge	4		12	6	2	2
Zygnema micropunctatum Transeaus			4	2		
Bacillariophyta						
Achnanthes andicola (Cl.) Hust.	6		2		4	
A. brevipes parvula (Kütz.) Cl.	8			4		2
A. lanceolata (Breb) Grun	8	4				
Amphora ovata typica Cl.	12	10	2	6		6
Biddulphia laevis (Ehr.) Hust	4	8			6	
B. polymorpha (Grun) Wolle	2	4	4			6
Cocconeis placentula euglepta (E) Grun	28	12	2		4	
Cyclotella kutzingiana genuina A. Cl	4			4		10
C. menenghiniana Kütz. Plana Fricke	10	16	2	10		
C. ocellata Pant	16	14			2	6
Cymbella affinis Kütz.	18	12	3			2
C. turgidula Grun.	6	4		8		
C. ventricosa genuina May	14	16		4	14	
Diploneis elleptica (Kütz.) Cl. F. minior	8	6	4			4
Epithemia zebra probosides (Kütz.) Grun.	4	8				4
Gomphonema acuminatum genuinum May	10	6		1		
G. lanceolatum genuinum A. Cl	12	8				2

Table (2). Continued.

Algal taxa \ Site	1 River Nile Damietta	2 El-Gamaliya	3 El-Mataryia	4 San El-Hagar	5 Mallahet Tel Sanhour	6 El-Cap
G. montanum acuminatum May	6	2	4			
Melosira granulata (Ehr.) Ralfs	14	8		10	8	
M. varians G. Ag.	4					4
Navicula cryptocephala Kütz.	10	12		8		
N. cuspidata Kütz.	8		4			
N. radiosa Kütz.	8	4		8	10	
N. viridula genuina Mayer	2	6	4			8
Nitzschia acicularis W. Smith	2	6				2
N. hungarica Grun	8	10			4	
N. palea (Kütz.) W. Smith	10	14	4	8		
Pleurosigma macrum Wm. Sm,	10	6	4		6	
Rhopalodia gibba genuina Grun	6	4	2	4		
Surirella ovata Smith.	6	8	4		4	
Synedra acus radians (Kütz.) A. Cl	12	6		6	8	
S. ulna (Nitz.) Ehr	12	4	4			
Euglenophyta						
Euglena viridis Ehr.	4		4	4	4	2
Phacus caudatus Huebner			2	4		2
P. longicauda (Ehr.) Duj	4	2	1	2	4	
Chrysophyceae						
Chrysosphaerella longispina Korsch.	4		2	2	1	
Mallomonas caudata Iwanoff	4		1		2	
Dinophyceae						
Ceratium hirundinella (O.F.M.) Bergh				2	4	
Peridinum cinctum Ehrenberg					6	2
Peridinum lomnicki Woloszynska					4	2
No. of taxa	67	59	62	53	52	55
Total No. of individuals	516	424	320	289	267	232
Species diversity index (H)	1.60	1.58	1.62	1.52	1.51	1.53
Pollution index (d)	0.076	0.077	0.080	0.079	0.0800	0.077

N.B.: Filamentous and colonial organisms were counted as one organism. Total counts x10 = organisms l^{-1}

The amounts of dissolved phosphate at all sites of El-Salam Canal waters exceeded that of the Nile water site (Table 1). The levels of such nutrient element ranged between 0.12-0.77 mg L^{-1} in the former sites as compared with 0.10 mg L^{-1} in the latter ones. Such increases may probably connected with disposal of Bahr Hadus drain water and/or to organic and inorganic phosphate salts precipitated in the sediments from decayed cells. Cole (1983) reported that in non-stratified Danish lake, the annual release of phosphorus from sediments was greater than the amount received from external source. The increased PO_4 content in some aquatic bodies was generally correlated with the increase in phytoplankton decay Cooper (1958).

The data herein obtained (Table 1) further indicate that nitrate contents of the Nile water and El-Salam Canal water were more or less similar to those obtained by some other investigators (El-Ayouty and Ibrahim, 1980; Ahmed *et al.*, 1986 a and Kobbia *et al.*, 1995). However, El-Salam Canal water showed always relatively high nitrate-N content compared to that of Nile water site . It ranged between 1.35 mg L^{-1} at site 2 (El-Gamaliya) to 5.49 mg L^{-1} at site 4 (San El-Hagar), whereas it reached 0.78 mg L^{-1} at Nile water site. The increase of nitrate values at El-Salam Canal sites may be connected with disposal of Bahr Hadus drain water and/or seepege of Manzala Lake. The data presented in Table (1) and Table 2 clearly demonstrate that nitrate contents of water in the different freshwater sites seemed to be inversely proportional to the total phytoplankton growth, since large proportions of this nutrient were consumed by algal cells. Such results are in harmony with the findings of (Hutchinson, 1957; El-Wakeel and Wahby, 1970; Mooney, 1989 and Kobbia *et al.*, 1995).

The chlorosity values of El-Salam Canal water at investigated area show high levels than that of the Nile water, it fluctuated between 42.6 mg L^{-1} and 550.25 mg L^{-1} in the former whereas it reached 39.05 mg L^{-1} in the latter. The increasing of chloride value at El-Salam Canal sites may be connected with passing the underground water at El-Manzala Lake region to El-Salam Canal and/or to the disposal of Bahr Hadus drain water which may reach to the El-Salam Canal.

The limiting concentration of silicate affecting phytoplankton growth varied between 700–1400 µg L^{-1}(Strickland and Parson, 1965). Therefore, it is worthy to conclude that, the silicate contents of El-Salam Canal water and Nile water in the investigated sectors during the present study are usually exceeding the demand of Bacillariophyta. The levels of silicate content at El-Salam Canal waters ranged between 2.34 mg L^{-1} and 4.91 mg L^{-1}, whereas at the Nile water site, it ranged 2.77 mg L^{-1} (Table 1) .

It is perhaps relevant to mention that the levels of sulphate contents in Nile water site and El-Salam Canal sites lay within the range of those recorded for other sectors of the Nile by Kobbia *et al.*, (1995). The high sulphte parts (124–244 mg L^{-1}) at El-Salam Canal water may be due to seepege of El-Manzala Lake water and/or dispoasl of Bahr Hadus drain water (Table 1).

It is worthy to notice that El-Salam Canal water showed always relatively higher contents of carbonates, bicarbonate, monovalent cations ($Na^+$and K^+) and divalent cations (Ca^{++} and Mg^{++}) as compared with those of the Nile water (Table 1). Such variation may be connected with the disposal of Bahr Hadus drain water which may reach to El-Salam Canal and/or seepege of El-Manzala Lake water, as well as the water of the mixing stations.

The role of high nutrient levels and excessive loads of organic substances in water on phytoplankton crop size and productivity of fresh water had been early emphasized by Lewis and Weibezahn (1981) who reported that the content of cations in relation to each other gave always an indication to the type and intensity of phytoplankton population.

Ahmed *et al.* (1986a) speculated that Mg^{2+} at all habitats exceeded always that of Ca^{2+}, also Na^{-} sustained high concentration, which exceeded that of K^{+}. No significant correlation could be established between the number of species and concentrations of mono and divalent cations.

The results demonstrated in Table 1 reveal that chlorophyll a contents of water at all sites were more or less correlated with total phytoplankton counts through the study period (Ahamed *et al.*, 1986 b). The results of this investigation (Table 2) revealed that the recovered species at all sites contributed to 90 species, out of these 32 species belong to Bacillariophyta, 28 species to Chlorophyta, 22 species to cyanobacteria, 3 species to Euglenophyta, 2 species to Chrysophyceae and 3 species to Dinophyceae.

Diatoms (Bacillariophyta) frequently appeared constituting about 35.6% of the total algal species of all water sampled and there were predominately the pennales forms: *Amphora ovata; Cocconeis placentula; Cymbella affinis; Cymbella ventricosa; Navicula radiosa; Navicula viridula; Nitzschia palea; Pleurosigma macrum; Rhopalodia gibba; Surirella ovata* and *Synedra acus radians.* The centric species were subdominant, these observations lend a support to the deduction that the Nile water and El-Salam canal water are oligotrophic. According to Swayer (1966), pennales generally exhibit strong oligotrophic tendency. The same results were also obtained by Kobbia *et al.* (1990). The data also show that Bacillariophyta members have the greatest number species and individuals in site 1 (Nile water), whereas the lowest number was found in site 5 (Mallahet Tel Sanhur) and site 6 (El cap region) at El-Salam Canal water (Table 3).

The results presented in (Table 3 and Fig2) clear that Chlorophyta members have the greatest number of species and individuals in El-Salam Canal waters at site 3 (El-Matariya) and site 4 (San El-Hagar) and they were represented mostly by Chlorococcales. The predominant species were: *Ankistrodesmus spiralis; Chlorella vulgaris; Kirchneriella lunaris; Scenedesmus obliquus* and *Tetraedron limneticum.* These species are considered as eutrophic plankton types (Hutchinson, 1967) and generally found in water containing high levels of phosphate and nitrate (Kobbia *et al,* 1993). The data also show that *Spirogyra varians* and *Zygnema micropunctatum* (Conjugales) were represented only at the same two sites. The presence of some genera as *Amphora, Cocconeis, Cymbella, Gomphonema, Navicula, Spirogyra* and *Zygnema* indicate that El-Salam Canal water tends to be stagnant habitat.

The results (Table 3 and Fig.2) further show that cyanobacteria members have the greatest number of species at site 5 and site 6 (El-Salam Canal). However, the lowest number of species were recorded at site 1 (Nile water). The predominant species were excelled by: *Chroococcus limneticus; Coelosphaerium dubium; Microcystis aeruginosa; Merismopedia elegans* and *Phormidium autumnale.* In this connection, it should be recalled that Holmes and Whitton (1981) reported that assemblages of cyanobacteria were presumably favoured in most cases, since they have the ability to grow under wide range of chemical variabilities, the same results were obtained by Kobbia *et al,* (1993).

The Euglenoids were poorly represented, only 3 species being recorded at site 3 and site 4 (El-Salam Canal). In this respect Round (1981) emphasized that Euglenoids often occur in deoxygenated waters.

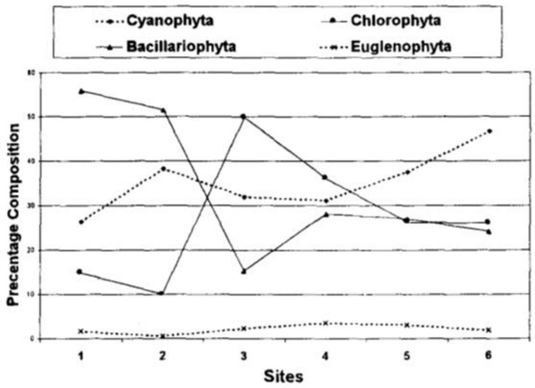
Chrysophyceae members were represented by two species at Nile water and at two sites of El-Salam Canal (3and5), whereas Dinophyceae members were represented by 3 species being recorded at site 5 (El-Salam Canal).

Table 3: Percentage distribution of the phytoplanktonic groups of El-Salam Canal and Nile water during May 1999.

Algal divisions	Site	1 River Nile Damietta	2 El-Gamaliya	3 El-Mataryia	4 San El-Hagar	5 Mallahet Tel Sanhour	6 El-Cap
Cyanophyta	Species number	13	17	14	15	21	22
	% of total	19.4	28.81	22.58	28.30	20.38	40.0
	Individual number	136	162	102	90	100	108
	% of total	26.35	38.20	31.88	31.14	37.50	46.50
Chlorophyta	Species number	18	14	28	20	13	17
	% of total	26.86	23.72	45.16	37.74	25.00	30.90
	Individual number	76	42	159	104	70	60
	% of total	14.72	9.90	49.69	35.99	26.21	25.86
Bacillariophyta	Species number	32	27	15	13	11	12
	% of total	47.76	45.76	24.19	24.53	21.15	21.82
	Individual number	288	218	49	81	72	56
	% of total	55.81	51.42	15.31	28.02	26.97	24.14
Euglenophyta	Species number	2	1	3	3	2	2
	% of total	2.98	1.69	4.84	5.66	3.85	3.64
	Individual number	8	1	7	10	8	4
	% of total	1.55	0.47	2.19	3.46	2.99	1.72
Chrysophyceae	Species number	2		2	1	2	
	% of total	2.98		3.22	1.88	3.85	
	Individual number	8		3	2	3	
	% of total	1.55		0.90	0.34	1.12	
Dinophyceae	Species number				1	3	2
	% of total				1.88	5.77	3.64
	Individual number				2	14	4
	% of total				0.34	5.24	1.72

N.B. : Individual number x10 = organism l^{-1}

The results of this investigation (Table 2) further show that, the diversity index ranged between 1.51 at site 5 and 1.62 at site 3 (El-Salam Canal). On the other hand it reached 1.60 at site 1 (Nile water). These observations indicate the presence of some changes in species composition and number of species between Nile water site and El-Salam Canal water, which may receive some pollutants from Bahr-Hadus drain and/or seepege water from El-Manzala Lake. In this connection, Liebmann, (1962) noticed some relations between certain algal species to clean or polluted waters, which indicate that phytoplankton inhabiting polluted waters differed from that in clean waters. The values of pollution index (Table 2) being recorded at El-Salam Canal sites ranged between 0.077 at site 6 (El-Cap region) and 0.080 at site 3 (El-Matariya), whereas it reached 0.076 at Nile water (site 1). Similar results were also obtained by Kobbia *et al* (1993) in his study at different transects of the Nile water.



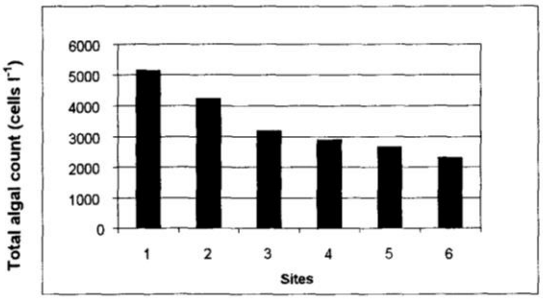


Fig. 2. Variations in Standing crop and percentage distribution of main phytoplanktonic groups of El-Salam Canal and Nile water during May 1999.

References

Ahmed, A. M.; Heikal, M. M. ; Mohammed, A.A. and Zidan, M. A. 1986 a. Field and Laboratory studies on Nile phytoplankton in Egypt. I- Some physical and chemical characteristics. *Inst. Rev. Ges. Hydrobiol.*,**71:127**.

Ahmed, A. M.; Heikal, M. M. ; Mohammed, A.A. and Zidan, M. A. 1986 b. Field and Laboratory studies on Nile phytoplankton in Egypt.II phytoplankton. *Inst. Rev. Ges. Hydrobiol.*,**71:233.**

Ahmed, Z. A. 1983. Studies on phytoplankton of the Nile system in Upper Egypt. *M. Sc. thesis, Faculty of Science, Assiut Univ.*, **pp.144.**

Abdin, G. 1948. Physiological and Chemical investigation relating to algal growth in the River Nile. *Bull* Inst. *Egypt.* **29:19-44.**

American Public Health Association 1985. Standard Methods for the examination of water and waste water 16th ed . *ABHA. AWWA WPCF N.W. Washington D. C.*, **pp. 1268.**

Beam, W. 1906. Report of the chemical section , in second report , Welcome Research Laboratories , *Khartoum. Rep. Welcome Trop. Ros. Lab.* **2:206.**

Bourrelly, P. 1981. Les algues d'eau douce Intitiation a la systematique Tomo II: Les algues Javunes et brunes Chrysophyces, Pheophyces, Xanyhophyces, et Diatomees. II *Place Saint Michel, Paris.* **(6e).**

Cole, A. G. 1983. " Text book of limnology " Professor Emeritus, Department of Zoology - *Arizona State University, Tempe, Arizona*, **pp. 401**.

Cooper, L. H. N. 1958. Consumption of nutrient salts in the English Canal *Symp. Internat. Counc. Explor. Sea Bergen.*

El- Ayouty, E. Y. and Ibrahim , E. A. 1980. Distribution of phytoplankton along the River Nile . *Water Supply and Management*, **pp. 4135**.

El-Nayal, A.A. 1935. Egyptian freshwater algae. *Bull. Fac. Sc.* **4:1-106**.

El-Wakeel, S. K. and Wahby, S. D. 1970 Hydrography and Chemistry of Lake Manzala , Egypt *Arch. Hydrobiol.* **67:173.**

Golterman, H. L. 1975. "Chemistry in River Ecology " *Whitoon , B. A. (Ed)* **pp. 39-80**. *Oxford , Blackwell.*

Holmes, N. T. H. and Whitton, B. A. 1981. Phytobenthos of the River trees and its tributaries. *Freshwater . Biol.* **11:139**.

Hutchinson, G. E. 1957. A treatise on Limnology, Vol. 1. " Geography, Physics and Chemistry " *John Willey and Sons. Inc, New York*, **pp. 1015.**

Hutchinson, G. E. 1967. "A treatise on Limnology" II . Introduction to Lake Biology and the Limnoplankton, *John Willey and Sons. Inc, New York*, **pp. 1115.**

Kobbia , I. A. ; Dowidar, A. E. ; Shabana, E. F. and El-Attar, S. A. 1993. Succession Biomass levels of phytoplankton in the Nile water near the starch and glucose factory at Giza (Egypt) . *Egypt. J. Microbiol* **28(1):131-143**.

Kobbia , I. A. ; Metwali, R. M. and El-Adel, H. M. 1995. Studies on Freshwater at Qaluobia province (Egypt) in relation to some physico –chemical factors . *Egypt. J. Bot.* **35(1):25-43.**

Kobbia , I. A. ; Shabana, E. F ; Dowidar, A. E. and El-Attar, S. A. 1990. Changes in Physico-chemical characters and phytoplankton structure of Nile water in the vicinity of Iron and Steel factory at Helwan (Egypt). *Egypt. J. Bot.* **33(3):215-233.**

Kwaitkowski, R. E. and Roff, J. C. 1976. Effects of acidity on the phytoplankton and primary productivity of selected northern Ontario Lakes. *Can. J. Bot.* **54:2546 – 2561.**

Lester, W. F. 1975. Polluted River ; River Trent England ; *In "River Ecology" ed . B. A. Whitton, Oxford* **pp. 725**.

Lewis, W. M. and Weibezahn, F. 1981. The chemistry and phytoplankton of the Orinoco river and Caroni river, Venezuela. *Arch. Hydrobiol.*, **91:521.**

Liebmann, H. 1962. "Handbuch Der Frischwakser and Abwasser. Biologie" 1,2nd ed *R. Oldenbourg. Munchen*, **pp. 588.**

Lucas, A. 1908. The chemistry of the River Nile, Surgery Dept. *Min. of Finance, Egypt, paper* **No. 12.**

Lund, J. W. G. 1965 The ecology of the freshwater phytoplankton. *Biol. Rev.* **40:231-293.**

Mahmoud, A. A. F. 1989. Evaluation of some inorganic nutrients limiting the phytoplankton growth in the River Nile using enrichment media. *M. Sc Thesis . faculty of Sci., Minia Univ.* **pp. 121.**

Mirsa, G. P. and Yadov, A. K. 1978. A comparative study of physico – chemical characteristics of river and lake water in Central Canada , *Hydrobilogia*, **59:275.**

Mohammed, A. A.; Ahmed, A. M. and Mohammed Z. A. 1986. Studies on phytoplankton of the Nile system in Upper Egypt. *Limnologica (Berlin)* **17:99-117.**

Mooney, E. P. 1989. A study of Lough corrib, Western Ireland and its phytoplankton. *Hydrobiologia.* **175:195.**

Nygaard, G. 1976. Tavlerne Fra "Dansk Pianteplankton" En flora over de Vigtigste Ferskvands former Gyldendalske Boghandel, *Nordisk Forlag. A. S.*

Palmer, C. M. 1980. Algae and water pollution. *CASTLE HOUSE BUBLICATIONS. LTD.* **pp.110.**

Pielou, E. C. 1966. The measurement of diversity in different types of biological collections. *J. Theor. Biol.* **13:131–144.**

Prescott, G. W. 1982. Algae of the western Great Lakes area. *Otto. Koeltz Science Publishers West Germany*, **pp. 977**.

Ramadan, F. M. and Shehata, S. A. 1976. early changes in phytoplankton on Nile water and Lake Dam projects session. 2: *water quality and pollution held at the National Research Centre Egypt*. **4:67.**

Riley G. A. 1967. phytoplankton of Long Island Sound. *Bull. Bingh. Oceangi cell.* **19:5-34.**

Round, F. A. 1981. The Ecology of algae – *Cambridge Univ. Press.; Cambridge CB 21 RP*, **pp. 653.**

Samaan, A. A. 1974. Primary production of Lake Edku. *Bull. Inst. Oceanogr. Fish Acad. Sci. Res. Egypt*. **4:259.**

Shabana, E. F. 1989. Responses and dynamics of Nile phytoplankton succession to waste water industrial effluents. *Egypt. J. Bot.* **32(3):201.**

Shannon, C. E. and Weaver, W. 1963. The mathematical theory of communication 117 pp. *University of Illinois Press.*

Strickland, J. D. H. and Parson T. R. 1965. "A manual of sea water analysis " *Fish Res. Board of Canada. Bull.* **1267:311.**

Swayer, C. N. 1966. Basic concepts of eutrophication . *Sewage indust. Wastes* **38:5** and **737**.

Talling, J. F. 1966. The annual cycle of stratification and phytoplankton growth in Lake Vicktoria (East Africa) *Inter. Revue Ges. Hydrobiol.* **51:545.**

التغيرات فى الصفات الفيزيائية والكيميائية وتركيب الهائمات النباتية لمياه ترعة السلام فى منطقة غرب قناة السويس

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فى هذا البحث تم دراسة التغيرات فى التركيب النوعى وحجم الهائمات النباتية والصفات الفيزيائية والكيميائية لمياه ترعة السلام (فى منطقة غرب قناة السويس) ومقارنتها بمياه نهر النيل فى فرع دمياط عند فارسكور خلال شهر مايو ١٩٩٩ .

أوضحت الدراسة وجود اختلافات جوهرية فى الصفات الفيزيائية والكيميائية بين مياه النيل ومياه ترعة السلام وقد يكون هذا الاختلاف ناجما عن اختلاط مياه ترعة السلام بمياه مصرف بحر حادوس وتسرب المياه الجوفية من منطقة بحيرة المنزلة إلى ترعة السلام خلال بعض الأماكن غير المبطنة من الترعة .

وقد أوضحت الدراسة ارتفاع قيم كل من (الرقم الهيدروجينى ودرجة التوصيل الكهربى والفوسفات والنترات والكلوريدات والكبريتات والكربونات والماغنسيوم والكالسيوم والصوديوم والبوتاسيوم) فى جميع المواقع المدروسة من ترعة السلام عنها فى مياه نهر النيل .

كذلك أوضحت الدراسة وجود اختلافات فى التركيب النوعى للطحالب وتم ترتيب السيادة الطحلبية لمياه ترعة السلام كالآتى : الطحالب الخضراء المزرقة/ أو الطحالب الخضراء > الطحالب العصوية > الطحالب اليوجلينية ، بينما تم ترتيب السيادة الطحلبية لمياه نهر النيل كالآتى : الطحالب العصوية > الطحالب الخضراء المزرقة > الطحالب الخضراء > الطحالب اليوجلينية .

أوضحت الدراسة زيادة قيم دليل التلوث فى جميع المواقع المدروسة من ترعة السلام عنها فى مياه النيل وتم أيضا دراسة دليل التباين النوعى .