CORRELATION STUDY ON PHYSICO-CHEMICAL AND PHYTOPLANKTON DYNAMICS OF RIVER NILE AT FAYOUM GOVERNORATE

Hanan A. Said and Mai M. Hassan

Botany Department, Faculty of Science, Fayoum University

Abstract

The diversity of phytoplankton and its relationships to the physico-chemical parameters were investigated in River Nile. The study area of the River Nile is located in Fayoum Governorate. Samples were collected monthly from October 2011 to September 2012, from the intake of seven drinking water treatment plants to a large extent cover the stream of River Nile branches in Fayoum governorate. The results of physic-chemical characteristics reveled that fluctuation in temperature between seasons was highly detected with respect to different seasons. In addition, results show no clear variation in pH values between different months or between different sites, where statistical analysis showed that no significant correlations between pH and phytoplankton count (r = -0.40). Also, in this investigation correlation analysis showed no significant correlation between total algal count and nitrate and total phosphorus concentration (r = 0.30 and r = 0.34 respectively). Furthermore, results of phytoplankton community structure showed that fifty four species in five divisions of phytoplankton were found. The greatest number of species were in division Chlorophyta (40.7%), followed by Bacillariophyta (33.3%), Cyanophyta (18.5%), Euglenophyta (5.6%) and Pyrrophyta (1.9%).

Key words: River Nile, Freshwater, phytoplankton, physic-chemical characteristics, community structure.

Introduction

Phytoplankton is assemblages of heterogeneous microscopic algal forms whose movement is more or less dependent upon water currents. Study of planktonic diversity contributes to understanding of the environmental status of a water body and, therefore, it may be used as an indicator of water quality (**Lund and Talling, 1957; Sreenivasan, 1976; Reynolds, 1984, Gujaria and Kumar, 1992, Ravikumar *et al*. 2006, Tsai and Gonulal, 2007, Sivakumar and Senthilkumar, 2008; Bhartikhare and PramodPatil, 2011; Rani and Sivakumar, 2012**). Phytoplanktons form the vital source of energy as primary

(ISSN: 1110-8649)

producers and serves as a direct source of food to the other aquatic plants and animals.

Increased human activities have significantly contributed to the pollution and toxicity of aquatic ecosystems. Pollutants bring changes not only in the physical and chemical quality of water but also result in a variety of alterations in the biological integrity of aquatic systems (**Simo-Matchim *et al*., 2016**).

The traditional physico-chemical measurements used in water quality monitoring programs provide a good indication of the quality of aquatic systems, but they do not the ecological state of the system (**Karr *et al*., 2000**).Biological assessment is a useful alternative for assigning the ecological quality of aquatic ecosystems since biological communities integrate the environmental effects of water chemistry in addition to the physical and geomorphological characteristics of rivers and lakes (**Stevenson and Pan, 1999**).

The River Nile forms the main water resource of Egypt. The High Dam construction resulted in great modification in the hydrodynamic regime of the River Nile, with significant changes in physico-chemical and biological characteristics of the downstream water (**Ramadan and Shehata, 1976; Saad and Goma, 1994; Shehata *et al*., 1995; Shehata *et al*., 1997; Abdel-Shafy and Aly 2002; Fishar and Khalifa, 2003; Shehata *et al*., 2008**). The river is known to be subjected to contamination by wastes derived from industrial sources, sewage and agricultural activities that alter the physico-chemical and biological properties and ecology of the biotic environment. Therefore, the present study is an attempt to record the changes in the community structure of phytoplankton in the River Nile in Fayoum governorate in relation to the physic-chemical characteristics.

Materials and Methods

1. Sampling Site

Fayoum is one of the 29 Governorates of Egypt. It lies about 90 km southwest of Cairo and has an area of 6,069 km^2. Nile floodwater reaches the Fayoum depression through the Hawara (Lahun) gap, where the altitude is about 25m above sea level. Bahr Youssef canal that feeds the entire irrigation and drinking water system of the governorate passes through this gap. Bahr Youssef Canal is a branch of Ibrahimeya Canal, which originates from Dayrout (Assiut Governorate).

In Fayoum water works intakes locate on Bahar Youssef canal and its branches. In this investigation Seven sampling sites were chosen (Fig.1), intake of New El-Azab water works (S_1), intake of Old El-Azab water works (S_2), intake of Quhafa water works (S_3), intake of Abo-Gandir water works (S_4), intake of El-Rayan water works (S_5) and the mixing point on Bahr El-Banat (S_6) and intake of Tamia water works (S_7).The water source of Tamia water works comes directly from the Nile through 15 Km long pipes come from (Gerza- El- Ayatt) to the plant.

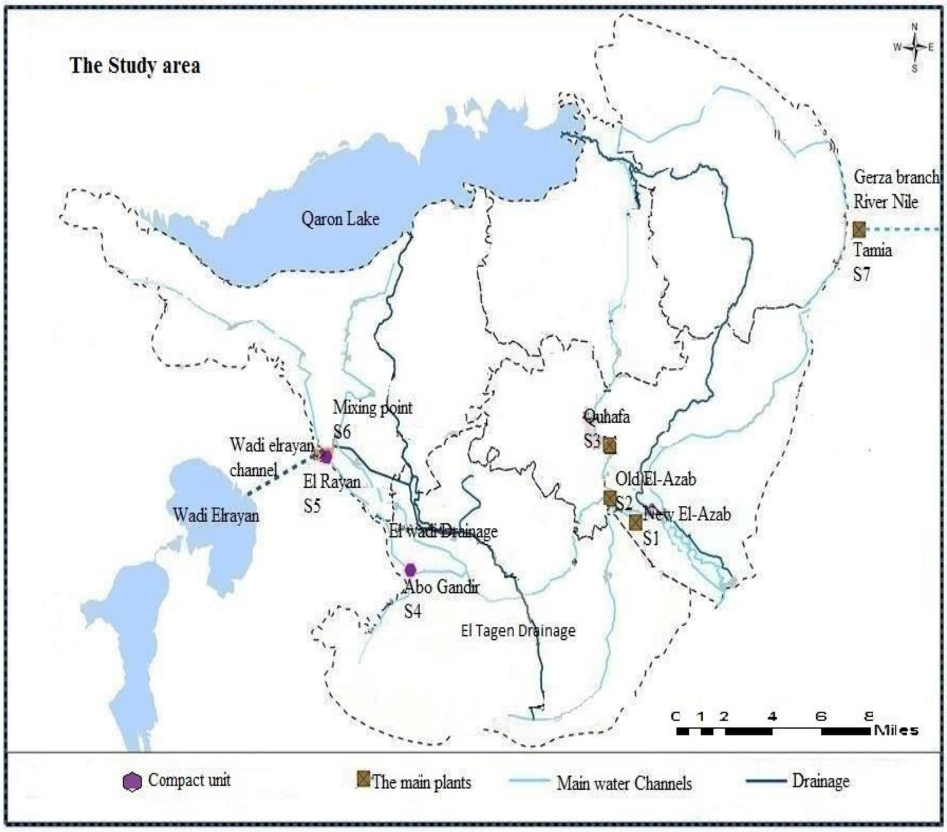

Figure (1): The study area and location of the sampling sites

2. Physio-chemical Water analysis

Water samples for chemical and biological analysis were collected at monthly intervals of a period (October 2011-September 2012). Determinations of the physico-chemical characteristics involves the temperature, pH, turbidity, electric conductivity (EC), total dissolved solids (TDS),dissolved oxygen, total alkalinity, total hardness, calcium and magnesium hardness, chloride, sulfate, ammonia, nitrate, nitrite, total phosphorus, silica, iron and manganese. The Standard Methods, recommended by the **APHA** (**2005**) as followed.

3. Biological water sample analysis

Sample collection

Sub surface water samples were collected from the sampling sites by auto sampler in dark bottles for phytoplankton counting and chlorophyll a determination. The phytoplankton counting bottles contain lugol's solution for preservation, while chlorophyll a determination bottles contain magnesium carbonate solution for chlorophyll fixation. Samples stored at $4^{O}C$.

Sample concentration

500ml water sample was concentrated by sedimentation technique in cylindrical settling champers with thin, clear glass. The supernatant was siphoned carefully to obtain the desired net volume.

Counting procedure

1ml concentrated sample transferred to Sedgwick-Rafter chamber and examined under up-right microscope.

Calculación:

$$\text{No. / ml} = \frac{C\ X\ 1000mm3}{A\ X\ D\ X\ F}$$

Where:

C= number of organism counted, A= area of field mm^2, D= depth of a field mm, F= number of fields counted.

In addition, all the Phytoplankton were identified according to the following workers: (**Geitler, 1932; Hustedt, 1976; Streble and Krauter, 1978; Komárek and Fott, 1983; Komárek and Anagnostidis, 1989**).

Chlorophyll a measurement

Chlorophyll a content of algal cells was extracted and measured according to **APHA (2005**).

Results and Discussion

The governorate of Fayoum lies within the Fayoum depression, which until recent times received floodwaters each from the Nile to the east and, like almost all of Egypt, still depends entirely on that river. This area has a unique physical setting, but also unique environmental and natural resource. Nile floodwater reaches the Fayoum depression through the Hawara (Lahun) gap, where the altitude is about 25m above sea level. Bahar Youssef canal that feeds the entire irrigation and drinking water system of the governorate passes through this gap (Drinking water supply and sanitation programmed in Fayoum, Egypt, 1990-2009). Because of the connection with the natural Nile branch, it spreads its water through many meandering natural branches that still used as irrigation canals in inefficient way.

The hydrochemical properties of water during the time of investigation were recorded in (Table 1). The inter-correlation between various physicochemical parameters and phytoplankton is illustrated by (Figures 1-9) and Pearson correlation analysis (Table 2).

Temperature:

The fluctuation in temperature between seasons was highly detected with respect to different seasons in winter; the lowest temperature was 14^{O}C while in summer the highest temperature was 33.1^{O}C. Temperature has a direct effect on the phytoplankton count where it reached the maximum in winter. Correlation analysis showed that temperature has a high negative correlation with phytoplankton count (r = -0.75) and chlorophyll a (r = -0.64).

pH:

The pH of all water samples emphasizes the alkaline characteristics of River Nile water where the pH value was in the range of 7.31 to 8.22. Results show no clear variation in pH values between different months or between different sites. Statistical analysis showed that no significant correlations between pH and phytoplankton count (r = -0.40).

Table 1: Average values of physico-chemical parameters at the selected sampling sites.

Parameters / Location		S_1	S_2	S_3	S_4	S_5	S_6	S_7
Temperature	°C	14.3 - 33.1	14.4 – 33.0	14.4 – 32.9	14.5 – 32.6	14.7 – 32.7	14.6 – 32.7	14.0 -32.9
pH		7.32 – 8.00	7.55 – 8.00	7.47 – 8.00	7.40 – 7.95	7.31 – 8.13	7.32 – 7.90	7.55 – 8.22
Turbidity	NTU	8.92 – 29.70	7.59 - 29.10	5.58 – 34.30	10.0 – 57.5	10.8 – 65.4	16.0 – 60.1	3.25 - 13.70
Electric Conductivity	µmhos/Cm	387 – 750	385 – 761	428 – 746	540 – 837	581 – 874	731 – 1119	317 – 500
Total Dissolved Solids	mg/L	232 - 450	231 – 456	257 – 448	324 – 502	348 – 525	438 – 672	190 – 300
Total Alkalinity (as CaCO3)	mg/L	121.0 – 171.2	120.6 – 172.8	125.8 – 174.4	131.2 – 189.6	137.2 – 185.6	148.2 – 200.8	119.8 – 165.6
Total Hardness (as CaCO3)	mg/L	105.5 – 167.2	98.1- 164.8	112.3 – 164.7	112.5 – 192.6	125.7 – 218.5	155.3 – 218.0	93.3 – 128.3
Calcium Hardness (as CaCO3)	mg/L	63.9 – 95.1	63.4 – 104.1	67.0 – 109.1	72.6 – 126.3	81.4 – 144.8	90.9 – 123.1	58.9 – 84.6
Magnesium Hardness (as CaCO3)	mg/L	38.5 – 72.1	32.0 – 64.6	42.4 – 67.5	39.9 – 67.9	41.6 – 70.0	54.6 – 96.4	32.4 – 49.4
Calcium	mg/L	25.6 – 38.1	25.4 – 40.1	27.60 – 36.66	29.09 – 40.60	32.6 – 58.0	36.4 – 49.3	23.6 – 29.9
Magnesium	mg/L	9.35 – 17.50	7.76 – 15.70	10.29 – 16.40	9.68 – 16.50	10.09 – 17.90	14.26 – 23.40	7.86 – 12.00
Chloride	mg/L	18.9 – 66.9	23.2 – 68.1	18.8 – 63.6	50.9 – 74.1	46.3 – 86	83.2 – 116.8	9.6 – 31.6
Sulfate	mg/L	27.40 – 82.33	31.50 – 83.61	26.30 – 85.99	59.4 – 107.3	60.40 – 105.76	96.1 – 143.2	18.80 – 36.69
Sodium (Na)	mg/L	22.39 – 72.20	16.52 – 62.70	21.9 – 80.3	23.08 – 72.30	32.92 – 72.30	55.66 – 136.10	12.97 – 34.30
Potassium (K)	mg/L	3.32 – 6.00	2.74 – 6.56	3.55 – 6.03	3.42 – 7.44	3.48 – 7.05	4.57 – 8.00	2.63 – 5.29
Ammonia	mg NH_3/L	0.06 – 0.57	0.07 – 0.63	0.06 – 0.65	0.12 – 0.81	0.03 – 0.89	0.10 – 1.47	0.04 – 0.48
Nitrite	mg NO_2/L	0.03 - 0.10	0.02 – 0.1	0.01 – 0.1	0.09 – 0.49	0.06 – 0.48	0.21 – 0.72	0.01 – 0.06
Nitrate	mg NO_3/L	1.32 – 3.84	0.97 – 3.94	0.82 – 13.30	0.49 – 10.54	2.68 – 12.20	1.00 – 13.19	0.45 – 2.10
Total Phosphorus	mg P/L	0.06 – 0.25	0.03 – 0.19	0.06 – 0.12	0.06 – 0.16	0.07 – 0.34	0.12 – 0.77	0.03 – 0.08
N/P ratio		14.7 – 52.2	8 – 104	9.1 – 221.7	4.9 – 75.3	14.6 – 152.5	4.5 – 111.6	9.6 – 63.6
Silica	mg SiO_2 /L	2.22 – 6.59	3.07 – 6.74	1.7 – 6.9	3.15 – 8.09	2.86 – 8.34	4.31 – 9.88	0.21- 5.93
Iron	mg/L	0.16 – 2.68	0.20 – 3.23	0.48 – 3.51	0.28 – 4.83	0.51 – 5.53	0.69 – 3.99	0.16 - 0.84
Manganese	mg/L	0.05 – 0.23	0.05 – 0.2	0.01 – 0.45	0.05 – 0.24	0.04 – 0.42	0.06 – 0.17	0.05 – 0.17
Dissolved Oxygen	mg/L	4.7 – 7.8	4.5 – 7.8	4.14 – 7.60	4.7 – 7.7	4.9 – 9.3	4.1 – 6.2	5.00 – 10.19

Table 2: Correlation between physicochemical parameters and algal density.

Parameters	Correlation coefficient
Temperature (^{O}C)	-0.75
pH	-0.40
Turbidity (NTU)	-0.62
Nitrate (mg NO_3/L)	0.30
Total Phosphorus (mg P/L)	0.34
Silica (mg SiO_2 /L)	-0.60
Dissolved Oxygen (mg/L)	0.61
Chlorophyll a (µg/L)	0.71

Note. The critical values are 0.58, 0.71, and 0.82 for significance levels0.05, 0.01, and0.001, respectively.

Turbidity:

Results revealed that the turbidity of water samples could be classified into three levels 7.3-34.3 ($S_1 – S_3$), 9.9-65.4 ($S_4 – S_6$) and 3.2-13.7 (S_7). The variation in turbidity level between the selected sites is due to the variation in the water source where S_1-S_3 locate on the main stream of Bahar Youssef canal and S_4-S_6 locate on small branches of the canal.

The water source of S_7 comes directly from the Nile through 15 Km long pipes come from (Gerza- El- Ayatt). Negative correlation was found between turbidity values and total algal count, this correlation confirmed by statistical analysis (r = -0.62).

Dissolved Oxygen (DO):

Dissolved oxygen is important for the survival of aquatic organisms and is used to evaluate the degree of freshness of a river (**Agbaire and Obi, 2009**).The WHO (World Health Organization) suggested the standard of DO is > 5 mgO_2/L. In this investigation, the lowest value of dissolved oxygen of 4.1mg/L was obtained in site S_6 and the highest value of 10.19 mg/L was obtained in site S_7. Dissolved oxygen in natural water depends on the physical, chemical and biological activities in the water body. Correlation analysis revealed significant positive correlation between total algal count and dissolved oxygen (r = 0.59), in contrast a significant negative correlation between dissolved oxygen and temperature illustrated by (Fig. 2) and also confirmed by correlation analysis (r = -0.67).

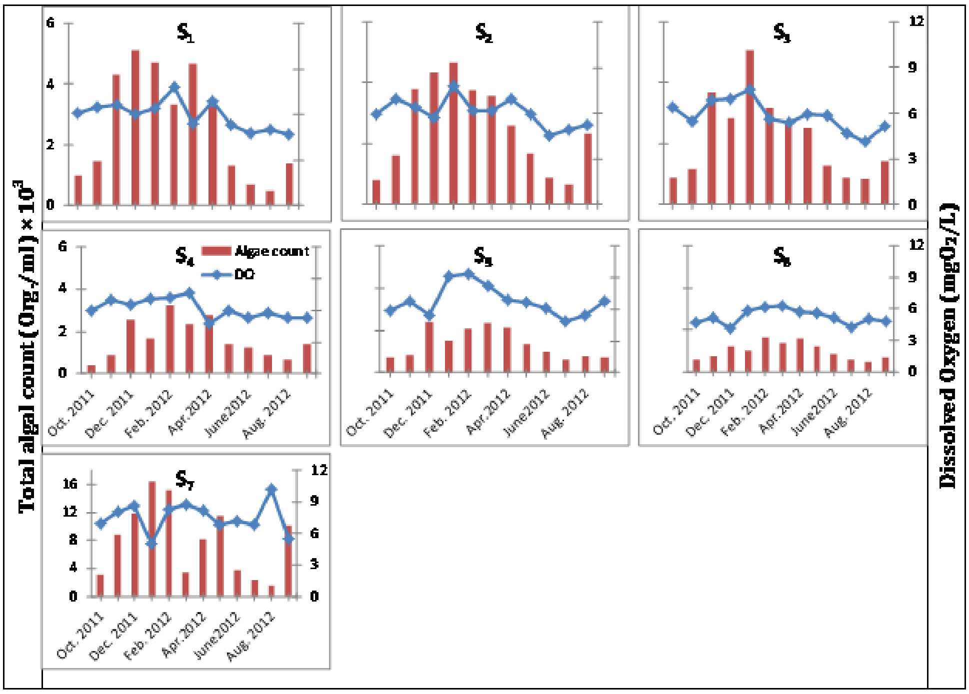

Figure (2): Relationship between total algal count and dissolved oxygen

Nutrient:

Nitrogen and phosphorus limit the growth of terrestrial plants, phytoplankton, macroalgae and vascular plants in fresh water and marine ecosystem (**Rabalais, 2002; Abdo and El-Nasharty, 2010**). Nitrogen in water occurs in various forms like nitrates, nitrites, ammonia and organic nitrogen. Nitrate is one of the most important indicators of pollution of water. According to **Kumar and Ravindranath (1998)** nitrate concentration of more than 5 mg/L in water, usually indicate pollution made by human and animal wastes or fertilizer runoff. The WHO (World Health Organization) standard drinking water quality guideline for nitrate (NO_3) value is 45 mg/L. Phosphorus occurs in natural water almost solely as phosphates. The major source of inorganic phosphorus are domestic sewage, detergent, industrial and agricultural effluents.

Phosphate is considered to be the most significant among the nutrients responsible for eutrophication (**Sushanth and Rajashekhar, 2012**). Nutrient concentrations of River Nile water and its branches mainly Bahr Youssef which feed Fayoum Governorate with freshwater emphasize the spatial and temporal variation from site to site and from month to month. The same observation was detected with the N/P ratio that revealed a pronounced difference between maximum and minimum values in different sites and different month through the investigation. Since the N:P ratio 16:1 is maintained under maximal growth rates in nutrient poor waters, steady state conditions are established and therefore the N:P ratio 16:1, also known as Redfield ratio, is considered as reference value. The relative constancy of the N:P ratio of nutrients is determined by physiological rather than chemical processes. Decreased N:P ratio values indicates nitrogen limitation whereas, higher N:P ratios, potential phosphorus limitation (**Redfield *et al*., 1963**). However, it has also been supported that these deviations from the typical N:P ratio values can also be linked to eutrophication problems. Changes of the N:P atomic ratio was first related to excessive phosphorus loads from sewage by **Ryther and Dunstan** (**1971**). In this investigation correlation analysis showed no significant correlation between total algal count and nitrate and total phosphorus concentration (r = 0.30 and r = 0.34 respectively) (Table 2, Figures 3 and 4).

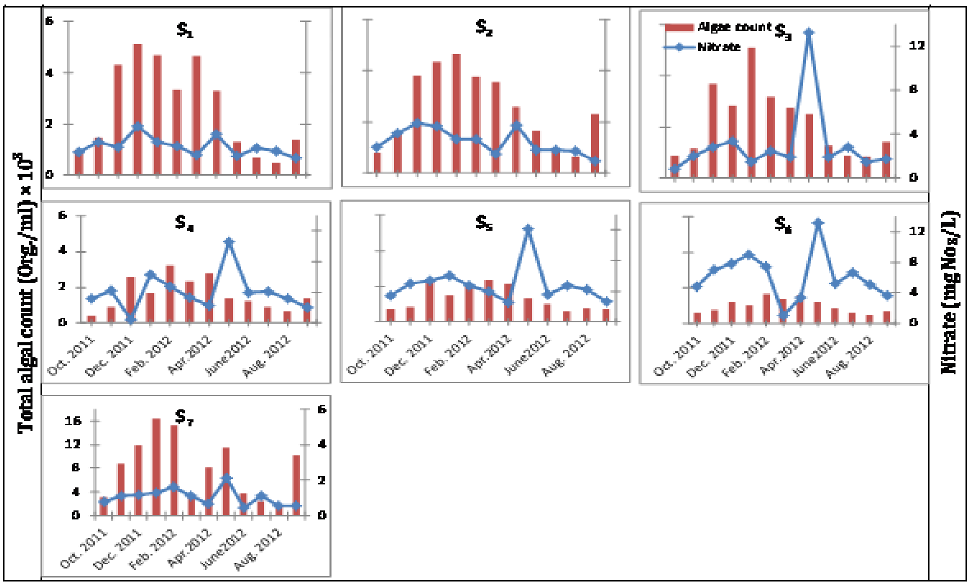

Figure (3): Relationship between total algal count and nitrate

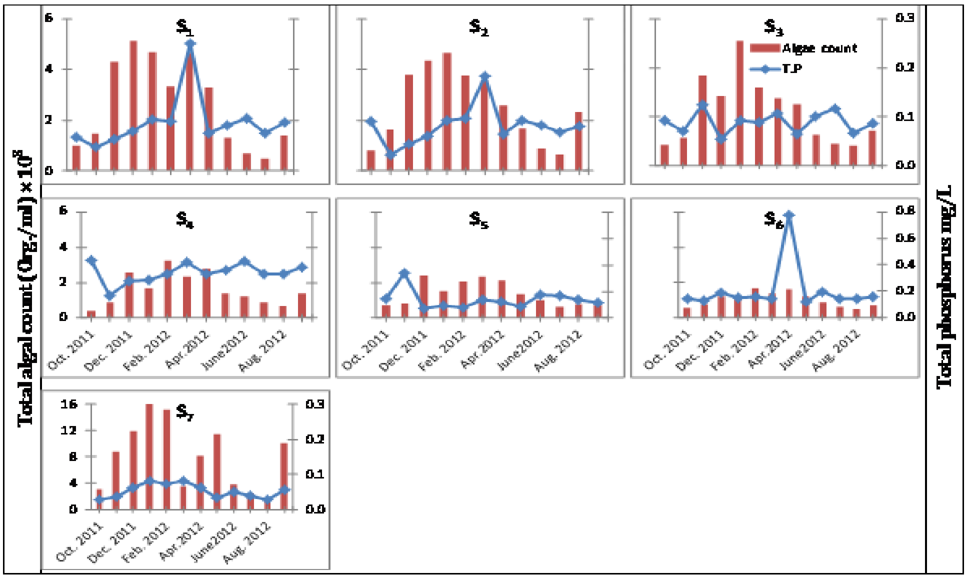

Figure (4): Relationship between total algal count and total phosphorus

Silica

Dissolved silica is an important nutrient for formation the silica wall of diatoms (dominate phytoplankton assemblages). Concentration of dissolved silica ranged between 0.21-9.88 mg SiO_2 /L. The lowest values were associated with the maximum growth of diatoms (Fig. 5). This correlation confirmed statistically (r =0.60).

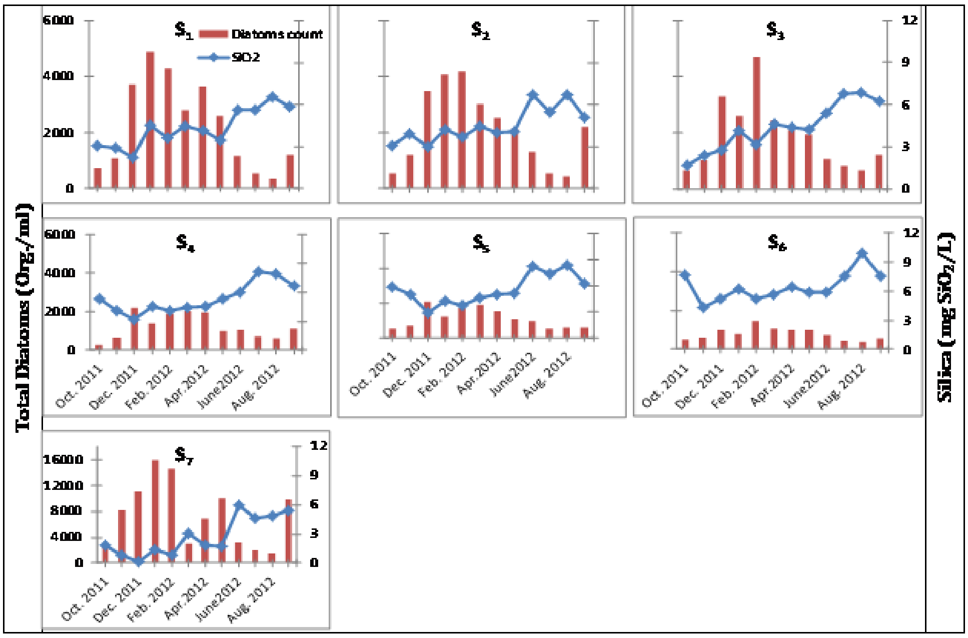

Figure (5): Relationship between total diatom count and silica

Chlorophyll "a" content

Chlorophyll "a" content ranged from 0.20 – 17.53µg/L. Clear relationship between phytoplankton numbers and chlorophyll "a" content were established (Fig. 6). Statistical analysis showed that positive correlation of Chl. "a" with total algal counts (r = 0.71). **Simo-Matchim *et al.*** (**2016**) stated that the highest values of primary production and Chl. a biomass were measured during the summer bloom, and those high values indicate that highly productive ecosystems.

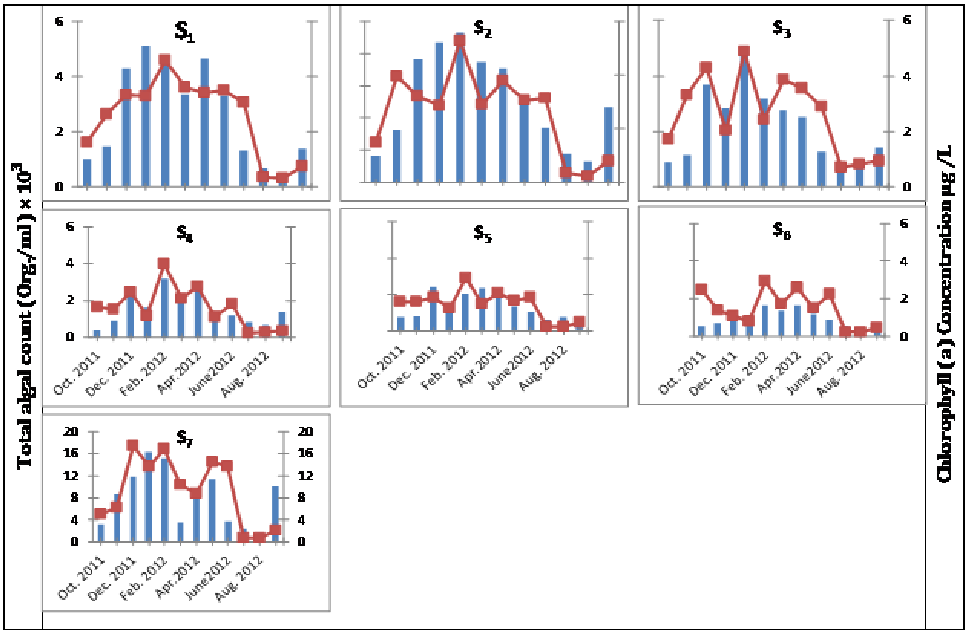

Figure (6): Relationship between total algal count and Chlorophyll (a).

Phytoplankton

In the present study, the phytoplankton community in of River Nile that reached to Fayoum Governorate through Bahr Youssef Canal and in front of drinking water treatment was represented by members of Chlorophyceae, Bacillariophyceae, Cyanophyceae, Euglenophyceae and Pyrrophytaceaeas represented in (Table 3). A total of 54 algal species can be identified, of which 22 species belonging to Chlorophyta, 18 belonging to Bacillariophyta, 10 belonging to Cyanophyta, 3 belonging to Euglenophyta and only one for Pyrrophyta. The percent composition of phytoplankton is illustrated by (Fig. 7). All the sampling sites were quite similar in community composition as well as the diversity and dominance of different algal group. Quantitative analysis of phytoplankton populations showed that it reached its maximum value during winter and spring months (Fig. 8). In the present study, quantitative analysis of phytoplankton populations showed that the abundance of diatoms group was detected in all sites

Table 3: Phytoplankton of the River Nile at Fayoum governorate, Egypt

Chlorophyta	Bacillariophyta	Cyanophyta	Euglenophyta	Dinophyta
Actinastrum hantzschii	*Amphora ovalis*	*Anabaena constricta*	*Euglena sanguine*	*Peridinium cinctum*
Ankistrodesmus falcatus	*Calonies amphisbaena*	*Chrococcus turgidus*	*Phacus triquester*	
Botryococcus braunii	*Cocconies placentula*	*Coelosphaeriumkuetzingianum*	*Tracheolomonace armata*	
Chlamydomonas variabills	*Cyclotella ocellata*	*Cylindrospermum stagnale*		
Chlorella vulgaris	*Cymatopleura solea*	*Gleocapsa sanguine*		
Chodatella cilliata	*Cymbella prostrasta*	*Gomphaspheria lacustris*		
Closterium pronum	*Diatoma hiemale*	*Merismopedia glauca*		
Coelosterum microporum	*Fragilaria capucina*	*Microcystis aeruginosa*		
Cosmarium bioculatum	*Gomphonema olivaceum*	*Oscillatoria mougeotii*		
Crucigenia rectangularis	*Melosira granulate*	*Spirulina abbreviate*		
Dictyosphaerium ehrenbergianum	*Navicula cuspidata*			
Golenkinia radiate	*Nitzschia linearis*			
Kirchneriella obese	*Pinnularia borealis*			
Micracitinum pusillum	*Pleurosigma delicatulum*			
Nephrocytium lunatum	*Stauraneis*			
Oocystis solitaria	*Stephanodiscus dubius*			
Pediastrum simplex	*Surirella ovalis*			
Scenedesmus quadricauda	*Synedra ulna*			
Selenastrum gracile				
Staurastrum paradoxum				
Tetraedron minimum				
Ulothrix subtiiissima				

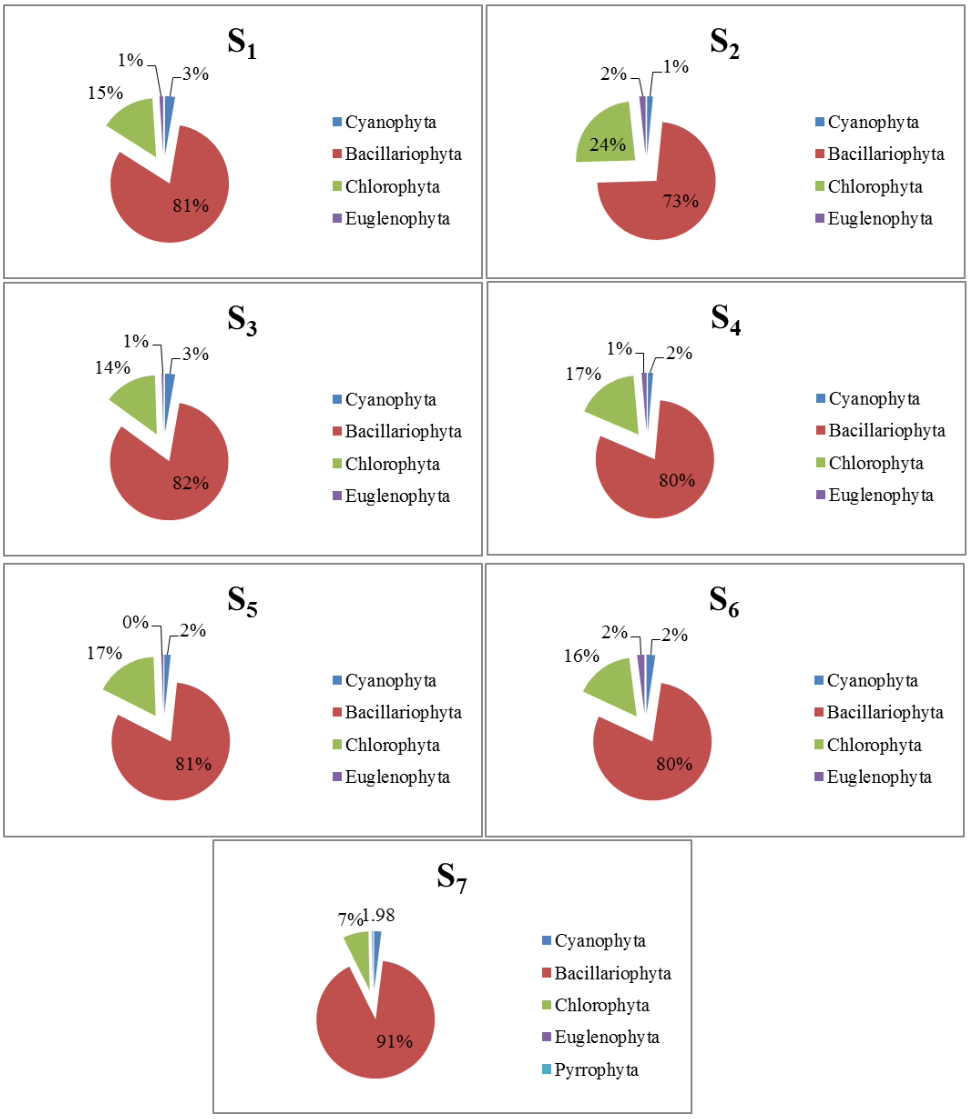

Figure (7): The percent composition of different phytoplankton groups at the selected study sites

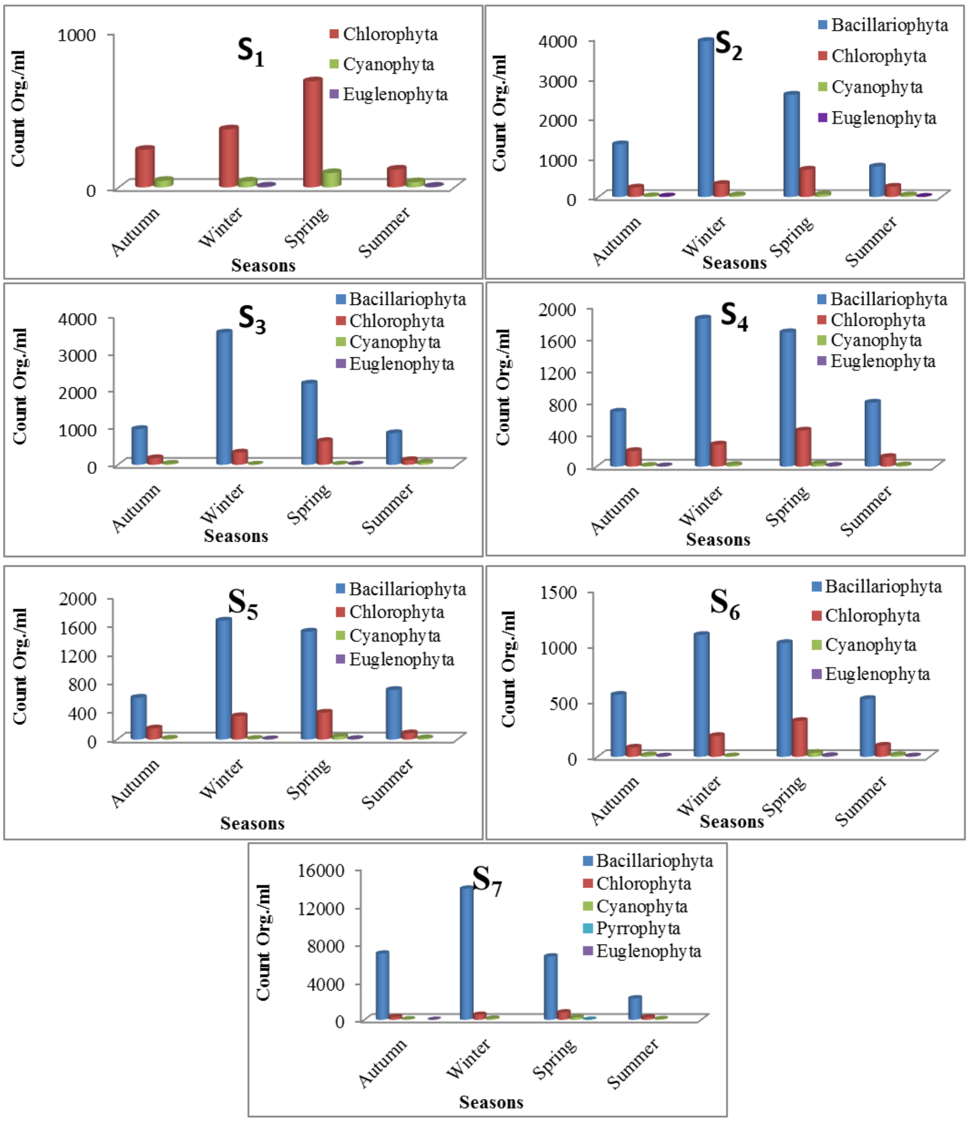

Figure (8): Seasonal Variation densities of different phytoplankton groups at the selected study sites

and along the time of investigation. The numerical superiority represented by species of *Cyclotella ocellata*, *Melosira granulate*, *Synedra ulna*, *Cocconies placentula*, *Stephanodiscus dubius*, *Nitzschia linearis* and *Navicula cuspidate.* **Simo-Matchim *et al*.** (**2016**) found that a mixed assemblage of diatoms and flagellates in summer, whereas the fall community was largely dominated by flagellates. Water temperature affects the abundance of diatoms. Most diatoms are suited to cold water, but if the temperature is too low, it will suppress the growth (**Wim and Koen, 1995**).

Furthermore, the present investigation established a considerable diversity in members of green algal group where it represented by 22 species in all sites. Many green algae such as *Scenedesmus quadricauda*, *Pediastrum simplex*, *Ankistrodesmus falcatus*, *Staurastrum paradoxum*, *Tetraedron minimum* and *Chlamydomonas variabills* are occurred abundantly and frequently. In addition blue-green algae are represented by species of *Microcystis aeruginosa*, *Merismopedia glauca*, *Chrococcus turgidus*, *Oscillatoria mougeotii* and *Spirulina abbreviate.* Species belonging to Euglenophyta and Pyrrophyta are *Euglena sanguine*, *Phacus triqueter*, *Tracheolomonace armata* and *Peridinium cinctum.* Hence, the most pollution-tolerant species such as *Euglena*, *Oscillatoria*, *Navicula*, *Nitzschia*, *Ankistrodesmus*, *Scenedesmus* and *Chlamydomonas* were recorded to be present in all sites and along different season of investigation. **Palmer** (**1969**); **Gunale and Balakrishnan** (**1981**) and **Jafari and Gunale** (**2006**) reported that genera like *Oscillatoria*, *Euglena*, *Scenedesmus*, *Chlamydomonas*, *Navicula*, *Nitzschia*, *Stigeoclonium*, and *Ankistrodesmus* are the species found in organically polluted waters. Further, **Kumar *et al.*** (**2012**) found that the planktonic forms of *Pandorina*, *Scenedesmus*, *Navicula*, *Chlorella*, *Spirulina*, *Anabaena*, *Eudorina*, *Melosira*, *Closterium* and *Cosmarium* were observed as indicators of organic pollution-tolerant species. *Microcystis aeruginosa* is associated with the highest degree of civic pollution (**Shekhar *et al*., 2008**) and may be considered as the best single indicator of organic pollution in any water body. River Nile water revealed slight change in physic-chemical characteristics such as pH, turbidity, total dissolved solids, alkalinity, total hardness, chloride, sulphate as well as nutrient content (nitrate, phosphate and silica) especially at all sites involved in this investigation. In addition, **Simo-Matchim *et al*.** (**2016**) found that seasonal variations in phytoplankton dynamics were mainly controlled by the strength of the vertical stratification and by the large differences in day length. The pronounced change can be observed in temperature during different season where it fluctuated between $14^{O}C$ in winter months to 33^{O}C in summer months, this result obtained in different sites. So, the fluctuation in algal abundance and algal count can be attributed to the effect of temperature on algal species. **Suresh *et al*.** (**2011**) stated that variations of water temperature were well marked with respect to different seasons and it plays an important role in controlling the abundance of phytoplankton (**Singh, 1960**). Also, **Simo-Matchim *et al*.** (**2016**) confirmed that a marked seasonal variability, with significant differences in phytoplankton structure and function between summer and fall, while the pH of water may promotes the growth of algae (**Geroge, 1961 and Suresh *et al*., 2013**).

Conclusion

1. Based on the present study phytoplankton density, community structure, and physicochemical characters of River Nile water was satisfactory and suitable for human consumption and other domestic uses.
2. Algal numbers may change in the raw Nile water according to the time and season of the year in addition to the site of sample collection. Therefore, analysis should be conducted over yearly cycles.
3. Dominance and diversity of algal species in aquatic ecosystem specify the quality of the ecosystem to different human uses.
4. Study algal community structure of aquatic ecosystem is a key factor in determining water treatment technology used in Drinking Water Treatment Plant.
5. The presence of different algal groups with high numbers during various seasons in the river Nile has led to a re-evaluation of traditional treatment technologies.

Dedication

To the sole of Professor Dr./ **Refaat M. Ali** for his encouragement and help during all lab work.

Acknowledgment

The authors are grateful to Prof. Dr./ **Gamila H. Ali**, Water Pollution Department, National Research Centre, Cairo, Egypt for her keen support and valuable comments, suggestions and sincere help in preparation of manuscript and also for her reviewing this manuscript.

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دراسة توافقية على الخواص الفيزيائية و الكيميائية و العوالق النباتية لنهر النيل بمحافظة الفيوم

حنان عبد الله سعيد ، مى مصطفى حسن
قسم النبات، كلية العلوم، جامعة الفيوم

تم دراسة تنوع العوالق النباتية وعلاقتها بالخواص الفيزيائية والكيميائية للمياه في نهر النيل. تقع منطقة الدراسة في نهر النيل في محافظة الفيوم. جمعت العينات شهريا من شهر أكتوبر 2011 إلى شهر سبتمبر 2012، من مداخل سبع محطات لمعالجة مياه الشرب و اللتى تغطي إلى حد كبير مجرى فروع نهر النيل في محافظة الفيوم. وقد أظهرت نتائج الخصائص الفيزيائية والكيميائية أن هناك تغير في درجة الحرارة بين الفصول المختلفة. كما أظهرت النتائج عدم وجود تباين واضح في قيم الرقم الهيدروجيني بين الأشهر مختلفة أو بين المواقع مختلفة، حيث أظهر التحليل الإحصائي عدم وجود ارتباطات ذات قيمة بين الرقم الهيدروجيني واعداد العوالق النباتية (r = -0.40). كما أظهرت نتائج التحليل الارتباطي عدم وجود علاقة ارتباط ذات قيمة بين مجموع الطحالب ، تركيز النترات والتركيز الكلي للفوسفور (r = 0.30 و r = 0.34 على التوالي). وعلاوة على ذلك، أظهرت نتائج تواجد العوالق النباتية أنه تم العثور على خمسين نوعا في خمسة أقسام من تلك العوالق. وكان أكبر عدد من الأنواع ينتمى إلى قسم Chlorophyta (40.7٪) ، تليها Bacillariophyta (33.3٪) ، Cyanophyta (18.5٪) ، Euglenophyta (5.6٪) Pyrrophyta (1.9٪).