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Monitoring of Water Pollution and Eutrophication using Phytoplankton as Bio-indicator in Burullus Lake, Egypt

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Abstract

Lake Burullus face tremendous ecological stresses due to rising of pollution originated from the discharges of the drains without treatment; eight stations were monitored in order to assess the eutrophication and the pollution levels at these stations using some species of phytoplankton as bio-indicator to the pollution. An average density of 1.406000 units l^{-1} phytoplankton belonging to four divisions namely; *Euglenophyceae, Bacillariophceae, Chlorophyceae* and *Cyanophyceae* were identified.

The most abundant genera at these stations were *Euglena* spp. and *Phacus* spp. (euglenords), *Scenedesmus* spp. (chlorophytes), *Cyelotella* spp. and *Nitzschia* sp. (*Bacillariophyceae*), while the genera of *Merismopedia* spp. and *Microcystis* spp. were the most dominant among *cyanophytes* (blue-green algae). These genera were the most dominant at the stations near to the drains which affected by the discharges originated from the drains (organic pollution) as well as the high levels of nutrient salts especially ammonia nitrogen (eutophication). The members of euglenoids were the most indicators to the pollution at station 2, 3 and 7 near to the drains.

1. Introduction

Lake Burullus belong administratively to Kafr El-Sheikh province. It lies in a central position between two branches of the Nile along Mediterranean coast in the north part of Nile Delta connecting with the sea through Boughaz El-Burullus opening.

From the new records after the cleaning process at the eastern part of the lake at Baltim City, the lake has a total area 453 Km^2. The length of the lake from Boughaz El-Burullus till Brimbal cannal in the extremely western side of the lake (47 km), on the other hand, the width of the lake varies from site to other. The western sector has the least width not exceed 5km, while the eastern and middle sectors were 14 and 11 km respectively. The depth in the lake increase gradually from the east (20 cm) to middle and western sector about 70 to 120 cm respectively.

Many authors studied the using of phytoplankton species as indicator to the water quality and pollution as well as the eutrophication, such as Reynolds (1984a), Rynolds (1997), Moss (1998), Straskraba and Tundisi (1999), Reynolds and Peterson (2000), Reynolds *et al.* (2002), Brettum and Adersen (2005), Radwan (2007) studies the impact of pollution on the phytoplankton community in lake Burullus and Amphorn and Wanninnee (2012).

Further, other studies reported the distribution pattern of phytoplankton with respect to the degree of water pollution such as chaudhary of Pillai, 2009; Singh & Balasingh 2011; Ghosh *et al.,* 2012 and Maske *et al.,* 2010. The aim of the present work is to study the qualitative and quantitative of phytoplankton community in Lake Burullus as well as the using of some species as indicators to the pollution at the different localities of the lake.

2. Material and Methods

2.1. Sampling localities and stations

Eight stations were chosen as Table (1) and Figure (1) representing the whole area of the lake station 1, 2 and 3 from the eastern sector, while station 4-7 from the middle sector and station 8 from the western sector Figure (1). The selected sampling stations presented in Table 1 was recorded by GPS.

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Subsurface water samples (20 cm depth) were taken from each station at the same time for chemical and phytoplankton analysis. The chemical variable (Dissolved oxygen, salinity and pH were determined according to APHA (1989). Nutrient salts were analyzed according to Grasshoff *et al.* (1999).

The identification of phytoplankton species were carried out using a binocular research microscope model XSZ –10BN Germany – No. 009707. Sedimentation technique used for the qualitative and quantitative analysis of phytoplankton. The cell count of hemocytometer used for counting the phytoplankton species according to Prescott (1978), Bold and Wynne (1978) and Vinard (1979). Where; One drop from the concentrated sample of phytoplankton on the groove of the hemocytometer chamber, allow the concentrated sample to flow under the cover glass then allow the cells settle for about 3 minutes, the count of phytoplankton species were carried out in four large square as the following:

The depth of the counting chamber is 0.1 mm and the area counted is 4 square mm (4 squares are counted, each with an area of one square mm therefore, 4x1.0 sq mm = a total of 4 sq mm). The volume counted is: area x depth = volume 4 sq mm x 0.1 =0.4cu mm.

Number of species per liter = number of species counted as an average 4 sq x conc factor x1000/0.4

2.2. Statistical analysis

The relationship and correlation coefficient between some hydro-chemical parameters and the total count of phytoplankton were carried out using statistical SPSS program.

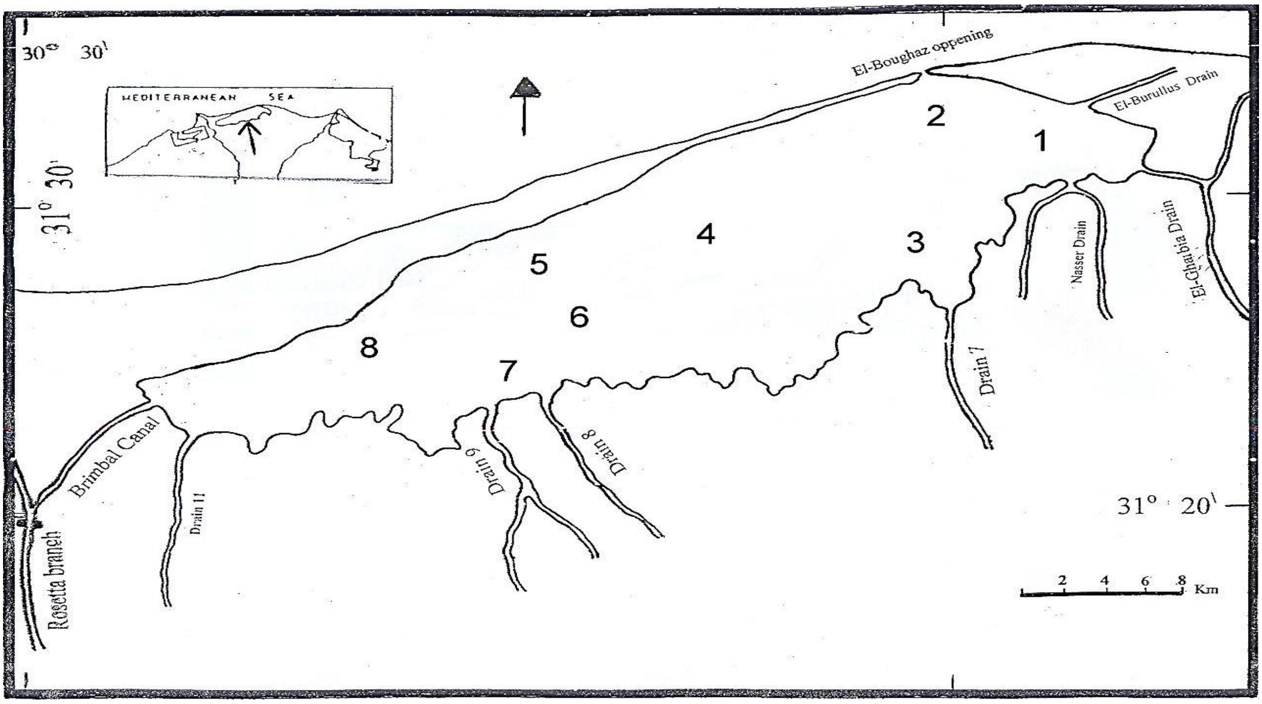

Fig. 1. Map showing sampling stations in Lake Burullus

Table 1: Latitude and Longitude of sampling stations of Lake Burullus

St. No	Station	Latitude (N)	Longitude (E)
1	Infront of El-Burullus Drain	31° 33` 29.9``	30° 04` 25.3``
2	El-Boughaz (outlet)	31° 34` 27.6``	30° 29` 28.4``
3	Drain 7	31° 27` 26.1``	30° 56` 17.5``
4	El-Zankah	31° 27` 53.3``	30° 47` 10.0``
5	Mastaroh	31° 29` 09.0``	30° 45` 24.4``
6	El-Tawillah	31° 26` 50.2``	30° 46` 10.0``
7	El-Shakhloubah (Drain 8&9)	31° 24` 46.9``	30° 45` 54.9``
8	Abou-Amer	31° 24` 17.5 ``	30° 30` 01.9``

3. Results and Discussion

Many authors discussed the distribution and relations of phytoplankton with some factors like lake temperature, pH, Transparency, sun light and nutrient enrichment. They noticed that each lake habitat is different from other lake habitat and concluded that phytoplankton is a bio-indicator for impacts of influencing factors. Phytoplankton aid in monitoring and assessing the strategies of the fresh water lake management (Manisha *et al.,* 2013).

The phytoplankton has been long used as an effective water bio-indicator that is sensitive to environmental changes. Some species thrive in highly eutrophic waters, where some species are very sensitive to environmental changes (Amphon and Wanninee, 2013).

The detailed study of phytoplankton at the different stations of Lake Burullus water revealed that, the diversity and flourishment of phytoplankton was affected mainly by the nutrient conditions of water as well as the different sources of pollution from the discharges originated from the drains (Radwan, 2007).

In our investigation, the phytoplankton community at the stations of Lake Burullus was more productive due to the pronounced increase of some species and classes at some stations near to the drains as shown in Table 2 which indicate the dominance and flourishment of class *Euglenophyceae* at station 7 recording about (1.145×10^3 cell l^{-1}); in the middle sector of the lake infornt of drain 8 & 9 followed by class *Bacillariophyceae* (1×10^6 cell l^{-1}) at the same station, also the observation was recorded at station 3 infront of drain 7 in the eastern sector where the class *Euglenophyceae* was the most dominant recording about (960×10^3 cell l^{-1}) due to the high load of discharges from the drain related to the high level of ammonia nitrogen (Table 3).

In this context, the *euglenoids* were the main component and most abundant among the standing crop of phytoplankton at the stations near to the drains. This attributed to the heavy load of organic matters discharged from the drains which lead to the flourish of the members belonging to this class, with taken in our consideration that this class not detected at the station further away from the drains.

The members of this class represented by eight species namely; *Phacus longicauda*, *P. Macrostigma, P. Sestosa, P. Pleuronectes, Euglena acus, E. promxia, E. grcilis and E. granulate*. The flourish of these species were dependent mainly upon the load of organic pollution originated from the drains in addition to the concentration of nutrients salts especially the high level of ammonia (eutrophication).

Many studies cleared that the occurrence and flourish of *Euglena* was due to the organic pollution (Abdallah *et al.,* 1991), Kimor, (1992) reported that the nutrients enrichment from sewage tends to stimulate the development of algal blooms especially microflagellate mainly euglenoids and coccoid forms, other study was carried out by Amphon and Wannine (2013) who reported that the rivers and lakes with stagnant and weak water currents always contain Euglenophyta such as *Euglena* spp. and *Phacus* spp. *Egulena* are indicator to eutrophic waters and organic pollution.

Concerning, the distribution of chlorophytes members at the different stations, it's obvious that class Chlorophyceae was the most abundant at station 7 infornt of drain 8 & 9 which characterized by heavy load of organic matters originated from the drains (sewage and fish farms effluents) recording about (930×10^3 unit l^{-1}). The species of *Scendesmus quadricauda* was more productive among the chlorophytes members at this station influenced mainly by the organic matter discharged, in addition to the low level of salinity which enhance the flourish of *Scenedesmus* spp. this observation agree with Walsh and Merrill (1984) who, reported that the effect of sewage upon the algal blooms due to the organic pollutions especially *Scenedesmus* spp., *Ankistrodesmus* sp. and *Cosmarium* sp. as shown at station 1 infront of El-Burullus drain which characterized by the high load of organic discharges. This observation coincided with Radwan (1994). Who reported that the flourish of *Scenedesmus* were due to the organic pollution.

The distribution of *Bacillariophyceae* species at the different stations indicated that, the dominant genera of diatoms frequently recorded in the lake were *Cyclotella* spp., *Nitzchia* spp. and *Cocconeis* sp., while the other genera persisted as infrequent. The genus of *Cyclotella* spp. was the most dominant at station 7 constituting about 46% of the total bacillarophytes at this station (Table 2), since this station was affected by the discharges of drain 8 & 9 with heavy load of organic pollution. The genus *Cyclotella* spp. was represented by two species namely; *C. meneghiniana* and *C. Kutzingiana* recording about 260×10^3 and 200×10^3 cell l^{-1} respectively, while the genus of *Nitzschia* spp. formed about 31% of the bacillariophytes at the same station represented by two species namely; *N. longissima* and *N. abtusa* recording about 180×10^3 and 130×10^3 cell l^{-1} respectively. The same observations were coincided with Sabatar and Sabater (1988) who reported that, the genus *cyclotella spp*. can tolerate different pollution conditions, Abdallah *et al.* (1991) found that the species of *cyclotella* and *Nitzschia* developed with the increase of organic load, other observation was recorded by Abdel Hamid (1986) who found that, the distribution of these genera was influenced by the load of organic matter. In general, the diatoms recorded the highest count at this station due to the high load of discharges from the drains and this agree with Mukherjee *et al.* (2010) who noticed that, the blooms of diatoms occurred in Ranchi lake were due to the organic matter with high concentrations in November month.

From the check list in Appendix, the members of *Cyanophyceae* were the most diversity especially at stations near to the point of discharges originated from the drains (St. 7) infornt of drain 8 & 9, also the blue green algae were recorded the highest count (456.000 unit l^{-1}) which decreased gradually with further away from the drains (Table 2& Figure 2). The genera of *Merismopedia* spp., *Chrococcus* spp., *Microcystis* spp. and *Oscillatoria* sp. were the most productive and important genera among the cyanophytes especially infront of the drains which characterized by heavy load of organic pollution from the discharges (sewage and fish farms). These observations were supported by Radwan (1994) who mentioned that, the flourish of cyanophytes were influenced mainly by the organic pollution and temperature in addition to the high load of nutrient salts (eutrophications). Other investigators noticed that, the maximum distribution of cyanophytes were correlated with domestic sewage (Saad and Antoine, 1983), Wang and Zhang (1993) reported that, in Summer, Autumn and Winter the dominant species of blue-green algal especially *Microcystis* spp. indicated that the lake under study suffered from pollution and can be regarded as a blue-green algae-eutrophic lake, the study of Rodrigues *et al.* (1995) revealed that, with the increasing supply of nutrients contributed to an increasing eutrophication and the blue-green algae dominated in Fumas Lake.

The results obtained from the statistical analysis as shown in Table (4) were indicated that, a highly significant positive correlation was found between ammonia & nitrate and phosphate & nitrate (r= 0.89 and r= 0.72 respectively). This indicate that, the nutrient salts in the lake represent the most effective on the flourishment of phytoplankton especially infront of the drains this observation is agreeing with Nassar (2007) who reported that, the relation between the nutrient salts (ammonia, Nitrate and Phosphate) was significant positive correlation, while the relation was inverse correlation between the dissolved oxygen and the total count of phytoplankton (r= -0.36). This is may be due to the high amounts of organic matters which decomposed by the bacterial activities leading to the consumption of oxygen at the same time flourishment of phytoplankton occur due to the enrichment of nutrient salts originated from the discharges of the drains. The water temperature exhibited insignificant correlation (r= 0.41). This coincided with those obtained by Behrendt (1990) who noticed that the effect of temperature variations on phytoplankton mostly manifested on periodicity and communities succession of algae but not necessary on the total count.

Table 2: Average numbers of the different phytoplankton classes (units or cells $l^{-1} \times 10^3$) recorded in the different stations

St. No.	Class				
	Euglenophyceae	**Chlorophyceae**	**Bacillariophyceae**	**Cyanophyceae**	**Total**
	Cell l^{-1}	**Unit l^{-1}**	**Cell l^{-1}**	**Unit l^{-1}**	**Unit l^{-1}**
1	284	250	125	130	789
2	-	70	275	295	640
3	960	450	125	275	1.810
4	-	155	120	155	430
5	375	900	135	215	1.625
6	rare	860	110	115	1.085
7	1145	930	1000	456	3.531
8	-	810	150	378	1.338
Average	346	553	255	252	1.406
Percent.	25	39	18	18	100%

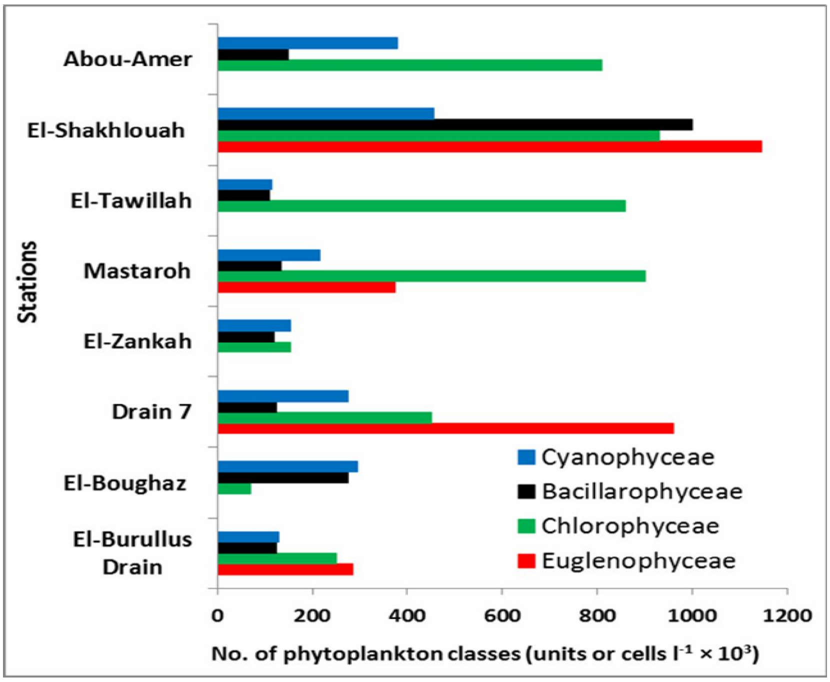

Fig. 2. Distribution of phytoplankton classes within different stations

Table 3: Physio-chemical parameters of water samples at the different stations of Lake Burullus

Parameters		Eastern Sector			Middle Sector				Western sector
		1	2	3	4	5	6	7	8
T°C		19.2	18.9	19.8	19.5	21.5	21.4	20.5	20.2
EC ms/cm		31.8	63.3	9.11	10.17	9.29	8.61	4.52	9.00
pH		9.07	8.89	9.06	9.01	9.18	8.96	8.87	8.99
Trans.	cm	20	20	10	10	20	20	20	20
Depth	cm	100	60	70	80	120	100	120	120
NH_3	µg/ l	123	69	96	119	60	288	79	96
PO_4	µg/ l	40.74	13.17	36.75	50.23	75.34	197.24	56.97	54.21
NO_3	µg/ l	178.73	52.4	71.36	139.27	246.7	395.98	281.44	325.23
NO_2	µg/ l	125.44	20.02	30.03	38.16	33.16	71.95	194.25	62.56
SiO_4	µg/ l	1907.5	2849	3097.5	3101	2383.5	2894.5	2940	2177
DO	mg/l	10.8	8.5	9.7	12.9	13.1	13.8	8.7	8.7
OM	mg/l	18	6	4	2	18	10	10	2

Trans: Transparency, EC: Electrical conductivity, DO: dissolved oxygen, OM: organic matter.

Table 4: Pearson-moment correlation (r) between different studied variables. EC: Electrical conductivity, Trans: Transparency, DO: dissolved Oxygen, OM: Organic Matter, T_Count: Total count

Variable	EC	pH	Trans	NH_3	PO_4	NO_3	NO_2	SiO_4	DO	OM	T°C	T_Count
EC	1.00											
pH	-0.28	1.00										
Trans	0.27	-0.19	1.00									
NH_3	-0.23	-0.15	0.07	1.00								
PO_4	-0.44	0.00	0.24	0.89**	1.00							
NO_3	-0.58	-0.06	0.54	0.56	0.72*	1.00						
NO_2	-0.26	-0.38	0.39	0.05	0.08	0.41	1.00					
SiO_4	-0.13	-0.42	-0.59	0.15	0.12	-0.26	-0.18	1.00				
DO	-0.36	0.51	-0.15	0.57	0.67	0.33	-0.25	0.07	1.00			
OM	0.06	0.46	0.55	0.02	0.19	0.21	0.34	-0.54	0.34	1.00		
T°C	-0.67	0.28	0.30	0.37	0.75*	0.77*	0.10	0.01	0.53	0.34	1.00	
T_Count	-0.48	-0.25	0.21	-0.24	0.01	0.32	0.69	0.16	-0.36	0.14	0.41	1.00

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

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Appendix: Check list of phytoplankton species identified and counted at the selected stations in Lake Burullus.

Phytoplankton species	**No. of cells l^{-1}**
Station 1 (El-Burullus east drain)	
1- Euglenophyceae	
Euglena acus Her.	80.000
E. graculis K1bs	50.000
Phacus longicawda (Her) Dujadin	60.000
Ph. Sestosa	54.000
Ph. Macrostigma	40.000
Total count Euglenophyceae	284.000
2- Chlorophyceae	
Scenedesmas qudricauda	40.000
S. acuminatus	20.000
Ankistrodesmus falcatus	60.000
Cosmarium galeatum	45.000
Chlorella vulgaris	40.000
Scenedesmas bijugatus	20.000
OOCystis borgi	25.000
Total count of Chlorophyceae	250.000
3- Cyanophyceae	
Oscillatoria limnetica Lemm	65.000
Merismopedia punctata Meyen	35.000
Chroococcus limneticus	30.000
Total count of Cyanophyceae	130.000
4- Bacillariophyceae	
Cocconeis placentula Her.	45.000
Nitzschia longissima (Breb) Ralfs	20.000
Cyclotella kutzingiana thwait	60.000
Total count of Bacillariophyceae	125.000
Total count (TC) of phy. at station 1	789.000

Station 2 (In front El-Boughaz (outlet)	
Euglenophyceae	**Not detected**
Chlorophyceae	
Scenedesmus bijugatus (Turp.) Kutz	45.000
Chlorore;;a vulgaris lenuissima lemm.	25.000
Total count of chlorophyceae	70.000
Bacillariophyceae	
Navicula grcillis Breb	35.000
Navicula humerosa Breb	45.000
Navicula cryptocephala kutz	30.000
Navicula schizonmenoids H.van H.	60.000
Synedra ulna Her	20.000
Cyclotella kutzingiana Thwaites	75.000
Dialoma hiemale	10.000
Total count of Bacillariophyceae	275.000
Cyanophyceae	
Chroococcus dispersus (keissl.) lemmer	25.000
Microcystis incerta lemmerman	50.000
Gloecapsa rupestris kuetzing	70.000
Chroococcus turgidus (kutz)	35.000
Chroococcus limneticus lemmermann	80.000
Merismopedia tenuissima	35.000
Total count of Cyanophyceae	295.000
Total count of phy. at st. (2)	640.000 units l^{-1}

Station 3 (In front of Drain 7)	
Euglenophyceae	
Euglena acus Ehrenberg	230.000
E. gracilis klebs	150.000
E.granulata lemm	50.000
E. promxia dangeard	70.000
Phacus macrostigma pachmann	160.000
Ph. Peuronectus (Muell) Dujardin	60.000
Ph. sestosa	80.000
Ph. Longicauda (Her.) Dujardin	160.000
Total count of Euglenophyceae	960.000
Chlorophyceae	
Scenedesmus a cuminatus (Lagerh) chodat	130.000
Scenedesmus quatricauda (Turp) Breb	150.000
Scenedesmus bijugatus (turp) kutz	110.000
Ankistrodesmus falactus var. acicularis	20.000
Cosmarium galeatum W. G.S. west	5.000
Chlorella vulgaris Beij	9.000
Chlorococcum humicola (Nag.)	25.000
Coelastrum sp.	1.000
Total count of Chlorophyceae	450.000
Cyanophyceae	
Merismopedia elegans (Braum)	80.000
Merismopedia glauca (Ehrenb) Nagelei	60.000
Merismopedia minima Beck	40.000
Microcystis incerta Lemm.	60.000
Spirolena sp.	5.000
Microcystis aerioginosa kutz: emend Elenkin	30.000
Total count of Cyanophyceae	275.000

Bacillariophyceae	
Cyclotella meneghiniana	40.000
Nitzschia longissima	50.000
Cocconeis placentuta	29.000
Navicula viridula	6.000
Total count of Bacillariophyceae	125.000
Total count of phy. at st. (3)	1.810.000 units l-1
Station 4 (El-Zankah)	
Chlorophyceae	
Scenedesmus quadricauda (Turp) Breb	80.000
Chlorella vulgaris Beij	30.000
Scenedesmus dimorphus (Turpin) kutz	20.000
Scenedesmus bijugatus (turp) kutz	15.000
Pediastrum boryanum (turp) Menegh	10.000
Total count of Chlorophyceae	155.000
Bacillariophyceae	
Cocconeis placentula Her.	90.000
Cycloella meneghiniana kutz	30.000
Total count of Bacillariophyceae	120 .000
Cyanophyceae	
Merismophedia punctata Meyen	50.000
Merismopedia tenuissima Lemm	65.000
Microcystis aerioginosa kutz. Emeno	40.000
Total count of Cyanophyceae	155.000
Euglenophyceae	Not detected
Total count of phyt. at st. 4	430.000

Station 5 (Mastrouh)	
Chlorophyceae	
Scenedesmus quadricauda (Turp.) Breb	200.000
Scenedesmus bijugatus (Turp.) Kuetz	160.000
Scenedesmus bijugatus var altermans Hansg	110.000
Scenedesmus dimorphus (Turpin) kutz	95.000
Sphaerocystis schroeteri	80.000
Botryococcus braunii	110.000
Pediastrum duplex Meyen	60.000
Chlorella vulgaris Beij	35.000
Chlorococcum humicola (Nag)	50.000
Total count of Chlorophyceae	900.000
Euglenophyceae	
Euglena acus Ehrenberg	75.000
Euglena promxia Dangeard	80.000
Phacus longicauda	130.000
Phacus macrostigma Pachmann	90.000
Total count of Euglenophyceae	375.000
Bacillariophyceae	
Cocconeis placentula Ehrenberg	70.000
Cyclotella meneghiniana kutz	20.000
Nitzschia lonissima (Breb) Ralfs	45.000
Total count of Bacillariophyceae	135.000
Cyanophceae	
Microcystis ineerta Lemm	50.000
Merismopedia temuissima Lemm	65.000
Merismopedia punctata Meyen	40.000
Chrococcus disperses (Keissl.) Lemm.	60.000
Total count of Cyanophceae	215.000
Total count of phyt. at st. (5)	1.625.000

Station 6 (El-Tawillah)	
Chlorophyceae	
Scenedesmus quadricauda	240.000
Scenedesmus dimorphus	200.000
Scenedesmus bijugatus (Turp.) Kuetz	160.000
Scenedesmus bijugatus var altermans Hansg	90.000
Pediastrum boryanum	50.000
Cosmarium galeatum	30.000
Ankistrodesmus falcatus var. acicularis	45.000
Chlorella sp.	45.000
Total count of Chlorophyceae	860.000
Bacillariophyceae	
Cocconeis placenlua	70.000
Cyclolella kutzingiana	20.000
Nitzschia longissima	20.000
Total count of Bacillariophyceae	110.000
Cyanophceae	
Merismopdia elegans	30.000
Merismopdia minima	25.000
Merismopdia enuissima	40.000
Chroococcus limneticub	20.000
Total count of Cyanophceae	115.000
Euglenophyceae	
Phacus pleuronectes	
Total count of phyt. at st. (6)	1.085.000

Station 7 (El-Shakhloubah)	
Euglenophyceae	
Phacus longicauda +++	360.000
Phacus macrostigma ++ pachmann	120.000
Phacus sestosa ++	160.000
Phacus pleuronectes +	60.000
Euglena acus Ehrenberg	210.000
Euglena promxia Dangeard	110.000
Euglena gracilis klebs	60.000
Euglena granulate Lemm	65.000
Total count of Euglenophyceae	1.145.000
Bacillariophyceae	
Cyclotella meneghiniana kutzing	260.000
Cycelotella kutzingiana thwaites	200.000
Cocconeis placenlula Ehrenberg	140.000
Nitzschia longissima (Breb) Ralfs	180.000
Nitzschia obtusa W. smith	130.000
Nitzschia palea (kutzing) W. smith	90.000
Total count of Bacillariophyceae	1.000.000
Chlorophyceae	
Scenedesmus quadricauda (1) (Turp) Breb	20.000
Scendesmus acumninatus (Lagerh) chodat	120.000
Scenedesmus bijugatus (Turp) kuetz	85.000
Ankistrodesmus falactus var spirilligormis	70.000
Botryococcus braunii kuetzing	75.000
Scenedesmus bijugatus var alternans Hansg	110.000
Pediastrum boryanum (Turp.) Meneghini	50.000
Pediastrum tetras (Ehrenb.) Ralfs	60.000
Pediastrum duplex Meyen	60.000
Actinastrum hantzschii larger	50.000
Total count of Chlorophyceae	930.000
Cyanophyceae	
Merismopedia elegans Braum	60.000
Merismopedia glauca (Ehrenb) Negeler (1)	80.000
Merismopedia minima Beck	25.000
Merismopedia tenuissima Lemmermann	50.000
Microcystis incerta Lemm.	75.000
Chrococcus limneticus Lemmermann	70.000
Chrococcus dispersus (Keissl) Lemmmermann	65.000
Anabaenopsis circularis (G.S. West) Wol & Miller	20.000
Spirulina major	11.000
Total count of Cyanophycea	456.000
Total count of phyt. at st. (7)	3.531.000

Station 8 (Abou Amer)	
Chlorophyceae	
Scenedesmus quadricauda (Turp) Breb	400.000
Scenedesmus accuminatus (Lagerh) chodat	150.000
Scenedesmus bijugatus (Turp.) Kuetz	60.000
Chlorella nulgaris Beij	50.000
Pediastrum boryanum (Turp) Menegh	20.000
Chlorococcum humicola (Nag)	55.000
Scenedesmus dimorphus (Turpin) kutz	35.000
Ankistrodemus falcatus var spirilliformis	25.000
Cosmarium galeatum G.S. west W.& S. West	10.000
Coelastrum sp.	5.000
Total count of Chlorophyceae	810.0000
Cyanophyceae	
Merismophedia elegans Braum	60.000
Merismopedia glauca (Ehrenb) Nagelei	50.000
Merismopedia minima Beck	20.000
Merismopedia tenuissima lemmerman	40.000
Microcystis incerta lemm	25.000
Microcystis aerugimosa kutz	30.000
Chrococcus disperses (Keissl) Lemmermann	55.000
Chrococcus limnetica Lemmermann	60.000
Chrococcus turgidus (kutz) Naegreli	30.000
Oscillatoria limentica Lemm.	8.000
Total count of Cyanophyceae	378.000
Bacillariophyceae	
Cocconeis placentula Her. ++	35.000
Cyclotella kutzingiana thwait ++	50.000
Cyclotella meneghiniana kutz +++	65.000
Total count of Bacillariophyceae	150.000
Euglenophyceae	Not detected
Total count of phyt. at st. (8)	1.338.000

ملخص البحث

رصد بيئي لتلوث المياه والزيادة المفرطة للخصوبة بإستخدام الهائمات النباتية كمؤشرات حيوية للتلوث في بحيرة البرلس

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تعتبر بحيرة البرلس واحدة من أهم البحيرات الشمالية من حيث الانتاجية، وهي ثاني أكبر البحيرات الشمالية من حيث المساحة، وهي الان تواجه إجهاد بيئي شديد بسبب ما يلقى بها من ملوثات من خلال مصارف مختلفة تلقي بمخلفاتها داخل البحيرة بدون معالجة. وقد أختير لهذه الدراسة ثمانية محطات تم جمع العينات منها لتقييم مستويات التلوث والزيادة المفرطة للخصوبة وذلك باستخدام بعض أنواع الهائمات النباتية كمؤشرات حيوية لتواجد الملوثات في المناطق المختلفة من خلال المحطات المختارة.

وقد توصلنا من خلال دراسة مجتمع الهائمات النباتية أن متوسط أعداد الأجناس المختلفة الممثلة للهائمات النباتية في البحيرة ١،٤٠٦،٠٠٠ وحدة في اللتر تنتمي إلى أربعة طوائف وهي:

Euglenophyceae, Bacillariophyceae, Chlorophyceae, and Cyanophyceae

وقد تبين أن جنسي *Euglena spp., Phacusapp.* هما الأكثر سيادة في مناطق التلوث وأمام المصارف بالنسبة لطائفة Euglenophyceae بينما كان جنسي *Cylotella spp., Nitzschia ssp.* هما الأكثر سيادة بالنسبة لطائفة Bacillariophyceae في مناطق التلوث وأمام المصارف.

وقد تبين أن جنس *Scenedesmus spp.* كان الأكثر سيادة في مناطق التلوث بالنسبة لطائفة Chlorophyceae بينما كان جنسي *Merismopedia spp., Mycrocystis spp.* الأكثر تواجدا في مناطق التلوث بالنسبة لطائفة Cyanophyceae. وقد تبين من الدراسة أيضا وبصورة واضحة أن الأنواع التابعة لطائفة Euglenophyceae كانت الأكثر وضوحا كمؤشرات حيوية للتلوث العضوي في البحيرة خاصة أمام مصارف ٢، ٣ و٧ مع زيادة الأملاح المغذية (الأمونيا) والمواد العضوية وهذا أدى بطبيعة الحال إلى زيادة مفرطة للخصوبة كمصدر غير مباشر للتلوث.

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JOESE 5

Monitoring of Water Pollution and Eutrophication using Phytoplankton as Bio-indicator in Burullus Lake, Egypt

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