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A preliminary Investigation of Man-Made Effects on Water Quality and Phytoplankton of Lake Nasser and Nearby Water Bodies

Ahmed M. El-Otify
Department of Botany, Faculty of Science, Aswan, 81528, Egypt

ABSTRACT

Water quality as well as phytoplankton qualitative and quantitative compositions of different aquatic habitats (Lake Nasser, fish ponds, and potable water) in a reclaimed cultivated area on the west shore of Lake Nasser were investigated in winter of 2007. In spite of the sampling sites were located in close proximity, the data obtained may indicate that the different water habitats acquired specific environmental conditions and man-made effects. The relatively alkaline pH value and oxygen super saturation of the majority of water samples may be in part attributed to the photosynthetic activity of phytoplankton. The differences that were recorded in nutrient concentrations of the collected water samples could be mainly due to the phytoplankton density, human activity in the vicinity of sampling sites in Lake Nasser, or due to manuring with various nutrients in fish ponds. The structure of phytoplankton assemblages revealed a floristic diversity and composed of various species appertaining to green algae, diatoms, cyanobacteria and dinoflagellates. Numerically, diatoms dominated the phytoplankton community in Lake Nasser and drinking water habitats. However, in fish ponds, green algae represented the dominant group. Species diversity did not differ significantly among the three investigated habitats. The sustainable management plan of the aquatic ecosystems in this region should include establishment of environmental monitoring system in order to record any alterations that may take place in water quality. For potable water supply, maintenance of high-quality water should be among the principal priorities in management plans.

Keywords: chlorophyll *a*, cyanobacteria, diatoms, dinoflagellates, fish ponds, green algae, Lake Nasser, phytoplankton, potable water.

INTRODUCTION

A sound management of the available water resources in Egypt is necessary for a sustainable social and economic development. Socio-economic development projects were established around Lake Nasser through the cooperation between the Ministry of Agriculture and World Food Programme as a way for stimulating a rapid economic growth. One of these projects was initiated in early 1980's on the west shore of Lake Nasser at Kalabsha - Garf Hussein region (about 50Km south of Aswan High Dam, at 23? 00̀, 33? 41̀ latitudes and 32? 00̀, 52? 04̀ longitudes). During the last two decades, a certain area of land was reclaimed and cultivated. Small villages were built for settlement of farmers. Compact units for potable water supply and fish culture ponds for rearing of the Nile tilapia *Oreochromis niloticus*, in order to increase fish production of Lake Nasser, were established. It is necessary to emphasize that, in this region, the multiple use patterns of water for agricultural irrigation, livestock watering, and aquaculture or probably other human activities may be of prime importance. Therefore, a better understanding of man-made effects on the biological characteristics of these aquatic habitats is an essential step towards a desirable trade-off between efficient economical utilization and environmental perturbations. Information concerning the ecological interactions in such aquatic ecosystems is important for optimum and sustainable exploitation of their resources.

The different aquatic ecosystems in this area may offer a relatively large habitat for the development of phytoplankton assemblages. These assemblages can reflect the ecological status of freshwater habitats (Lepist?, 1999) and can be regarded as a criterion for assessment of water quality (P?disak *et al*., 2006). Knowledge of phytoplankton species diversity as well as their ecological and geographical status is substantial as base line information for biodiversity conservation (Kassas, 2002) and to address the deficiency of information about species composition (Jasprica and Hafner, 2005). Deterioration of water quality, heavy blooms of plankton, the decrease of biodiversity, and changes in lake ecosystem are considered as major problems in management of man-mad lakes (Kira, 1997). Evaluation of man-made effects on aquatic habitats in Lake Nasser region and its surroundings is important to assess and forecast bio-ecological degradations. The aquatic ecosystem in Lake Nasser is mainly affected by the seasonal flood of the Nile (Latif, 1984; Ali *et al*., 2007) and consequently, the patterns of the annual cycle of water level fluctuations affect the phytoplankton assemblages (El-Otify, 2002). No information regarding phytoplankton community structure in the different aquatic habitats in the cultivated area around Lake Nasser has been previously reported. This investigation was conducted to provide information on water quality and biological characteristics in terms of phytoplankton qualitative and quantitative compositions in a an attempt to understand how far the water habitats in this region can be altered and differ from each other. In addition, it is necessary for decision makers of economic and environmental

* *e-mail: elotify57@yahoo.co.uk*

Figure (1): Map showing the investigated sites in Kalbsha-Garf Hussein region, west of Lake Nasser.

development over freshwater and agriculture as well as health conditions to help in sustainable development of the area.

MATERIALS AND METHODS

Sampling and *in situ* determinations

Subsurface water samples were collected from 15 different sites of aquatic habitats located in the shore-line farming cultivated area, west of Lake Nasser at Kalabsha - Garf Hussein region (Fig. 1) including Lake Nasser, fish culture ponds, and potable water around the compact units in winter, 2007. The samples were collected from Lake Nasser at sites 1, 2, 3 (Garf Hussein), and 11, 12, 13 (Kalabsha); from fish culture ponds at sites: 6, 7, 8, and from potable water at the settlement regions comprising sites 4, 5 (Garf Hussein), 9, 10 (Bashaer), and 14, 15 (Kalabsha). These water samples were collected for analyses of chemical and phytoplankton parameters (chlorophyll *a* and phytoplankton abundance) using acid washed polyethylene bottles. Measurements of water temperature, pH with a glass electrode pH meter (Orion model 601/ digital ionalyzer), electrical conductivity and salinity (using an Amber Science Inc., San Diego conductivity meter model 1062), and dissolved oxygen by an oxygen electrode (Jenway Oxygen meter, model 1070) were carried out. Aliquots of water samples for phytoplankton qualitative and quantitative determinations were immediately fixed with Lugol's iodine solution and stored for further microscopic examinations after returning to the laboratory.

Laboratory procedures

Chemical analyses and estimation of chlorophyll *a* of the collected water samples were performed according to standard methods [American Public Health Association (APHA), 1985]. For water chemistry determinations, one liter aliquots were filtered using acid-washed 0.45 ?m membrane (cellulose acetate) filters (Sartorius AG.W-3400, Goettingen, Germany). The filtrate water samples were analyzed within few days. Phytoplankton chlorophyll *a* concentrations were estimated after filtering aliquots of water samples onto Whatman GF/C (1.2?m) glass fiber filters buffered with $MgCO_3$, grinding with a tissue grinder and 12 hours extractions in 90% acetone in a dark freezer.

Phytoplankton identification and enumeration

Cyanobacteria and eukaryotic phytoplankton species were identified according to the following principal taxonomic references: Smith (1950), Prescott (1954), Kimor and Pollingher (1965), Bourrelly (1970, 1972, 1981), Weber (1971), Barber and Haworth (1981) Krienitz (1990), Compere (1991), Guarrera and Echenique (1992), Horiguchi *et al*. (1992), and Cox (1996). To facilitate the identification of planktonic diatoms, hydrogen peroxide method (Horvath, 1975) was applied for preparing clean diatom frustulae. Phytoplankton individuals were enumerated in terms of individual's cells, colonies, coenobia or 100?m trichomes per liter after an overnight settling period (Stein, 1973) using a (0.1 cm^3) counting cell.

Data analysis

Phytoplankton species diversity index, *H'* values were calculated according to the formula of Shannon and Weaver (1949). The correlation of phytoplankton community with different water parameters was estimated using the statistical computer programme MINITAB.

RESULTS

The mean values and standard deviations of the estimated physico-chemical and phytoplankton species diversity index for the different aquatic habitats in the study area are reported in Table (1). Statistical analysis was used to evaluate the correlation of phytoplankton assemblage's parameters: total counts, chlorophyll *a* concentrations and species diversity index with different water variables. Only values within the range of significance valid for the samples ($p < 0.05$) were reported in Table (2). They were additionally divided into three categories as depending on the value of p: *** ($p < 0.001$), ** ($0.001 < 0.01 < p < 0.01$) and * ($0.01 < p < 0.05$). The mean values of water temperature ranged from 18.5 to 21.27?C. Slight variations could be observed in water temperature of the different investigated aquatic habitats. Water temperature was significantly correlated with species diversity index. The hydrogen ion concentrations (pH values) lay in the vicinity of 8 and significantly correlated with species diversity index. The mean values of dissolved oxygen concentrations (10.57mgl^{-1}) in fish ponds were relatively higher than those in Lake Nasser (8.35mgl^{-1}) or drinking water (7.86mgl^{-1}). Super saturated levels of dissolved oxygen appeared in Lake Nasser and drinking water. In contrast, only relatively high levels (90.52%) in the mean values of oxygen percentage saturation were recorded in fish ponds. Regarding to salinity and electrical conductivity, no considerable differences could be recognized between Lake Nasser and drinking water. While a slight tendency to be relatively of somewhat higher values in the fish ponds was observed. High levels of nitrate-nitrogen contents exceeding 400μgl^{-1} were recorded in the water of the three investigated habitats. Mean values of the concentrations of these ions in fish ponds were relatively higher than those either in Lake Nasser or in drinking water. Nitrate-nitrogen contents did not show any significant relationship with phytoplankton's quantity or quality. The results concerning the mean values of phosphate-phosphorus concentrations revealed that the water contents of these ions in fish ponds were lower than those in Lake Nasser or drinking water. Positive significant correlation appeared between the phytoplankton chlorophyll *a* contents and the levels of PO_4 concentrations. Relatively low levels of soluble reactive silica contents were recorded in all investigated sites and the mean values of their concentrations did not show considerable differences between the different water habitats. However, high silica to phosphorus ratios were noticed (Table 1) and very high significant correlation appeared between the silica contents and the quantitative composition of phytoplankton (Table 2). Sulphate ion concentrations that correlated significantly with the total counts of phytoplankton did not show considerable differences among the investigated water habitats. Calcium was the dominant divalent cation in all investigated water samples. Significant correlations between the quantitative measurements of phytoplankton assemblages and calcium were recorded (Table 2).

Substantial differences were reported among the three studied aquatic habitats (Fig. 2) in the phytoplankton densities either in terms of chlorophyll *a* concentrations or total counts which were in remarkably good agreement with each other. Phytoplankton densities

Table (1): Mean values of physico-chemical parameters and phytoplankton species diversity index of the water samples collected from three aquatic habitats in winter, 2007. Standard deviations are reported in parentheses

Temperature (?C)	Lake Nasser	Fish ponds	Drinking water
Temperature (?C)	19.12 (1.63)	18.5 (1.64)	21.27 (2.48)
pH value	8.38 (0.16)	8.71 (0.48)	8.28 (0.20)
Oxygen mgl^{-1}	8.35 (0.56)	10.57 (2.93)	7.86 (0.80)
Oxygen % saturation	108.21 (9.27)	90.52 (24.50)	106.10 (9.27)
Salinity %	0.075 (0.01)	0.093 (0.02)	0.075 (0.01)
Electrical conductivity	174.83 (14.80)	208.67 (38.18)	172.33 (69)
NO_3-N ?gl^{-1}	461.16 (359.43)	650.59	411.40 (272.27)
PO_4-P ?gl^{-1}	39.56 (52.62)	22.48 (22.79)	47.46 (77.01)
SiO_2 mgl^{-1}	0.98 (0.33)	1.23 (0.05)	1.27 (0.83)
SO_4 mgl^{-1}	7.44 (1.81)	9.85 (1.27)	8.93 (1.86)
Ca^{2+} mgl^{-1}	20.84 (7.33)	20.04 (2.4)	19.36 (6.97)
Mg^{2+} mgl^{-1}	6.40 (1.52)	6.64 (1.84)	7.55 (1.44)
Total hardness mgl^{-1}	27.24 (6.31)	26.68 (1.46)	26.91 (5.90)
Species diversity index (*H* ')	2.21 (0.68)	2.20 (1.27)	2.15 (0.60)

Table (2): Significant correlations between phyto-plankton assemblages and water variables.

	Phytoplankton counts	Chlorophyll *a*	*H* ' value
Temperature			0.624*
pH value			0.854***
PO_4-P		0.561*	
SiO_2	0.777***	0.880***	0.617*
SO_4	0.586*		
Ca^{2+}	0.525*	0.981***	
Total hardness	0.645**	0.772***	

*: significant, **: high significant, and ***: very high significant

were of considerably higher values in fish ponds and of relatively lower values in drinking water than those of Lake Nasser. The algal growth potential in aquaculture (fish ponds) and the populations of phytoplankton in drainage water of aquaculture seem to be relatively of high values.

The phytoplankton assemblages were represented mainly by: green algae, diatoms, cyanobacteria, and dinoflagellates. The overall contribution of each group to the total phytoplankton density (Fig. 3) indicated that, the phytoplankton community was dominated by diatoms in Lake Nasser and drinking water while green algae represented the dominant group in fish ponds. Dinoflagellates were represented only by two genera, namely; *Ceratium* and *Peridinium*. In Lake Nasser and drinking water, *peridinium* was recorded as a major individual.

A total of 74 species within 45 phytoplankton genera (Table 3) were recorded and listed with their authorities in (Table 4). Twenty-four of the recorded species individually contributed at least 5% of total phytoplankton abundance in one or more samples and were designated as major species. The relative frequencies of the species were indicated by the number of occasions in which they were present out of the fifteen investigated water samples. The most common species was the small centric diatom *Cyclotella meneghiniana* that was recorded in all samples (100%). in more than 75% of the collected samples. Sixteen species appeared in over 50% of the samples; *Anabaena* sp., *Chroococcus* sp., *Merismopedia warmingiana, Planktolyngbya* sp. (cyanobacteria), *Cocconeis placentula*, *Fragilaria ulna*, *Navicula exigua* (diatoms), *Ankistrodesmus falcatus*, *Elakatothrix genevensis*, *Golenkinia radiate*, *Lagerheimia ciliate*, *Lagerheimia quadriseta*, *Oocystis* sp., *Scenedesmus* sp., *Staurastrum paradoxum*, *Tetraedron minimum* (green algae). A further twenty species were recorded in over 25% and other 15 species in > one-tenth of the samples. At the other extreme, the remaining 18 species were recorded only once (in < one-tenth of the samples) and considered as rare species. The mean values of species diversity index, (*H*') of the investigated aquatic habitats displayed more or less the same species diversity and lay in the vicinity of 2 with no significant differences among the three habitats (Table 1). The toxic cyanobacterium *Microcystis aeruginosa* was recorded in this investigation as a rare taxon. However, its over growth should be avoided to protect the area from the toxic water blooms.

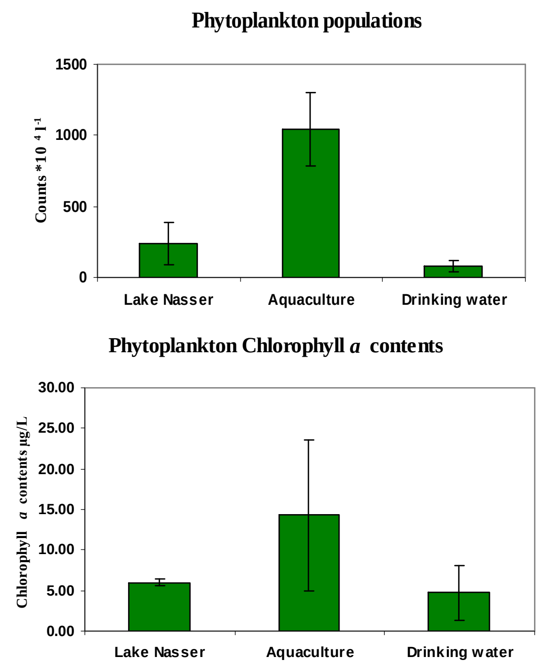

Figure (2): Mean values (±SD) of the phytoplankton density of the three investigated aquatic habitats in winter, 2007.

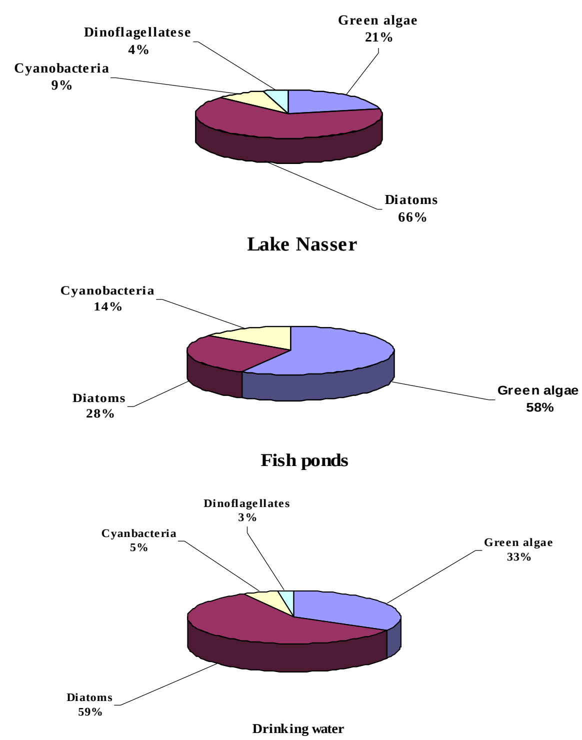

Figure (3): Pie diagrams showing the differences in relative density of the various phytoplankton groups of the three investigated water habitats in winter, 2007.

Table (3): Number of phytoplankton taxa recorded in the three investigated aquatic habitats in winter, 2007.

	Genus	Species
Cyanophyceae:		
Chroococcales	4	4
Oscillatoriales	6	8
Bacillariophyceae:		
Coscinodiscales	2	2
Naviculales	13	21
Dinophyceae:		
Peridiniales	2	2
Chlorophyceae:		
Tetrasporales	2	2
Chlorococcales	13	29
Conjugatophyceae		
Desmidiales	3	6
Total number	45	74

While three pinnate diatoms *Cymbella ventricosa*, *Navicula cryptocephala*, and *Nitzschia holsatica* were recorded in more than 90% of the investigated water samples. The cosmopolitan centric diatom *Aulacoseira granulate* was present in 86.67% of the water samples and represented the only one species that was recorded.

DISCUSSION

Water temperature, which was significantly correlated with species diversity index in this investigation, is a major factor controlling several chemical and physical properties of water (Hecky, 2000) and consequently phytoplankton community structure is strongly temperature dependent. The slight recorded variations in water temperature of the different investigated aquatic habitats were most probably depending on the differences in day time of measurements. The mean values of water temperature lay within the ranges of 15-24?C (Latif, 1984) or 15 – 28?C (Ahmed *et al*., 1989) that were previously recorded in Lake Nasser. The relatively alkaline pH values that lay in the vicinity of 8 and significantly correlated with species diversity index could be related to the depletion of CO_2 via the photosynthetic activity of phytoplankton (Kotut *et al*., 1999) particularly in the fish culture ponds. Due to such increase in phytoplankton photosynthesis, super saturated levels of dissolved oxygen appeared (in Lake Nasser) and relatively high levels (90.52%) in the mean values of oxygen percentage saturation (in fish ponds). Similarly, the measured values of oxygen concentrations in Lake Nasser (Ahmed *et al*., 1989) and in other African reservoirs (Kotut *et al*., 1998) were regarded as a clue to the magnitude of the assimilation activities of phytoplankton. The oxygen saturation of water in these habitats may reflect the influence of some other factors: temperature, the effect of wind, aquatic life conditions and the desert surroundings (Entz, 1997). The moderate levels of electrical conductivity could be related to the influence of the considerable evaporation rate of Lake Nasser which was estimated by the High Dam Authority (personal communication) as 830 million cubic meters per month. There was no salinity difference between Lake Nasser and drinking water,

Table (4): The frequency of occurrence (%) of the different phytoplankton species in the three investigated aquatic habitats in winter, 2007. M: major species that comprising > 5% of the total phytoplankton density in at least one sample. L: Lake Nasser, F: Fish ponds, and D: Drinking water.

	Frequency (%)	L	F	D
Cyanobacteria:				
Anabaena sp.	66.67			
Anabaenopsis circularis (G.S. West) Wol. & Miller	26.67			
Anabaenopsis cunningtonii Taylor	46.67	M		M
Chroococcus sp.	53.33			
Gomphosphaeria sp.	13.33			
Merismopedia warmingiana Lagerh.	66.67		M	
Microcystis aeruginosa (Kütz) Kütz	26.67			
Oscillatoria sp.	46.67			
Phormidium mucicola Naumann *et* Huber Bestalozei	6.67			
Phormidium sp.	33.33			
Planktolyngbya sp.	73.33		M	
Spirulina sp.	13.33			
Diatoms:				
Amphora ovalis (Kütz.) Kütz.	6.67			
Aulacoseira granulate (Ehr.) Simonsen	86.67	M	M	M
Caloneis silicula (Ehr.) Cleve	13.13			
Cocconeis placentula Ehr.	53.33			
Cyclotella meneghiniana Kütz.	100	M	M	M
Cymatopleura solea (Breb.) W. Smith	26.67	M		
Cymbella ventricosa Kütz.	93.33	M		M
Epithemia sorex Kütz.	6.67			
Fragilaria ulna (Nitzsch) Lange-Bertalot	66.67			
Frustulia sp.	6.67			
Gomphonema angustatum (Kütz.) Rabenhorst	6.67			
Gomphonema olivaceum (Hornemann) Breb.	46.67	M		
Navicula cryptocephala Kütz.	93.33	M		M
Navicula exigua Greg.	53.33			M
Navicula gastrum Ehr.	6.67			
Navicula pupula Kütz.	13.33			
Navicula rhynchocephala Kütz.	13.33			
Nitzschia holsatica Hust.	93.33		M	M
Nitzschia lacunarum Hust.	13.33			
Nitzschia parvula W. Smith non Lewi	20			
Nitzschia sp.	46.67	M		M
Rhopalodia gibba (Ehr.) O. Mull.	46.67	M		
Surirella ovata Kütz.	6.67			
Dinoflagellates:				
Ceratium hirundinella O. F. Mull.	20			
Peridinium sp.	33.33	M		M
Green algae:				
Actinastrum sp.	6.67			
Ankistrodesmus falcatus (Corda) Ralfs	60			
Ankistrodesmus spiralis (Turpin) Lemm.	13.33			
Closterium aciculare T. West	6.67			
Closterium acutum Breb.	13.33			
Closterium venus Kütz.	26.67			
Coelastrum microporum Nag.	6.67			
Coelastrum reticulatum (Danjeard) Senn.	40			
Cosmarium botrytis Menegh.	26.67	M		
Cosmarium depressum Lundell	46.67		M	M
Crucigenia rectangularis (Nag.) Gay	46.67			M
Dictyosphaerium pulchellum Wood	46.67			
Elakatothrix genevensis (Reverdin) Hindak	53.33	M		M
Gloeocystis sp.	40			
Golenkinia radiate Chod.	66.67			M
Kirchneriella obesa (W. West) Schmidle	20			
Lagerheimia ciliata (Lagerh.) Chod.	66.67			
Lagerheimia quadriseta (Lemm.) G. M. Smith	60	M		M
Oocystis solitaria Wittrock	20			
Oocystis sp.	73.33			

Table (4): continued

Pediastrum boryanum (Turp.) Menegh.	6.67			
Pediastrum duplex Meyen	6.67			
Pediastrum ovatum (Ehr.) A. Braun	6.67			
Pediastrum simplex Meyen	33.33			
Pediastrum tetras (Ehr.) Ralfs	6.67			
Scenedesmus acuminatus (Lagerh.) Chod.	20		M	
Scenedesmus bijigua (Turp) Lagerh.	13.33			
Scenedesmus ecornis (Ehr.) Chod.	46.67	M		M
Scenedesmus quadricauda (Turp) Brebisson	33.33			
Scenedesmus tibiscensis Uherkovich	20			
Scenedesmus sp.	73.33			
Schroederia setigera (Schr?d) Lemm.	6.67		M	
Staurastrum paradoxum Meyen	60			
Tetraedron caudatum (Corda) Hansg.	6.67			
Tetraedron incus G. M. Smith	6.67			
Tetraedron minimum (A.Br.) Hansg.	73.33			M
Tetraedron trigonum Hansg.	6.67			

while a slight tendency to be relatively of somewhat higher values in the fish ponds. Water quality of aquatic ecosystems is controlled by the quality and quantity of nutrient loading (Kennedy and Walker, 1990). No significant relationship appeared between nitrate-nitrogen contents and the different measured phytoplankton parameters indicating the occurrence of excessive amounts of these ions (Wilk-Wozniak and Kosinski, 2001). The relatively high nitrate concentrations could be mainly due to the human activity in the vicinity of sampling sites in Lake Nasser or manuring with various nutrients including nitrates in aquaculture (fish ponds). Phosphate is regarded as the main factor controlling the growth of diatoms and affects their dominance over other phytoplankton groups (Bucka *et al*., 1993). The correlation of PO_4 with phytoplankton chlorophyll *a* in the present investigation may explain the dominance of diatoms due to the prevalence of the small centric diatom, *Cyclotella meneghiniana*. The relatively low levels of soluble reactive silica contents, high silica to phosphorus ratios and the dependence of the phytoplankton parameters upon SiO_2 may be related to the high density of planktonic diatom assemblages (Willén, 1991; Kotut *et al*., 1999). A clear significant correlation appeared between the concentration levels of sulphate ion and phytoplankton density. In this context, significant correlations were recorded by Abd El-Monem (1995) for Lake Nasser's phytoplankton chlorophyll *a* contents and sulphate. The relationship of the phytoplankton parameters and calcium may indicate the role of this dominant divalent cation in the freshwater habitats for controlling the development of phytoplankton communities (Bucka *et al*., 1993).

Considering the quantitative characteristics of the investigated phytoplankton assemblages, similar combinations were reported by Mugidde (1992, 1993) and Kling *et al*. (2001) in aquatic ecosystems of the head water lakes of the Nile. The pronouncing differences in phytoplankton densities among the three investigated aquatic habitats could be mainly due to the nature of the water area itself as well as to the availability of nutrients. The increase of algal growth potential in aquaculture could be mainly related to the incubation of water under standard light and temperature conditions and continuous manuring. The dense populations of phytoplankton in drainage water of aquaculture can positively affect the development of agricultural crops (Levich, 1996). Thus, the use of this water for irrigation of the cultivated soil in this area is recommended. For drinking water, problems may arise, when mass development of planktonic algae takes place and the technology of drinking water production is not adapted. Some species of algae are notorious for their production of taste and odor compounds. Clogging of filters by bulky and/or slimy algae is another serious problem. It is necessary to avoid mass development of planktonic algae, which cause problems for the drinking water preparation.

Diatoms dominated the phytoplankton populations in Lake Nasser and drinking water habitats, while in fish ponds green algae represented the dominant group. The phytoplankton assemblages in Lake Nasser were consistently dominated by diatoms in winter season (El-Otify *et al*., 2003) following the same pattern recognized in several African Lakes (Talling, 1986; Patterson and Kachinjika, 1993; Hecky, 1993). In general, these data indicated that the different water habitats acquired specific environmental conditions and man-made effects particularly in the fish ponds which were dominated by green algae. *Ceratium* and *Peridinium* were the only two genera of dinoflagellates that were recorded in this investigation. This group was recorded as quantitatively minor component among Lake Nasser's phytoplankton assemblages (El-Otify *et al*., 2003) and other African Lakes (Hecky and Kling, 1987). However, the genus *Peridinium* was recorded as a major individual in the present investigation. This may reflect some evidence of the increase in organic matter contents (not measured in this investigation) due to human activities in this region. In this respect, the organic matter concentrations are considered as a main factor controlling dinoflagellate distributions in the freshwater habitats (Grigorszky *et al*., 2003).

Regarding to the phytoplankton species composition and relative abundance, the small centric diatom; *Cyclotella meneghiniana* was the most common species. The abundance of this species may be in part attributed to the favorable light intensity conditions on the surface water layer (Shafik *et al*., 1997). The cosmopolitan centric diatom *Aulacoseira granulate* was recorded in the vast majority of the investigated water samples. This species was carried by the annual flood water from the headwater lakes of the Nile where it was recorded as an abundant diatom (Talling, 1976). The species diversity index of the investigated aquatic habitats could be considered as low values compared with those of other freshwater ecosystems (P?disak, 1993; Trifonova, 1993).

To date no toxin testing has been conducted on Lake Nasser's phytoplankton although development of water blooms during the last four decades of Lake Nasser's history was recorded intermittently particularly in the southern third of the lake (Entz, 1997; Hamed, 2000; El-Otify, 2002; El-Otify *et al*., 2003) mainly due to the enormous masses of the toxic cyanobacterium *Microcystis aeruginosa*. This alga forms very heavy water blooms; in some places several centimeters thick floating layers that may be driven to the shore forming a blue green drift with a very peculiar smell. This species was recorded among the rare taxa in this investigation. However, its over growth should be avoided to protect the area from the toxic water blooms.

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دراسة أولية عن تأثير النشاط البشرى على نوعية المياه والهائمات النباتية ببحيرة ناصر والبيئات المائية المتاخمة لها

أحمد محمد العطيفى
قسم النبات، كلية العلوم، أسوان، مصر

الملخص العربـــى

تعد منطقة كلابشة – جرف حسين الواقعة بالصحراء الغربية على ضفاف بحيرة ناصر هى إحدى مناطق الزراعات الشاطئية غرب بحيرة ناصر والتى تم إنشاؤها على ضفاف البحيرة فى إطار خطة وزارة الزراعة لإستصلاح منطقة بحيرة ناصر بالتعاون مع برنامج الغذاء العالمى.

يعتبر هذا البحث دراسة مبدئية للوقوف على مدى تأثير النشاط البشرى على نوعية المياه والهائمات النباتية فى النظم البيئية بهذه المنطقة. وقد تم إجراء هذه الدراسة فى شتاء عام 2007 على عدد 15 عينة من مياه النظم البيئية المختلفة بالمنطقة (بحيرة ناصر، و المزارع السمكية، و مياه الشرب). وقد اتضح من خلال القياسات الحقلية والتحاليل المعملية لعينات المياه مدى التباين فى كل من الصفات الكيميائية والبيولوجية مما يدل على تأثر كل من هذه النظم بالعوامل البيئية والنشاط البشرى بالمنطقة.

كما أوضحت الدراسة أن مجتمعات الهائمات النباتية تتكون من أربعة مجموعات رئيسية هى: الطحالب الخضراء والدياتومات بالإضافة إلى الطحاب الخضراء المزرقة والطحالب السوطية الدوارة. وقد أظهرت النتائج أن السيادة العددية لمجتمعات الهائمات النباتية كانت ممثلة بمجموعة الدياتومات فى كل من بحيرة ناصر ومياه الشرب، بينما سادت الطحالب الخضراء تلك المجتمعات فى مياه المزارع السمكية، و توصى الدراسة بضرورة متابعة ما قد يطرأ على الصفات المختلفة للمياه من تغيرات نتيجة للنشاط البشرى فى المنطقة حتى تكون المحافظة على نوعية المياه ببحيرة ناصر ومياه الشرب من أولويات خطة التنمية على ضفاف بحيرة ناصر.