EPIPELIC AND EPIPHYTIC MICROALGAE AT WADI EL-RAYIAN LAKES, WESTERN DESERT OF EGYPT

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Abstract

This study was carried out on microalgae attached with sediment and three submerged macrophyte namely, *Potamogeton pectinatus* (L.), *Myriophyllum spicatum* (L.) and *Najas armat* (H.) during 2006. Mean Chl. *a* concentrations on biofilm of sediment varied between 18.50 in autumn and 31.73 mg/m^2 in summer, respectively. Qualitatively, 200 taxa of periphytic microalgae were identified, 73 epipelic taxa and 127 epiphytic algae. Diatoms were the most dominant epipelic algae (> 91%). The pinnate forms of epipelic diatoms (*Navicula, Nitzschia, Melosira* and *Gomphonema* spp.) were abundant at the upper lake, while the centric forms (*Cyclotella* spp.) dominated at the lower one. Similarity index value of epipelic algae showed a weak relationship between the north and the south lakes and disappearance of this relation between the stations of the second lake. Epiphytic algae were represented by Bacillariophyceae (86 taxa), Cyanophyceae (21 taxa), Chlorophyceae (19 taxa) and Dinophyceae (one taxon). The current data revealed that, 71 species were attached with *P. pectinatus*, 47 with *N. armata* and 43 species with *M. spicatum*. Diversity index values of epiphytic diatoms were generally higher than green and blue green algae. Generally, the epiphytic algae are usually more abundant compared to epipelic microalgae inhabiting Wadi El-Rayian Lakes.

Key words: Periphyton microalgae, macrophytes, brackish water.

Introduction

Wadi El-Rayian Lakes (29^0 05\ & 29^0 18\ N and 29^0 21\ & 29^0 32\ E) are located in the western desert of Egypt and are one of three depressions constituting El-Faiyoum area; Wadi El–Muweilih at the extreme south, Wadi El-Rayian in the middle and Birket Qarun to the north. Its upper lake (15.000 feddans) received the first lot of agricultural drainage water (200 million m^3/year) of El-Fayoum province in 1973, and overflow via a connecting canal to the lower reservoir (20.000 feddans) (Figure, 1) in 1987 to solve the problem of increasing the drainage water level in Lake Qarun.

Microphytobenthos are a major component of intertidal sediment microbial communities in terms of biomass, production and provide a food source for animals such as deposit feeders (Heip et al. 1995, Underwood & Kromkamp 1999). Benthic and planktonic habitats are physically juxtaposed generating the potential for several modes of interaction via resources and food webs (Blumenshine *et al.*, 1997). Submerged macrophytes provide food, shelter, and substrate for a variety of organisms in the aquatic system (Rennie and Jackson, 2005). Periphyton represents a readily available food base for many invertebrates, waterfowl and fish (Van Donk *et al.*, 1994), as well as, 70% of the invertebrate production was supported by attached algae (Lamberti, et al., 1995). Crayfish and omnivores acquire as much as 50% of their diets from attached

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algae and so do carnivores during the period of prey scarcity (Browder *et al.*, 1994). Periphytic algae may affect nutrient dynamics at the benthic algal-water interface thus influencing the nutrient available for phytoplankton (Mark, 1996). In situation with relatively abundant nutrient, phytoplankton proliferation can shade periphyton and reduce them, become light limited rather than nutrient-limited (Hansson, 1992). Abd El-Karim (2004) reported that differences in water salinity and the negative effects of macrophytes cover the connecting channel reduce fish production in the lower Wadi El-Rayian lake. Diatoms biofilm increase the stability of the sediment surface and used as a food source for heterotrophic consumers through execration of polymeric substances (Hanlon *et al.*, 2006).

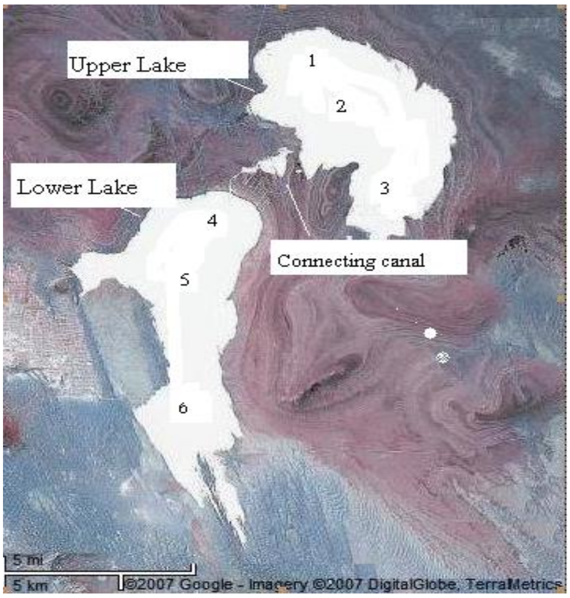

Figure 1: Map of Wadi El-Rayian Lakes Showing the selected stations

This is the first study on epipelic microalgae at Wadi El-Rayian Lakes to set out the best habitats harbored high communities of microalgae for fish production.

Materials and Methods

The attached algae were studied in sediment quarterly while submerged macrophytes were collected in autumn 2006. *Potamogeton pectinatus* (L.), *Myriophyllum spicatum* (L.) and *Najas armata* (H.) are the most common aquatic plants in Wadi El-Rayian Lakes (Saif, 2001). The biomass of benthic algae as represented by Chl. *a* was determined at quarterly intervals, one Cm^{-2} of surface sediments were collected from different stations. Chlorophyll *a* was extracted in 90% aqueous acetone at -20 ºC for 24hr., and its concentrations were measured spectrophotometery (Kontron instruments, UVIKON 930) according to SCOR/UNESCO (1991).

Qualitative collections of epipelic or sediment algae was made by scraping benthic algae from bottom substrates using a knife. The samples were immediately fixed with a 4% formaldehyde. Several slides were prepared and scanned under inverted microscope to identify the types of microalgae. The main references used for identification of phytoplankton organisms were Weber (1971), Vinyard (1975), Stansbery (1971) and Dillard (1989).

Epiphytes were detached from 100g freshly collected submerged plants by strong shaking in 500 ml tap water for three minutes and the suspension was poured into graduated cylinder after filtration through 300µm mesh to remove the small fragments according to Cattaneo *et al.,* (1997). The samples were preserved with Lugol's Iodine solution, and allowed to stand for five days and the supernatant siphoned off with 20 µm mesh diameter. A drop method technique was applied for counting and identifying the different microalgae according to APHA (1992).

Relative abundance (R.A)

Relative abundance of each taxon is estimated as follows: Rare**,** present in <25% of the examined fields and only 1 unit per field. Common**,** present in 25-75% of the examined fields and 2-10 units per field. Abundant**,** present in >75% of the examined fields and >10 units per field.

Similarity index

Bray-Curtis measure was calculated to assess the degree of similarity between algal classes of the selected stations using Primer 5 program, normal windows.

Diversity index

This index was calculated using periphytic abundance expressed as absolute cell density (cell/g) It was calculated according to the equation represented by Raymont (1980).

$$D = \frac{S-1}{\ln N}$$

Where S = number of species in the population.

N = number of individuals in the population

Results and Discussion

The seasonal variations of benthic algal biomass as represented by chlorophyll *a* (Chl *a*) revealed an average two major peaks in summer (31.73 mg/m^2) and winter (22.76 mg/m^2), whereas the minor one of 18.50 and 18.75 mg m^{-2} occurred in autumn and spring, respectively (Table 1). Its annual average value in the two depression was 22.94 mg/m^2. These results coincide with Underwood & Paterson (1993) and Santos *et al.,* (1997) who reported that epipelic biomass as represented by Chl. *a* often shows seasonal patterns of increase during summer months or throughout the year, even in winter. Epipelic biomass (Chl *a*) at Wadi El-Rayian Lakes was consistently lower than that recorded at Qarun Lake as reported by Anon (1996) who found that its annual average value amounted to 30.52 mg/m^2. This finding because of increase in the clay in Qarun sediment which have high cellular chlorophyll content compared to sand clay sediment in Wadi El-Rayian depression (Ibrahim, 2001). Also, Daniel *et al.,* (2002) found that Low chl *a* concentrations were associated with the exposed sandy sediments and low water column nutrient concentrations.

Table (1) Chlorophyll *a* mg/m^2 of benthic algae in wadi El-Rayian Lakes in 2006

Stations	winter	spring	summer	Autumn	Avg.
1	29.5	18.0	42.1	23.6	28.29
2	28.7	12.1	29.0	27.0	24.20
3	24.1	31.9	37.5	18.7	28.05
4	19.6	15.0	29.5	8.8	18.22
5	13.3	9.8	25.0	9.6	14.41
6	21.4	25.7	27.3	23.4	24.45
Avg.	22.76	18.75	31.73	18.50	22.94

Species composition of epipelic algae (Table, 2) revealed that, a total of 73 taxa were identified, Bacillariophyceae was the most dominant class (> 91%), while Chlorophyceae (6.8%) and Dinophyceae (1.3%) were rarely occurred.

The highest occurrence of diatoms may be due to high competitive advantage on nutrients over the other algal classes (Muller, 1994 and 1996).The highest epipelic composition was recorded at the entrance of the 2nd lake, decreased to the lower value at the highest depths of the middle area and increased again at the shallowest southernmost station. Also, *Cyclotella* spp., *Cymbella* spp., *Epithemia* spp. and *Fragilaria* spp. were declined with increasing salinity from 4.98 to 7.81‰ and decreasing nutrients southwards (Figure, 2). This phenomenon explain the role of turbulences, light, salinity and nutrient concentrations in epipelic distribution (Sullivan, 1999; Underwood & Provot, 2000). In particular, diatoms are useful indicators of biological integrity because they are ubiquitous; at least a few can be found under almost any conditions (Smith & Underwood 2000). The pinnate forms such as *Navicula*, *Nitzschia*, *Melosira* and *Gomphonema* spp. were abundant at the silt clay sediments of upper lake, which may be represent an important substratum rather than the centric forms (*Cyclotella* spp.) that dominated at sandy silt sediment of the lower lake. The Chlorophyceae and Dinophyceae were scarcely found and represented by *Staurstrium chaetoceras*, *Staurstrium dilatata*, *Staurstrium* sp., *Korschikoviella limnetica* and *Cosmarium* sp., while Dinophyceae was represented by only one taxon namely *Prorocentrum* sp. This finding was also observed by Sobhy (2007) in Manzala Lake sediment who found that, Cyanophyceae, Chlorophyceae, Dinophyceae, and Euglenoides were rarely present and they were not as important as diatoms.

Similarity index values of epipelic algae showed a weak relationship between the north and south lakes(Table, 3). Also, there was a relatively high link between the stations of the first lake and disappearance of this relation between the stations of the second lake. This finding mainly due to the variations between the sedimentary type and epipelic microalge of Wadi El-Rayian depression, where it is historically the recent man-made lake in Egypt (Zahran 1973).

Table (2): Species composition of epipelic algae at Wadi El-Rayian Lakes during 2006.

Note: +, recorded; -, not recorded

Epipelic algae	Stations					
	1	2	3	4	5	6
Amphora catrearia var.*quadrata* Breb.	-	-	-	-	-	+
Amphora ovalis (Kütz.) Kütz.	-	-	-	-	-	+
Amphora robusta Greg.	-	-	-	-	-	+
Amphora veneta (Kutz.)	-	-	-	-	-	+
Anomoeoneis serians (Breb.)Cleve	-	-	-	-	-	+
Biddulphia favus (Ehrenb.)	-	-	-	-	-	+
Caloneis amphisbaena (Bory) Cleve	-	-	-	-	+	-
Caloneis formosa (Greg.) Cleve	-	-	-	-	+	-
Campylodiscus clypeus Ehrenb.	-	-	-	-	+	-
Campylodiscus clypeus Ehrenb.	-	-	-	-	+	-
Cocconeis pediculus Ehrenb.	-	-	-	+	-	-
Cosinodiscus sp.	-	-	-	+	-	-
Cyclotella dieselbe var. *radiosa* Fricke	-	-	-	+	-	-
Cyclotella Kutzingiana Thwaites	-	-	-	+	-	-
Cyclotella Kutzingiana Thwaites	-	-	-	+	-	-
Cyclotella meneghiniana Kutz.	-	-	-	+	-	-
Cyclotella ocellata Pant.	-	-	-	+	-	-
Cyclotella sp.	-	-	-	+	-	-
Cyclotella stelligera Grun.	-	-	-	+	-	-
Cyclotella striata (Kutz.) Grun.	-	-	-	+	-	-
Cymatopleura elliptica (Bréb. & Godey) W. Smith	-	-	-	+	-	-
Cymbella cistula (Ehrenb.	-	-	-	+	-	-
Cymbella naviculiformis Auerswald	-	-	-	+	-	-
Epithemia argus Kutz	-	-	-	+	-	-
Epithemia hyndmanni wm. Hm.	-	-	-	+	-	-
Epithemia reichelti Fricke	-	-	-	+	-	-
Epithemia sorex Kutz.	-	-	-	+	-	-
Epithemia sp.	-	-	-	+	-	-
Epithemia turgida (Ehrenb.) Kutz.	-	-	-	+	-	-
Epithemia zebra var. *porcellus* (Kutz.) Grun.	-	-	-	+	-	-
Eucocconeis flexella (Kutz.)	-	-	-	+	-	-
Eucocconeis laponica Hust.	-	-	-	+	-	-
Fragilaria undata var. *quadrata* Hust.	-	-	-	+	-	-
Fragilaria nitzschioides Grun.	-	-	-	+	-	-
Gomphonema constrictum var. capitata (Ehrenb.) Van Heurck	-	-	-	+	-	-
Gomphonema lanceolatum Ehrenb.	-	-	+	+	-	-
Gomphonema olivaceum var. *calcarea* Cleve	-	-	+	+	-	-
Gomphonema ventricosum Gregory	-	-	+	+	-	-
Licmophora sp	-	-	+	+	-	-
Mastogloia braunii Grun.	-	-	+	+	-	-

Melosira distans (Ehrenb.) Kütz.	-	-	+	+	-	+
Melosira granulata (Ehrenb.) Ralfs	-	-	+	-	-	-
Navicula apicula (Dickie) Cleve	-	-	+	-	-	-
Navicula cryptocephala var. *veneta* (Kutz.) Grun.	-	-	+	-	-	-
Navicula gibbula Cleve	-	-	+	-	-	-
Navicula placenta Ehrenb.	-	-	+	+	-	-
Navicula pusilla W. Smith	-	+	+	+	-	-
Navicula sp.	-	+	+	+	-	-
Navicula spicula (Dickie) Cleve	-	+	+	+	-	-
Navicula tuscula (Ehr.)Grun.	-	+	+	+	-	-
Nitzschia fonticola Grun	-	+	+	+	-	-
Nitzschia frusulum var. *Subsalina*	-	+	+	-	-	-
Nitzschia obtusa W.Smith	+	+	+	-	-	-
Nitzschia palea (Kütz.) W. Sm.	+	+	+	-	-	-
Nitzschia paleacea Grun.	+	-	+	-	-	-
Nitzschia thermalis (Ehrenb.) Auersw.	+	-	+	-	-	-
Peronia erinacea Breb. & Arn.	+	-	+	-	-	-
Pinnularia globiceps Gregory	+	-	+	-	-	-
Rhizosolenia Robusta Norm.	+	-	-	-	-	-
Rhoicosphenia curvata (Kutz.)	+	-	+	-	-	-
Rhopalodia gibba (Ehrenb.) O. Mull.	+	-	-	-	-	-
Rhopalodia gibberula (Ehrenb.) O. Mull.	+	-	-	-	-	-
Stauroneis anceps Ehrenb.	+	-	-	-	-	-
Stephanodiscus astraea var. *minutula* (Kutz.) Grun	+	+	-	-	-	-
Surirella striatula Turpin	+	-	-	-	-	+
Synedra ulna (Nitzsch) Ehrenb.	+	+	-	-	-	+
Tetracyclus lacustris Ralfs	+	-	+	-	-	+
Chlorophyceae						
Cosmarium sp.	-	-	-	+	-	-
Korschikoviella limnetica (Lemm.) Silva	-	-	+	-	-	-
Staurstorium chaetoceras Puaita	+	+	-	-	-	-
Staurstorium dilatata Ehrenb.	+	-	-	-	-	-
Staurstorium sp.	+	-	-	-	-	-
Dinophyceae						
Prorocentrum sp.	+	-	-	-	-	-

A total of 127 taxa of epiphytic algae in Wadi El-Rayian Lakes were identified (Table 4). They were represented by Bacillariophyceae (86 taxa), Cyanophyceae (21 taxa), Chlorophyceae (19 taxa) and Dinophyceae (one taxon). Cattaneo, *et al.,* (1997) and Tesolin & Tell (1996) found that diatoms were the dominant class attached with submerged macrophytes in an Italian Lake., compared to the relative abundance of the other classes. Among the 127 recorded species, 71 species attached with *P. pectinatus* and 43 species with *M. spicatum* sp. while 47 with *N. armata*. At the same time, *P. pectinatus* harbored the highest diatoms density (48 x 10^3/gm) due to its growth at the 1st Wadi El-Rayian Lake under low salinity and high nutrients (Abd-Elstar, unpublished data), while the least diatom densities of 3 x 10^3/gm and 10 x 10^3/gm were

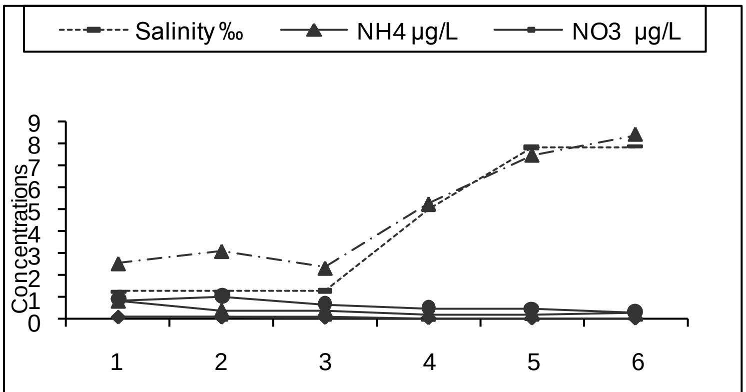

Fig.2: Variations in chemical characteristics of water at Wadi El-Rayian Lakes in 2006 (after A. Abd-Elstar, personal communication)

Table (3):Similarity indices of epipelic algae between the different station at Wadi El-Rayian Lakes in 2006

Stations	1	2	3	4	5	6
1	100					
2	33.3					
3	16.2	27.6				
4	0.0	0.0	8.7			
5	0.0	0.0	0.0	0.0		
6	26.7	9.1	13.8	5.1	0.0	100.0

observed respectively with *N. armata* and *M. spicatum* which grow under the subsurface water of the 2nd lake. This finding agrees with Abd El-Karim (2004) who pointed out that salinity and trophic status obviously control diatoms distribution. Pinnate diatoms were the most common attached algae, compared to centric forms which are usually planktonic forms (Kara and Sahin, 2001). This phenomenon was also observed in River Nile (El-Khatib (1991) and Gaballah *et al.,* 2000). Also, the present data revealed that, the green and blue green algae abundant on *N. armata* more than the other aquatic plants, especially cyanobacteria, that cell densities reach an average of 161 x 10^3/g compared to *M. spicatum* (9 x 10^3/g) and *P. pectinatus* (4 x 10^3/g). This finding may be due to increase in selectivity of epiphytic communities to specific submerged aquatic substratum (Williams, 1996), besides, the blue greens can fix nitrogen and store phosphorus, when nutrient and other environmental conditions do not favor the other algae (Ariosa, *et al*., 2004).

Table (4): Cell counts of epiphytic algae in Wadi El-Rayian Lakes during 2006 (No. x 10^3 cells/gm) . Note: R, rare; C, common; A, abundance; R.A, relative abundance

Epiphytic algae	Macrophytes					
	Potamogeton pectinatus		*Myriophyllum. spicatum*		*Najas armata*	
	R.A	Density	R.A	Density	R.A	Density
Bacillariophyceae						
Achnanthes brevipes Agardh		0	R	6.5		0
Amphiprora alata Baileyl	R	6.5		0		0
Amphiprora paludosa W. Smith	C	13		0		0
Caloneis amphisbaena (Bory) Cleve		0	R	6.5		0
Campylodiscus clypeus Ehrenb.	C	19.5		0		0
Cocconeis placentula Ehrenb.	C	26	C	52		0
Cocconeis placentula var. euglypta (Ehrenb.) Cleve		0		0		0
Cocconeis pediculus Ehrenb.	C	19.5		0		0
Cyclotella glomerata Bachm.		0	R	6.5		0
Cyclotella bodanica Eelenst	C	19.5		0	R	6.5
Cyclotella Kutzingiana Thwaites	C	13		0	R	6.5
Cyclotella meneghiniana Kutz.	C	19.5		0		0
Cyclotella striata (Kütz.) Grunow	C	26		0		0
Cymbella austriaca Grun.		0	R	6.5		0
Cymbella hebridica (Gregory) Grun.	R	6.5		0		0
Cymbella hustedtii Kraoke	R	6.5		0		0
Cymbella affinis (Hustedt)		0		0	R	6.5
Cymbella cymbiformis (Hustedt)		0		0	R	6.5
Diatoma anceps (Ehrenb.) Grun.		0		0	C	52
Diatoma hiemale (Roth) Heib.		0	R	6.5		0
Diploneis pseudovalis Hust.	R	6.5		0		0
Epithemia hyndmannl Wn. Sm	R	6.5		0		0
Fragilaria contruens (Ehrenb.) Grun.	R	6.5		0		0
Gomphonema constrictum var. capitata (Ehrenb.) Van Heurck		0	R	6.5	R	6.5
Gomphonema lanceolatum Ehrenb.	R	6.5		0	C	13
Gomphonema ventricosum Gregory	R	6.5		0	C	13
Gomphonema longiceps var. subclavata Grun.		0		0	R	6.5
Maastoglia grevillei W.Smith		0	C	32.5		0
Mastogloia braunii Grun		0	A	97.5		0
Mastogloia dieselbe Agardh		0	C	32.5		0
Melosiera dickiei (Thwait) Kutz.	C	13		0		0
Melosiera nummuloides (Dillw.)C.A.Ag.	C	19.5	C	13		0
Navicula cincta (Ehrenb.) Ralfs	C	65		0		0
Navicula cryptocephala Kutz.	A	97.5		0		0
Navicula digitoradiata (gregory)	A	130		0		0
Navicula gracilis Ehrenb.	A	162.5		0		0
Navicula gregaria Donkin	A	97.5	R	6.5		0
Navicula radiosa Kutz.	C	65		0		0
Navicula rostellata Kutz.	A	91		0		0
Navicula tuscula Ehrenb.	A	104		0		0

Navicula *viridula* Kutz.	A	130		0		0
Navicula cryptotenella Lange-Bert.	A	162.5		0		0
Navicula cryptocephala var. *venter* (Kutz.) Grun.	A	1248		0		0
Navicula graciloides A. Mayer	A	91		0		0
Navicula menisculus Schumann	A	84.5		0		0
Navicula rhynchocephala Kutz.	A	110.5		0		0
Navicula salinarum Grun.	A	123.5		0		0
Navicula *simplex* Kraoke	A	97.5		0		0
Navicula spicula (Gregory) Grun	A	104		0		0
Navicula viridula Kutz.	A	130		0		0
Navicula lanceolata (Agardh) Kutz.	A	162.5		0	R	6.5
Navicula laterostrata (Hust.)	A	195		0		0
Neidium dubium (Ehrenb.)Cleve	R	6.5		0		0
Nitzschia acicularis (Kütz.) W. Sm.		0	C	32.5		0
Nitzschia amphibiana (Ehrenb.)Ralfs		0	C	26	R	6.5
Nitzschia cupitellata Hust		0		0	R	6.5
Nitzschia clausii Hantzsch	C	19.5	C	26		0
Nitzschia closterium (Ehrenb.) W. Sm.	C	45.5	C	32.5		0
Nitzschia *filiformis* (W. Sm.) Van Heurck	C	26	C	13		0
Nitzschia frustulum (Kutz.)Grun.		0	C	32.5	R	6.5
Nitzschia fusciculata Grun	R	6.5	C	26		0
Nitzschia ignorata Krabke	C	32.5	C	26		0
Nitzschia kutzingiana Hilse	R	6.5	C	13		0
Nitzschia obtusa W. Sm.	C	39	C	39		0
Nitzschia ovalis Norman	R	6.5	A	26		0
Nitzschia *palea* (Kutz.)W.Smith	C	19.5	R	6.5		0
Nitzschia sigmoidea (Ehrenb.)	C	45.5	C	52		0
Nitzschia sigma (Kütz.) W. Sm.	A	123.5	C	19.5		0
Nitzschia sublinearis Hust.		0	C	39		0
Nitzschia cupitellata Hust		0	C	13		0
Nitzschia frustulum (Kutz.)Grun.		0	C	26		0
Nitzschia vitrea Norman	R	6.5	C	32.5	R	6.5
Pinnularia appendiculata var. *budensis* Grun.		0		0	R	6.5
Pinnularia globiceps Gregory	R	6.5		0		0
Rhoicosohenia curvata (Kutz.) Grun	R	6.5		0		0
Rhopalodia gibba (Ehrenb.)O.Mull.		0		0	R	6.5
Stauroneis acuta W. Smith	R	6.5		0		0
Stauroneis montana Kraoke	R	6.5		0		0
Stauroneis anceps Ehrenb.		0		0	R	6.5
Surirella biseriata Bréb. & Godey		0	R	6.5		0
Surirella didyma Kutz.		0		0	R	6.5
synedra actinastroides Lemm.	C	45.5	C	26		0
Synedra rumpunes Kutz.		0	C	58.5		0
Synedra ulna (Nitzsch) Ehrenb.	R	6.5		0		0
Tabellaria flocculosa (Roth) Ktz.		0	R	6.5	C	52
Tetracyclus lacustris Ralfs		0	R	6.5		0
Total Bacillariophyceae	57	48	35	10	19	3

Chlorophyceae						
Ankistrodesmus falcatus (Corda) Ralfs			R	6.5	C	39
Closterium dianae Ehrenb.				0	R	6.5
Coelastrum microporum Nageli	A	104		0	C	52
Cosmarium depressum (Nageli.) Lundell	R	6.5		0	C	65
Cosmarium formosulum Hoff		0		0	C	39
Cosmarium laeve Rbenhorst		0		0	C	45.5
Cosmarium margaritatum (Lundell) Roy & Bisser		0		0	C	26
Cosmarium ornatum Ralfs		0		0	C	19.5
Dictyospherium pulchellum Wood		0		0	R	6.5
Lagerheimia longiseta (Lemm.) printz		0		0	R	6.5
Oocystis elliptica W. west		0		0	C	52
Oocystis solitaria Wittrock		0		0	C	26
Pediastrum duplex Meyen	C	65		0		0
Planktonema lauterbornii Schmidle		0		0	A	97.5
Scenedesmus bicaudatus (Hansgirg) Chodat		0		0	C	26
Scenedesmus bijuga (Turp.)Lager.	A	104	C	26		0
Scenedesmus dimorphus (Turpin) Kutz.	C	26		0		0
Scenedesmus quadricauda (Turpin) Breb.	C	26		0		0
Tetraedron minimum (Braun) Hansgirg		0		0	C	32.5
Average	6	20	2	2	15	28
Cyanophyceae						
Chrococcus dispersus (Keissler) Lemm.					R	6.5
Chrococcus limneticus			C	13	R	6.5
Chrococcus minutes (Kutz.) Naglei			R	6.5		0
Chrococcus turgidus (Kutz) Nageli	C	26	R	6.5	R	6.5
Gomphosphaeria aponiana Smith	R	6.5	R	6.5		0
Lyngbya limnetica Lemmer		0		0	A	1300
Lyngbya chlorospira Skuja	C	39	R	6.4	A	650
Lyngbya birgei G.M.Smith		0		0	A	650
Merismopedia tenuissima Lemmer.		0		0	C	45.5
Microcystis aeruginosa Kutz	R	5.4	C	38.9	R	6.5
Microcystis flos-aquae Witter		0		0		0
Oscillatoria sp.		0		0	C	32.5
Phormidium fragile Gomont	C	13		0		0
Phormidium mucicola Naumann		0		0	A	130
Phormidium sp.		0		0	A	162.5
Phormidium dictyothallum Skuja	C	26		0	A	130
Phormidium retzii (C.A. Agardh)	C	39		0	A	97.5
Spirulina major Kutz.		0		0		0
Spirulina meneghiniana Zanard.	R	6.5		0		0
Spirulina major Kutz.	R	6.5		0		0
Spirulina subsalsa Orsted	R	6.5		0		0
Total Cyanophyceae	10	10	6	4	12	154
Dinophyceae						
Peridinium africanum Lemm					R	6.5
Total Dinophyceae					1	
Total cell counts	71		43		47	

Diversity index values of diatoms were generally higher than green and blue green algae(Table, 5). Diatoms diversity attached with *P. pectinatus* (6.7) collected from the 1st lake was relatively higher than *M. spicatum* (5.03) and *N. armata* (3.31). These findings may be due to diatoms strategic advantages to light, nutrient and moving ability (Mulholland *et al.,* 1994). Diversities of green and blue green algae attached with *N. armata* (2.2 and 1.56, respectively) were higher than the other plants. This finding is generally due to abundance of *Cosmarium*, *Planktonema*, *Oocystis* and *Scenedesmus* from green algae and *Lyngbya* spp. from blue greens. In this connection, Hillbrand and Kahlert, (2001) postulated that filamentous blue green algae *Lyngbya* spp. and pinnate diatoms (*Nitzschia*, *Navicula* and *Synedra* spp.) were clearly dominated the algal community at lakes.

Table (5): Diversity index values of epiphytic algae at Wadi El-Rayian Lakes

Epiphytic classes	*Potamogeton pectinatus*	*Myriophyllum. spicatum*	*Najas armata*
Diatoms	6.7	5.03	3.31
Green algae	0.86	0.28	2.2
Blue green	1.48	1.14	1.56

In general, the abundance of epiphytic microalgae is more than microphytobenthos inhabiting Wadi El-Rayian Lakes. Also, Mark (1996) and Galanti and Romo (1997) reported that attached algae (periphyton) in the littoral zone always exceed up to 5 times, the seaston standing crop in the pelagic water. Therefore, it is important to increase these submerged plants at different areas to increase the natural food and consequently fish production at Wadi El-Rayian Lakes.

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الطحالب الدقيقة الملتصقة بالرسوبيات والنباتات المائية المغمورة في بحيرات وادي الريان. الصحراء الغربية - مصر

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أجريت هذه الدراسة على الطحالب الدقيقة الملتصقة بالرسوبيات وثلاثة من النباتات المائية المغمورة في بحيرات وادي الريان 2006.

أظهرت النتائج أن متوسط تركيز كلوروفيل أ في الرسوبيات تراوح بين 18.5 في الخريف إلى 31.7 مجم/م2 في الصيف. وكذلك تم حصر 200 نوع من الطحالب الدقيقة منها 73 ملتصقة بالرسوبيات و 127 ملتصقة بالنباتات المائية. وشكلت الدياتومات غالبية الأنواع الملتصقة بالأسطح المختلفة وكانت الأنواع الريشية الشكل منها (نافيكولا- نتشيا - مبلوزيرا- جيمفونيما) هي السائدة في رسوبيات المسطح الأول بينما الأنواع الدائرية الشكل (سيكلوتيلا) هي السائدة في المسطح الثاني. أظهرت النتائج أيضا ضعف الترابط بين المسطحين الأول والثاني لاختلاف طبيعة التربة بينهما.

كما أوضحت النتائج أن الطحالب الملتصقة بالنباتات المائية كانت ممثلة بالدياتومات (86 نوع) والطحالب الخضراء المزرقة (21 نوع) والطحالب الخضراء (19 نوع) والسوطيات (نوع واحد). وتبين أن أكثر أنواع الطحالب الدقيقة كانت الملتصقة بالبوتاموجيتون بكتنيوناتس (71 نوع) ومعظمها من الدياتومات بينما تم تحديد 47 نوع ملتصقة بالناجس أرماتا معظمها من الطحالب الخضراء المزرقة و43 ملتصقة بالمروفيلم اسبكاتم معظمها أيضا من الدياتومات. أيضا أشارت النتائج إلى التنوع الكبير في الدياتومات مقارنة بالطحالب الخضراء والخضراء المزرقة.

وبصفة عامة كانت الطحالب الملتصقة بالنباتات المائية المغمورة أكثر كما ونوعا من الملتصقة برسوبيات بحيرات وادي الريان. ولذلك فإن زيادة مثل هذه الأنواع من النباتات المائية وخاصة بالبوتاموجيتون بكتنيوناتس في أماكن تجمع الأسماك سيؤدى إلى زيادة الإنتاج السمكي الذي انخفض بشكل واضح في هذا المنخفض خلال السنوات الأخيرة نتيجة لانخفاض الغذاء الطبيعي.