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Abundance and distribution of phytoplankton in some southern Iraqi waters

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Abstract

Qualitative and quantitative study of phytoplankton and some related physico-chemical parameters were investigated .Samples were collected monthly for the period from May to October/2000 from 9 stations in southern Iraqi fresh waters and marine waters north-west Arabian Gulf.

Three different aquatic areas were recognized based on salinity values .These are Oligohaline area (1.5 - 2.6 $^0/_{00}$) , Mesohaline area (7.2 – 14.5$^0/_{00}$) and Mesohaline – Marine area (10 – 40$^0/_{00}$). Highest mean phytoplankton biomass as chlorophyll-a (13.9 mg m^{-3}) was found in the first area compared with second area (5.53mg m^{-3}) and third area (2.8mg m^{-3}). This result is in agreement with N:P ratio values, where highest ratio (93.2:1)was recorded in the first area compared with second area (80.5:1) and third area (21.0:1). Present study included also a list of phytoplankton taxa recoded in the study area along with their occurrence in the above three areas.

1.Introduction

Earlier studies on abundance and distribution of phytoplankton in southern Iraqi waters were well reviewed (Talling, 1980 ; Hinton and Maulood, 1983 ; Al-Saboonchi and Al-Saad, 1988 ; Al-Handal, 1989 ; Hussein *et al*., 1991 ; Maulood *et al*., 1993) . Despite , the comparative survey carried out by Maulood *et al*., (1979) during February for the area from southern marshes to the Arabian Gulf , most previous studies were restricted to one of the southern aquatic ecosystems . The present study aimed primarly to investigate the abundance and distribution of phytoplankton along with closely related physico-chemical characteristics , particularly salinity gradient and trophic status in most of southern Iraqi waters. To achieve these aims, the study area was extended to include the upper Shatt Al-Arab river and the estuary mouth , the Shatt Al-Basrah canal , Khor Al-Zubair , Um-Qaser , Khor Abdullah and Khor Al-Ummaia . This study is part of an extensive project entitled " Fish mortality and Red tide in southern Iraqi waters" . The project was carried out by Marine Science center in collaboration with college of Science / University of Basrah . It was undertaken to evaluate the possibilities of such phenomenon , especially the occurrence of any causative species in Iraqi marine waters .

Study Area

Nine stations were selected in southern Iraqi waters (Fig. 1). Three stations (1,2,3) were located in upper Shatt Al-Arab river up an downstream of Basrah paper factory and Al-Hartha thermal power plant. These are Al-Dair bridge (station 1) , Saad bridge (station 2) and Khalid bridge (station 3) . Further station in the Shatt Al-Arab river was selected in the estuary mouth (station 9). Following construchion of the main drain river (the third river), the Shatt Al-Basrah canal used primarily to receive the drainage of the extensive agricultural lands from the catchments area of both Tigris and Euphrates rivers and discharges it into the Arabian Gulf via Khor Al-Zubair. The remaining five stations were selected , therefore mainly to study the impacts of such agricultural runoff on the phytoplankton in these waters. Station 4, was located in the Shatt Al-Basrah canal (Al-Zubair bridge), stations 5 and 6 were in Khor Al-Zubair and Um-Qaser, respectively. However, stations 7 and 8 were in Khor Abdullah and open marine waters in Khor Al-Ummaia, respectively .

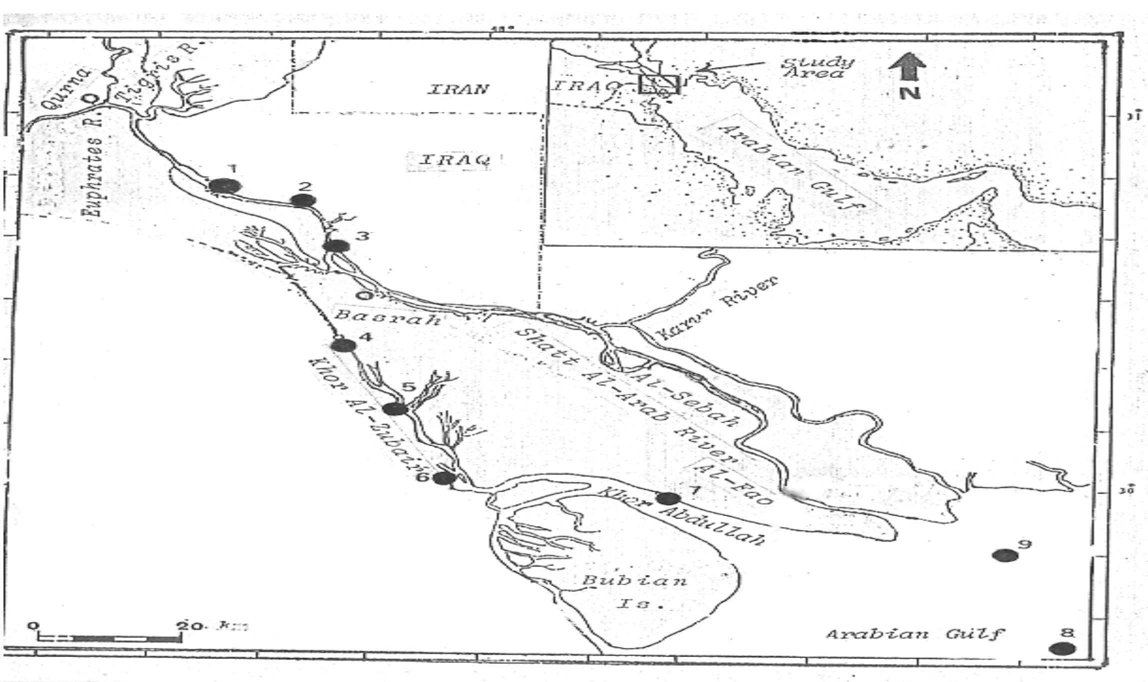

Fig. 1 : Map of the Shatt Al-Arab estuary and North-West Arabian Gulf showing the position of stations .

2.Materials and Methods

Surface water and phytoplankton samples were collected for the period from May to October of the year 2000 . Water temperature was measured using thermometer accurate to 0.1°C . Transparency was estimated by a seechi disc of 30cm diameter . Salinity was measured using a digital laboratory salinometer (Kent Lie 5005). Nitrite-nitrogen was estimated according to the method of Bendischneider and Robinson (1975) as described by Parsons *et al.*(1984). Nitrate-nitrogen was determined after reduction to nitrite using a cadmium column as described by Wood *et al.* (1967). Phosphate-phosphorus was determined according to Murphy and Riley (1962) as described by Parsons *et al.*,(1984). Silicate-silicon was measured following the method of Mullin and Riley (1955) as described by Parsons *et al.* (1984). Chlorophyll-a was extracted using 90% acetone and calculations were done according to Lorenzen (1967). Statistical analysis was made using a computer software (SPSS, Ver. 11) to estimate Correlation coefficient (r) and Similarity Matrix percentage (SM%).

3.Results and Discussion

Present study was restricted to the warm period of the year (May-October/2000). Thus, water temperatures recorded ranged between 24 and35.5°C(Table1). Highest water temperatures observed, however , in second and third areas were never exceeded 31.5°C compared to a maximum degree of 35°C reached in first area. This is mainly due to heated effluents discharged from Al-Hartha thermal power plant Similarly, Hussein *et al.*, (2001) recorded exceptionally abnormal temperatures in upper Shatt AlArab river with maximum temperatures ranged between 33.4 and 36.3°C due to the effects of Al-Najebia power plant.

Mean light penetration readings (Table 1) attained it's lowest value in second area (29 cm) in comparison with those observed in first and third areas (39.9cm , 42.3cm , respectively). However, highest range during the study period were exhibited in Khor Al-Ummaia (190-400 cm). Water transparency values were always high towards Iraqi open marine waters (Al-Saadi *et al*., 1975 ; 1976 ; Maulood *et al.*, 1979 ; Al-Rekabi, 1990). This may be related to calm environment known in this area which is responsible for the deposition of sediments as the direction of the transport is mostly downstream the Shatt Al-Arab river and Khor Abdullah due to the high velocity of the ebb-tide currents (Al-Badran,1995; Al-Badran *et al.*, 1995).

Salinity gradient in study area was evident (Table 1). Range and mean values were lowest in first area (1.5-2.6‰ , 2.1‰ , respectively),

Table(1):

Water temperature, light penetration and salinity values in some southern Iraqi waters for the period from May – October/2000 .

	First area			Second area	Third area				
	Al-Dair bridge	Saad bridge	Khalid bridge	Shatt Al-Basrah	Khor Al-Zubair	Um-Qaser	Khor Abdullah	Khor Al-Ummaia	Shatt Al-Arab estuary
Water temperature(ºC)									
Minimum	24	26	26	24	25	26	29	29	29.5
Maximum	33	35	35.5	31.5	31	31	30.5	30.5	29.6
Range	24 – 35.5			24 – 31.5	25 – 31				
Light penetration (cm)									
Minimum	25	29	30	18	13	13	35	190	20
Maximum	58	63	58	43	28	29	35	400	25
Range	25 – 63			18-43	13 – 400				
Mean (S.D.)	42.3(± 8.0)			29(±7.8)	39.9(±29.2)				
Salinity(‰)									
Minimum	2.0	1.5	1.5	7.2	23.5	30.2	21.5	21	10
Maximum	2.3	2.5	2.6	14.5	35.5	39.5	41.4	40	32.5
Range	1.5-2.6			7.2-14.5	10-41.4				
Mean (S.D.)	2.1(± 0.2)			10.2(±2.3)	30.8(±4.4)				

intermediate in second area(7.2-14.5‰ , 10.2‰ respectively) and highest in third area (10-41.4‰ , 30.8‰ , respectively). Three distinct aquatic areas , therefore , apparently distinguished in the study area based on salinity. These are oligohaline, mesohaline and meso-euhaline (marine) waters (Perkins, 1974). Salinity gradient , however , were noticed earlier in several studies in lower Shatt Al-Arab river(Al-Saadi *et al.*,1975;1976;1977;Saad and Arlt,1977; Darmoian and Lindqvist , 1988 ; Al-Mahdi and Abdullah, 1966 ; Al-Zubaidi and Salman, 2001). The above meintioned differentiation of waters in study area was a dopted here as a base in presentation and discussion of the results in present study .

Plant nutrients and chlorophyll-a concentrations are given in Table 2. Highest mean values of nitrite and nitrate concentrations were recorded in first area (0.19,14.7 µg at. NL^{-1} , respectively) compared to those in second area (0.15, 10.5µg at. NL^{-1}, respectively) and

Table (2):
Nutrients and chlorophyll-a concentrations in some southern Iraqi waters for the period from May – October / 2000 .

		First area	Second area	Third area
NO_2(µg at NO_2-NL^{-1})				
	Minimum	0.02	0.03	0.04
	Maximum	0.90	0.37	0.25
	Mean (S.D.)	0.19(± 0.1)	0.15 (± 0.1)	0.11 (± 0.05)
NO_3(µg at NO_3-NL^{-1})				
	Minimum	2.0	2.8	0.26
	Maximum	30.0	19.0	32.5
	Mean (S.D.)	14.7 (± 2.8)	10.5 (± 5.5)	10.1 (± 9.3)
PO_4(µg at PO_4-PL^{-1})				
	Minimum	0.04	0.05	0.04
	Maximum	0.70	2.40	1.25
	Mean (S.D.)	0.22 (± 0.1)	0.75 (± 0.8)	0.41 (± 0.2)
N:P				
	Minimum	23.8:1	4.4 :1	0.3 :1
	Maximum	456.7 :1	237.4 :1	110 :1
	Mean (S.D.)	93.2:1 (± 58.0)	80.5 (± 111.4)	21.0 (± 11.2)
SiO_3(µg at SiO_3-SiL^{-1})				
	Minimum	19	19	13
	Maximum	155	162	144
	Mean (S.D.)	82.8 (± 30.6)	93(± 59.3)	49 (± 33.4)
Chlorophyll1a ($mg.m^{-3}$)				
	Minimum	3.2	1.9	0.3
	Maximum	39.4	8.6	19.6
	Mean (S.D.)	13.9 (± 10.7)	5.5 (± 2.7)	2.8 (± 2.1)

third area (0.11,10.1 µg at. NL^{-1}, respectively) . An opposite situation was detected in respect to phosphorus concentrations , where lowest mean value obtained in first area (0.22 µg at. PL^{-1}) and higher mean values were in second and third areas (0.75,0.41µg at. PL^{-1} , respectively). It is well known that nitrite is an instable and intermediate product controlled by the rate of oxidation-reduction processes of the different inorganic nitrogen forms (Hutchinson, 1957). It seems most likely, that nitrite concentrations in the study area were a result of nitrate reduction since warm waters and expected low levels of dissolved oxygen will increase the activity of nitrate reducing bacteria (Al-Imarah *et al*., 2001). Data presented earlier in the study area suggested that salinity relationships were inverse with nitrate and linear with phosphate, whereas an inverse correlation occurred between nitrate and phosphate (Abaychi *et al*., 2001; Al-Imarah *et al*., 2001 ; Hussein *et al*., 2001). This is in close agreement with present study. High concentrations of nitrate were exhibited in first area with oligohaline waters and low concentrations were in second and third areas with mesohaline and mesohaline-euhaline waters, respectively . In contrast, phosphate concentrations were with an opposite situation in the study area .

Southwick (1972) demonstrated that the normal level of N:P ratio in natural ecosystems is 23:1 , while Goldman and Horne (1983) quoted 16:1 as the typical plant requirement . From present data mean N:P ratio values obtained in the study area indicating the presence of a pronounced eutrophication status in each of first and second areas (93.2:1 , 80.5:1 , respectively), whereas normal level (21.0:1) was encountered in third area. Comparing the present results plus recent works in study area with those carried out in 1980s, indicate the occurrence of much larger quantities of nitrate in first and second areas in latest years compared to normal and balanced nutrient regime in third area . Nitrate values recorded in first area by Abdullah *et al*., (2001) ranged between 2.33 and 65.08 µg at. NL^{-1} in comparison to 0.1 and 4.7 µg at. NL^{-1} recorded by DouAbul *et al*.., (1987). The responses of phytoplankton in first area at this time which revealed nitrogen diffeciency (Al-Mousawi, 1992) giving further evidence of new habitat may be recently established here. On the other hand , Nitrate concentrations recorded in the second area by Hussein *et al*., (2002) ranged between 6.0-60.8 µg at. NL^{-1} compared to earlier concentrations of 0.15 - 3.9 µg at. NL^{-1} given by Abdullah (1989). However , the concentrations encountered in third area of both nitrate and phosphate in present study compared to those reported earlier (0.13 - 28.72 µg at. NL^{-1} and 0.21-2.3 µg at. PL^{-1}) by Abaychi *et al*., (1988) were almost similar.

High concentrations of nitrate observed in first and second areas , could not be related to industrial waste and agricultural runoff (Abdullah *et al*., 2001) only. it should be considered as direct impacts on the trophic status of waters in these two areas , due to southern marshes drying in the former and to recent construction of the main drain river in the latter. Maulood *et al*., (1979) demonstrated that a considerable reduction in plant nutrients may be occurred in marshes , where nitrate was some times reduced by more than 50% . However, Hussein *et al*., (2002) reached to the conclusion that all ecological variations noticed (in the second area) were definitely a result of the main drain river construction . It should be added , that balanced nutrient regime of waters in third area may be resulted due to salinity relationships mentioned earlier . This condition give rise to conclusion that Iraqi marine waters may be self-protected from eutrophication and subsequent expected red tide phenomenon (Goldman and Horne, 1983) at present (Table 5) , although such a phenomenon was almost occurred in other neighbouring Arabian Gulf waters. However , this may not be the situation in future, if present impacts on trophic status of southern waters are left untreated.

Mean silicate concentrations in study area were high in first and second areas (82.8 , 93.0 µg at. SiL^{-1} , respectively) and low in third area (49 µg at. SiL^{-1}). Despite of silicate importance for diatoms , it's quantity was always exceeding their requirements (Maulood *et al.*, 1979 ; Al-Handal *et al.*, 1992 ; Hussein *et al.*, 2002). It seems, that it's concentrations were largely related to sediments load in water (Ghani, 1988). In present study , a significant inverse correlation (r=-0.787 , p>0.05 and SM% =78) has been found between monthly silicate concentrations and light penetration readings in the second area .

Phytoplankton biomass was measured as chlorophyll-a in present study. Highest mean concentrations was recorded in first area (13.9 mgm^{-3}) compared to those in second area (5.5 mgm^{-3}) and third area (2.8 mgm^{-3}). This coincided with N:P ratio values noticed in these areas. Monthly variations in mean chlorophyll-a concentrations , nutrients and light penetration readings are presented in Table 3. However, it is evident from table 4, that a constant inverse correlation occurred between chlorophyll-a and N:P ratio values in all studied areas. This correlation , although it is of variable similarity matrix percentage in different areas , it was a significant in second area (r= -0.806 , P>0.05). This may indicate that phytoplankton biomass in study area was largely controlled by N:P ratio values. The chief source of nitrogen in the study area is from land drainage in contrast to local sources of phosphorus (Abaychi *et al*., 1987 ; Al-Imarah *et al.*, 2001; Hussein *et al.*, 2001). Thus, N:P ratio values reported in present study were mostly determined by nitrogen sources rather than by phosphorus.

A total of 79 species of phytoplankton were recorded in the study area (Table 5). The majority is Bacillariophyta (54 taxa), followed by Pyrrophyta (9 taxa), Chlorophyta (8 taxa), Cyanophyta (5 taxa) and Euglenophyta (3 taxa) . Spatial differences in species composition were evident. A total of 48 species were reported in first area in comparison with 23 and 33 taxa in second and third areas , respectively . Chlorophycean species were dominant only in first area, whereas Cyanophaycean and Euglenophycean species were reported only in first and second areas. This is apparently resulted from to high trophic status of the waters in these areas (Al-Saadi and Antoine, 1981 ; Antoine, 1983) . However , common genera of diatoms and dinoflagellates of marine origin were noticed only in second and third areas. Trophic status of water and salinity , therefore, may be considered as the most important ecological factors controlling the phytoplankton in the study area . It is well known that, salinity is inversely correlated with

Table (3):

Monthly variations in values of mean chlorophyll-a and some ecological variables in some southern Iraqi waters for the period from May-October /2000.

First area

	May	June	July 9-10	July 29-30	August	September 2-3	September 16-17	October
Chlorophyll/a(mgm^{-3})	38.3	16.6	13.2	15.3	5.6	6.4	5.1	11.0
NO_2(μg at NO_2-NL^{-1})	0.23	0.10	0.38	0.16	0.12	0.16	0.37	0.05
NO_3(μg at NO_3-NL^{-1})	10.8	16.40	14.70	18.6	16.4	16.26	14.0	10.50
PO_4(μg at PO_4-PL^{-1})	0.22	0.11	0.25	0.57	0.09	0.11	0.20	0.22
N:P	50.1:1	150:1	60.3	32.9:1	183.5:1	149.2:1	71.8:1	47.9:1
SiO_3(μg at SiO_3-SiL^{-1})	66.0	78.6	81.0	20.3	84.6	1.4	115	112.6
Light penetration (cm)	44	31.6	43.3	48	29.6	41.6	52.6	48

Second area

	May	June	July 9-10	July 29-30	August	September 2-3	September 16-17	October
Chlorophyll/a(mgm^{-3})	2.7	8.6	3.5	7.5	7.9	6.4	1.9	-
NO_2(μg at NO_2-NL^{-1})	0.14	0.08	0.26	0.16	0.06	0.03	0.37	-
NO_3(μg at NO_3-NL^{-1})	19.0	5.1	15.2	10.5	11.1	2.9	10.0	-
PO_4(μg at PO_4-PL^{-1})	0.07	1.00	0.72	2.40	0.98	0.07	0.05	-
N:P	273.4:1	5.2:1	21.4:1	4.4:1	11.4:1	41.5:1	207.4:1	-
SiO_3(μg at SiO_3-SiL^{-1})	63	120	19	21	112	162	154	-
Light penetration (cm)	30	32	30	43	27	18	23	-

Third area

	May	June	July 9-10	July 29-30	August	September 2-3	September 16-17	October
Chlorophyll/a(mgm^{-3})	7.2	3.9	0.8	2.7	2.0	2.5	0.3	-
NO_2(μg at NO_2-NL^{-1})	0.09	0.06	0.08	0.09	0.13	0.10	0.25	-
NO_3(μg at NO_3-NL^{-1})	2.87	8.08	19.40	27.65	10.32	1.11	10.05	-
PO_4(μg at PO_4-PL^{-1})	0.36	0.39	0.57	0.85	0.49	0.09	0.32	-
N:P	8.2:1	20.8:1	34.1:1	32.6:1	21.3:1	13.4:1	32.0:1	-
SiO_3(μg at SiO_3-SiL^{-1})	96	43.4	17	17	48.5	99.5	57	-
Light penetration (cm)	57.5	100	25	28	25	22	22	-

water discharge (Al-Mansoury, 1996) as well as the distribution of nutrient salts (Abaychi *et al.*, 1988) and zooplankton in the study area (Al-Zubaidi and Salman, 2001). Thus, It may be concluded that both qualitative and quantitative composition of phytoplankton in the study area are mainly determined by water discharge.

Table (4):
Correlation coefficient (r) and Similarity Matrix percentage (SM%) for the relationships between monthly values of chlorophyll-a and some ecological variables in some southern Iraqi waters for the period from May – October / 2000 . (* significant value P>0.05) .

	First area		Second area		Third area	
	r	SM%	r	SM%	r	SM%
NO_2(µg at NO_2-NL^{-1})	0.020	2	0.758*-	75	-0.512	50
NO_3(µg at NO_3-NL^{-1})	-0.430	43	-0.592	59	-0.409	40
PO_4(µg at PO_4-PL^{-1})	0.194	19	0.614	61	-0.133	10
N:P ratio	-0.412	41	-0.806*	80	-0.706	78
SiO_3(µg at SiO_3-SiL^{-1})	-0.453	45	0.061	6	0.429	50
Light penetration (cm)	0.038	3	0.306	30	0.587	58

Table(5):
List of phytoplankton species identified and their occurrence in some southern Iraqi waters for the period from May – October / 2000 . (+ : species present ; - : species absent) .

Taxa	**First area**	**Second area**	**Third area**
Cyanophyta			
1. *Arthrospira platensis* (Nordst) Commont	+	+	-
2. *Gomphspheria aponina* Kuetz	+	+	-
3. *Lyngbya martensiana* Menegh. exGomont.	+	-	-
4. *Merismopedia glauca* (Ehr.) Naeg.	+	+	-
5. *Oscillatoria Subbrevis Schmidle.*	+	+	-
Chlorophyta	+	-	-
6. *Actinastram hantzchii* Lagerheim	+	-	-
7. *Coelastrum microporum* Nageli in Braun.	+	-	-
8. *Pandorina morum* (Muell) Bory.	+	-	-
9. *Pediastrum simplex* Meven.	+	-	-
10. *Scenedesmus acuminatus* (Lag.) Chodat.	+	-	-
11. *S. diamorphus* (Trup.) Kuetz.	+	-	-
12. *S. quadricauda* Bred. Var. maximus West and West.	+	-	-
13. *S. opoliensis* P.Richter.	+	-	-
Euglenophyta			
14. *Lepocinclis ovum* (Ehr.) Lemmermann.	+	+	-
15. *Phacus longicauda* (Ehr.) Duiardin.	+	+	-

16. *P. pleuronectes* (Muell.) Duiardin.	+	-	-
Pyrrophyta			
17. *Ceratium furca* (Ehr.) Stein.	-	-	+
18. *C. fuscus* (Ehr.) Duiardin.	-	-	+
19. *C. massilliense* Joeig.	-	-	+
20. *C. troips* (O. Muell.) Nitz.	-	-	+
21. *Dinophvsis caudata* Sav. Kent.	-	-	+
22. *Glenodinium armatum* Lev.	+	-	-
23. *G. borgei* (Lemm.) Schill.	+	+	-
24. *G. pulvisulcatus* (Ehr.) Stein.	+	+	-
25. *Peridinium retiferum* Matz.	-	-	+
Bacillariophyta			
26. *Amphiprora alata* (Ehr.) Kutz.	+	-	-
27. *Amphora coffeaeformis* Ag.	+	-	-
28. *Anomoenies costata* (Kuetz.) Hust.	+	-	-
29. *Bacillaria paxillifer* (Muller) hendev.	+	-	-
30. *Bacteriastrum delicatulum* Cleve.	-	-	+
31. *Biddulphia sinensis* Greville.	-	+	+
32. *Caloneis permagna* (Bail.) Cl.	+	-	-
33. *Chartoceros affinis* Lauder.	-	-	+
34. *C. didymus* Ehr.	-	-	+
35. *C. lorenzianus* (Grun.)	-	-	+
36. *Cocconeis placentula* Var. euglypta (Ehr.) Cl.	+	-	-
37. *C. pediculus* Ehr.	+	-	-
38. *Coscinodiscus asteromphalus* Ehr.	-	-	+
39. *C. eccentricus* Ehr.	-	+	+
40. *C. oculus- iridis* Ehr.	-	-	+
41. *C perforatus* Ehr.	-	-	+
42. *Cyclotella meneghiniana* Kuetz.	+	+	+
43. *C. striata* (Kuetz.) Grun.	-	+	+
44. *Cymatopleura elliptica* (Breb.) W. Smith.	-	+	-
45. *Cymbella cistula* (Hemp.) Grun.	+	-	-
46. *Diploneis interupta* (Kuetz.) Cl.	-	-	+
47. *D. ovalis Var.oblongella* (Naeg.) Cl.	-	+	-

48. *Gyrosigma acuminatum* (Kuetz.)	+	+	+
49. *G. attenuatum* (Kuetz.) Rab.	+	+	-
50. *G. balticum* (Ehr.) Rab.	+	-	-
51. *G. distorum* Var. pakeri (Harriss)	-	+	+
52. *G. tenuirostrum* (Grun.) Cl.	+	-	-
53. *Mastogloia smithii* Var. amphicephala Grun.	+	-	-
54. *Melosira granulata* (Ehr.) Ralfs.	+	+	-
55. *M; varians* C.A.Ag.	+	-	-
56. *Nitzschia acicularis.*	+	-	-
57. *N. fasciulata* Grun.	+	-	+
58. *N. filiformis* (W. Smith.) Hust.	+	-	-
59. *N. granulata* Grun.	-	-	+
60. *N. longissima.*	+	-	-
61.*N. seriata* Cl.	-	-	+
62. *N. sigma* (Kuetz.) W. Smith.	+	-	-
63. *N. sigma* Var. rigidula Grun.	-	+	+
64. *N. tryblionella* Hantz.	+	-	-
65. *N. tryblionella* Var. lavidensis (W. Smith.) Grun.	+	-	-
66. *Pleurosigma delicatulum* W. Smith.	+	+	+
67. *Podosira steliger* (Bail.) Ehr.	-	-	+
68. *Rhizosolenia fragilissima* Bergon.	-	-	+
69. *Rhoicosphenia curvata* (Kuetz). Grun.	+	-	-
70. *Surirella capronii* Breb.	+	-	-
71. *S. gemma* (Ehr.) Kuetz.	-	-	+
72. *S. ovalis* Breb.	+	-	-
73. *S. ovata* Kuetz.	-	+	+
74. *Synedra ulna* (Nitzsch.) Ehr.	+	+	-
75. *Thalassionema nitzschioides* (Grun.) Hust.	-	-	+
76. *Thalassiosira fluviatilis* Hust.	+	-	-
77. *Thalassiothrix frauenfeldi* (Grun.) Cleve and Moeller.	-	+	+
78. *T. longissima* Cleve and Grun.	-	-	+
79. *Triceratium reticulum* (Ehr.)	-	-	+
Total number	48	23	33

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وفرة و توزيع الهائمات النباتية في بعض المياه العراقية الجنوبية

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الخلاصة

تناولت الدراسة نوعية و وفرة الهائمات النباتية بالإضافة إلى بعض العوامل الفيزياوية و الكيمياوية ذات العلاقة. جمعت العينات شهرياً للفترة من مايس / 2000 و لغاية تشرين الأول / 2000 ، من تسعة محطات في المياه العراقية الجنوبية ضمن منطقة المياه العذبة شمال مدينة البصرة و منطقة المياه البحرية شمال غرب الخليج العربي. تشير النتائج إلى إن محطات الدراسة توزعت إلى ثلاث مناطق مائية متفاوتة في ملوحتها ، الأولى قليلة الملوحة (1.5 – 2.6 %) والثانية مويلحة (7.2 – 14.5 %) و الثالثة مويلحة – مالحة (10 – 40 %) . لوحظ إن معدل كتلة الهائمات النباتية معبراً عنها بكمية الكلوروفيل – أ (13.9ملغم / م^3) قد كان اكبر ما يمكن في المنطقة الأولى بالمقارنة مع المنطقتين الثانية (5.53 ملغم / م^3) و الثالثة (2.8ملغم / م^3) .النتيجة أعلاه كانت منسجمة مع أعلى القيم المسجلة لنسبة النيتروجين إلى الفسفور في المنطقة الأولى أيضاً (93.2 : 1) بالمقارنة مع المنطقة الثانية (80.5 : 1) و المنطقة الثالثة (21.0 :1) . تضمنت الدراسة أيضاً قائمة بأنواع الطحالب المشخصة في منطقة الدراسة و توزيعها في المناطق المائية الثلاثة أعلاه.