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SPECIES COMPOSITION AND SEASONAL VARIATIONS OF THE EPIPELIC DIATOMS IN SOME SOUTHERN IRAQI MARSHES

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ABSTRACT

Species compostion, total cell counts and seasonal variations of epipelic diatoms were investigated at three marsh areas of Southern Iraq for one year. Sixty nine species belonging to pennate diatoms, particularly the biraphid forms were listed. Nitzschia and Navicula were the most important genera in their qualitattive and quantitative dominance cell densities in the studied area ranged from 0.2 x 10 cell cm to 47.2 x 10 cell cm. Multiple peaks pattern of seasonal variation in the total cell counts of epipelic diatoms was noted. High cell numbers generally occurred during autumn-Winter period. Possible effects upon species composition and the seasonal variations were discussed.

INTRODUCTION

In many shallow water bodies, epipelic diatoms are the most important group of benthic microalgae colonizing the sediment (Round, 1964; Moss, 1969; Round and Hickman, 1970 Moore, 1972, 1974a, 1976, 1979; Tai and Hodgkiss, 1975; Happy-Wood and Priddle, 1984). Among the photosynthetic communty of the microphytobenthos, benthic diatoms are the most important group to owing to large number of species and the significant role they play in benthic productivity (Al Handal, 1985). Information on the general ecology of benthic micrcalgal groups from Iraqare very limted (Maulood and Hashim, in press). The present study aimed primarly to investigate the species composition and the seasonal variations exhibited by the epipelic diatoms from three localities in the Southern marshes.

STUDY AREA AND METHODS

The extesive marsh region of Iraq lise between 30 35-32 45N and 46 13-48 E, extending for about 210 km and 170 km wide. Three stations were selected in the marsh area near Qurna city where rivers Tigris and Euphrates Join together to from the Shatt Al-Arab estuary (Figure 1). Station I, was located west to Dair and Characterized by closed area feature due to the presence of local artificial dams. Station II, was located in Al-Shaffi river which is a canal between the marsh region and Al-Arab estuary. StationIII, was located near Um Al-Schwach which was characterized by open marsh area feature.

The present study was carried out for year from July 1983 to June 1984. Monthly samples were collected randomely from the top centemeter of sediment from shallow areas (less than 30 cm in depth)at stations I,III and from the bank region of the river at station II of the epipelic diatoms was done according to Eaton and Moss (1966). Permenant slides prepared from the preserved samples after cleaning with concentrated Nitric acid as oxidizing agent and Naphrax as a mountant. Counting was made according to the modified microtransect method (Furet, 1979 under the high (oil) power magnification . Zeiss microscope with phase contrast objectives was used. Results of cell counts are expressed as cell cm

RESULTS AND DISCUSSION

Atotal of species were identified during the study period (Table 1). Kassim (1986) gave a list off 111 species of epipelic diatoms froms other areas in south marshes, whille 51 species only was recorded from Shatt Al-Arab setuary by Hadi and Al-Saboonchi (1989).

Aconsidration of the whole list revealed that all species belon to pennate diatoms particulary the motile biraphid froms which comprised a percentage of 85.5% of the total species recrded (Table 1). Nearly all epipelic diatoms being biraphidean and freely motile (Hutchinson, 1975), since motality is essential to enable species to move to the surface after any disturbance of the sediment (Round, 1973).

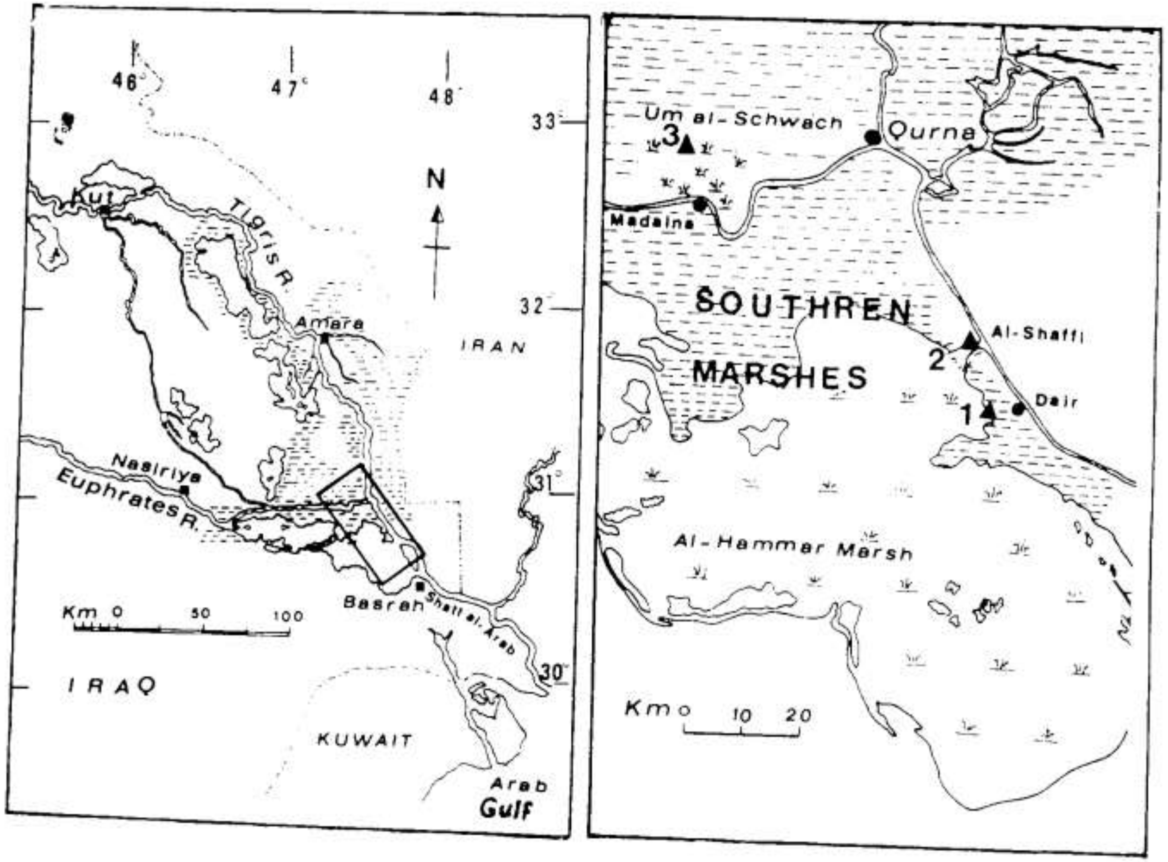

Figure (1) : Maps of the Southern marshes of Iraq showing location of the study area and the sampling stations .

Table(1) : Epipelic diatom species with their average percentages of the total population during the study period in each sampling station.

Taxa	Stations I	Stations II	Stations III
Achnanthes minutissima Kuetz.	0.29	0.96	5.52
Amphipleura pellucida (Kuetz.)Kuetz.	——	——	0.97
Amphiprora alata Kuetz.	——	0.23	——
Amphora angustata var.typica(Greg.)Cl.	1.98	0.25	——
A. coffeaformis Ag.	5.85	0.59	0.21
Anomoeoneis costata (Kuetz.)Hust.	——	——	2.69
Bacillaria paxillifer (O.F.Muller)Hendey	0.66	0.51	——
Caloneis permagna (Bail.)Cl.	——	0.11	——
Campylodiscus clypeus var.bicostata(W.Sm.)	0.37	——	——
Cocconeis placentula var.euglypta(Ehr.)Cl.	1.00	6.34	1.70
Cylindrotheca gracilis(Bréb)Grun.	0.11	2.61	1.79
Cymbella cistula(Hemp.)Grun.	0.11	——	0.50
C. microcephala Grun.	——	0.11	0.21
C. turgida Greg.	——	0.25	——
Denticula rainierensis Sov.	——	0.25	——
Diatoma tenue var.elongatum Lyngb.	——	0.75	——
Diploneis ovalis (Hisle)Cl.	0.23	——	0.78
D. ovalis var.oblongella(Naeg.)Cl.	0.10	——	——
Epithemia sorex Kuetz.	——	0.25	——
E. zebra(Ehr.)Kuetz.	0.06	——	——
Eunotia pectinalis var.undulata(Ralfs)Rabh.	——	——	0.52
Fragillaria brevistriata var.inflata(Pan.) Hust.	——	0.84	0.93
F. pinata Ehr.	1.03	——	——
Gomphonema gracile Ehr.	0.05	——	——
G. intricatum var.lunatum Germain	0.05	0.25	——
G. montanum var. acuminatum Mayer	——	0.89	1.01
G. parvulum(Kuetz.)Kuetz.	——	0.11	——
Gyrosigma acuminatum(Kuetz.)Rabh.	——	1.18	——
Mastogloia smithi var. amphicephala Grun.	——	0.24	0.48
M.smithi var lacustris Grun.	0.74	——	3.40
M.braunii Grun.	0.47	0.23	——
Navicula buccella Hohn et Hellerman	51.70	0.83	——
N. caterva Hohn et Hellerman	0.28	——	——
N. cryptocephala Kuetz.fo.minuta Boy-p.	5.16	2.53	2.43

N. graciloides A.Mayer	0.95	——	——
N. inexpectans J.R.Carter	0.22	——	——
N. parva (Menegh)Cl.	5.64	29.26	12.88
N. spicula(Hickie)Cl.	——	0.25	——
N. vuridula var. rostellata(Kuetz.)Cl.	0.72	9.24	21.55
N.placentula (Ehr.)Grun.	0.11	——	——
N.pygamea Kuetz.	0.11	——	——
N. tenera Hust.	0.05	——	——
N. pupula var.rectangularis(Greg.)Grun.	——	——	0.48
N. radiosa Kuetz.	——	——	0.26
N. schroeteri Meister	——	——	0.24
Nitzschia acicularis W.Sm.	——	0.38	——
N. amphibia Grun.	0.23	1.66	2.39
N. apiculata(Greg.)Grun.	——	0.74	0.48
N. filiformis (W.Sm.)Van Heurck	——	3.11	5.05
N. fonticola Grun.	0.72	6.19	3.07
N. gracilis Hantz.	——	0.37	——
N. granulata Grun.	2.72	1.22	——
N. hungarica Grun.	0.30	——	0.48
N. kerguelensis (O.Meara)Hasle	11.17	15.45	9.60
N. longissima (Bré b.)Ralfs.	0.79	0.23	——
N. lorenziana Grun.	0.06	——	——
N. obtusa W.Sm.	0.95	——	3.07
N. palea (Kuetz.)W.Sm.	——	——	13.18
N. paleaceae Grun.	0.34	——	——
N. punctata var. coarctata Grun.	0.11	——	——
N. sigma (Kuetz.)W.Sm.	0.06	0.59	——
N. tryblionella var. levidensis(W.Sm.) Grun.	1.24	2.31	0.73
Pleurosigma delicatulum W.Sm.	0.39	——	——
Rhopalodia gibba (Ehr.)O.Mueller	0.05	0.48	0.24
R. musculus (Kuetz.)O.Mueller	0.11	0.25	——
Synedra capitata Ehr.	——	0.60	0.78
S. fasiculata (Ag.)Kuetz.	1.09	1.97	0.97
S. pulchella Kuetz.	0.11	1.75	——
S. ulna (Nitzsch.)Ehr.	1.29	3.46	1.25

Data showed that only 20% of the recorded species were present at all stations (Table 1) The possibility of variation in the benthic floras is great owing to the interplay of water chemistry, physical nature of the substratum, niche strucher and interction of species with the environment (Round, 1964). A significant change in the epipelic diatom population, for example found to be associated with the variation in sediment grain size (Al-Haudal, 1985).

All stations indicate an alkaline-hard water nature (Table 2). Eleven common species listed in the present study (Table 3) were belonged to the genera Navicula, Nitzschie, Amphora, Cocconeis and Achnanthes. These genera with many others such as Amphipleura, Anomoeoeoneis, Denticula, Epithemia, Fragillaria, Mastogloia and Rhopalodia (Table 1) were all classified as representatives of such chemical conditions (Hickman, 1975). Nitzschia with 17 taxa and Navicula with 14 taxa were the most common genera. Collectively, they comprised total monthly percentages of 82.2%, 74.4% and 75.9% at stations I, II, III respectively (Table 1). Their occurrence at each sampling date at the different stations are shown in (Figure 2). they were also the dominants in several othe investigations (round, 1965, Hickman and Round, 1970; Tai and Hodgkiss, 1975; Moore, 1977; Aykulu, 1982; Hadi and al-Saboonchi, 1989). Moreover, moderate monthly percentages namely Amphora coffeaformis, Cocconeis placentula var. englypta, and Achnanthes minutissima at stations I, II and respectively were also noted (Table 3). These three species are epiphytic (Round, 1973), thus, indicating the possibility of a cusal species due to water movements their seasonal varations on the sediment reflect the amount of detachments from the epiphyton habitats rather than changes in growth conditions (Moore, 1977). Similarly, several common diatoms noted during the present study particularly Nitzschia kerguelensis, Navicula buccella and Navicul parva were also common in the plankton at the study (Al-Zubaidy, 1985), thus their seasonal variations in the sediment, consequently affected by the rate of loss due tote the same processes of detachments. Such findings were also noted by Moss and Karim (1969) and Sullivan (1977).

Table (2) : Some physico - chemical parameters of the study stations (from AL-Zubaidi, 1985) .

		Total depth (cm)	Air temperature (C^o)	Water temerature (C^o)	pH	Salinity (‰)	Total alkalinity ($mg\ l^{-1}$) as $CaCO_3$	Total hardness ($mg\ l^{-1}$) as $CaCO_3$	Calcium concntration ($mg\ l^{-1}$)	%Saturation of oxygen	Nitrate (ug - at.NO_3 - N l^{-1})	Nitrite (ug - at. NO_2 - N l^{-1})	Phosohate (ug - at. PO_4 - p l^{-1})	Silicate (ug - at. SiO_2 - Si l^{-1})	N:P
Station I	Min.	30	18.0	14.0	7.99	3.4	53.0	875	70.6	23.2	0.40	0.01	0.17	36.3	1.0 :1
	Max.	145	40.0	32.0	9.16	21.5	355.0	13765	249.0	112.3	3.39	2.19	1.88	306.4	19.2 :1
	Mean	86	31.0	24.2	8.43	8.8	221.0	3826	149.6	80.5	1.51	0.41	0.64	143.6	4.6 :1
Station II	Min	85	19.0	15.0	7.67	1.6	26.0	461	39.0	33.1	0.67	0.03	0.17	10.8	1.7 :1
	Max	150	40.0	29.0	8.36	4.9	190.0	981	244.3	87.4	3.91	0.42	0.68	325.3	12.7 :1
	Mean	105	32.4	23.4	7.91	2.2	153.8	613	119.2	70.2	1.70	0.17	0.40	73.9	5.3 :1
Station III	Min		15.0	12.0	7.39	0.6	162.0	158	11.2	42.4	0.37	0.01	0.14	18.5	0.6 :1
	Max.		37.0	32.0	8.04	2.2	231.0	417	96.4	81.9	1.20	0.13	1.37	325.0	6.0 :1
	Mean		28.6	22.3	7.82	1.0	209.4	325	35.1	65.0	0.84	0.06	0.44	122.2	2.3 :1

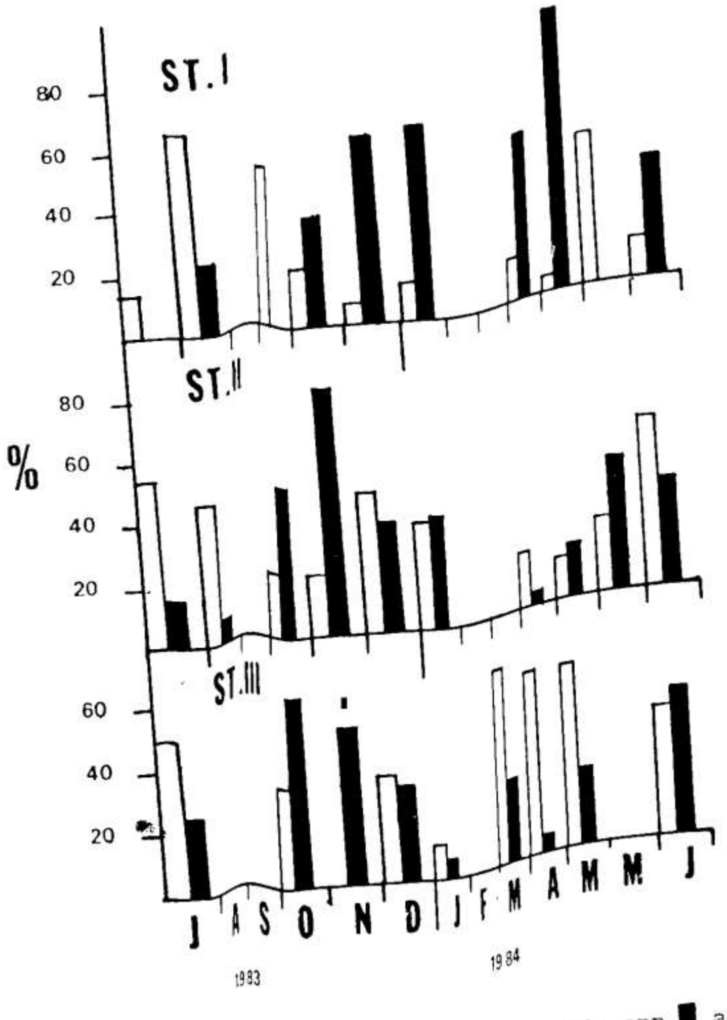

Figure (2): Nitzschia spp. ▯ and Navicula spp. ■ as percentage of the total population in each sampling date in the study stations.

Table(3) :Common epipelic diatoms and their seasonal maxima in each sampling station.Taxa arranged according to their average percentages of the total population during the study peri .

Taxa	Seasonal maxima of common species(x 10^4cell cm^{-2})	Average percentage
Station I		
Navicula buccella	2.2(Apr.),41.5(May)	51.7
Nitzschia kerguelensis	7.2(Aug)	11.1
Amphora coffeaeformis	1.7(Nov.),1.4(Dec.)	5.8
Navicula parva	1.6(Aug.),1.1(Dec.),1.0(Jun.)	5.6
Navicula cryptocephala f.minuta	1.4(Dec)	5.1
Station II		
Navicula parva	2.5(Oct.),4.6(Nov.),1.2(Jan), 1.0(Jun.)	29.2
Nitzschia kerguelensis	1.1(July),0.9(Nov.),0.8(Jan.)	15.4
Navicula viridula f. rostellata	2.0(Nov.),0.6(Jan.)	9.2
Cocconeis placentula var.euglypta	0.4(Aug.),0.3(Oct.),0.4(May)	6.3
Nitzschia fonticola	0.4(Jul.),0.3(Oct.),0.5(Dec), 0.3(Jun.)	6.2
Station III		
Navicula viridula f.rostellata	2.5(Oct.)	21.5
Nirzschia palea	0.4(Oct.),0.5(Dec.),2.6(Jun.)	13.1
Navicula parva	0.9(Dec.),1.3(Jun.)	12.8
Nitzschia kerguelensis	0.3(Oct.),1.0(Jun.)	9.6
Achnanthes minutissima	0.5(Jan.)	5.5
Nitzschia filiformis	0.3(Dec.)	5.0

Total cell counts were high station I rnged from 0.3-47.2x10^4 cell cm^{-2} withmonthly mean of 8.6x10^4 cell cm^{-2}, low at station III, ranged from 0.2-5.4x10^4 cell cm^{-2} and a monthly mean of 2.0x10^4 cell cm^{-2}, intermediate at station II, ranged from 1.0-10.4x10^4 cm^{-2} and a monthly mean of 3.8x10^4 cell cm^{-2}. This squence of station differences in the monthly mean of cell densities was found to be parallel to a simila sequence in the monthly mean of some basic chemical conditions of the ovellying waters (Table 2).

A direct relationship between diatoms standing crop and total ionic content was founded by moss and Karim (1969) and with calcium content by Antoine et al. (1984). Whereas a weak relation between epipelic algae and nutrients' status of the overying water was indicated in several investigations (Grundeling, 1971; Moore, 1974; Hickman, 1978; al-Handal, 1985) presumbly that many nutrients may be obtained from the sediment. However, many others (Hopkins, 1964;Moore, 1974a; Wetzel, 1975; Antoine et al. 1984) have indicated that high diatom biomass corresponded to high organic matter content of the sediment. No data available for the total organic matter in the sediment of the studied stations, otherwise its effect may be expected due to the Known positive correlation between the calcium content and the total organic matter (Round, 1975; Antoine et al. 1984). The other evidence for the largely possible roleof total organic matter in the present study, might be arised from the dominance of Nitzschia and Navicula members either in species composition or in the total cell counts at each particular station. These two genera were among the top eight genera of algae tolerating organic pollution as shwed by palmer (1969), who conculuded also that the genus Nitzschia is similar to Euglena in the pollution tolerance and the genus Navicula as Scenedesmus failed in intermediate range.

The maxima of 47.2 X10^4 cell cm^{-2} for the total epipelic diatoms in the presen study remained clese to the maxima 31.4x10^4 cell cm^{-2} recorded by Kassim (1986) from other areas in the Southern Iraqi marshes. However, these densities represented 6 - 9 times more than the maxima of 4.8x10^4 cell cm^{-2} given for Shatt Al-Arab by Hadi and Al-Saboonchi (1989).

Seasonal variations in the total cell counts in the studied stations (Figure 3) showed that each station exhibited its own fluctuations with the occurance of several peaks during the study period. Similar pattern of seasonal variations was noted also by Kassim (1986) and Hadi and Al-Saboonchi (1989). Such a feature, apparently correlated with the timing and the extent of the common species maxima (Table 3). No species extends over the entire year in significant population number. Wetzel 91975) reffered that epipelic algal populations tend to increase quite rapidly and then to decline equally rapidly. The cause of the drop in the standing crop of epipelic algae after periods of rapid expantsion is quit possibily related to the high phhotosynthetic activity and unusually large standing crop 9Moore, 1974a;;1976). However, on shallow sediment the epipelic algal populations tend to exhibit early winter and spring peaks, followed by mid summer manima in temperate regions (Round, 1964;; Wetzel, 1975a) or maximumgrowth in winter, moderate spring and autumn growth periods and low summer growthh in tropical waters (Taiand Hodgkiss, 1975).

A part from the multiple peaks pattern of seasonal variations in the total cell counts in the present study there was an overall tendency for peak in numbers during autumn-winter periods at all stations and during at least at station I which was less effected by water movements due to its closed area feature, suggesting that growth was controlled mainly by climatic variables (Round 1964; Grundeling, 1971; Moore, 1974a; Wetzel, 1975a; Aykulu, 1982). Significant variations within this pattern of growth may brought about in the total epipelon standing crop due to wave action at the margins (Moss, 1969; Grundeling, 1971; Hickman, 1978) and the physically unstable nature of benthic algal populations (Mcintire, 1975; Wetzel, 1975b).

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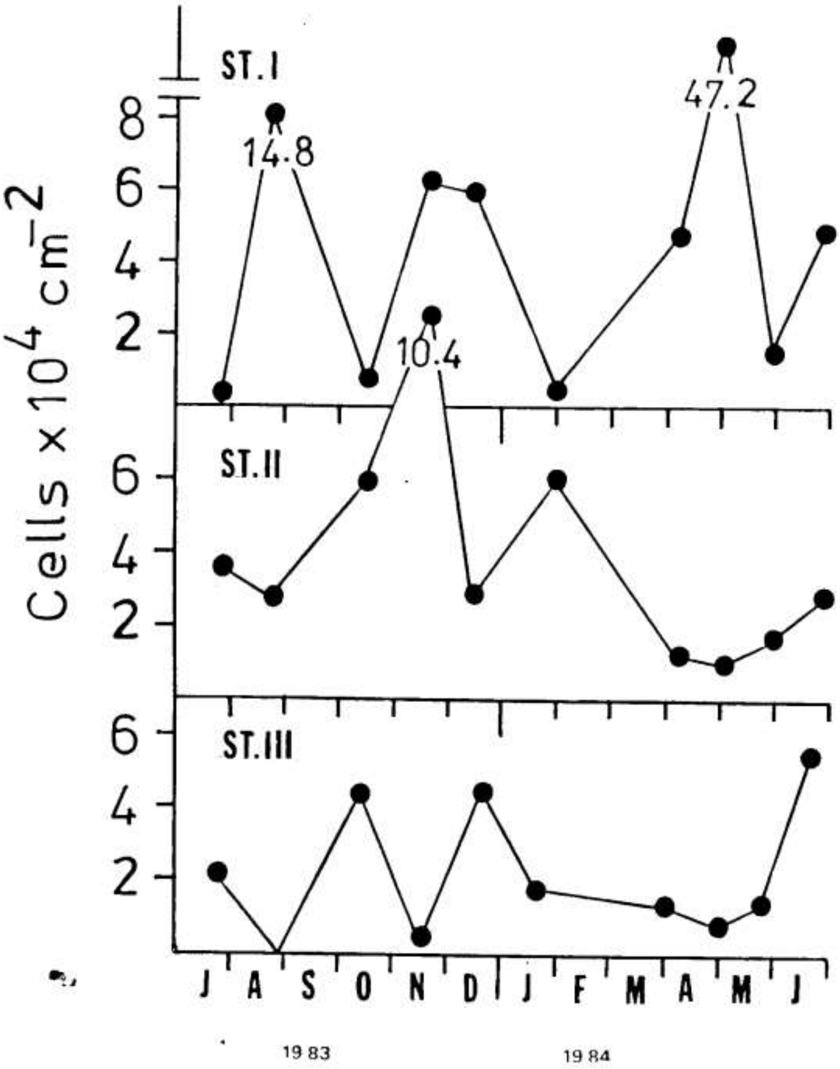

Figure (3) : The seasonal variations in *total cell counts* of epipelic diatoms in the study stations.

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التكوين النوعي والتغيرات الفصلية للديتومات الملتصقة على الطين في بعض اهوار العراق الجنوبية

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الخلاصة

تم دراسة التكوين النوعي، الاعداد الكلية للخلايا والتغيرات الفصلية للدايتومات الملتصقة على الطين في ثلاث مناطق من اهوار جنوب العراق لفترة سنة واحدة. سجل تسعة وستين نوعاً تعود الى الدايتومات الريشية ، من نوع ثنائية الرافي بشكل خاص. الجنسان *Nitzschia* و *Navicula* هما الاكثر اهمية وسيادة سواء من الناحية النوعية او الكمية. تراوحت اعداد الخلايا الكلية في منطقة الدراسة من اقل قيمة لها (0.2×10^4) خلية/ سم^2 الى اعلى قيمة لها وهي (47.2×10^4) خلية / سم^2 لوحظ تعدد الزيادات في شكل التغير الفصلي ، وبشكل عام فان الزيادات في اعداد الخلايا كانت تحدث في فترة الخريف - الشتاء . نوقش في الدراسة كذلك التاثيرات المحتملة على طبيعة التكوين النوعي وشكل التغيرات الفصلية.