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Study of phytoplankton blooms incident in shatt al-arab river and marine coast Iraqi line

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Abstract:

Phytoplankton blooms, were noticed a long Shatt Al-Arab river and costal waters of north-west Arabian Gulf. The efforts were made to study this phenomena which was observed in this part of ROPME Sea Area . Phsio-chemical and biological parameters were studied to evaluate the relationship between these factors and the phytoplankton blooms which cauase the water to appear brow . The occurrence of suitable environmental factor such as water temperature(25.7-26.7)C^o, salinity (39.1) ppt, calm weather, and relative increase of nutrients Nitrate(5.83 µg-at N/l), orthophosphate(0.929 µg-at PO_4/l) and silicate(118.78 µg-at SiO_4/l) lead to massive growth of phytoplankton achieved (4.46 x 10^6 cell/L) specially in the coastal area.The phytoplankton assemblage and biomass were studied. Fourty species of phytoplankton were identified (32) species belonging to diatoms and (8) species were dinoflagellates. Phytoplankton were dominated by diatoms *Chaetoceros Thalassionema Rhizoslenia odentella* and *Coscinodiscus* - Dinoflagellates were dominated by *Dinophysis* and *Protoperdinium.* Two species of *Dinophysis* and two species of *Protoperdinium* were recorded for the first time in Iraqi coastal water *Dinophysis acuta, D. mitra and Protoperidinium crassipes, P. gracilie*. The study clearly showed a relationship between the development of phytoplankton blooms and the input of nutrients.

Keywords: Phytoplankton blooms, Shatt Al-Arab,Nutrients ROPME SEA AREA ,Diatoms, Dinoflafellates

Introduction

Shatt Al-Arab river and coastal ecosystem of Arabian Gulf support divers and important fisheries, and reservoir of great biological diversity, population growth and development, as well as use of these natural system for petroleum activities and shipping has substantially increased the pressure place upon marine and fresh water resources[1] In recent years, fertilizers which is used in a large amount in agriculture introduce a large amount of hydrocarbons, organic materials and heavy metals[2,3 and 4]

Nutrients runoff in to the waters bodies can stimulate a rapid phytoplankton growth[5,6 and 7]. Some of their phytoplankton may benefit the water bodies as an important source of food for bottom living organisms[8] However, proliferation of some plankton species represent a risk to public health because they produce eaten by consumable fish and shellfish[9 and 10]. Phytoplankton blooms in marine and estuarine coastal waters has been identified in recent years as a potentially serious environmental problem[11 and 12]. It is essential to study the inventory species in the area specially it was recorded 16 species of harmful dinoflagellates in this area[13].There are some studies on phytoplankton of this area[14, 15 and 16].But no one of them deal with comprehensive studies on the biomass and abundance of phytoplankton in this area comparing with its importance as largest area waters bodies and one of the most productive habitat in terms of fish captured. The impact of wastewater in the coastal zone on production and biomass varies system[7 and 1]. However to understand how the anthropogenic factors interact with the natural variation of phytoplankton biomass and, in turn, be able to assess their impact on water bodies, it is necessary to document the seasonal variability of phytoplankton and their physical-chemical environment .This study is regarded as a first real one to discuss the changes in abundance and composition of phytoplankton in relation to phsio-chemical factorss in ROPME Sea Area, Iraqi coast.

Material and Methods

Study Area

Regional Organization for the Protection of the Marine Environment (ROPME) Sea Area Located in the northwest corner of the Indian Ocean. The ROPME Sea Area (RSA) lies between latitude 23.9º-30.25º N and longitude 48-56.2 E. It is important area because of its strategic location, economic resources and intensity of shipping. The RSA is semi-enclosed sea connected on the southeast to the Gulf of Oman through the narrow Strait of Hormuz. It ends in the northwest at the shores of Iraq in a delta formed by the Euphrates and Tigris rivers[17].The length of Iraqi coast is shorter compared with Kuwaiti and Iranian coast[18 and 19]. Figure(1) shows the sampling spots which was covered during this study in Shatt Al-Arab area phytoplankton samples were collected from four stations one station in Shatt Al-Arab river Abu-Floos port(station 1) ,two in Shatt Al-Arab estuary at Seba (station 2) and Faw (station 3) and the fourth one at north-west Arabian Gulf Kreen (station 4).

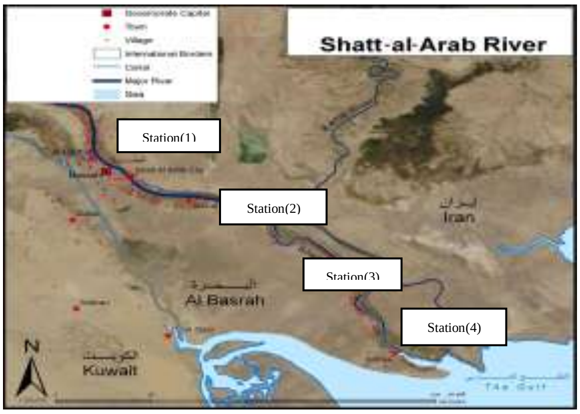


Figure 1 Sampling Area in the Shatt Al-Arab and North West Arabian Gulf

Sample collection and identification

Air and water temperature ,pH, salinity ,TDS. Turbidity and Dissolved oxygen were by using Horiba Multimeter made in USA. Two liters of water were collected and filtered immediately. Two liter collected to determined chlorophyll (a). Nutrients salts were determined in lab, according to procedure described in the MOOPAM/ROPME manual .Chlorophyll (a) was measure according[20]. Phytoplankton assemblage and total number were determined in the lab using light microscope and Sedgwich-Rafter slide.The taxonomy followed on[21, 22,23 ,24,25,26,27,28,29,30,31 and 32].

Results

Physico-Chemical Variables

The physio-chemical variables Showed distinct differences among the sampled station. Surface water temperature ranging between (26.6-28.2) ^{o}C (Fig. 2). The pH values ranged from (8.08-8..23) Fig.(4). The salinity showed graduated increasing from the north to the south with minimum value (2.4 g/l) at station 1 and maximum value(39.1 g/l) at station 4 Fig.(3). Dissolved oxygen were very low at Kreen stations(5.7) comparing with Abo-Floos station(7.0 mg/l) fig.(7) . The highest concentration of turbidity(58 and 56)NTU in station 1 and 2 respectively while lowest value(14.1)NTU in station 4 Fig.(5).The concentration of nitrite were lowest at station 4 (0.047-0.075) µg-at N-NO_3/l and highest at station 1(0.053-0.108) µg-at N-NO_3/l, while nitrate showed highest value in station 4 (4.02-5.8) µg-at N-NO_3/l and lowest value at station 2 Figures(9 and 10). Maximum concentration of Orthophosphate were in station 4 (0.897- 0.929) µg-at P-PO_4/l and minimum concentration at station 1(0.0929- 0108) µg-at P- PO_4/l fig.(11) . Silicate concentrations were in the same range at stations 1,2,3 and highest at station 4(96.628- 118.7858) µg-at Si-SO_4/l Fig.(12).

Phytoplankton distribution

In this study Forty species of phytoplankton were identified thirty two species belonging to diatoms and eight species dinoflagellates (Table(1). The abundance of phytoplankton was highest in station(4) with maximum concentration of (4.46 x 10^6 cell/l) and the lowest numbered were noticed in station(2) reaching 0.02 x 10^6 cell/l (fig.18) . The major contributors to the maximum concentration of chlorophyll a (0.453) µg/l (Fig.13) were recorded at station(4) .The dominants genera of diatoms were *Chaetoceros, Thalassionema, Rhizoslenia* , *Odentella*, *Cocinodiscus* while dinoflagellates were dominated by genus *Dinophysis* and *Protoperdinium*(fig.18). At Station 1 the dominated genus were(5) including *Campylodiscus* , *Coscinodiscus*, *Nitzschia sigma*, *Plerusigma* sp, *Protoperidinium* sp**.** fig.(14), and (7) genus *Coscinodiscus*, *Gyrosigma* sp. , *Nitzschia sigma*, *Thalassionema* spp., *Campylodiscus* spp., *Plerusigma* sp, *Cyclotella* sp. were dominated in station 2 (fig.15). The(fig.16) showing the dominant (11) species in station 3 were *Coscinodiscus* , *Cyclotella* sp, *Ditylum brightweellii* , *Eucampia zodiacus* , *Odentella*, *Melosira* sp, *Skeletonema costatum* , *Rhizoslenia* , *Thalassionema* spp, *Chaetoceros*, *Protoperdinium* . The phytoplankton of Kreen area were represented by (10) genus *Chaetoceros* , *Thalassionema* spp, *Coscinodiscus* , *Cyclotella* sp, *Ditylum brightweellii* , *Eucampia zodiacus* , *Odentella*, *Melosira* sp, *Skeletonema costatum*, , *Protoperdinium* (fig.18) Two species of Dinophysis and two species of Protoperdinium were recorded for the first time in Iraqi coastal water (*Dinophysis acuta*, *D. mitra and Protoperidinium crassipes, P. gracilie*.

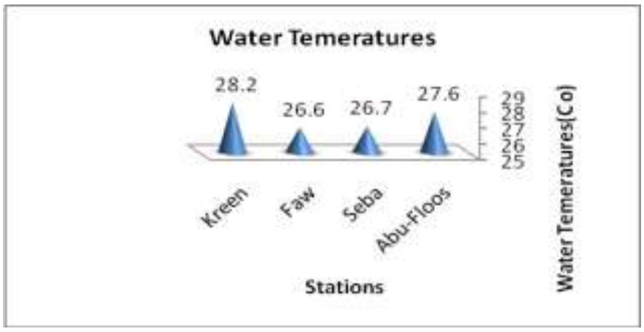


Fig.(2). water temperature

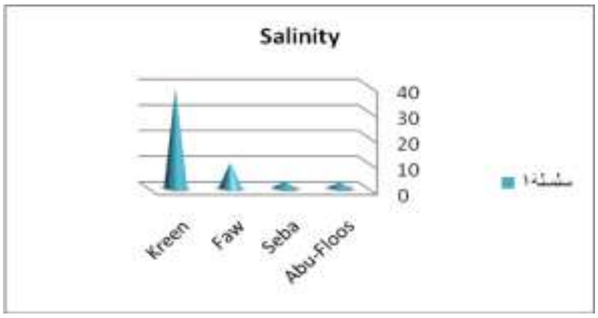
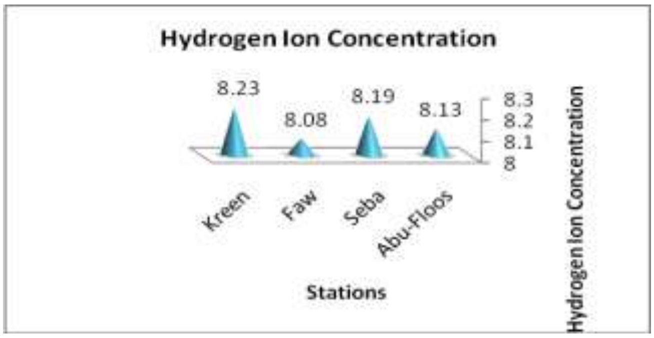
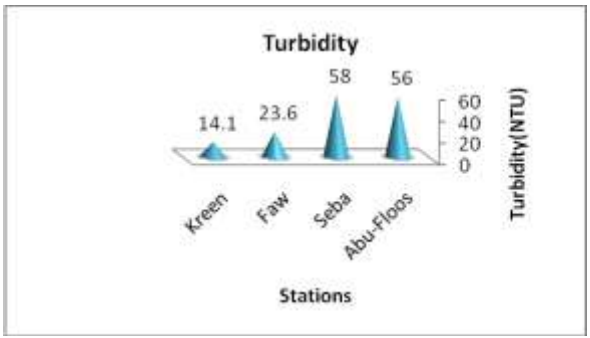


Fig.(3) Salinity concentration



Fig(4). Hydrogen Ion Concentrations.



Fig(5) Turbidityconcentration

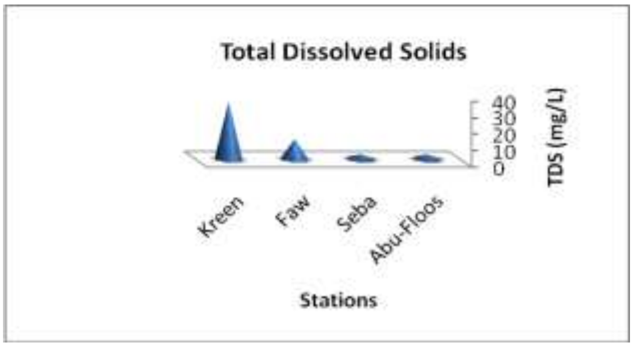


Fig.(6). Total dissolved solids

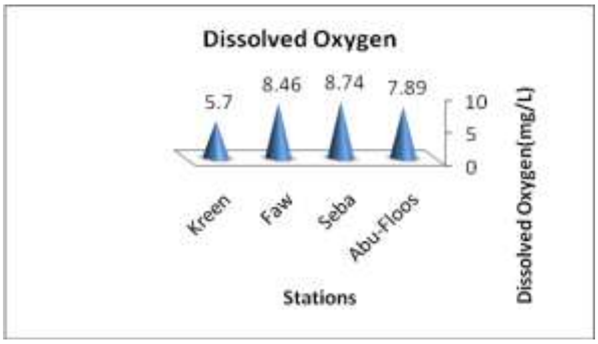


Fig.(7). Dissolved oxygen concentration

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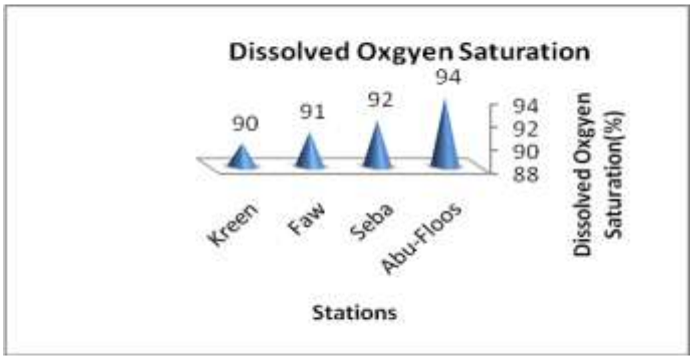


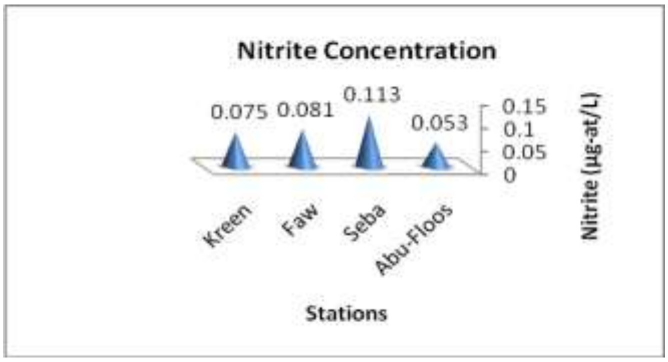
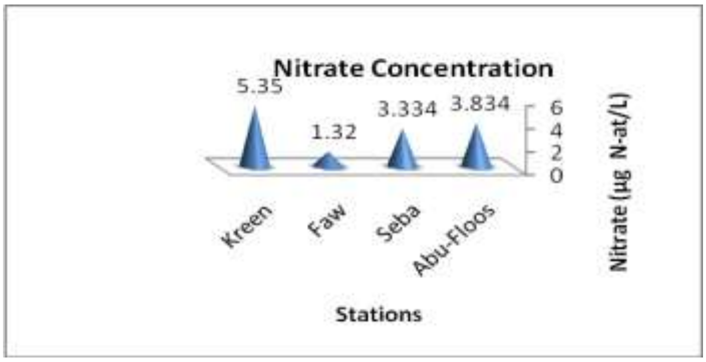


Fig.(8). Dissolved oxygen saturation

Fig (9). Nitrite concentrations



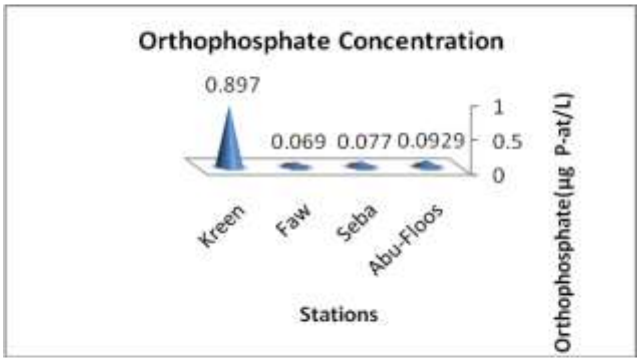
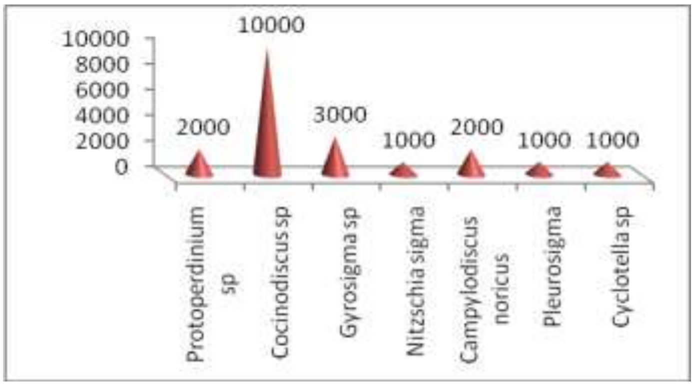


Fig.(12). Silicate concentrations

Fig.(13). Chlorophyll(a) concentrations



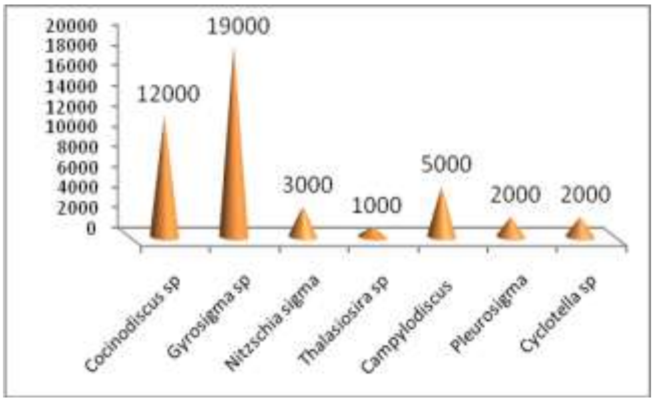
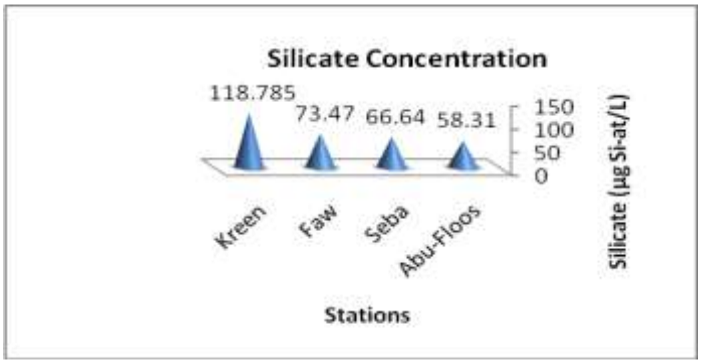


Fig.(14).Biomass of phytoplankton at station

Fig.(15). Biomass of phtoplankton at station



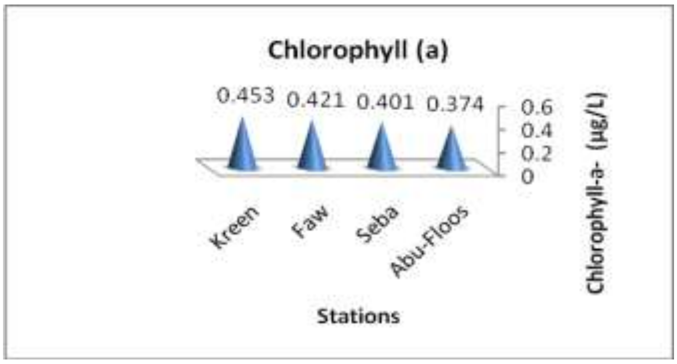
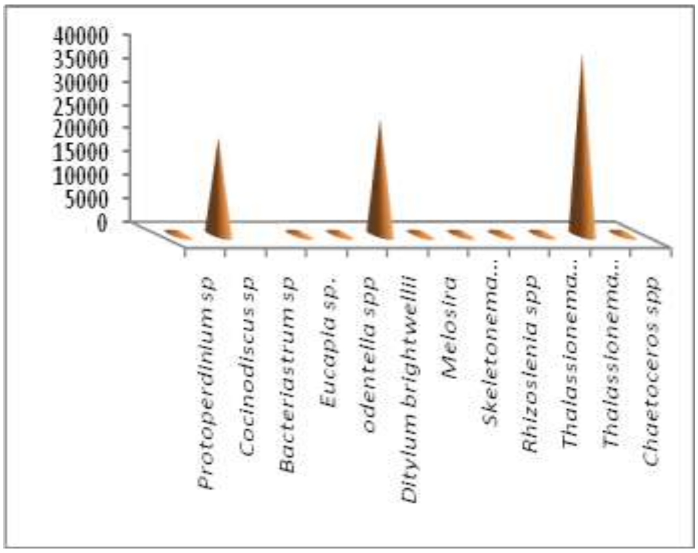
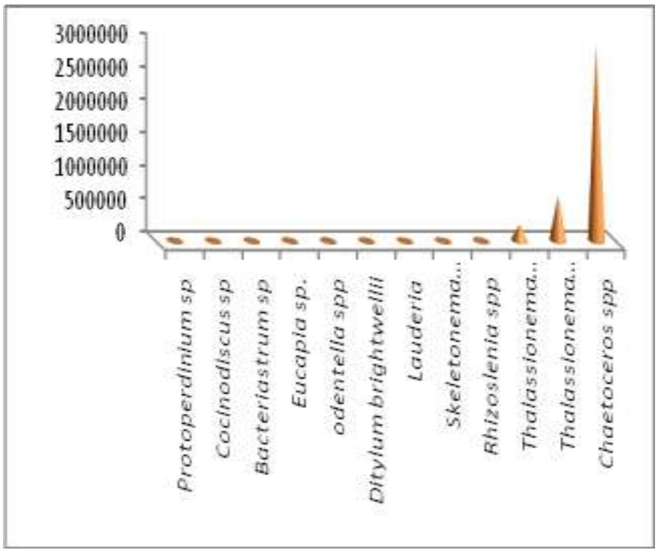
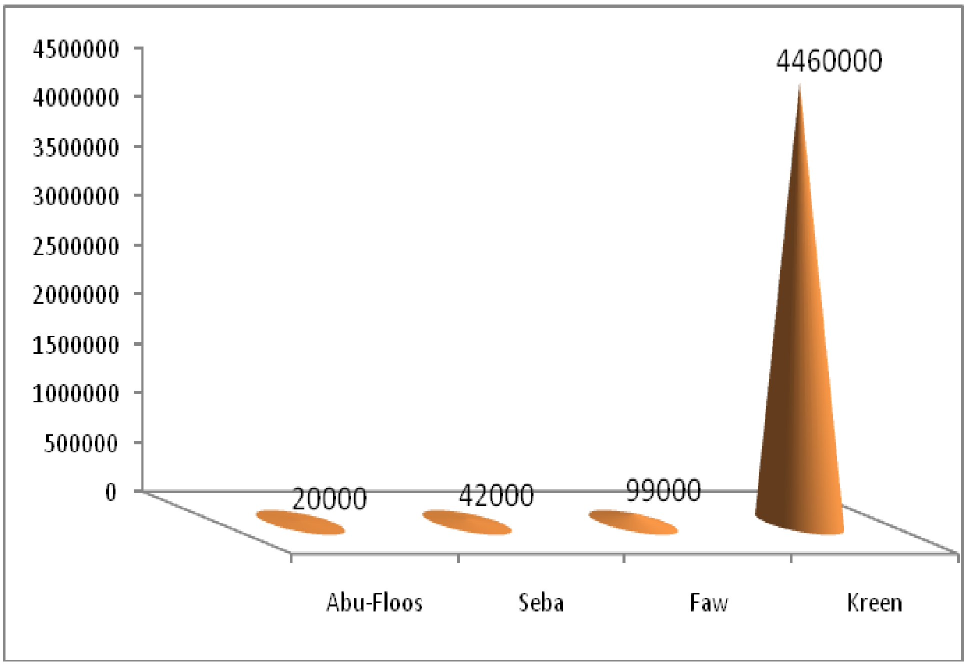


Fig.(16). Biomass of phtoplankton at station

Fig.(17). Biomass of phytoplankton at station







Table(1). Phytoplankton Identification species in different stations of Shatt Al-Arab And NW Arabian Gulf
(-) absent , (+) present, (++) common, (+++) dominant

Species	Abo-Floos	Seba	Faw	Kreen
Bacillariophyceae				
Actinocylu octonarius Her.	-	+	-	+
Bacteriastrum sp	-	-	+	
Campylodiscus noricus	++	++	-	
Arataulins sp	-	-	-	+
Coscinodiscus asteromphalus Ehr.	++	-	++	+
Coscinodiscus oculus-iridis Her	+	++	++	++
Cyclotella sp	+	+	+	+
Dactyliosolena sp.	-	-	-	+
Chaetocerose pseudocurvisetus	-	-	-	+++
Ch. Constrictus	-	-	-	+++
Chaetocerose sp.	-	-	-	+++

Ditylum brightweellii (T.West)Grun.	-	-	+++	+
Eucampia zodiacus Her.	-	-	+	+
Gyrosigma sp.	++	++	+	+
Lauderia borealis Gran.	-		+	
Melosira sp.	-	-		++
Nitzschia sigma (Kuetz.) W.Smith	+	+	+	+
Odontella mobiliensis (Bail.) Grun	-	-	+	++
Odontella sinensis (Grev.) Grun.	-	-		++
Plerusigma sp	+	+	+	+
Proboscia alata	-	-	+	++
Pseudosolen calcar-avis	-	-	-	++
Rhizosolenia hebetate	-	-	-	++
Rhizosolenia imbricate	-	-	-	++
Rhizosolenia clevei Sund.1984	-	-	-	++
Pseudosolenia calcar-avis (Shu.)Sund.1986	-	-	-	++
Rhizosolenia sp.	-	-	-	++
Skeletonema costatum	-	-	_	++
Surirella SP.	-	-	-	+
Thalassionema nitzschioides Grun.	-	-	+++	+++
T. frauenfeldii (Grun) Hallegraeff 1986	-	-	-	+++
Thalassiosira sp.	-	+		+
Dinophyceae				
C. tripos (O.Muell.) Nitz.	-	-	-	+
Dinophysis caudata Sav.-Kent	-	-		++
D. miles	-	-		++
* *D. Acuta*				+
* *D. Mitra*				+
Protoperidinium sp.	+	-	+	++
* *P. Crassipes*				+
* *P. Gracilie*				+

Discussion

The present work discuss the chemical and physical elements supporting the biological factors and in particular nutrients condition and algal blooming. The concentration of dissolved available inorganic nitrogen, phosphate and silicate(figs.10,11,12) are much higher in Kreen station where the population activities is high comparing with the other stations, which may indicate that the agricultural activities surrounded Shatt Al-Arab make small contribution to nutrients input than waste coming from the activities of this station which is regarded as part of big oil port. The analysis of changes in the values of physio-chemical parameters in the water has demonstrated differences between the four station especially in relation to salinity and dissolved oxygen saturation(fig.1and 2). Which is normal situation as four stations represented three different ecosystems(fresh , brackish, and marine). There are some studies on classification of algae in shatt Al-Arab and north –west of Arabian Gulf but few of them focusing on the biomass[33 and 16] The abundance of phytoplankton were high at Kreen station which may be connected with the highest level of nitrate and phosphate. The dominance of diatoms and dinoflagellates is a major feature found in this study which is in agreement with previous studies[34,35]. Nutrients often have major regulatory effects on phytoplankton abundance and composition, however properties of elements are particularly important . Phytoplankton growth were high at Faw and Kreen station(0.099 x 10^6 and 4.46 x 10^6 cell/l) respectively while oxygen saturation were low(fig.7). This concentration were twice higher than Seba and Abu-Floos station (fig.18). This phenomena may related to the high concentration of N and P in these two station. Other elements beside N and P can have a major influence on the structure of the phytoplankton communities and effect the nature of their response to nutrients inputs. The availability of silicate has little or no effect on the overall rate of algal growth in the aquatic environment but when silicate is abundance, diatoms are one of the major components of the phytoplankton. The availability of nitrogen and silicate may influence the abundance of diatoms species[36], explaining why there was a diatoms blooms in the studied area. For many year there has been speculation that discharge from agriculture area can stimulate the development of phytoplankton blooms from the considerable quantities of fertilizers use in agricultural area around Shatt Al –Arab estuary and soil washing in to coastal side of Arabian Gulf, but this study shows that waste disposals from human activities shipping are the major sources for nutrients environments in this part of ROPME Sea Area.

Conclusions

(1) The occurrence of suitable environmental factors such as temperature, salinity, calm weather and nutrients were increasing the occurance of blooms in north part of ROPME Sea Area (Shatt Al-Arab river) and coastal marine water of Iraq.
(2) The physio-chemical parameters showed remarkable differences a mong the sampling stations.
(3) The concentration of available inorgamic nitrogen , phosphate and silicate were high in Kreen station comparing with other stations indicating that the agricultural activities make small contribution to nutrients.
(4) Diatoms are the major components of the studied phytoplankton blooms representing by 32 species followed by dinoflagellates (8) species. The availaibility of nitrogen and silicate may explaine why there was a diatoms blooms in the studied area.

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