

DISTRIBUTION OF PHYTOPLANKTON IN ABU QIR BAY (EGYPT).

Amin A. Samaan and Samia K. Mikhail

National Institute of Oceanography and Fisheries, Kayet Bey,
Alexandria-Egypt.

ABSTRACT

The distribution of phytoplankton in Abu Qir Bay (Egypt) was estimated for three seasons. The Bay is a shallow estuary with a total area of about 38,000 hectares and it receives considerable amounts of continental discharges. The phytoplankton community in the Bay was mainly represented by diatoms (100 species), while dinoflagellates (25 species) were infrequently or scarcely recorded. The majority of the diatoms encountered are neretic euryhaline marine forms and of wide distribution in the Mediterranean Sea. Few species are fresh water diatoms which tolerate brackish conditions and were confined around the outlets of inland discharges.

The average standing crop of phytoplankton during spring (March) was 87,770 cells/l, increased to 482,840 cells/l in summer (June) and 518,030 cells/l during autumn (November). A bloom of *Asterionella japonica* was recorded in October.

Results indicate that the Bay lies among the highly fertile marine habitats in Egypt due to the eutrophication by the continental discharges. The western coast shows signs of pollution produced by the influx of El-Tabia Drain water which is contaminated with industrial wastes.

INTRODUCTION

Abu Qir Bay is a semicircular estuary situated at the western side of Rosetta Nile Branch at latitude 31° 25' N and longitude 30° 15' E and has a total area of about 38,000 hectares. It is relatively shallow, with a depth ranging from less than one meter along the shore, increasing gradually to a maximum of 15 m about the middle (Fig. 1).

The marine water of Abu Qir Bay is affected by three main continental discharges. The most important one being the slightly brackish water flowing from Lake Edku into the Bay through Boughaz El-Maadiya at its south western side at a rate of about 3.5 million cubic meter per day. The Bay receives also at its western margin considerable amounts of drain water intermixed with industrial wastes through El-Tabia Pumping Station. The daily discharge of this

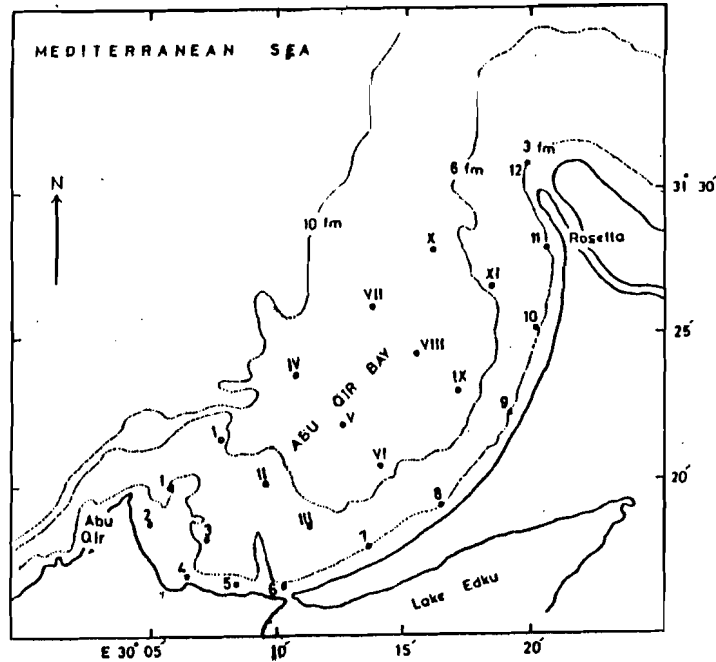


Fig. 1

Position of sampling stations in Abu Qir Bay.

station fluctuates between 1.5 and 2.0 million cubic meter. Thenorth eastern coast of the Bay ends with the opening of Rosetta Nile Branch. The amount of the Nile water flowing into the sea through this branch average about 3.3×10^3 million cubic meter per year. The bulk of this water is mostly confined to a short period between December and February. Other minor effluent is directly discarded at the south western margin of the Bay from Abu Qir Urea Fertilizer factory.

MATERIAL AND METHODS

Quantitative estimation of phytoplankton in Abu Qir Bay was performed for three seasons during 1980, namely; spring (March), summer (June) and autumn (October and November). 23 sampling stations were chosen to represent the different parts of the estuary. As shown in Fig. 1, twelve stations were selected along the coast to represent the inshore stations (arabic figures) while the other eleven stations were fixed at the offshores (latin figures).

Sampling of phytoplankton was carried out at each station by collecting one liter of sea water from the available standard depths (surface, 5, 10 and 15 meters) with a Nansen bottle and preserved with neutral formalin solution. The different plankters in the collected samples were counted

using the sedimentation technique and calculated as their total numbers per litre. The standing crop at each station was taken as the average value of the vertical samples.

RESULTS

The phytoplankton community in Abu Qir Bay was rich in the number of species. Diatoms dominated the population and were represented by 100 species within 39 genera. Most of them are neretic euryhaline marine forms. Dinoflagellates remained rare throughout spring and autumn but showed a pronounced increase in summer. They included 10 genera with 25 species. Scattered specimens of chlorophytes and silicoflagellates were scarcely recorded in the collected samples. The following is a summary on the seasonal distribution of the total phytoplankton in the Bay.

a - Distribution of phytoplankton during spring:

The inshore station 4 which lies adjacent to El-Tabia outfalls harboured 20,230 cells/l. The density of the standing crop of phytoplankton increased rapidly within a distance of about 3 Km around this area, reaching a peak of 317,700 cells/l at station 3 (Fig. 2). This reflects the eutrophic effect of the diluted waste water. *Melosira granulata* (Ehr.) Ralfs and *Melosira crucipunctata* Bachm. were the dominant diatoms at station 4. These two species are fresh water diatoms with brackish affinities. In the other littoral stations *Chaetoceros socialis* Lauder, *Chaetoceros affinis* Lauder and *Liptocylindrus danicus* Cleve were more dominant. The lowest counts of phytoplankton (9,530 cells/l) appeared in front of Boughaz El-Maadiya (opening of Lake Edku).

At the offshores, the phytoplankton was less dense except a lense of water mass with higher counts noticed about the middle of the Bay at station V. The community there consisted mostly of *Cyclotella kutzingiana* Thwaites *Cosinodiscus* sp., *Nitzschia longissima* (Breb.) Ralfs. and *Thalassionema nitzschioides* Grunow. Other frequent diatoms comprised *Leptocylindrus danicus* Cleve, *Skeletonema costatum* (Grev.) Cleve and *Thalassiothrix frauenfeldii* Grunow.

Dinoflogellates remained rare during spring and were represented mainly by *Peridinium* spp. and *Prorocentrum micans* Ehr.

The average standing crop of the total phytoplankton recorded in the Bay during the spring reached 141,410 cells/l at the inshore stations and decreased to 34,130 cells/l at the offshores.

Distribution of phytoplankton during summer:

The number of phytoplankton increased rapidly in summer at both the coastal and offshore stations. The areas adjacent to El-Tabia outfalls (station 4) harboured a high

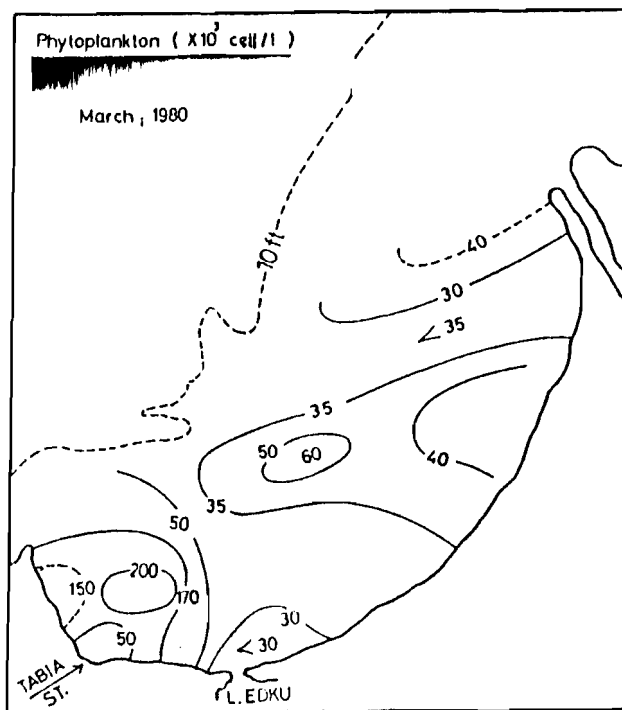


Fig. 2

Horizontal distribution of the total numbers of phytoplankton in thousand cells/l recorded in Abu Qir Bay during the spring.

density of 932,600 cells/l. This value increased to a peak of 2,403,260 cells/l at station 5 which lies nearby to the influx of the Urea Fertilizer Factory (Fig. 3). The Boughaz region still sustained a low density of phytoplankton which tended to increase again eastwards. Another increase was noticed in front of the opening of Rosetta Nile Branch (1,254,100 cells/l).

The community at the coastal stations was dominated by *Asterionella japonica* Cleve & Mull., *Skeletonema costatum* (Grev.) Cleve, *Chaetoceros affinis* Lauder and *Ch. sociales* Lauder. Lower counts of *Chaetoceros decipiens* Cleve, *Ch. didymus* Ehr., *Ch. Cruisetus* Cleve, *Cyclotella kutzingiana* Thwaites, *Leptocylindrus danicus* Cleve, *Thalassionema nitzschioides* Grunow and *Nitzschia longissima* (Breb) Ralfs. were also recorded. Dinoflagellates appeared infrequently and were mainly represented by *Prorocentrum micans* Ehr., *Peridinium cerasus* Paulsen, *Per. trochoideum* (Stein) Lemm. *Per. steinii* Jorgensen and *Exuviella compressa* (Bail.) Ostenfeld.

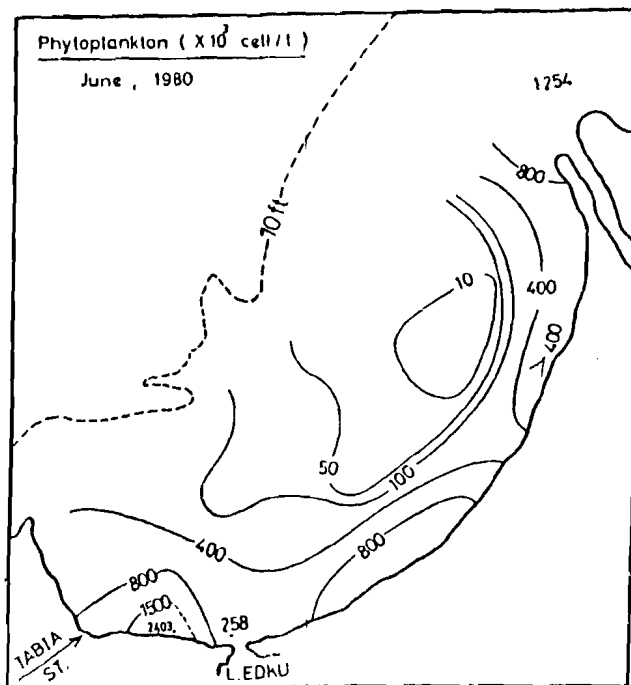


Fig. 3

Horizontal distribution of the total numbers of phytoplankton in thousand cells/l recorded in Abu Qir Bay during the summer.

The numbers of phytoplankton tended to decrease gradually away from the shore to reach lowest density about the northeast of the Bay. The more dominant diatoms recorded at the offshore stations included *Cyclotella kutzingiana* Thwaites, *Leptocylindrus danicus* Cleve, *Mastogloia smithii* Thw., *Skeletonema costatum* (Greve) Cleve, *Nitzschia sigma* (Kutz.) Smith and *Nitzschia longissima* (Breb.) Ralfs. The same dinoflagellates recorded at the inshore stations were also observed at the offshore but with lower counts.

The average numbers of the total phytoplankton during the summer reached 885,770 and 79,910 cells/l at the coastal and offshore stations respectively.

Distribution of phytoplankton during autumn:

Sampling of phytoplankton during autumn compared two trips, namely; in October which was restricted to the coastal stations and during November which covered the whole Bay.

The October collections revealed the highest peak during the present investigation as a result of blooming of *Asterionella japonica* Cleve & Mull. which formed about 92.3 % of the total phytoplankton counts.

The other components were nearly similar to those of the summer records. The highest density of phytoplankton appeared eastern of Boughaz El-Maadiya at stations 7 and 8 which harboured respectively 19,045 and 21,181 thousand cells/l, while the lowest one was observed at station 3 (177,670 cells/l). The other coastal stations which were rich in phytoplankton during that month included St. 2 (13,952 thousand cells/l), St. 5 (12,198 thousand cells/l) and St. 12 (9,253 thousand cells/l). The average counts for the whole littoral stations during October reached 7,323 thousand cells/l.

The blooming of *Asterionella* disappeared in November and this was associated with a sharp drop of the total phytoplankton counts to values fluctuating between 20,960 cells/l at the offshore station IV and 4,194 thousand cells/l in front of Rosetta Nile Branch. As shown in Fig. 4, the density of the total phytoplankton tended to decrease gradually southwards along the eastern coast as well as towards the middle of the estuary. The western coast remained more homogenous except in front of El-Tabia Pumping Station.

The main components of the autumn population rather than *Asterionella* comprised *Chaetoceros affinis* Lauder, *Ch. decipiens* Cleve, *Ch. sociales* Lauder, *Skeletonema costatum* (Grev.) Cleve and *Leptocylendrus danicus* Cleve. besides, *Chaetoceros didymus* Ehr., *Ch. curvisetus* Cleve., *Nitzschia longissima* (Breb) Ralfs, and *N. serriata* Cleve. *Thalassionema nitzschioides* Grunow was also frequently recorded.

The magnitude of the phytoplankton standing crop in November averaged 805,040 cells/l at the littoral stations and 231,020 cells/l at the offshores.

DISCUSSION

Abu Qir Bay represents a shallow estuary which receives considerable amounts of continental discharges including the drain water from Lake Edku, the influx of El-Tabia Pumping Station which is contaminated with industrial wastes and the fresh Nile water flowing from Rosetta Branch. Such different types of water intermix affect considerably the community composition of phytoplankton particularly around the openings of these continental discharges.

The Bay lies among the warm temperate zones with average monthly water temperature fluctuating between 14.0°C during the winter (January and February) and 29.0°C in summer (July and August). It has no clear vertical thermal gradient. Most of the phytoplankton recorded in the Bay are temperate species while few of them are tropical or subtropical forms.

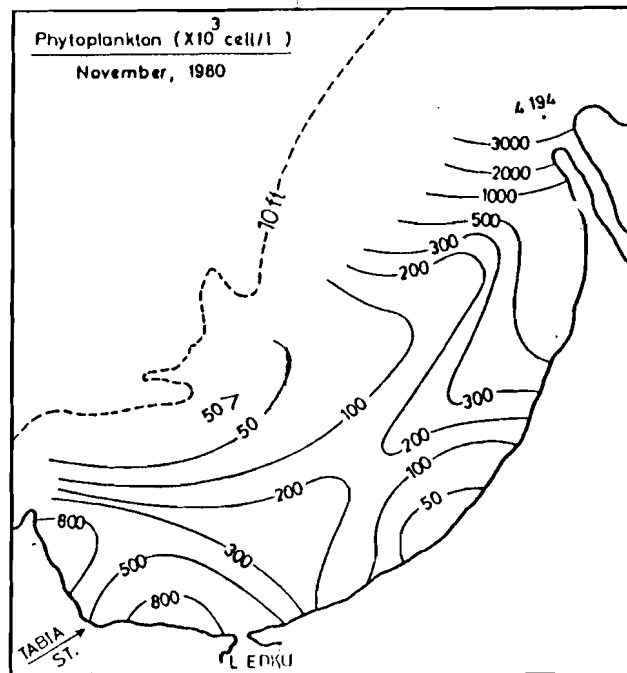


Fig. 4

Horizontal distribution of the total numbers of phytoplankton in thousand cells/l recorded in Abu Qir Bay during the Autumn.

According to the prediction of Mousa (1981) which is based on the previous data of the current regime in Abu Qir Bay, the water circulation follows a clockwise direction in the eastern two thirds of the Bay and a weaker anticlock current in the western part. At the point of contact these two currents join forming a northwestern current. The contour lines concerning the horizontal distribution of phytoplankton in the Bay confirms the existence of a water mass lying western to Boughaz El-Maadiya which is affected by the influx of both El-Tabia Pumping Station and the drain water of Lake Edku, besides an eastern one which on certain occasions receives considerable amounts of fresh Nile water from Rosetta Nile Branch.

Some of the physicochemical parameters of the Bay water show wide variations as a result of the continental discharges. Thus, the pH fluctuates between 7.3 and 8.5. The lower values usually accompany the discharge of El-Tabia Pumping Station as a result of water pollution while the higher ones predominate the area of Boughaz El-Maadiya. The

water salinity is also subjected to wide fluctuations between 31.0 ‰ and 38.0 ‰, the lower values prevail around the outlets of inland discharges. Some of the diatoms encountered in the Bay are euryhaline fresh water species like *Melosira granulata* and *M. crucipunctata* which appeared as dominant diatoms in front of El-Tabla outfalls in spring. Most of the others are neretic marine species showing wide distribution in the Mediterranean waters (Tregouboff and Rose, 1957).

The phytoplankton community of Abu Qir Bay is characterized by the presence of a large number of species, although few of them were responsible for the bulk of the population. The diatoms (100 species) appeared as the most dominant plankters particularly *Skeletonema costatum*, *Asterionella japonica*, *Chaetoceros* spp., *Cyclotella kutziana*, *Leptocylindrus danicus*, *Nitzschia longissima*, *Nitzschia serriata* and *Thalassionema nitzschioides*.

Skeletonema costatum appeared during the whole investigation period with a peak in summer. It is regarded as a cosmopolitan neretic marine diatom (Hasle, 1973). *Asterionella japonica* showed a bloom in autumn. It was also recorded by Zaghoul (1976) as a dominant diatom in Rosetta Estuary and is regarded as cosmopolitan neretic species, tolerant to a wide range of salinity (Sournia, 1968). *Cyclotella kutziana* appeared mostly in spring particularly at the offshore stations. It was frequently recorded along the Egyptian Mediterranean coasts particularly in winter (Gergis, 1983).

Chaetoceros affinis, *Ch. socialis*, *Ch. decipiens* and *Ch. curvisetus* were more dominant at the inshore stations. They are regarded as cosmopolitan neretic marine diatoms and typical Mediterranean forms. *Chaetoceros socialis* was previously recorded as the most dominant diatom in front of Damietta Branch during the flood season (Halim, 1960).

Dinoflagellates (25 species) appeared infrequently in summer but remained rare in spring and autumn. They were mainly represented by *Peridinium trochoidium*, *Per. cerasus*, *Per. steinii*, *Propocentrum micans* and *Exuviaella coppersa*. These species are neretic euryhaline marine forms, previously recorded along the Egyptian Mediterranean shores (Gergis, 1983).

The Bay is considered among the highly fertile marine habitats in Egypt. This is particularly due to its eutrophication by the continental discharges rich in nutrients, beside being a relatively shallow sheltered area. The average standing crop of phytoplankton recorded in the Bay during the present investigation reached 906 thousand cells/l. This is comparable to the annual standing crop of phytoplankton in Rashid Estuary which averaged 1,259 thousand cells/l (Zaghoul, 1976) but lower than that estimated by Sultan (1975) in the Eastern Harbour (average annual 2,488 thousand cells/l). The western coast of Abu Qir

Bay shows signs of pollution produced by the influx of El-Tabia Drain water which is contaminated with industrial wastes.

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