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ZOOPLANKTON OF LAKE QAROUN (FAYOUM - EGYPT) DURING 1996

By

ADEL A. A. MAGEED*

**National Institute of Oceanography and Fisheries, Cairo, Egypt*

Key Words: Protozoa, Rotifera, Copepoda, Meroplankton, Zooplankton, Lake Qaroun.

ABSTRACT

The present work dealt with the status of zooplankton of Lake Qaroun during 1996. Twelve cruises were carried out during January - December, 1996 at five stations in Lake Qaroun, the samples were collected vertically using a standard plankton net (55 micrometers).

The results revealed that Lake Qaroun is an eutrophic lake, it is very rich with zooplankton.

*Holoplanktonic groups were represented by Protozoa, Rotifera and Copepoda whereas the larvae of Oligochaeta, Polychaeta, Cirripedia and Mollusca represented the Meroplanktonic groups. Ostracoda was represented by only one species (**Cyprideis torosa**). Cladocera was obscured totally from the lake.*

Protozoa was the most diverse group, while Rotifera was the most dominant group during most of the twelve cruises. The hot months harbored the highest density of zooplankton due to the dominance of Brachionus plicatilis. All the zooplankters of Lake Qaroun are marine forms.

INTRODUCTION

Lake Qaroun is the remnant of an ancient prehistoric lake (Lake Moris), it was originally a fresh water lake and was freely connected with the Nile River. As the centuries passed, the lake disconnected from the Nile and its area diminished gradually.

Now, Lake Qaroun has an area of about 240 km^2 which lies between the longitude 30° 25\ and 30°50\ E and latitude 29° 24\ and 29° 33\ N. It lies at 90 km SW of Cairo. Its maximum depth is 8.2 m at EL Qarn EL Zahaby Island. The main Source of the water is the agricultural drainage water of the cultivated areas of EL Fayoum governorate. It discharged to the lake through two main drains (EL Batts and EL Wadi drains) in addition to other twelve small drains. The drainage water is loaded with salts, nutrients and pesticides that may accumulate and eventually contaminate the aquatic environment. The drainage water leads to great leaching of salts due to the high evaporation particularly in summer. So, the salinity of the lake increased vigorously with time passes. It has increased from about 12 gm/l in 1922 up to 30 gm/l in 1985 (Payne, 1986). Now, the salinity reached to about 42 gm/l (Sabae, 1993 and 1996). The water salinity increases gradually from the eastern to the western sides of the lake.

Zooplankton of Lake Qaroun was studied by Wimpenny and Titterington (1936), they observed that most of the species are fresh water organisms. Girgis (1959) recorded the marine copepod as abundant forms. Naguib (1961), Abdel - Malek and Ishak (1980), Dowidar and EL Nady (1982), Khalifa (1994) and Mageed (1996) noticed that the lake harboured the marine forms only, some of the species are transported to the lake through the transplantation of the Mullet fry from the Mediterranean Sea at Alexandria.

The aim of this work is to study the standing stock and the species composition of different zooplankton groups in Lake Qaroun and discuss their distribution along the lake through five stations, monthly for one year during 1996.

MATERIAL AND METHODS

Choice of stations:

Five stations were chosen to represent the lake ecosystem, two at the east, one at the middle and two at the west (Fig.1). The latitude, longitude and the average depths of the stations are shown below:

St.	Latitude N			Longitude E			Depth (m)
1	29°	29`	06``	30°	46`	17``	4
2	29°	29`	11``	30°	41`	32``	3.1
3	29°	27`	15``	30°	36`	50``	6.2
4	29°	26`	26``	30°	31`	55``	6.8
5	29°	25`	34``	30°	28`	27``	3.5

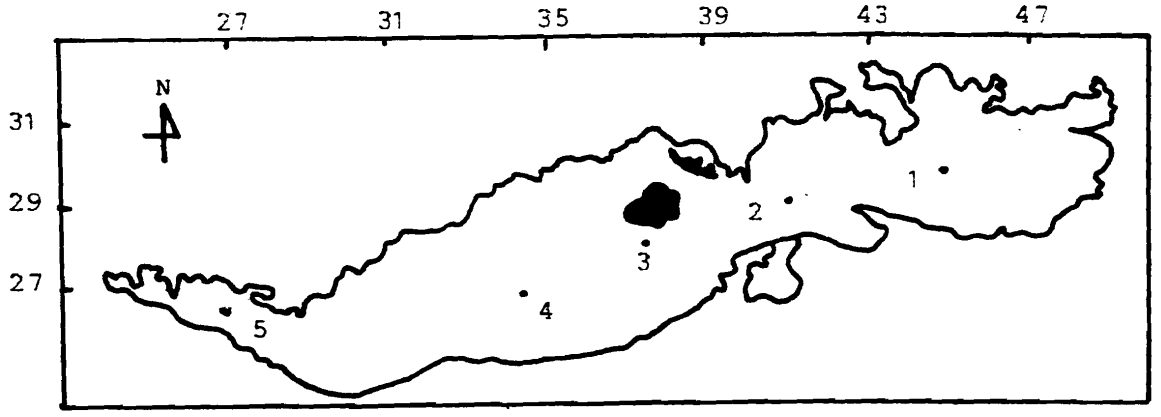

Fig. (1): Showing cites of sampling collection at Lake Qaroun

Methods of collection and study:

The zooplankton samples were collected monthly during the period January, - December 1996. Each cruise spent two days at the end of each month. Standard plankton net of 55 micrometers (mesh size) with a diameter of 24 cm was used for the collection. The net was towed vertically from near the bottom layer to the water surface. Sixty zooplankton samples were collected. In laboratory, the collected samples were preserved directly with 4% formalin solution. The volume of each sample was concentrated to 100 ml and subsamples of 5 ml were transformed into a counting cell, and each plankter was identified under binocular research microscope up to the species order as possible according to Rose, 1933; Tregouboff & Rose, 1957; Bick, 1972; Grell, 1973 and Yamaji, 1978. The data were calculated as their total numbers per cubic meter, tabulated and represented by the figures.

RESULTS

The zooplankton community comprised twenty five holoplanktonic species belonging to Protozoa, Rotifera and Copepoda groups (Fig. 2) beside the meroplanktonic forms namely; Cirriped larvae, veliger larvae of Mollusca, zoea larvae of Decapoda, Oligochaete larvae, Polychaete larvae, Ostracoda, Nematoda and fish eggs (Chordata).

The annual average of the standing stock of the total zooplankton recorded 334304 organisms/m^3. Number of organisms varies from site to site (Fig. 3). The maximum number was recorded at station 3 (middle lake) (430512 organisms/m^3). Regarding to the monthly variations (Fig. 4), the highest number was observed during the period June - October with maximum counts in August (974324 organisms/m^3).

The following is a list of zooplankton species recorded in Lake Qaroun during 1996.

A. Holoplanktonic forms:

Protozoa:

Tintinnopsis kofoidi Hada	***T. beroidea*** Stein
T. strigosa Meunier	***T. campanula*** Ehrenberg
T. amphora kofoid & Campbell	***Leprotintinnus*** *bottnicus* Nordqvist
Favella taraikaensis Hada	***F.* sp.**
F. ehrenbergii Claparede & Lachmann	***Helicostomella subulate*** Ehrenberg
F. panamensis Kofoid and Campbell	***Euplotes vannus*** O.F Muller
F. serrata Mobius	***Textularia sp.***
F. adriatica Imhof	***Globigerina* sp.**

Rotifera:

Keratella tropica Apstein	***Testudinella patina*** Hermann
Brachionus plicatilis O. F. Muller	***Synchaeta pectinata*** Rousselet
Notholca salinus Foecke	***Monostyla closterocerca*** Schmarda

Copepoda ;

Acartia latisetosa Kriczaguin	***Mesochra heldti*** Monard
Apocyclops panamensis Smirnov	

B. Meroplanktonic forms :

Nematoda	Cirriped larvae
Oligochaete larvae	Zoea larvae of decapods
Polychaete larvae	Veliger larvae of molluscs
Ostracoda : ***Cyprideis torosa*** Jones	Fish eggs (Chordata)

Distribution and monthly variations of zooplankton groups

A - Rotifera:

Rotifera group constituted 74.19% of the total zooplankton organisms. They were represented by six species; ***Brachionus plicatitis***, ***Keratella tropica***, ***Synchaeta pectinata***, ***Monostyla closterocerca***, ***Notholca salinus*** and ***Testudinella patina***.

The highest number of rotifers were observed at the middle of the lake, it decreased gradually toward the eastern and the western sides (Fig. 6). As regard to their monthly variations, the peak of abundance was observed from June to October (Fig.7). It was disappeared in March.

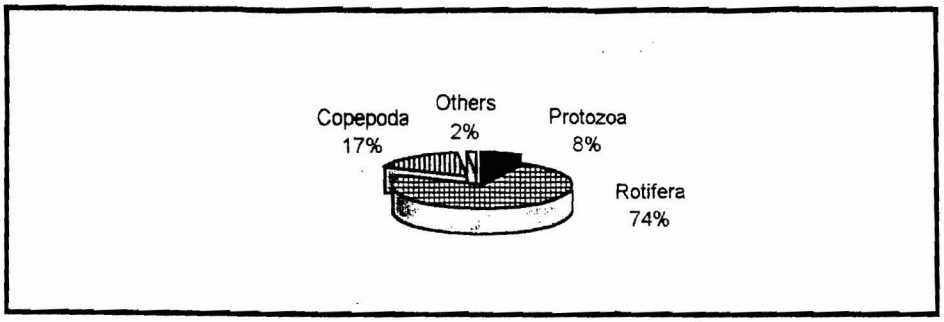

Fig.(2) : Percentage frequencies of occurrence of the total zooplankton at Lake Qaroun during 1996.

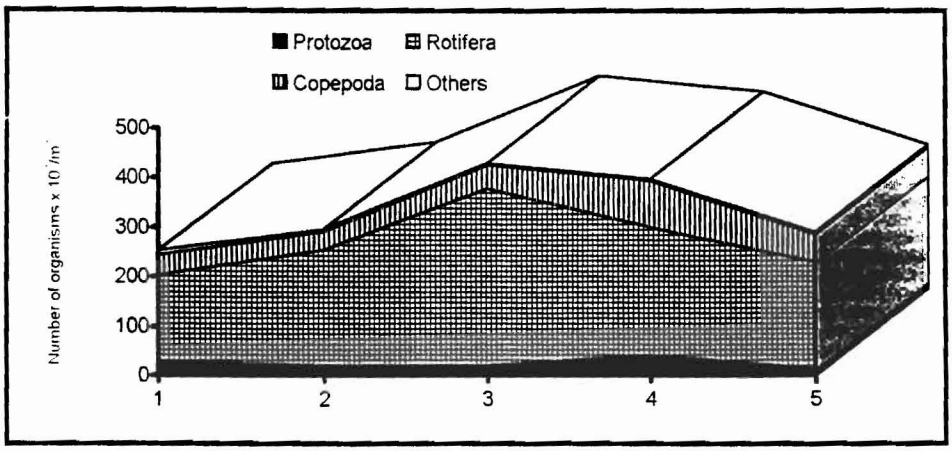

Fig. (3) : Horizontal distribution of the total zooplankton organisms (organisms/m^3) recorded at Lake Qaroun during 1996

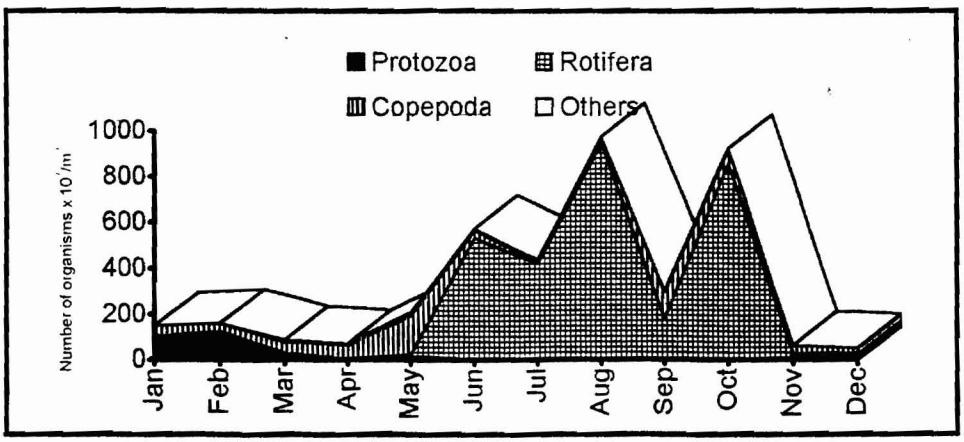

Fig. (4) : Monthly variations of total zooplankton organisms (organisms/m^3) recorded at Lake Qaroun during 1996

Brachionus plicatilis was not only the dominant rotifer species, but also the dominant zooplankton species at all. It constituted 98.88% of the total rotifers (Fig. 5) and 73.36% of the total zooplankton organisms. The horizontal distribution of ***B. plicatilis*** is more or less similar to the general trend of the total rotifer distribution. ***B. plicatilis*** is a summer form. It was observed in the samples with high quantities during the period June -October. It was completely disappeared during February and March, with very few numbers during January and April.

The other rotifer species constituted collectively 1.12% of the total number of rotifer population. They were mostly dominated during winter season in addition to April and September.

B - Copepoda:

Copepoda constituted 16.72% of the total zooplankton population with an average of 55898 organisms/m^3. Adult Copepoda contributed only 2.68% of this number, whereas the Juvenile stages (nauplius larvae and copepodite stages) formed 97.32% of the total copepod number (Fig. 8).

The copepod organisms were mostly concentrated at west of the lake (Fig. 9). Shwing two peaks of abundance, the first during May and September (167617 and 116935 organisms /m^3 respectively) (Fig.10).

Adult Copepoda:

Adult Copepoda was represented by three species, ***Acartia latisetosa, Apocyclops panamensis*** and ***Mesochra heldti.***

They appeared as very rare species, except ***A. latisetosa*** which was the most observed copepod species, it represented 99.40% of the total adult copepods and 2.67% of the total copepod organisms. ***A. latisetosa*** was distributed throughout the year. It was occurred during winter as well as summer seasons with annual average numbers of 1490 organisms/m^3. The maximum counts were observed at station 4 (3859 organisms/m^3).

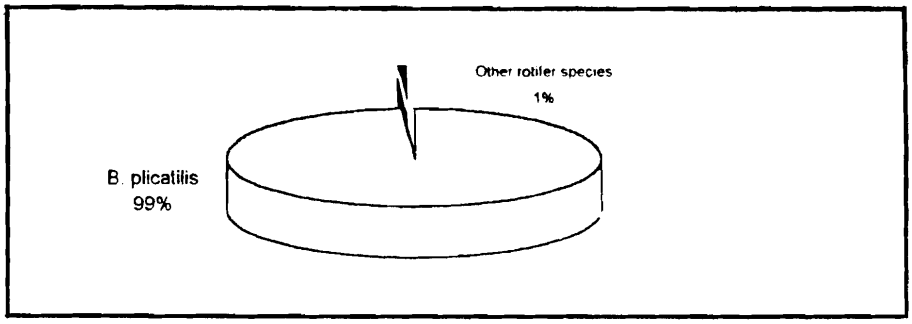

Fig. (5) : Percentage frequencies of occurrence of the total rotifers (organisms/m^3) recorded at Lake Qaroun during 1996

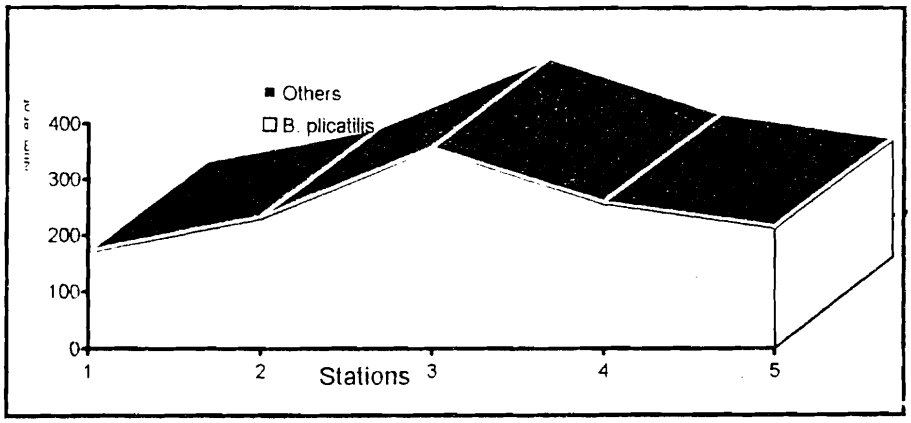

Fig. (6) : Horizontal distribution of the total rotifer organisms (organisms/m^3) recorded at Lake Qaroun during 1996

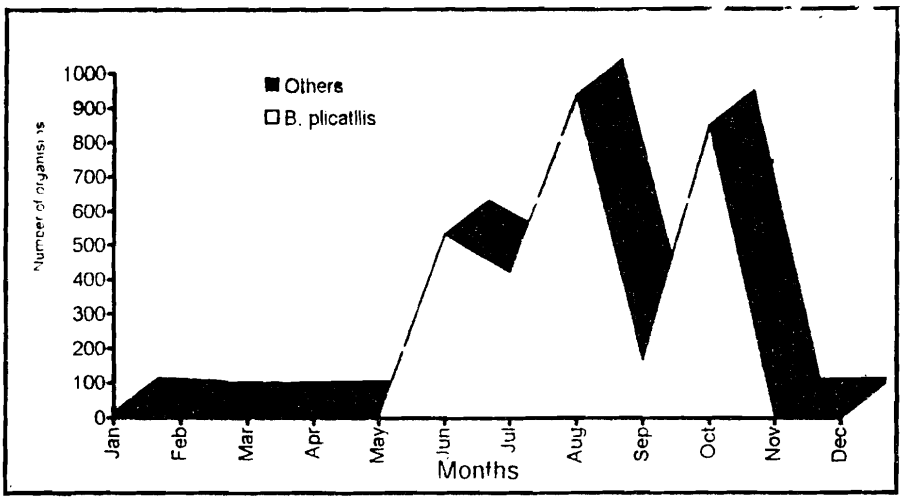

Fig. (7) : Monthly variations of the total rotifer organisms (organisms/m^3) recorded at Lake Qaroun during 1996

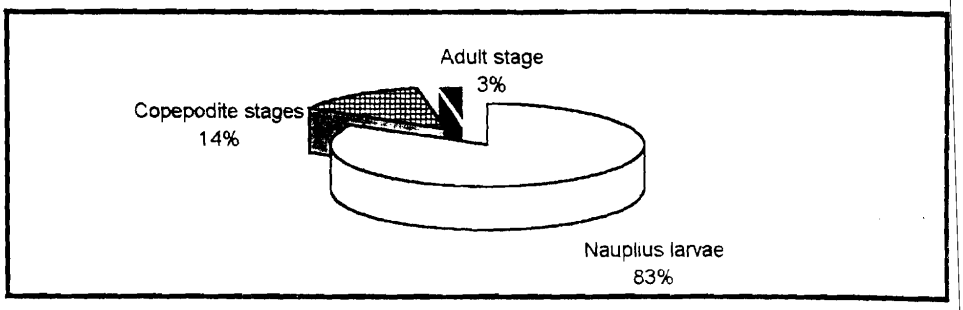

Fig. (8) : Percentage frequencies of occurrence of the total Copepoda (organisms/m^3) recorded at Lake Qaroun during 1996

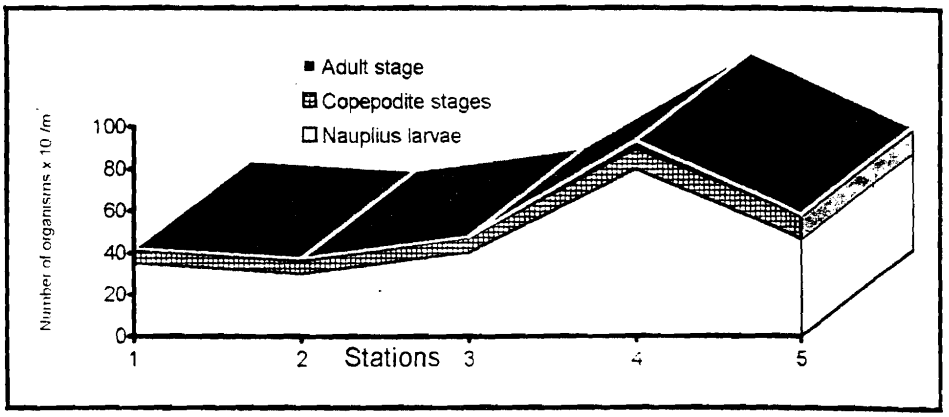

Fig. (9) Horizontal distribution of the total copepod organisms (organisms/m^3) recorded at Lake Qaroun during 1996

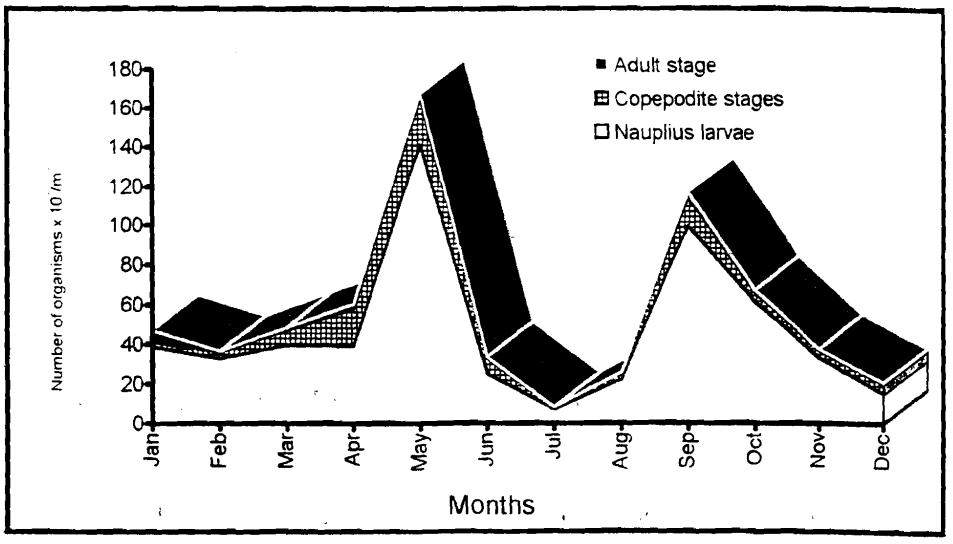

Fig. (10) Monthly variations of the total copepod organisms (organisms/m^3) recorded at Lake Qaroun during 1996

Juvenile stages:

Copepodite stages and nauplius larvae of Copepoda contributed 14.33% and 82.99% respectively of the total copepod counts.

The spatial and monthly variations of the nauplius larvae and copepodite stages were more or less the same; they were dominated at western side of the lake with maximum counts during May.

C - Protozoa:

Protozoa group constituted about 7.56% of the total zooplankton population. It was represented by sixteen species. The most dominant species were ***Helicostomella subulata, Tintinnopsis kofoidi*** and ***Euplotes vannus*** (33.04%, 13.26% and 12.46% respectively of the total protozoan organisms) (Fig. 11).

The other species constituted collectively 41.25% of the total protozoan population. The highest counts of Protozoa was observed at station 4 (41973 organisms/m^3), while the lowest attained at station 5 (13372 organisms/m^3). Whereas stations 1,2 and 3 contained 29580,21015 and 20350 organisms / m^3 respectively (Fig. 12). The flourishing of the protozoan organisms was during January, February and March (85251,120330 and 30707 organisms/m^3 respectively) (Fig.13). Generally, the annual average number of the protozoan species was 25258 organisms/m^3.

Helicostomella subulata was the most dominant protozoan organisms. It was predominated at station 4. Its maximum counts was observed during January, February and November (69552,10933 and 12231 organisms/m^3 respectively). It disappeared totally from Lake Qaroun during April, June, July and October. Whereas, *Euplotes vannus* showed its abundance at station 1, with maximum counts during May and December (12600 and 13440 organisms/m^3). It completely disappeared during the period January - April.

Tintinnopsis kofoidi is the third dominant protozoan organisms after E. ***vannus***. It was dominated at stations 2 and 4. March is the most adequate period for it's flourishing.

The other protozoan organisms were flourished during the cold months with maximum counts at station 4 (23123 organisms / m^3).

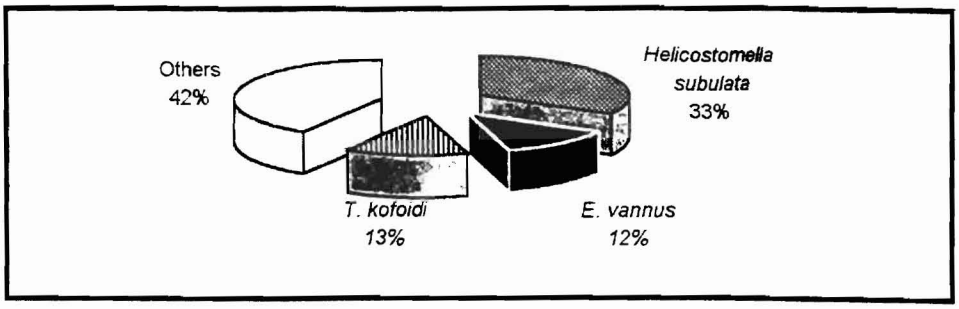

Fig. (11): Percentage frequencies of occurrence of the total protozoa at Lake Qaroun during 1996

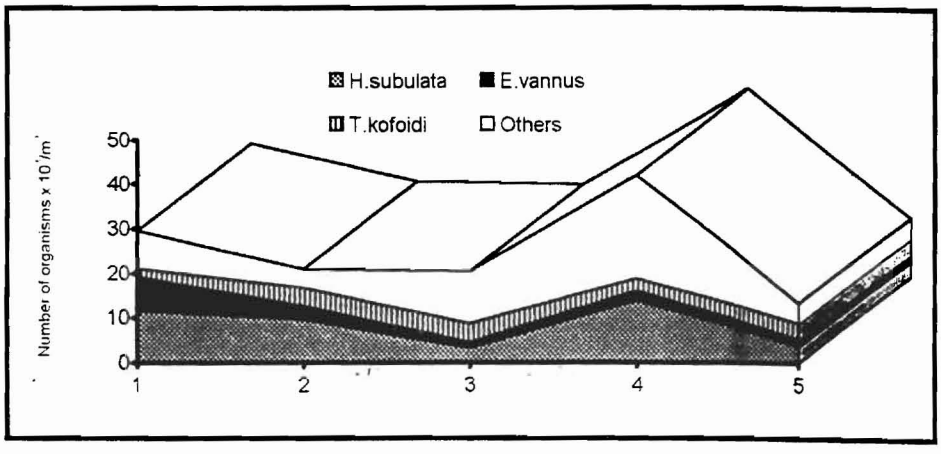

Fig. (12) : Horizontal distribution of the total protozoan organisms (organisms/m^3) recorded at Lake Qaroun during 1996

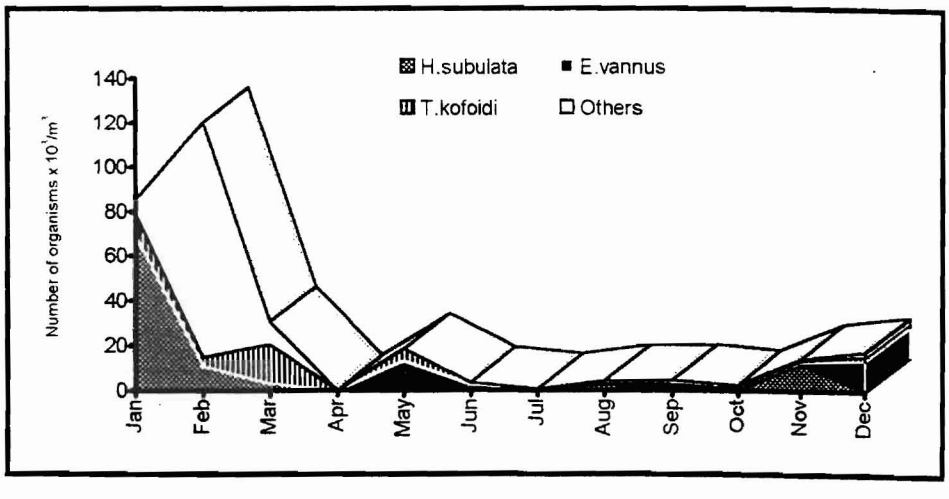

Fig. (13) : Monthly variations of the total portozoan organisms (organisms/m^3) recorded at Lake Qaroun during 1996

Other forms (Meroplankton)

Meroplanktonic forms constituted 2.12% of the total zooplankton number. They increased gradually toward the eastern side. They were flourished during March to October. These forms were represented by cirriped larvae, veliger larvae of molluscs, zoea larvae of decapods, Oligochaete larvae, polychaete larvae, ostracods, nematods, and fish eggs of chordates.

Polychaete larvae and Cirriped larvae were the most dominant forms; they constituted 60.48% and 20.63% of the total meroplanktonic forms respectively.

Ostracoda was represented only by ***Cyprideis torosa, which*** was appeared sporadically with very few numbers.

DISCUSSION

The climate of EL Fayoum is hot and dry. So, the rate of evaporation from Lake Qaroun is nigh particularly during summer season. The drainage water of the neighboring agricultural lands which discharges their water into the lake has about 430×10^3 tons of salts discharges into the lake annually (Meshal, 1973). The total salt content in the lake water undergoes and progressive increase with time. Soliman (1989) said that, the best-fit curve relating the total salt content with time is a straight line with a slop of 0.101. He expected that the rate of increase of the total salt content will remain constant during the period 1982-2050, while the mean salinity of the lake may show a progressive increase with time which intern must lead to a change in the lake fauna. So, salinity is the most important factor affecting the lake ecosystem.

Wimpenny and Titterington (1936) noticed the presence of one species of Copepoda namely, ***Diaptomus salinus*** Daday beside the decapod Leander *squilla* var *elegans* Rathke and the cladoceran ***Moina salinarum*** Gurney at salinity 12 ‰. in the lake during 1928. They also observed that the cold period was characterized by a simple community abundant in individuals while the warm period showed a more complex community and fewer individuals.

The marine plankton was introduced into the lake between 1928 - 1933 with the transplantation of the Mullet fry in the lake, which were transported from the Mediterranean Sea.

Abdel Malek (1981) reported the changes in the composition and biomass of ichthyofauna, Phytoplankton, zooplankton and zoobenthos as a result of increasing salinity. He recorded that, ***Diaptomus salinus*** and ***Moina salinarum*** disappeared completely. However some Rotatoria were able to withstand the high salinity.

The recent studies on the zooplankton community shows that the marine zooplankton species prevailed the lake. In the present study; Protozoa, Rotifera and Copepoda in addition to larvae of benthic animals and other meroplanktonic forms were recorded. Cladocera were disappeared absolutely from the lake. This observation agrees with the results of Abdel Malek, and Ishak (1980), Khalifa (1994) and Mageed (1996).

Dowidar and EL Nady (1982) observed ***Acartia latisetosa*** as the most abundant zooplankton species in the lake, it contributed from 75 - 100% of the total zooplankton counts; but they collected their samples by plankton net of 158 micrometers mesh size. They also estimated the protein, lipid and carbohydrate content in ***A. latisetosa*** (12.9, 2.97 and 0.6% respectively of the total wet weight).

The maximum number of zooplankton organisms was observed at the middle of the lake, this might be due to that most of the agricultural drainage water inflow through the drains at the east and middle parts. The present study showed the flourishing of zooplankton during summer season, this due to the dominance of ***Brachionus plicatilis, which*** is a summer form. It is a mainly marine form with euryhaline affinities (Capuzzo, 1979). It was abundant during summer. This observation was previously emphasized by Hutchinson (1967), Epp and Winston (1977), Samaan and Aleem (1972), and Aboul Ezz ***et al*** (1990). It can tolerate high salinities. Egborge (1994) recorded it in the Lagos Harbour - Badagry Creek system (Nigeria) at salinity ranges between 0.27 & 32‰, whereas Galat ***et al*** (1981), Timms (1981) and Williams (1987) observed it in Pyramid Lake (Nevada - USA) and Victorian Salt Lakes (USA) at salinity ranges from 0.4 to 50‰. Mageed (1998) recorded it at salinity of 167‰.

Meroplanktonic forms were represented in Lake Qaroun by the larvae of benthic invertebrates. This agreed with the concept of Morales - Boquero ***et al*** (1989). They concluded that, high conductivity lakes contained larvae of benthic and periphytic species. This coincided with observations of Abdel Malek and Ishak (1980) and Khalifa (1994).

Ostracoda was represented in Lake Qaroun by only one species, ***Cyprideis torosa***. Vesper (1962) and Heip (1976) concluded that, ***C. torosa*** is a widespread species. It can tolerate salinity more than 40‰.

Lake Qaroun is a highly eutrophic lake. It is suitable for transplantation of the marine fishes particularly the planktonic feeder species, to consume the high quantities of the plankton.

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