ISSN 1110-0354
Bull. Nat. Inst. of Oceanogr. & Fish., A.R.E., 1997. Vol. (23): 333-349

ABUNDANCE AND DISTRIBUTION OF BOTTOM FAUNA IN LAKE MANZALAH, EGYPT

By

MOHAMED A. IBRAHIM*; M. H. MONA;
AND EL-AZAB E. EL-BOKHTY.

*National Institute of Oceanogr. & Fisheries, Anfoushy - Alexandria, Egypt.

Key Words: Benthos, Limnology, Lake Manzalah, Egypt.

ABSTRACT

Broad quantitative sampling over wide areas of lake Manzalah has been used to define the living bottom fauna of the Lake. The general picture of bottom fauna was the empty calcareous forms of mollusca, barnacles and tubeworms. Living benthic organisms were generally represented by small number of species ranging between 3 species (at the South boundaries of the lake) to 16 species at sea-lake connection area. As a whole, 20 different species of bottom fauna in addition to one species of brown algae and 4 species of vascular plants were encountered during the present study. The low number of species encountered in some stations is probably due to high level of water pollution and/or water stagnation. The rest of the stations showed intermediate numbers due to their situation between the fresh water from the southern drains and the intrusion of saltwater at the lake-sea connection area.

INTRODUCTION

Benthic organisms play an important role in the economy of the natural water systems. They act as a link in the energy flow from the primary producers to fish. They also affect the structure of fish and invertebrates communities that act as benthic predators. McIntyre (1964) had shown that microfauna are

important in benthic communities; both as competitors with the macrofauna for food resources and as prey for benthic invertebrates and fish. Mollusks furnish the food requirements for some bottom invertebrates (Tyler, 1972), and for some demersal fishes (Steven, 1930). It is believed that in some cases the bottom fauna by itself is not a good indicator of the trophic state of the lake (Kajak, 1983); nevertheless, the nature of the benthic communities transformations is triggered by the combined action of various physical and chemical factors.

It has been proven that the species composition of the benthos may reflect changes in the environmental conditions over a long period of time (Lander 1976, Nagel *et. al.* 1977). The number of species present in a given habitat can be used as indicator of organic pollution (Wisniewskie and Dusoge 1983). This is in line with the principle that under the conditions of considerably increased sedimentation of organic matter, and the process of its decomposition and consequently a deficit of oxygen; only a limited number of tolerant species can survive, while the most unsusceptible ones grow in density.

Many benthic organisms may be used as useful material in evaluating the quality of water. Larvae of chironomidae and Oligochaeta (as an example) are regarded as biological indicators of purity and trophic state of the lakes due to some of their specific properties such as sedentary life, relatively long life span, and also the ecological differentiated type of their distribution. The ratio of Oligochaeta density to the density of chironomidae larvae tends to increase under the conditions of progressing eutrophication and the increasing pollution with organic matter (Adams *et. al.* 1976, Lander 1976, Wiederholm 1980).

Benthic colonization and production are determined by many factors such as physical and chemical factors, which include temperature, salinity, light, oxygen, turbulence, and turbidity. It is also determined by biological factors such as nutrition and peridation. Both form groups of agents that might be dependent on water depth. Ecological interpretations often suffer from the problem of not knowing how to separate the substrate factors which include grain size distribution, composition and structures of sediments from the other factors.

In ecosystem works; information on abundance and amounts of living matter are most essential for the understanding of energy flow within the systems as

well as for subsequent modeling. Among such ecologically important parameters are number of individuals, area occupied, biomass measures or metabolic rates, beside the environmental physical parameters. It is worthy mentioning that the numerical methods, although frequently used for various approaches, are only of ecological significance within comparable functional groups with limited size classes, and if distinct individuals can be distinguished.

Organisms are adapted to sets of environmental conditions, to physical factors as well as to other organisms. There are varying levels of success in the settlements of populations, resulting in an intricate pattern of species abundance. Corresponding to environmental changes in space and time

The present study aims at depicting the spatial distribution of macrobenthic organisms in lake Manzalah in relation to grain size and organic content of the sediments.

MATERIALS AND METHODS

The lake was covered by eleven sampling stations. Each of which is located in one of the different basins of the lake (Bahr) as shown in Figure (1). Each station was sampled monthly and/or seasonally during the sampling period from Nov. 91 to April 93 for the prevailing environmental parameters and for bottom fauna. The Quantitative and Qualitative sampling of the bottom fauna was performed using an Ekman bottom sampler covering an area of about 0.02 square meter of the upper layer of the bottom sediments. The bottom fauna samples were washed thoroughly in a small hand net of bolting silk with 14 mesh/cm or 14X14 cm^2 and preserved with 10% neutral formalin solution in polyethylene jars for later laboratory investigations. In the laboratory. The bottom fauna was sorted into groups where each group was counted and weighed separately after being left for about five minutes on a paper towel to get rid of external moisture.

Cluster and multivariate analysis of the encountered species; their abundance and distribution pattern were performed by computing the similarities between every pair of samples using the Brey-Curtis coefficient (Bray & Curtis 1957).

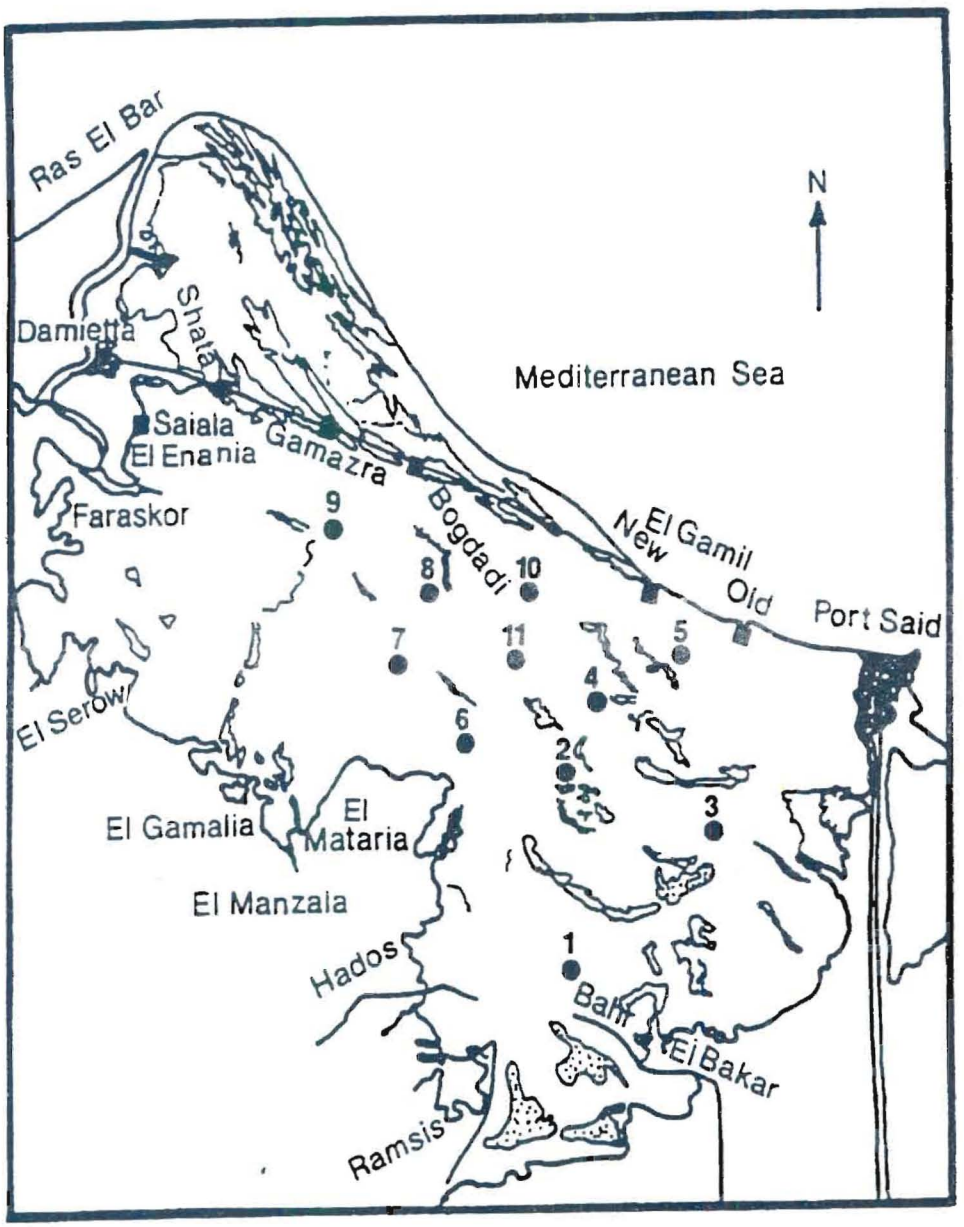

Figure (1): Location map of the sampling stations in Lake Manzalah.

These similarity matrices were then subjected to both clustering and ordination analysis. Clustering was carried out according to a hierarchical, agglomerate method employing group-average-linkage and the results are then displayed in the form of a dendrogram. Ordination was carried out by non-metric multi-dimensional scaling (MDS) to construct a "map" of the more similar stations containing more the similar samples in terms of species abundance.

RESULTS AND DISCUSSION

The general picture of bottom fauna in lake Manzalah is the empty calcareous form of mollusca, barnacles and tubeworms. Living benthic organisms were generally represented by few number of species ranging between 3 species at station (1) to 16 species at station (5) Figure (2). The low number of species encountered is probably due to high level of water pollution and/or water stagnation. The rest of the stations showed intermediate numbers due to their lacatiob between the fresh water from the southern drains and the intrusion of salt water at the lake-sea connection area. As a whole, 20 different species of bottom fauna; in addition to one species of brown algae and 4 species of vascular plants were encountered during this study as presented in Table (1).

The monthly and seasonal abundance (no. Of organisms/m^2) of bottom fauna in lake Manzalah showed pronounced variations with no distinct pattern of change as based on Table (2). The abundance during the spring season is more pronounced than during the other seasons. The average number of organisms per square meter of the bottom surface was 1397, 3141, 799 and 654 organisms for the seasons of Winter, Spring, Summer and Autumn. The over all annual percent abundance for all of the stations revealed that station No. 5 showed the maximum average annual number of organisms (5699 org. /m^2) as well as the maximum number of species among all stations Table (3) and Figure (2).

The higher annual abundance (5699 org. /m2) of the benthic fauna in station No. 5 can be attributed not only to the high number of bottom fauna groups encountered in the station (16 spp.), but also to the large number of individuals inhabiting this station.

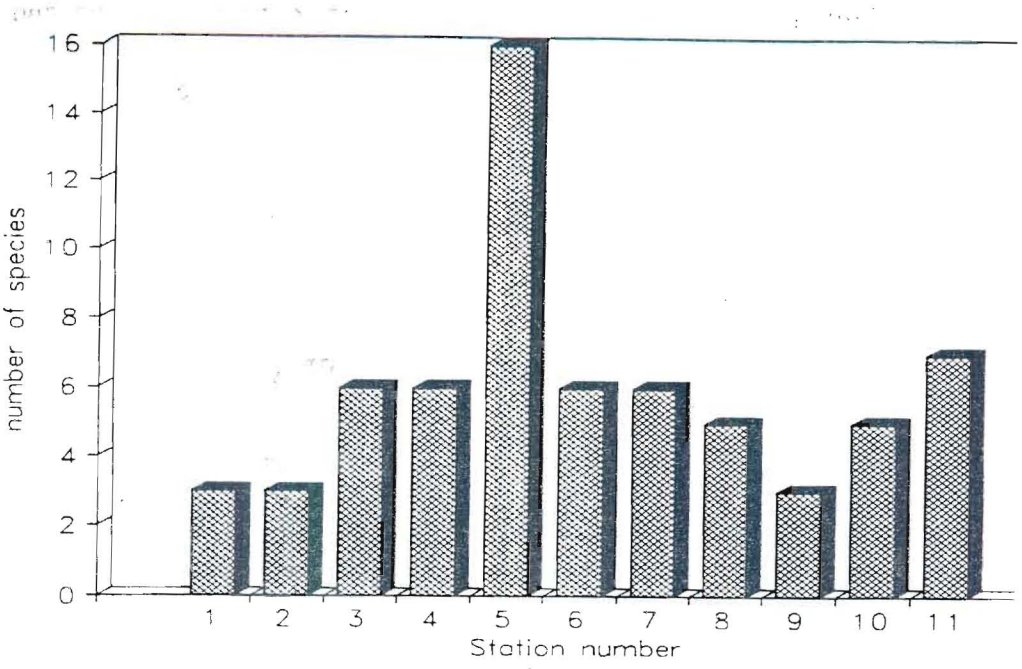

Figure (2): Distribution of Bottom Fauna species in lake Manzalah.

Sampling results showed that station (5) is characterized by having the maximum salinity values in the lake (6.43 g/l as an average), by sediment components as sand, silt and clay (20%, 46% and 34% respectively) and 4% of organic carbon. Which means that the present level of organic carbon in this station is not a limiting factor for such organisms. On the other hand the lowest numerical abundance of the benthic fauna (499 org./m^2) was observed in station No. (10) which showed a level salinity of 0.74 mg/l, sand, silt and clay content of 54%, 33% and 13% respectively.

It is worthy mentioning that the insect larvae of ***Tendipes tentans*** and the Oligochaeta ***Chaetogaster limnaei*** were found in all stations forming an overall average of 42% for the former and 20.3% for the latter respectively relative to the total abundance. The third major bottom faunal group in lake Manzalah is the Polychaeta. It is represented by an average of 15.4% of the total fauna by numbers. It represents 54.9% of the fauna in station No. 5. The fourth major group is the Amphipoda. It comprises 12.4% of the bottom fauna in the lake with no records in stations; (1) & (2). The Isopoda ***Mesanthura*** sp. and

Sphaeroma sp. were noticed only in station No. 5, which is directly affected by marine waters. The Bivalvia group was noticed only at station No. 5. Other infrequent forms such as Decapoda, Turbellaria, Bryozoan, Cirripedia have no distinct pattern of distribution.

Major bottom fauna groups of lake Manzalah:

SEA ANEMONES:

Sea anemones are marine forms found only at station No. 5 accumulating in patches on ***Cardium*** shells. They showed a year average of 222 org./m^2 representing 1.1 % of the total benthic community of the lake, and 3.9 % of the fauna recorded at station No. 5. They were recorded only during July.

PLATYHELMINTHES:

Free living platyhelminthes were recorded only at station No. 5 with an annual average of 28 org./m^2 This represents 0.1% of the total fauna recorded. They flourish in Spring more than any other season.

POLYCHAETA :

The polychaetes represent the third dominant bottom faunal group in lake Manzalah but with little number of species. Their numerical abundance shows an average of 15.4 % of the total benthic communities of the lake.

About 54.9 % of the total fauna recorded at station No. 5 are represented by polychaetes. This may be attributed to the relatively higher water salinity of this station. The station is also characterized by having sediments of higher organic matters and higher clay content (47.0 % clay).

Table (1) : Checklist of the bottom fauna encountered in lake Manzalah during 1992 - 1993.

BROWN ALGAE:
Ectocarpus confervoides (Roth)
VASCULAR PLANTS:
Potamogeton pectinalus L.
Lemna sp.
Ceratophyllum demersum L.
Eichhornia sp.

ANIMAL GROUPS:
Sea Anemone sp.
BRYOZOA:
Pottsiella erecta (Potts)
POLYCHAETA:
Hydroides elegans.
Mercierella enigmatica
Neanthes (Nereis) Limnicola (Johnson)
Nereis diversicolor O.F. Mull
Polydora ciliata.

OLIGOCHAETA:
Chaetogaster limnaei K.Von Bear

CIRRIPEDIA:
Balanus amphiterite Darwin
Balanus improvisus Darwin
AMPHIPODA:
Corophium volutator (Pallas)
Elasmopus pectenicrus (Bate)
Gammarus lacustris (Fabricius)
ISOPODA:
Mesanthura sp.
Sphaeroma serratum.
DECAPODA:
Palamontes elegans.
INSECTA: Diptera:
Tendipes(Chironomus)tentans (Meigen)
MOLLUSCA:
GASTROPODA:
Cleopatra bulimoides (Olivier)
PELECYPODA:
Cerastoderma (Cardium) edule
Macoma cumama (Costa)

Table (2) : Seasonal distribution of bottom fauna in Lake Manzalah during 1992-1993.

(as % number of organisms/m^2)

Group / Station	1	2	3	4	5	6	7	8	9	10	11	Average
(A) : During the Winter season.(avg. for Nov., Dec. and Jan.)												
% abundance												
POLYCHAETA			3.3		72.8						1.0	7.0
OLIGOCHAETA	98.3	35.0	0.8		0.4	75.6	26.6				2.9	21.8
CIRRIPEDIA			23.8	19.1	23.0							6.0
AMPHIPODA					0.8	24.0		5.8		2.2	2.0	3.2
ISOPODA					0.4							0.0
DECAPODA					0.4							0.2
INSECTA	1.7	65.0	72.1	80.9	1.7	0.4	73.4	94.3	100.0	95.6	94.2	61.7
PELECEPODA					0.4							0.0
Tot. No. of Org./m^2	873	888	1805	1391	3538	3819	334	400	111	681	1525	1397
No. of Species	2	2	4	2	8	3	2	2	1	3	4	
(B) : During the Spring season. (avg. for Feb., March & April).												
% abundance												
PLATYHELMINTH					0.2							0.0
POLYCHAETA				1.2	78.6					7.3		7.9
OLIGOCHAETA	96.6	52.8		1.0		37.1	12.8		1.1		0.4	18.3
CIRRIPEDIA			2.1		16.0							1.6
AMPHIPODA			4.6	0.5	2.3	5.6	64.5		92.3	17.7	6.0	17.6
ISOPODA					0.5							0.0
DECAPODA							1.0					0.1
INSECTA		47.2	93.3	97.3	2.2	57.3	21.7	100.0	5.6	75.0	93.6	54.0
GASTROPODA	3.4											0.3
PELECEPODA					0.2							0.0
Tot. No. of Org./m^2	444	2131	2871	6142	6477	2635	5964	888	2044	1511	3448	3141
No. of Species	2	2	3	4	7	3	4	1	3	3	3	
(C) : During the Summer season. (avg. for May, June & July).												
% abundance												
SEA ANEMONES					11.8							1.2
POLYCHAETA					64.2		3.6					6.8
OLIGOCHAETA	52.4	53.2				20.3	19.6	52.8				19.8
CIRRIPEDIA					7.2							0.7
AMPHIPODA				3.2	5.5	73.6	58.9		15.9			15.7
ISOPODA					3.0							0.3
DECAPODA		2.3	1.6			6.0	3.6				17.7	3.1
INSECTA	47.6	44.5	98.4	96.8	7.1		14.3	47.2	84.1		82.3	52.2
PELECEPODA					1.2							0.1
Tot. No. of Org./m^2	466	1281	962	680	2501	364	414	925	145		248	799
No. of Species	2	3	2	2	7	3	5	2	2		2	
(D) : During the Autumn season. (avg. for Sept., October & Nov.)												
% abundance												
POLYCHAETA						10.9						1.1
OLIGOCHAETA	100.0	20.5					89.8	86.2				29.7
CIRRIPEDIA											15.3	1.5
AMPHIPODA							7.7	9.2	44.4			6.1
DECAPODA							0.8					0.1
INSECTA		79.5			100.0	66.9	1.7	4.6	55.6	100.0	100.0	84.7	59.3
PELECEPODA						22.1							2.2
Tot. No. of Org./m^2	2397	112			333	402	1928	236	133	59	933	576	654
No. of Species	1	2			1	3	3	3	2	1	1	2	

Table (3): Annual Abundance averaged from May 1992 to April 1993.
(A) as No. of Organisms/ m^2

Group / Station	1	2	3	4	5	6	7	8	9	10	11	Average
SEA ANEMONES					222							20
PLATYHELMINTHS												
Turbellaria					28							2
POLYCHAETA												
Hydroides elegans					1428							130
Mercierella enigmatica					285					7		27
Neanthes limnicola			15	19			7			11	4	4
Nereis diversicolor					880							81
Polydora ciliata					538							49
OLIGOCHAETA												
Chaetogaster limneal	1104	873	4	15	4	1454	500	244	4		15	383
CIRRIPEDIA												
Balanus sp			122	67	1407						7	146
AMPHIPODA												
Coreophium voltator			33	9	493	87	1382	11		48	58	193
Elasmopus						4		4				1
pectenicrus				4	44	53	26	4	322		4	42
Gammarus lacustris												
ISOPODA												
Methanthura sp					59							5
Sphaeroma serratum					7							1
DECAPODA												
Palaemon elegans		22	11		4	9	22			4		7
INSECTA												
Tendipes (Chironomus)												
Tentans	170	838	1706	2325	250	393	398	557	279	429	1393	794
GASTROPODA												
Cleopatra bulimoides	4											0
PELECEPODA												
Ceratoderma												
u ardumi edule					11							1
Macoma cumana					41							4
Tot. No. of Org /m^2	1278	1733	1891	2439	5699	2000	2335	820	605	499	1488	1890
No. of Species	3	3	6	6	16	6	6	5	3	5	7	

Table (3 cont.): Annual Abundance averaged from May 1992 to April 1993.
(B) as % No of Organisms/ m^2

SEA ANEMONES					3.9							1.1
PLATYHELMINTHS					0.5							0.1
POLYCHAETA			0.8	0.8	54.9		0.3			3.8	0.3	15.4
OLIGOCHAETA	86.4	50.4	0.2	0.6	0.1	72.7	21.4	29.8	0.7		1.0	20.3
CIRRIPEDIA			6.5	2.7	24.7						0.5	7.7
AMPHIPODA			1.7	0.5	9.4	7.2	60.3	2.3	53.2	9.6	4.0	12.4
ISOPODA					1.2							0.3
DECAPODA		1.3	0.6		0.1	0.5	0.9			0.8	0.5	0.4
INSECTA	13.3	48.4	90	95.3	4.4	19.7	17.0	67.9	46.1	86.0	93.7	42.0
GASTROPODA	0.3											0.0
PELECEPODA					0.9							0.3
Total %	100	100	100	100	100	100	100	100	100	100	100	100

In lake Manzalah polychaete worms flourish mainly during Winter and Spring seasons as they contributed 72.8 % and 78.6 % respectively to the fauna recorded at station No. 5. Their abundance declined during Summer and Autumn months. Polychaeta is represented in the lake by 5 species. ***Hydroids elegans, Mercenigmatica, Neanthes limnicola, Nereis diversicolor*** and ***Polydora ciliata.*** The mentioned species were recorded in station No. 5 with the exception of ***Neanthes limnicola*** which was noticed once at stations (No. 3, No. 4, No. 7 and No. 11) exhibiting annual averages 178, 222, 44 and 44 org. /m^2 respectively.

The polychaeta community was found to be dominated by ***Hydroids elegans*** and ***Nereis diversicolor*** (average 1428 and 880 org. /m^2) at station No. 5, while ***M. enigmatica*** and ***P. ciliata*** were relatively low (average 285 and 538 org. /m^2 respectively). ***M. enigmatica*** and ***N. diversicolor*** were also noticed at station No. 10 (average 7 org. /m^2); while the rest of stations were lacking the polychaete worms.

Samaan and Aleem (1972) regarded *Nereis sp.* as the most important bottom dweller inhabiting Lake Mariut, and the maximum occurrence of ***N. diversicolor*** in Lake Edku was during March and April (Samaan, 1977), while ***N. succinea*** was recorded as a common mud dweller in Lake Manzalah (Guerguess, 1979).

OLIGOCHAETA:

They are the second dominant bottom dweller organisms in the lake. ***Chaetogaster limnaei*** *represents the* Oligochaeta in the lake. It is omnivorous feeder that feeds on animal or detritus material and also shows high preference for algae. The distribution of ***Chaetogaster limnaei*** exhibits wide changes from station to another. Stations No. 1 and No.6 harbour most of the individuals, with a year average of 1104 and 1454 org. /m^2 respectively. This species represents 88.2 % of the total fauna recorded at station No. 1 and 52.2% of that recorded at station No. 6. The drains directly affect both stations. It seems however, that ***Chaetogaster limnaei*** can tolerate the anoxic conditions caused by the increased sedimentation of organic matter and the process of its decomposition. In converse, stations No. 3, No. 5, No. 9, No. 4 and No. 11 harbour very low population densities of ***Chaetogaster limnaei*** (average 4, 4, 4,15 and 15 org./m^2 respectively). With the exception of station 9, the

mentioned stations are more or less affected by relatively high water salinity.

Station No. 9 showed very low numerical abundance; not only for Oligochaeta but also for the total benthic fauna as a whole. This may be attributed to the dense vegetation at this station that aids in stagnating the water and accelerating the precipitation of suspended particles; and hence depriving the water from its nutrients. This process results in suppressing the phytoplankton growth (Abdel-Baky and El-Ghobashy, 1990) and decreasing zooplankton and zoobenthos in the area.

Autumn and Winter are the most populated seasons with Oligochaeta. The highest records were at station No. 1 namely 5772 org. /m^2 during September. and station No. 6 with 5195 org./m^2 during October. Station No. 2 recorded the lowest numerical abundance of ***Chaetogaster limnaei***. The highest counts during May and June were 488 and 444 org./m^2 respectively .

CIRRIPEDIA :

Among the acorn worms (barnacles) of the genus Balanus present in lake Manzalah *is* ***B. improvisus***. It is found accumulating in patches on the empty shells and on clusters of the empty calcareous tubeworms. According to the concept of "parallel communities" which states that similar animals will be found in association wherever similar environmental conditions exist, and similar groups of more or less closely related species would always occur where similar selective forces and responses occur (Thorson, 1957). Hence, it seems that the productivity of the barnacles is great because of the abundance of what has been considered as highly productive animals as parallel communities such as crustaceans and polychaetes.

Balanus improvisus showed a year average 3.4% of the total benthic community of Lake Manzalah. It was found just in station No. 5 with an annual average of 1407 org./m^2. It was also found in stations (No. 3, No. 4 and No. 11) with averages of 122, 67 and 7 org. /m2 respectively. It flourishes in Winter and Spring seasons. It is obvious to note that the population density of ***B. improvisus*** was much more pronounced at station No. 5 than any other station. This may be attributed to the relatively high salinity caused by seawater invasion through the lake sea connection.

In Lake Mariut, the adult ***B. improvisus*** was scarcely found among the bottom fauna although the nauplius larvae of it were more or less frequent in the plankton. It was found accumulated in patches on hard substratum and on the empty shells of ***Cardium*** (Samaan and Aleem, 1972). Neither In Lake Edku nor in lake Burollus ***B. improvisus*** was recorded.

AMPHIPODA :

It is the fourth dominant group among bottom fauna in lake Manzalah (average 12.4%). Mainly ***Corophium volutator*** and ***Gammarus lacustris*** represent it. A third species, ***Elasmopus pectinicrus*** was observed at stations No. 6 and No. 8. It browses on the organic detritus in the mud as well as the on suspended particles. They appear more frequent in areas devoid of the hydrophytes.

C. volutator is a widespread species feeding on suspended material by filtration and also on surface deposits. Its population was dense at stations (No. 7 and No. 5) with annual averages of 1382 and 493 org. /m^2 respectively. Such stations were devoid of hydrophytes or at most with scattered patches of ***Potamogeton***. Area preference returns to the fact that ***Corophium*** browses on the detritus present in the organic mud. The same observation was previously noticed in Lake Mariut (Samaan and Aleem, 1972) and in Lake Burollus (Samaan, *et al* 1989). For ***Gammarus lacustris*** it was heavily abundant at station No. 5 (322 org. /m^2) as a result of the richness in aquatic vegetation. The highest numerical abundance of these organisms in lake Manzalah was between April and July. The seasonal frequency of the total Amphipoda showed maximum abundance during Spring and Summer months and low abundance during Autumn and Winter .

ISOPODA :

The isopods in lake *Manzalah* are represented by only two species namely, ***Mesanthura*** *sp.* and ***Sphaeroma serratum*** contributing only 0.3 % of the total bottom fauna. They occurred only at the station No. 5 with annual averages of 59 and 7 org./m^2 respectively. They were flourished during Summer season contributing 3.0 % of the total fauna of station No. 5.

DECAPODA:

This group is of rare occurrence in lake Manzalah. It is represented only by ***Palaemon elegans*** which contributed about 0.4% to the total bottom fauna. It was found at the stations (No. 2, No. 3, No. 5, No. 6, No. 7, No. 10 and No. 11) with annual averages of 22, 11, 4, 9, 22, 4 and 7 org. /m^2 respectively. This species flourishes mainly during Summer; where it contributed 178, 89 and 44 org./m^2 at the stations (No. 2, No. 3 and No. 6) respectively during May and by 44 org./m^2 at both stations (No. 7 and No. 11) during July.

INSECTA:

Chironomus larvae (***Tendipus tentans***) are the most dominant bottom dwellers in lake Manzalah. They are characteristic members of the littoral zone of both oligotrophic and eutrophic, fresh and brackish water lakes. They are good indicators of water pollution and may be found in moderately contaminated areas but their growth is slightly retarded. They feed on the plant material especially the ***potamogeton*** belt, which is frequently present all over most of the lake.

The larvae are widely distributed all over the lake basin showing a year average of 42% of the total fauna. They are found in all stations with much more concentration in areas rich in ***Potamogeton.*** Similar results were achieved by Samaan and Aleem (1972) in Lake Mariut, Samaan (1977) in Lake Edku and Samaan ***et al*** (1989) in Lake Burollus. They tend to be more common on sediments with high allochthonous content. Despite of the relatively high organic matter at station No. 5 (6.2%); it seems that the slightly higher salinity levels prevent the growth of Potamogeton plant in this area and also causing the decline of Chironomus larvae numbers in this station (4.4%).

Although the drains directly affect station No. 1, yet it shows low abundance of such larvae. This can be attributed to the fact that, even though Chironomus larvae can tolerate low oxygen levels (Samaan and Aleem, 1972); It seems that the hypoxic conditions (caused the load of pollutants of the drains) enhances Sulfate-reducing bacteria which turn increase the sulfide content of sediments. It is known that the oxygen uptake of benthos is suppressed in the H_2S rich environment, even if the oxygen concentration is not at a lethal low level. As regard to seasonal variations, the *Chironomus* larvae appeared more frequent at

the middle of the lake (stations No. 2, No. 4, and No. 3) and at the northwestern area (stations No. 9, No. 10, and No. 11). The higher numerical abundance of these larvae was noticed during Spring and Summer reaching maximum during June (43182 org./m^2). The Autumn season showed the minimum abundance with only (576 org./m^2) over the lake during September.

Mollusca (BIVALVIA):

Most of the living mollusks are of marine origin which are mostly derived from the Mediterranean Sea fauna. Hence station No. 5 is characterized by a relatively higher salinity, organic matter and silty-clay sediments. They flourished mainly during Autumn as they amounted to 22.1% of the total fauna recorded at station No. 5 during that season .

It was generally observed that most of the mollusks were present widely distributed over the lake bottom as empty shells. This indicates a remarkable predomination in the last 50 years over other phyla. This is mostly attributed to the water salinity, which was high then With the gradual decrease in the chlorosity values after construction of Aswan high dam, most of these organisms, which could not tolerate low chlorosity, died out. The shell accumulations represent relics of that time (Guerguess, 1979). At the same time, some of the fresh water species invaded the Lake through the drains. The bottom sediments in the middle and northeastern regions of the lake are mostly silty-mud mixed with plenty of empty shells and shell fragments of mollusks such as ***Cardium edule, Macoma cumana*** and ***Corbicula consobrina.*** Calcareous remains of the tube worms and barnacles ***Balanus improvisus*** were also recorded. In addition, empty shells of the gastropod ***Melanoides tuberculata, Biompholaria alexandrina, Thiodoxus niloticus, Bulinus trancatus, Lymnea auricularia, Physa acuta, Cleopatra bulimoides, Bellamya unicolor, Pirenella conica*** and ***Hinia nitida*** were also observed. It is worthily mentioning that the living mollusks of the lake are of less importance among the other groups as they contribute an annual average of 0.3% of the benthic community of the lake. The living pelecypodes were represented only by two species, which were recorded frequently at station No.5. These are ***Cerastoderma edule*** and ***Macoma cumana*** which show annual averages of 11 and 41org./m^2 respectively. The only living gastropod species was ***Cleopatra bulimoides.*** It was found at station No. 1, at salinity much lower than any other station in the lake.

REFERENCES

Abdel-Baky. 1.E & El-Ghobashy. A.E. 1990. Some ecological aspects of the Western region of Manzalah Lake. Egypt. 1- Physico-chemical characteristics. Mans. Sci. Bull., 17 (2).

Adams. J.C.. Kilambi R.V.. Wickizer W.Z.. Brown A.V. 1976. Macrobenthos population changes in Crystal Lake. Arkansas. subsequent to cage culture of fish-Ark. Acad. Sci. Proc. 30: 12-13.

Bray. j.r. and J.T. Curtis. 1957. An ordination of the upland forest communities of Southern Wisconsin. Ecol. Monogr.. 27: 325-349.

Guerguess. Sh.K. 1979. Ecological study of zooplankton and distribution of macrofauna in Lake Manzalah. Ph. D. Thesis, Faculty of Science Alexandria University. 361 P.

Kajak. Z. 1983. Ecological characteristics of lakes northeastern Poland versus their trophic gradient. XII. Dependence of the chosen indices of structure and functioning of ecosystems on trophic status and mictic type of 42 lakes-Ekol. pol. 31: 495-530.

Lander. L. 1976. The influence of a fertilizer factory on Lake Malaren - Prog. Wat. Tech. 8: 435-442.

McIntyre. 1964. Meiobenthos of sublittoral moods. J. Mar. Biol. Assoc. U.K. 44: 665-674.

Nagel. B.. Landahl. C.C.. Lann. H. 1977. Quantitative and qualitative composition of bottom fauna in polluted parts of lake Vanern and some aspects on water quality indices Vatten. 33: 434-441.

Samaan. A.A. and A.A. Aleem. 1972. Quantitative estimation of bottom fauna in Lake Mariut. Bull. Inst. Oceanogr. and Fisheries, Egypt, 2: 377-397.

Samaan, A.A. 1977. Distribution of bottom fauna in lake Edku. Bull. Inst. Oceanogr. and Fisheries, Egypt, 7 (1): 59-90.

Samaan, A.A., Ghobashy, A.F.A. and Aboul Ezz, S.M. 1989. The benthic fauna of Lake Burollus 1- Community composition and distribution of the total fauna. Bull. Nat. Inst. Oceanogr. & Fish., ARE, 15 (1): 217-224.

Steven, G.A. 1930. Bottom fauna and food fishes, J. mar. biol. Ass. U.K., 30: 677-698.

Thorson, G. 1957. Bottom communities (Sublittoral or shallow shelf)., Mem. Geol. Soc. Am., 1 (67), 461-536.

Tyler, A.V. 1972. Food resources division among northern marine demersal fishes. J. Fish. Res. Bd. Canada 29 (7), 997-1003.

Wiederholm, T. 1980. Use of benthos in lake monitoring-J. Wat. Poll. Contr. Federat. 52: 537-547.

Wisniewski, R.J., Dusoge K. 1983. Ecological characteristics of lakes in northeastern Poland versus their trophic gradient. IX. Macrobenthos of 44 lakes-Ekol. Pol. 31: 429-457.