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DISTRIBUTION AND ABUNDANCE OF BENTHIC ASSEMBLAGES IN EL-GAMIL BASIN (LAKE MANZALAH, EGYPT)

B) MACROBENTHOS

BY

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Key words: **Macrobenthos, Lake Manzalah, distribution, composition, pollution.**

ABSTRACT

Macrobenthic samples were collected during summer and winter of 1997 from El-Gamil Basin (part of Lake Manzalah). Samples were taken from 20 stations arranged in three sections.

Macrobenthic community consisted from fifteen species belonging to four phyla, Arthropoda (six species), Annelida (four species), Mollusca (four species) and Coelenterata (one species). Most of these species are of marine origin. The abundance of macrobenthic species was closely correlated with nature of bottom sediments, turbidity and salinity. The low number of benthic invertebrates at stations of section I is due to action of water current coming from connecting canal. Results showed that the wastewater treatment plant having no effect on the total number of macrobenthic individuals but it decreased the number of species (diversity) which still tolerate organic pollution. In addition, large number of dead and empty shells of Mollusca are observed in the area opposite to the plant effluent.

INTRODUCTION

The discharge of wastewater effluents into aquatic environments can affect the nearby benthic environment through the decomposition of organic particles carried in the wastewater. Species, which are sensitive to pollution, will then be reduced in number while other species which are tolerant to pollution, will increase in numbers. This observation permits benthic organisms to be used as indicator of changes occurring in the benthic ecosystem. Various approaches have been proposed for assessing pollution effects using benthic macrofauna (Wass, 1967; Wilham & Dorris, 1968; Gray & Mirza, 1979; Guhl, 1987 and Diaz, 1974). Several studies were carried out on the macrobenthos of Lake Manzalah (Guerguess,1979; Khalil,1990; El-Bokhty, 1996 and Ibrahim ***et al***, 1997 a & b).

The aim of the present work was to determine the impact of different abiotic variables of water and sediment quality on macrobenthos in El-Gamil Basin (part of Lake Manzalah) which is influenced to different stress from: -

1- Discharge of Port Said Wastewater Treatment Plant (WWTP)
2- Marine water coming through the connecting canal (Boughas El-Gamil).
3- Sewage and agricultural pollution coming from south of the lake through drains.

THE STUDY OF AREA

Lake Manzalah is the largest of the four Nile Delta lakes. It is situated in the northeastern part of Egypt. It is bounded on the east by the Suez Canal and on the west by Damietta Branch of the Nile and is separated from the Mediterranean Sea by a narrow sandy fringe at the north. The lake is connected to the Mediterranean Sea through a narrow channel (Boughas El-Gamil). The surface area of the lake has been significantly reduced in recent years, to an estimated 215,440 feddans (Ibrahim ***et al***, 1997a), as a result of land reclamation programs primarily on the lake's south border and on the east border in the vicinity of Port Said.

The islands and reed beds divided the lake into well defined basins (which is known as Bahr) having more or less distinctive ecological conditions.

The investigation area (El-Gamil Basin) is located in the northeast corner of the lake. The Port Said Wastewater Treatment Plant discharge into El-Gamil Basin through narrow culverts underneath the new Port Said ring road (Fig. 1).

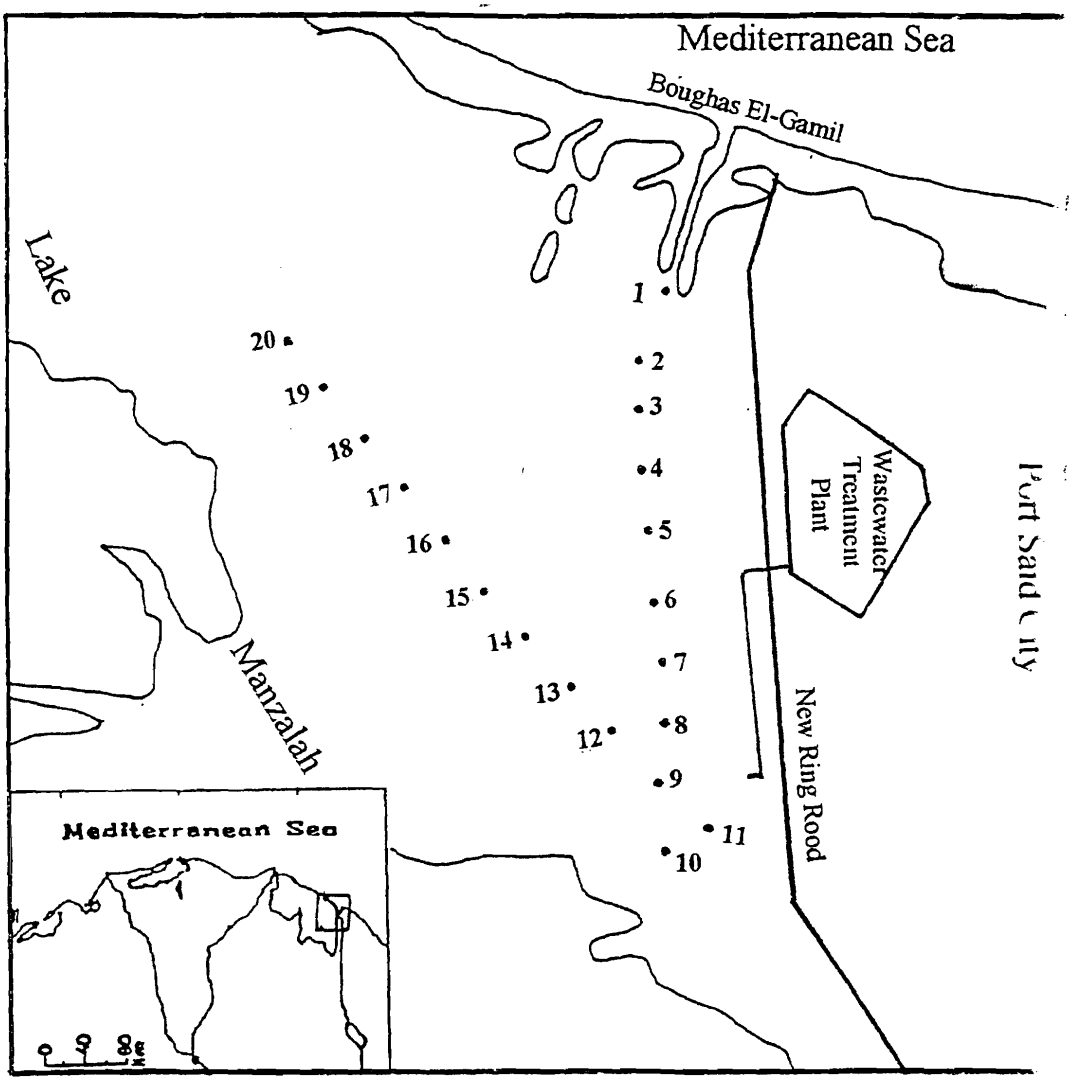

Fig. (1): Map showing the locations of sampling sites

MATERIALS AND METHODS

Sampling of macroinvertebrates were surveyed during summer and winter of 1997. As shown in Figure 1, samples were taken from the selected 20 sites belonging to three sections (I, II & III). Section I includes 6 stations (1–6), section II includes 7 stations (7–13) and section III (14-20).

The benthic samples were collected from the sampling localities using Ekman Grab with opening area equivalent to 250 cm^2. The collected samples were washed in the field through a small hand net of 500 µm mesh diameter. The samples were stored in plastic jars after adding 7% formalin solution. Sorting and identification of different species were carried out in the laboratory. Results were given as the total number of individuals per square meter. Data of sedimentological (grain size analysis and organic matter content) and physicochemical parameters (water temperature, pH, dissolved oxygen and salinity) were cited from Fishar (1999).

RESULTS AND DISCUSSION

1- Community composition and relative abundance:

A total of fifteen species of living bottom invertebrates were identified in the collected benthic samples during summer and winter of 1997. Of these 6 arthropods, 4 annelids, 4 molluscs and one species of sea anemones. The species are listed in Table (1). Most of these species are of marine origin introduced into the area through Boughas El-Gamil and tolerant to environmental conditions of the Basin.

a - Arthropoda:

Arthropoda was the most common group in the investigated area. It was represented by four crustaceans (***Sphaeroma serratum, Corophium volutator, Gammarus lacustris*** and ***Balanus*** spp.), one ostracod species and two instars of Chironomidae (chironomus larvae and pupae).

During summer, Arthropoda formed about 85.73 % of the total density of macrobenthos. It was common in all sections but with different percentages. It contributed 82.08 %, 84.74 % and 89.01 % to the total benthic density of sections I, II and III, respectively (Figure, 2). Ostracod species was the most

common species of the total benthos. It was recorded in all sampling sites (except stations 4 and 20), followed by the amphipod ***Corophium volutator*** and chironomus larvae.

During winter, a remarkable decrease in population density of Arthropoda were recorded. It formed about 33.01 % of the total population density in the whole area. In sampling sections, it formed 56.79%, 23.95 % and 27.99 % of the total benthos in sections I, II and III, respectively. This mainly attributed to reduction in number of all individuals especially ostracod species, ***Balanus*** species and ***Corophium volutatur*** and absence of the amphipod ***Gammarus lacustris*** (Table, 1).

The abundance of major arthropod species was influenced by some abiotic variables. Aquatic diptera larvae of tendipes (Chironomus) were more frequent particularly at stations opposite to WWTP effluent (9, 13 and 14). These larvae are good indicator of pollution (Rivosechi ***et al***, 1976). They may be found moderately at the contaminated area (Wentsel ***et al***, 1977). These larvae showed high counts in stations 1 and 3 (Figure, 3) which characterized by presence of the macrophyts ***Ulva lactosa*** and ***Gelidium*** sp. Similar results were mentioned by Samaan and Aleem, (1972) in Lake Mariut, Samaan (1977) in Lake Edku, Samaan ***et al*** (1989) in Lake Burrollus and El-Bokhty (1996) in Lake Manzalah.

b – Annelida:

Phylum Annelida was represented by four species, 3 polychaetes (***Nereis diversicolor***, ***Polydora ciliata*** and ***Hydroides elegans***) and one oligochaete, ***Chaetogaster limnaei***.

During summer, Annelida constitute 8.86 % of the total benthos in the whole area. In sampling sections (Figure 2). It formed 12.96 % and 7.47 % in sections I and II due to extensive appearance of ***Hydroides elegans*** and ***Polydora ciliata*** in stations of section I and section II, respectively (Figure, 4). In section III, number of annelid species was decreased at most stations of this section except ***Polydora ciliata*** at stations 15 and 16. ***Hydroides elegans*** was the most populated species. Its highest value (1920 and 820 organisms/m^2) was observed in stations 4 and 15, respectively. ***Polydora ciliata*** occupied the second position and showed its highest appearance in stations 7, 12 and 15 where 620, 600 and 540 organisms/m^2 were observed.

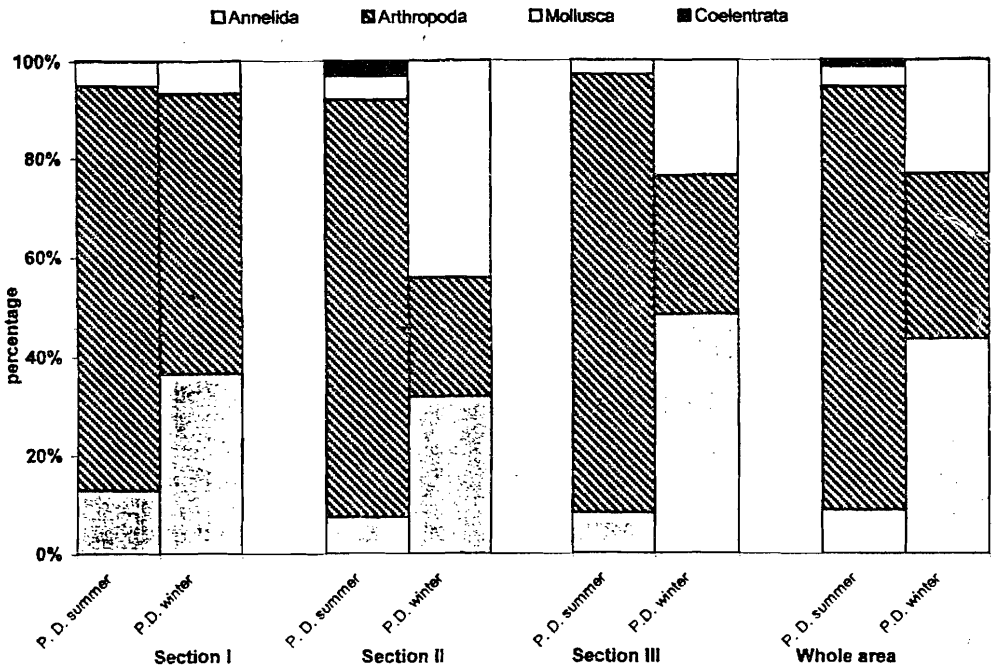

Fig. (2) Percentage composition of different benthic phyla in sampling sections during 1997

Table (1) Species composition and abundance (number of individuals /m^2) of macrobenthos in sampling sectors of the are investigated

Species name	Section I		Section II		Section III		Average	
	summer	winter	summer	winter	summer	winter	summer	winter
Annelida								
Chaetogaster limnaei	7	27	29	103	129	177	55	102
Nereis diversicolor	67	33	37	0	60	103	55	45
Polydora cilita	70	87	346	0	131	497	182	195
Hydroides elegans	327	120	146	194	143	91	205	135
Arthropoda								
Ostracoda species	943	200	3406	217	2126	257	2158	225
Balanus amphitrite	160	7	743	6	194	91	366	35
Sphaeroma serratum	27	0	0	0	43	6	23	2
Corophium volutator	803	173	1303	0	1531	114	1212	96
Gammaras lacustris	193	0	214	0	671	0	395	0
Chironomus larvae	853	27	660	0	426	34	649	20
Chironomus pupae	3	7	6	0	6	0	5	2
Mullosca								
Prinella conica	33	7	9	11	20	40	21	19
Semisalsa sp.	127	27	229	389	89	354	148	257
Cerastoderma glaucum	10	7	9	0	17	0	12	2
Abra ovata	10	7	106	11	23	29	46	16
Sea anemone species	0	0	229	0	0	0	76	0
Total	3633	729	7472	931	5609	1793	5608	1151
Number of species	14	12	14	7	14	12	15	13

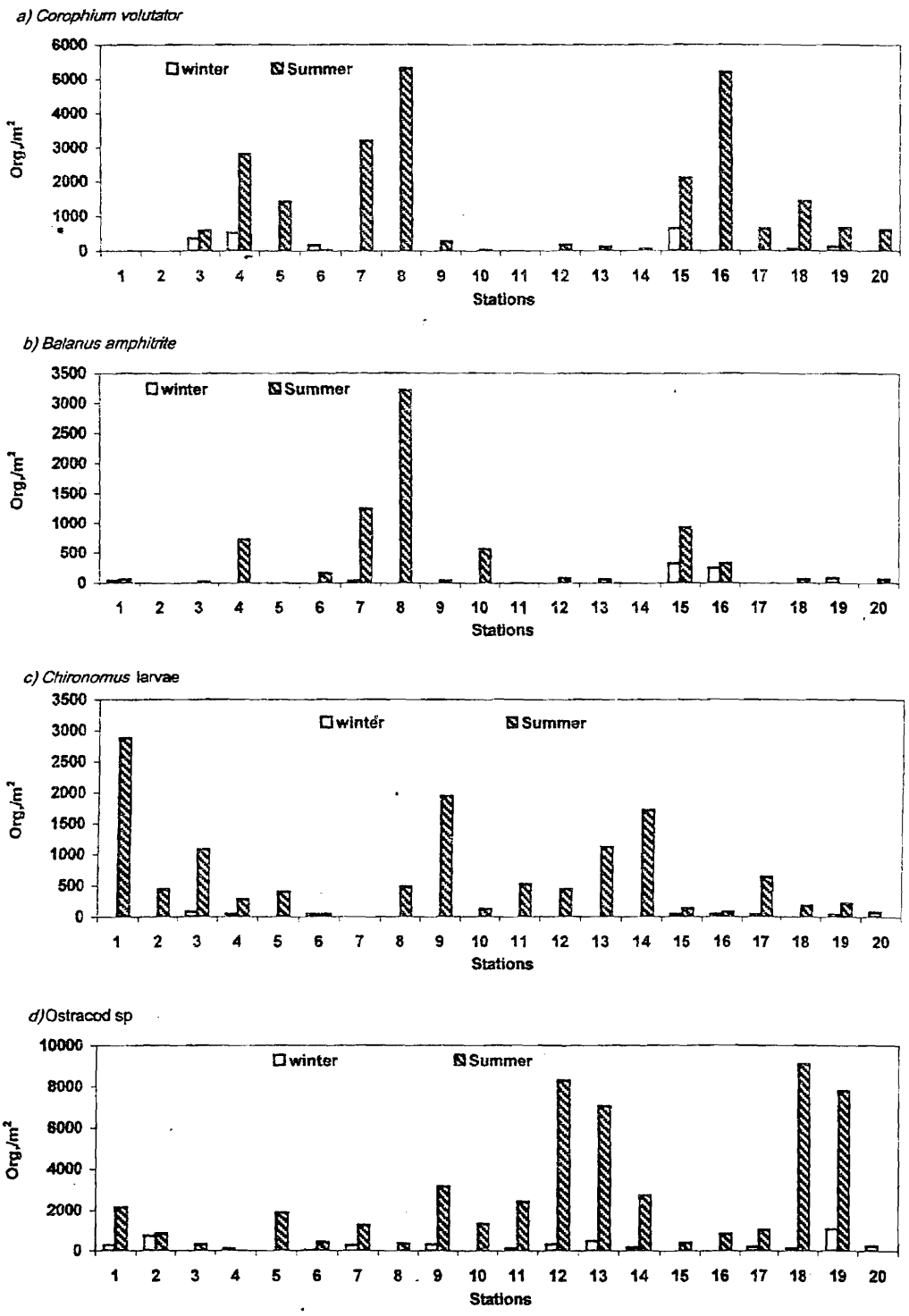

Fig. (3) Distribution and abundance of major arthropod species in the area investigated

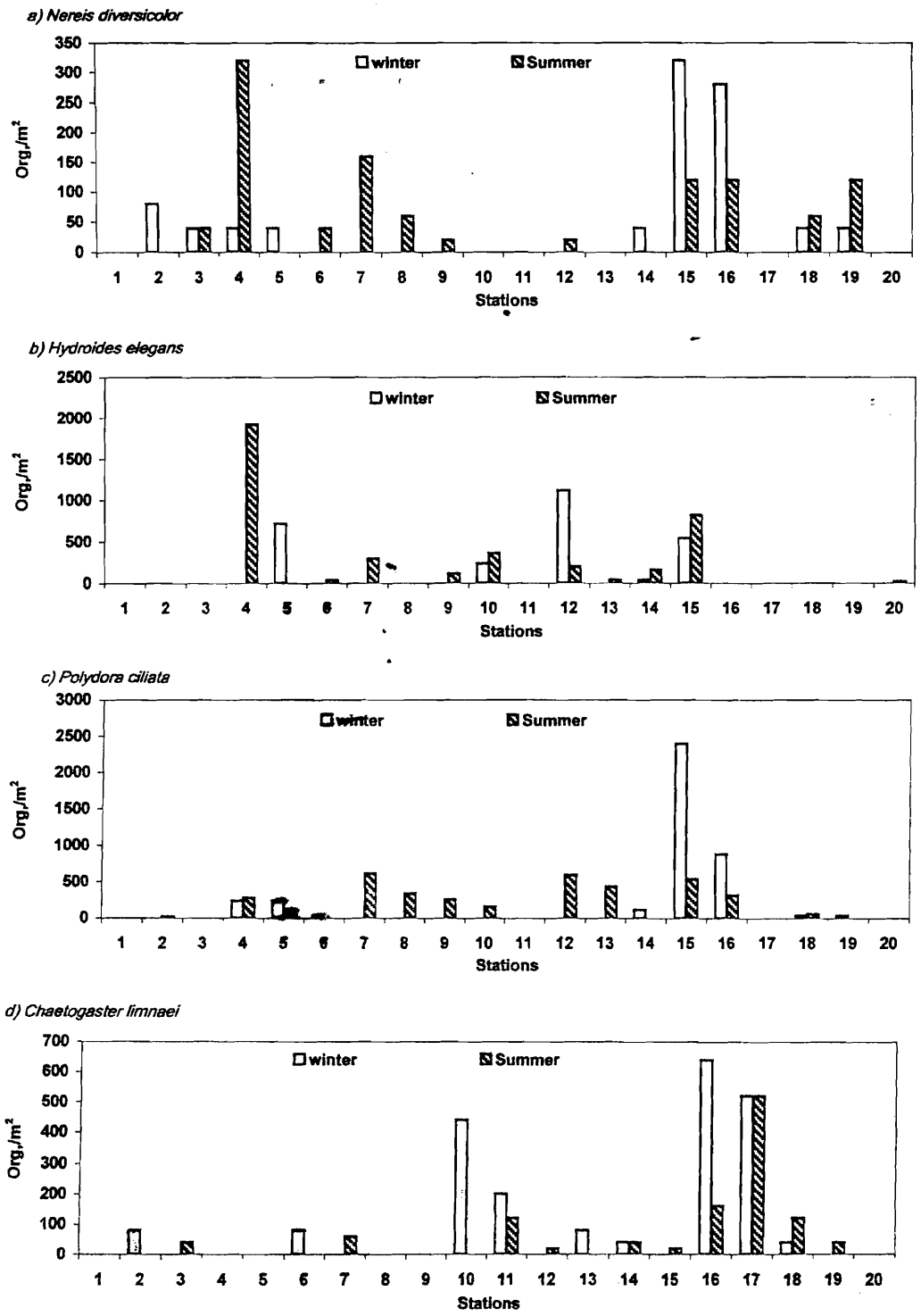

Fig. (4) Distribution and abundance of annelid species in the area investigated

Table (2) Significante correlation between major bentheic species and some abiotic parameters at El-Gamil Basin during period of study

		Silt	Clay	Mud	Sand	Organic matter	Dissolved oxygen	Secchi disc
Nereis diversicolor	r		0.4072				0.4498	
	P -Value		0.0009				0.0012	
Hydroids elegans	r		0.4525					-0.3317
	P -Value		0.0035					0.0245
Polydora ciliata	r		0.2553				0.3189	
	P -Value		0.0068				0.0069	
Chaetogaster limnaei	r	-0.1338						
	P -Value	0.0359						
Balanus amphitrite	r			0.1078				-0.2765
	P -Value			0.0245				0.0403
Diptra larvae	r					0.5306	-0.2708	
	P -Value					0.0009	0.0012	
Ostracod sp.	r	-0.3834			0.4666	-0.2384		
	P -Value	0.0110			0.0002	0.0050		

Table (3): Relative occurrance of dead shells or tubes of different species recorded at sampling sites

Section	Species / Stations	Calcareaus tube worms	*Balanus* species	*Cerastoderm glaucum*	*Abra ovata*	*Pirenella conica*	*Semisalsa* sp.
Section I	1			+++			+
	2		+	+	+		+
	3		+	++++			
	4			+	+		+
	5	++++		+++			
	6		+	+	+		
Section II	7	++		+++	+		
	8	+	+	+++			
	9	+	+++	++		+	+
	10	+	++	++++	+	+	
	11	++	+	++	+		
	12	+++	++	+++	++	+	
	13		++	++	+	+	
Section III	14	+	+	+	+	+	
	15	+	+++	++++			
	16	+	++	+++			
	17	++	+	+			
	18	++	+		+		
	19		+	+++	+		
	20			+			

\+ : 1 - 10 individuals.m^{-2} ++ : 10 - 20 individuals.m^{-2}

+++ : 20 - 50 individuals.m^{-2} ++++ > 50 individuals.m^{-2}

During winter, Annelida was the most abundant group contributing 37.18 % of the total benthos in the whole area. The highest percentage value (48.41%) was recorded in section III Followed by section I (36.62%) and section II (31.90%). ***Polydora ciliata*** was the most common annelid species during this season and showed their great numbers (2400 organisms/m^2) at station 15. The oligochaete ***Chaetogaster limnaei*** showed its highest appearance at stations 16 and 17 of section III (Figure, 4).

The polychaete species (***Nereis diversicolor***, ***Hydroides elegans*** and ***Polydora ciliata***) showed their highest counts in stations having a higher clay content. As shown in Table (2), high significant positive correlation was observed between clay percent in sediment and the pre mentioned species. Hughes ***et al*** (1972) observed that 46 % of the variance in the occurrence of polychaete in coastal areas was associated with soft mud. This observation was also recorded in Lake Qarun (Fishar, 1992). The oligochaete ***Chaetogaster limnaei*** which is essentially a fresh water species (Hutchinson, 1957) showed its lowest population density at stations of section I, which have high salinity values, and increased in stations of sections II and III where salinity decreased.

c - Mollusca:

Phylum Mollusca was represented by two bivalves namely ***Cerastoderma glaucum*** and ***Abra ovata***, and two gastropods namely ***Pirnella conica*** and ***Semisalsa*** sp. These species are marine origin and mostly derived from the Mediterranean Sea fauna.

During summer, Mollusca formed 4.05% of the total number of benthos in the area investigated. The highest percentage (4.96%) was recorded at section I followed by sections II (4.76%) and III (2.74%). ***Semisalsa*** sp. was the most common Mollusca species in this season. It was widely distributed in the sampled locations especially at stations 5 and 11 (Figure 5).

During winter, the total population density of Mollusca were slightly decreased than summer forming 23.09% of the total benthos. Section II showed high abundance of Mollusca species especially ***Semisalsa*** sp. while the lowest one was observed in section I. The wide distribution of this species may be due to their tolerance to organic pollution. Mason ***et al*** (1970) showed that some snails are often associated with organic pollution.

d – Coelenterata

An unidentified species of sea anemone species was recorded in summer season representing 3.06% of the total number during this season. It was recorded only in two stations (12 and 13) of section II where 940 and 660 organisms were observed, respectively.

2 - Regional distribution:

The population density of total bottom invertebrates during summer averaged 5608 organisms/m^2. As shown in Figure 6, station 12 was the most productive area where 11520 organisms/m^2 were recorded. This is mainly attributed to the extensive appearance of the ostracod species, sea anemone and polychaetes ***Hydroides elegans*** and ***Polydora ciliata*** (Figure, 3 & 4). On the other hand, the lowest standing crop recorded at station 2 where 1440 organisms/m^2 was recorded. With regard to sections, the lowest abundance of macrobenthos was recorded at section I. This is could be mainly attributed to strong water current coming from Boughas El-Gamil which prevent these animals from adhering to their substrata.

During winter, a noticeable decline in population density was recorded compared with that of summer. Stations 14, 15 and 16 were the most productive sites in the area (Figure 7) this is may be due to increasing number of polychaet and crustacean species. (Figure 5 & 7). During this season, section III having the highest population density (1743 organisms/m^2) followed by section II. Section I still shared the lowest standing crop of total benthos.

As shown in Table (1), the annual average number of total bottom fauna in the area investigated amounted 3380 organisms/ m^2 while sections I was the least productive one. On the other hand, population density in section II having the highest average value (4202 organisms/m^2) may be related to the effect of WWTP discharge on the benthic community.

3 – Dead shells

As shown in Table (3), dead shells of Mollusca, calcareous tube worms of polychaete and empty shells of ***Balanus*** species, were recorded at different sampling sites. It is noticed that most of these shells were small in size and belongs to juveniles. This may be evidence that most individuals of these species usually die before reaching adult size due to the effect of WWTP effluent.

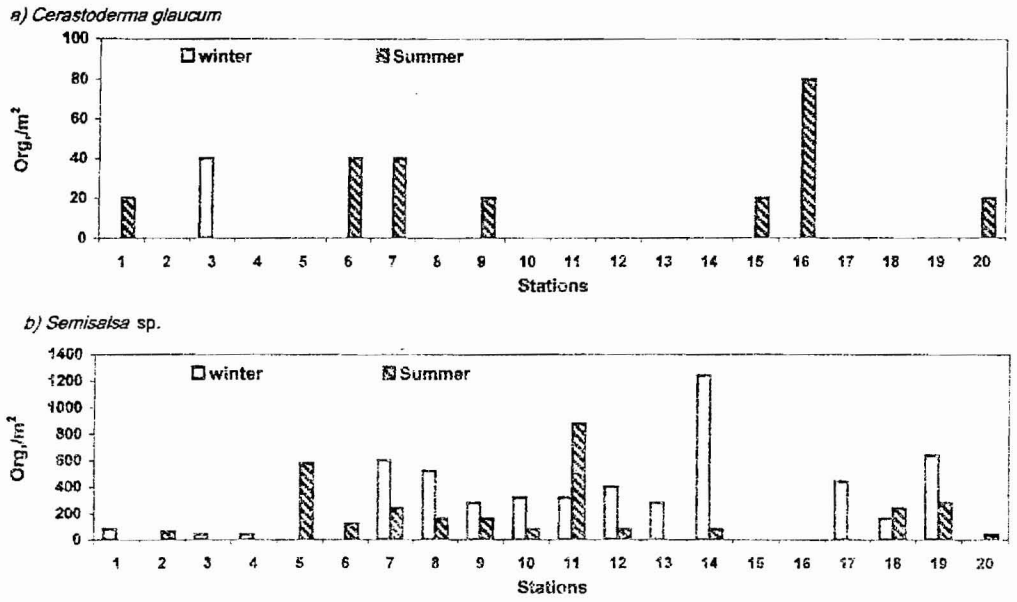

Fig. (5) Distribution and abundance of major mollusca species in the area investigated

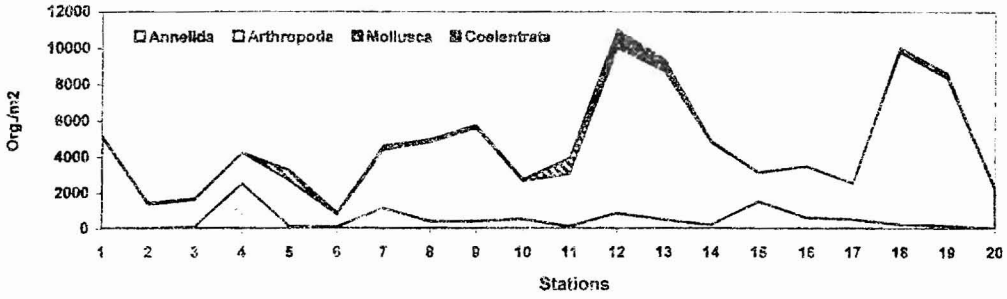

Fig. (6) Distirbiution of macrobenthic invertebrate phyla in sampling localities during summer

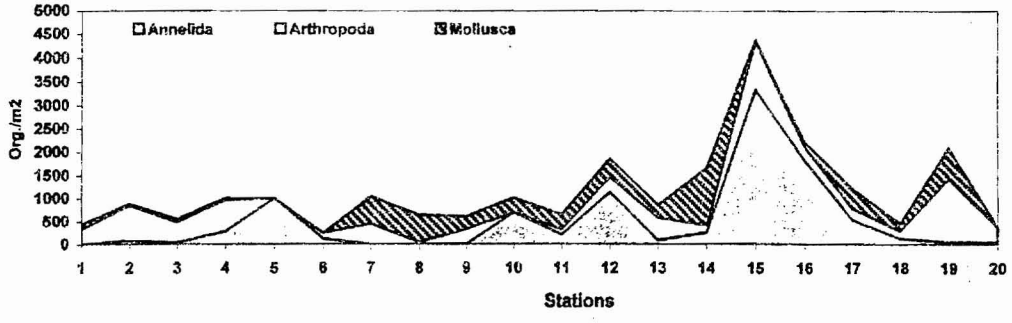

Fig.(7) Distirbiution of macrobenthic invertebrate phyla in sampling localities during winter

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