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Ecological studies on the macrobenthic invertebrates in the eastern coast of Alexandria, Egypt

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Recieved 16th August 2009, Accepted 4th Novamber 2009

Abstract

The regional distribution and temporal changes in species composition, abundance besides to species diversity of macro benthic assemblages were studied along the eastern coast of the Alexandria, Mediterranean waters. Bottom samples were collected from the coastal area at different 8 stations namely, Rosetta, Abu-Khashaba, Borollus, Balteem, Gamasa, Damiatta, Sahl El-Tina and El Arish. Samples were collected during summer and autumn seasons 2008. A total of 27 species of bottom invertebrate animals and 2 species of macrobenthic algae were found during summer 2008, while 31 species were recorded during autumn 2008. Dominant macro benthic species included Polychaetes *(Prionospio cirrifera, Scolaricia sp., Magelona papillicornis, Capetilledes, Polydora caeca, Cirratulis sp., Serpula sp., Sabella fabricii, Aphrodite aculeate, Nephthys hombergii, Glycera convolute, Goniada norvegica, Perinereis sp., Syllis sp., Onuphis erennata and Lubriconereis latreilli). Bivalves (Scrobicularia sp., Corbula gibba) and Echinodermata, class Ophoiroidae (Ophiopsila aranea).*Bottom fauna and flora were, in general, more dense in Gamasa and Sahl El-Tina in summer and Rosetta and Gamasa in autumn. The densities of bottom fauna ranged between 30 and 970 ind./m^2 during summer and from 150 to 2310 ind./m^2 during autumn in El Arish at the eastern coast of Alexandria. The density was high in the neritic zones (inner, outer-sublittoral and offshore zones) at depths of 10 to 100 meters and was low in the oceanic zones of more than 100 meters. Shannon-Wiener index values (H^-) for the species diversity of macrobenthos showed a regular pattern at the different stations. It was high at Balteem during summer which recorded H^- =0.09 and H^- =0.11 at Abu Khashaba during autumn, while it was low at Borollus during summer and autumn that attained H^-=0.02.

Keywords: Macrobenthic invertebrates, Bivalvia, polychaetes, crustacean, pollution, Eastern coast of Alexandria, Mediterranean Sea.

1. Introduction

The eastern Mediterranean is susceptible to biological invasions because of its placement between the Atlantic, Pontic and Erythrean regions, busy maritime traffic, and lagoons and bays that are crowded with fish and shellfish farms. However, the greatest influx of invaders resulted from the opening of the Suez Canal in 1869, which allowed entry of Indo-Pacific and Erythrean biota. Exotic macrophytes, invertebrates and fish are found in most coastal habitats in the eastern Mediterranean. Some invaders have outcompeted or replaced native species locally, some are considered pests or cause nuisance, whereas other invaders are of commercial value. However, at variance with other invaded seas, the invasion into the eastern Mediterranean has increased the region's biodiversity.

Eastern Harbour of Alexandria is one of the most important areas for tourism, Fisheries and several recreational and developmental purposes. Till the year 2003, the basin received a huge amount of unprocessed sewage. Large quantities of metals and paints are still dampened the harbour by local boatyard. Accumulation of nutrients, organics and other elements on the bottom as well as their diffusion from the sediment pore water to overlying water are expected **(**Nessim, *et al*., 2005).

The Mediterranean Sea is a large closed basin in which land drainage increases productivity in the coastal regions, however most of it is oligotrophic (Azov (1991). During the last two decades; the Mediterranean coast showed increased coastal development activities including large urbanization and industrial development. So far the coastal water of the Mediterranean is the main recipient of the effluents of untreated domestic and industrial waters as well as land drainage which may influence the ecosystem structure in the coastal waters.

Benthos is important in the ecosystem which has a wide variety in the species composition of mainly polychaete worms, molluscs, echinoderms, and crustaceans living in burrows in the sediment (infauna) or on the sediment surface (epifauna). It represents a food source for many species of commercially exploited fish and crustaceans and for many species of seabirds.

According to Caracciolo and Steimle, (1983) benthic macrofauna are useful monitoring tools

because: 1) they are relatively immobile, living at or near the sediment surface and are thus unable to avoid exposure to contaminants in water or sediments; 2) they are important in food webs where many species are preyed upon by resource species; 3) they are possible direct sources of contaminant transfer to food species and ultimately to man; and 4) some species, such as ampeliscid amphipods, are extremely sensitive to low levels of contaminants and their rarity or absence may be used as an indicator of contaminated, stressed, or altered habitats. The most notable contributions on the taxonomy of marine molluscs of Egypt are that given by Hassan (1979&1983) who investigated the bottom molluscs particularly gastropods and bivalves, in Abu-Qir Bay. On the other hand, El-Komi and Beltagy (1997) investigated the distribution of macrobenthos assemblages in the north coast of Egypt from Marsa Matrouh to El Arish.

Since the opening of the Suez Canal, more than 120 Red Sea species colonized the eastern Mediterranean, whereas less than 10 Mediterranean species colonized the Red Sea. For most of the species involved in this colonization, the mode of dispersal from the source to the colonized area is through free-drifting propagules. In order to examine whether the current regime of the Suez Canal may be involved in this assymetry in colonization, a mathematical hydraulic model that forecasts the direction and velocity of water currents through the year, along the length of the canal, was utilized. The movements of free-floating propagules that occur at either entrance of the canal, was simulated on a computer, and it was found that the completion of a Mediterranean-bound passage of Red Sea propagules is far faster and much more likely than a completion of a Red Sea-bound passage of Mediterranean propagules (Agur and Safriel, 1981).

According to Fishar (1999), macrobenthic community in El-Gamil Basin (Lake Manzalah) consists of fifteen species belonging to four phyla, Arthropoda (six species), Annelida (four species), Mollusca (four species) and Cnidaria (one species). Most of these species are of marine origin. The abundance of macrobenthic species was correlated with nature of bottom sediments, turbidity and salinity.

The Red Sea mussel *Brachidontes variabilis* (Krauss) has colonized the Mediterranean Sea following immigration through the Suez Canal (Safriel *et al*. 2003). In the Mediterranean, it encountered *Mytilaster minimus* (Poli) a smaller species with a higher intrinsic rate of population increase. Both inhabit identical intertidal habitats, where they are mixed together in a random spatial pattern, but in different relative densities, depending on wave exposure.

The EHA (Eastern Harbour of Alexandria) received an amount of $1.5x10^4$ m^3/day of raw domestic sewage (Shriadah, 1982). This quantity increases by time and considerably in summer, especially in the summer of 1986, when all the domestic sewage of the eastern part of Alexandria was turned into the EHA to protect the eastern summer resort coasts of Alexandria from pollution by domestic sewage. Under the new conditions, the domestic sewage discharged into the EHA through 11 outlets was estimated to be 6.3×10^4 m^3/day (Said and Maiyza, 1987).

The objective of this study is to compare geographical distribution of macro-benthic organisms in the eastern coast of the Alexandria, Mediterranean Sea from Rosetta to El Arish assess the risk of pollution and the consequence anthropogenic impacts on the marine ecosystem and the structure of aquatic communities.

2. Materials and methods

2.1. Sampling

Bottom samples were collected from the coastal area at different 8 stations of the Eastern Coast of Alexandria namely, Rosetta, Abu-Khashaba, Borollus, Balteem, Gamasa, Damiatta, Sahl El-Tina and El Arish (Figure 1). Samples were collected during summer and autumn 2008 by using Van Veen grab sampler (equivalent to 0.1 m^2). The collected samples were washed through a sieve with mesh size 1 mm on board and the residue was preserved with 5-10% formalin solution. In the laboratory the sample was washed throughly and sorted to their main constituents.

Each group was identified to the species or the genus levels, counted and weighed. They were identified to the lowest possible taxon using a dissecting microscope and counted.

Quantitative analysis of the macro benthos communities was carried out; in order to estimate the density and regional distribution patterns of each group of macrobenthos. The results were expressed as number of organisms per meter square and the corresponding biomass of the total macrobenthos groups were expressed in grams per meter square.

2.2. Data analysis

Several approaches were used to measure and compute the species diversity. The Shannon-Wiener index (H^-) is one of simplest methods as was reviewed by Valiela (1995).

$$H^- = -\sum_{i=1}^{n} Pi \log_e Pi$$

Where Pi= ni/N is the proportion of the individuals of a species (ni) to the total number of individuals (N) in the sample.

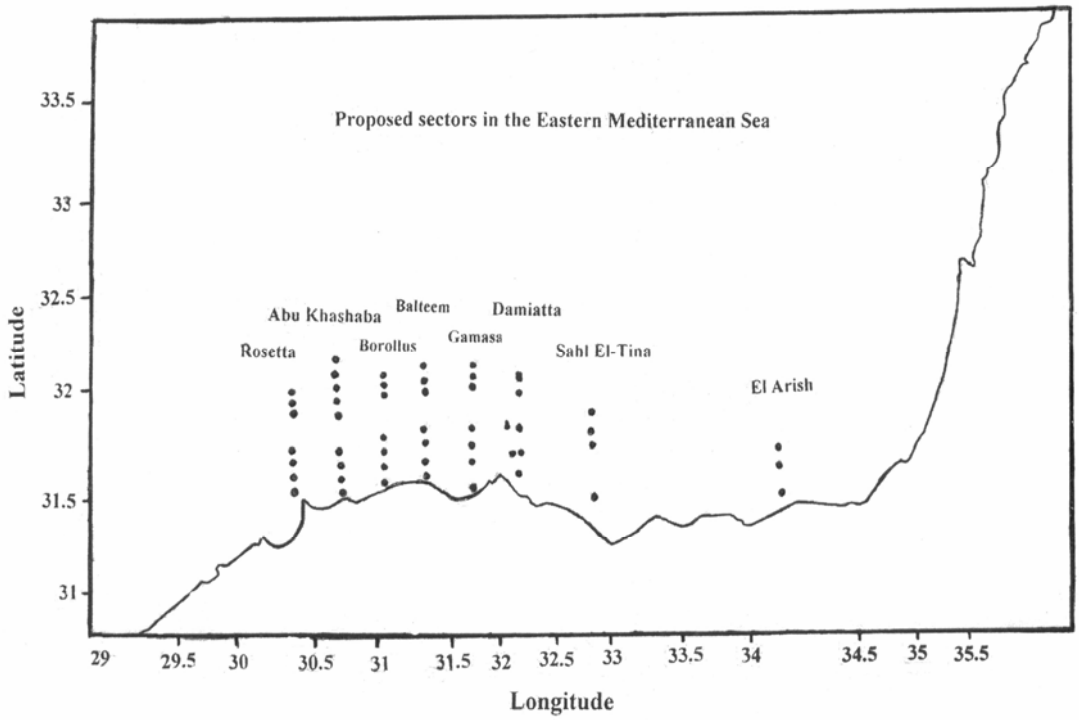

Figure 1: Eastern coastal waters of the Mediterranean Sea showing locations of benthic sampling sites.

3. Results

3.1. Community composition

The study area harbored a diversified macro-benthic community (27 species and 8040 individuals that included a total of 1470, 240, 440, 720, 1710, 160, 1750 and 1550 individuals at the different sites in Rosetta, Abu-Khashaba, Borollus, Balteem, Gamasa, Damiatta, Sahl El-Tina and El-Arish from 8 stations respectively during summer 2008 (Tables 1&2) and recorded (31 species and 21730 individuals), that included a total of 4230, 720, 1210, 3350, 3680, 1840, 3290 and 3410 individuals during autumn 2008, (Tables 3&4). Two red algae species were represented, namely *Jania runeus* and *Ceramium rubrum.* The most productive organisms of benthic fauna were Nematoda and polychaeta that represented 28.23% and 27.49% respectively during summer (Table 2) and 17.30% and 35.02% respectively during autumn, 2008 (Table 4).

3.2. Number of species and numerical abundance during summer

3.2.1. Rosetta

There are 4 and 5 species of polychaeta at sts.2 and 3 of Rosetta, during summer, respectively namely, Capetilledes, *Cirratulis* sp., *Nephthys hombergii, Glycera convolute, Onuphis erennata and Lubriconereis latreilli* with 260 and 180 total number of individuals/m^2. The density number of organisms/m^2 at sts. 1, 2 and 30 were 510, 530 and 430 with the total biomass 110, 135 and 105 gm/m^2 respectively as listed in Table (1).

3.2.2. Abu-Khashaba

Polychaeta were represented by two species at st.1 namely *Polydora caeca* and *Lubriconereis latreilli* that recorded 80 and 70 ind./m^2 respectively, while at st.2, there are 30 individuals/m^2 represented by one species namely *Magelona papillicornis*. The density number of benthic assemblages at sts. 1 and 2 were 150 and 90 ind./m^2 with 67 and 54 gm/m^2 respectively.

3.2.3. Borollus

At Borollus, polychaetes were represented by 100 ind./m^2 of 3 species, namely *Magelona papillicornis,* Capetillidae, *Polydora caeca* at st.1, while *Prionospio cirrifera* characterized st.2, but st.3 was devoid of any species. At Borollus the density and biomass of macrobenthos were attained 440 ind./m^2 with 83 and 77 gm/m^2 at sts.1and 2 respectively (Table 1).

3.2.4. Balteem

This location was characterized by moderately diversity of polychetes species than Gamasa and Damiatta where 3 and 5 species were found respectively at sts. 1 and 2

3.2.5. Gamasa

Nephthys hombergii is the characterized one at st.3 in Gamasa.

3.2.6. Damiatta

Damiatta was characterized by weakly diversity of species that recorded only 120 and 40 individuals /m^2 of Nematoda and polychaeta respectively at st.1. The density number of benthos reached 160 ind./ m^2 with the total biomass of 32 gm/m^2 (Table 1).

3.2.7. Sahl El-Tina

There are 4 species of Polychaetes at st.2 represented by 200 individuals (40,70,60 and 30 ind./m^2) namely, *Scolaricia* sp., *Magelona papillicornis*, *Nephthys hombergii* and *Glycera convolute* and at st.3 were 3 species namely, *Polydora caeca, Glycera convolute* and *Goniada norvegica* that were represented by 220 individuals (100, 90 and 30 ind./m^2 respectively) as listed in Table (1). Finally, at El-Arish, there is only two species, one at st.1 (*Glycera convoluta*) and the other was (*Scolaricia* sp.) at st.2 of polychaete represented by 30 ind./m^2 for each species.

3.2.8. El-Arish

At st.1, 170, 30, 320 and 30 individuals/m^2 were represented by the free living Nematodes, Polychaeta, Anisopoda and Penaeidae with a total 550 of the density number of organisms/m^2 (Table 2) and the total biomass
91gm/m^2. While at st.2, Polychaeta were represented by 30 ind./m^2 of one species namely, *Scolaricia* sp. while, Harpactoids, Anisopoda and Ophoiroidae at st.2 were represented by 460, 460 and 20 individuals/m^2 respectively (Table 2). The density number of organisms/m^2 recoded 970 with the total biomass 125 gm/m^2, while at st.3, only 30 ind./m^2 of Ophoiroidae namely *Ophiopsila aranea* were recorded (Table 1). The total density number of organisms/m^2 recorded 30 with the total biomass of 24 gm/m^2 at st.3.

3.3. Number of species and numerical abundance during autumn

3.3.1. Rosetta

Macrobenthic invertebrate animals were heavily distributed in all stations of Rosetta except Harpactoids and Penaeidae, also Nematoda were represented by 350 ind./m^2 (130 at st.2 and 220 at st.3), Oligochaeta were represented by 520 ind./m^2 (150 at st.1, 160 at st.2 and 210 at st.3), while Polychaeta reached 360, 770 and 610 ind./m^2 at sts.1,2 and 3 respectively, (Table 4) that included *Magelona papilliconereis*, *Polydora caeca*, *Nephyths homergii*, *Serpula* sp., *Onuphis erennata* and *Lubriconereis latreilli*. Amphipoda attained 430, 140 and 150 ind./m^2 at sts.1, 2 and 3 which were represented by *Elasmopus* sp. and *Bathyporeia* sp. Anisopoda were recorded by 170 and 120 ind./m^2 at sts.1 and 2 were represented by one species namely, *Apsuedes latreilei*. Finally, Bivalvia were recorded by 250 ind./m^2 at sts. 1 and 2 which were represented by 2 species namely, *Scrobicularia* sp. and *Corbula gibba*, (Tables 3&4).

3.3.2. Abu-Khashaba

During autumn, Polychaeta were represented by 3 species namely; *Polydora caeca*, *Nephthys homebergii* and *Lubriconereis latreilli* which were represented by 170, 110 and 170 individuals/m^2 at st.1 but at st.2, 100 individuals of *Magelona papilliconereis* were recorded. At st.2 amphipoda were represented by 140 individuals of *Gammarus* sp.

3.3.3. Borollus

St.1 and st.2 the bottom fauna were represented by 4 and 3 species of Polychaeta included of 90, 130, 120 and 100 individuals/m^2 (*Magelona papilliconereis*; Capetilledes, *Polydora caeca* and *Lubriconereis latreilli*) respectively at st.1, while *M. papilliconereis*, *Onuphis erennata* and *L. latreilli* were represented by 110, 130 and 120 ind. /m^2 at st.2 respectively. Isopoda were represented by 140 ind. /m^2 of *Cirolana boreales* at st.2 (Table 3).

3.3.4. Balteem

During autumn, Balteem was characterized by heavily diversity of species than the previous stations. 150 and 270 individuals of Oligochaeta were presented at sts. 1 and 2. Polychaeta were represented by 660, 670 and 260 individuals/m^2 at sts.1, 2 and 4 respectively, (Table 4). These species were *Prionospio cirrifera*, *Scolaricia* sp., *Magelona papilliconereis*, *Polydora caeca*, *Cirratulis* sp., *Serpula* sp. and *Lubriconereis latreilli* besides to *Syllis* sp. and *M. papilliconereis*. Also, amphipoda were characterized by heavily diversity of species where, there were 3 and 2 species recorded at st.1 and st.3 respectively named *Elasmopus* sp., *Corophium* sp. and *Bathyporeia* sp. They were represented by 250, 180 and 200 individuals/m^2 respectively at st.1, while, 170 and 150 ind. /m^2 of *Elasmopus* sp. and *Corophium* sp. were recorded at st. 3 respectively (Table 3).

3.3.5. Gamasa

Nematoda was characterized by high numerical during autumn that were represented by 850, 600 and 500 individuals/m^2 at sts. 1, 2 and 3 respectively. As will as Oligochaeta included 200, 230 and 180 individuals/m^2 respectively at the previous stations and 2 species of Polychaeta were recorded at st. 3, but Harpactoids recorded 110 ind. /m^2 at st.2 (Table 3).

3.3.6. Damiatta

There are 4 species of Polychaeta were found at both sts.1 and 3, while Bivalvia recorded 350 individuals/m^2 (200 ind. /m^2 of *Scrobicularia* sp. and 150 ind./m^2 of *Corbula gibba*) respectively at st.3 during autumn.

3.3.7. Sahl El-Tina

There are 4 species of Polychaeta namely *Scolaricia* sp.*, Magelona papillicornis, Nephthys hombergi* and *Glycera convolute* were represented by a total of 450 individuals/m^2 at st.2 (90, 150, 130 and 80 ind./m^2 respectively), while at st. 3 there were a total of 390 individuals/m^2 were recorded (160 ind./m^2 from *Polydora caeca*, , 150 ind./m^2 from *Glycera convolute* and 80 ind./m^2 from *Goniada norvegica*. Amphipoda were represented by 3 species at st.1 namely, *Elasmopus* sp., *Corophium* sp. and *Bathyporeia* sp. which, yielding a total of 470 ind. /m^2 (100, 200 and 170 individuals/m^2 respectively). On the other hand, a total of 370 of Anisopoda were represented by *Apsuedes latreillei*. The density number of bottom invertebrates at Sahl El-Tina sampling sites reaching 970, 1170 and 1150 ind./m^2 with the total biomass 120, 132 and 130 gm/m^2 (Tables 3&4).

3.3.8. El Arish

This station was characterized by the heavily diversity of species at st.2 that comprised 5 species of Polychaeta included 350 individuals/m^2. Amphipoda, Anisopoda and Ophoiridae represented 530, 650 and 120 ind. /m^2 that comprised 3, 1 and 1 species respectively. The density number of organisms/m^2 at El Arish recorded 950, 2310 and 150 ind. /m^2 with the total biomass 110, 187 and 30 gm/m^2 (Tables 3&4).

3.4. Regional distribution of macrobenthos species during summer 2008

During summer (August) 2008 a total of 27 species were recorded in the different bottom samples. They included the following species as listed in Table 1 namely, Algae (2 species), Bryozoa (2 species), Nematoda (1 species), Oligochaeta (1 species), Polychaeta (11 species), Harpactoids (1 species), Crustacea (Amphipoda, 3 species; Isopoda, 1 species and Anisopoda 1 species), Penaeidae (1 species), Bivalvia (2 species) and Ophoiroidae (1 species), besides to many species were represented by empty shells of Gastropoda, bivalves, Echinoidae and unidentified species of Polychaeta.

3.4.1. Inner-Sublittoral zones (10-20 m depth)

The density of benthos as shown in Table 1 was 50 ind. /m^2 for Oligochaeta at st.1of Rosetta. The corresponding biomass was 110 and 135 gm/m^2. Rosetta and Balteem were composed mainly of Polychaeta (*Prionospio cirrifera, Scolaricia* sp., *Magelona papillicornis;* Capetilledes**,** *Polydora caeca, Cirratulis* sp., *Serpula* sp., *Sabella fabricii, Nephthys hombergii, Glycera convolute, Goniada norvegica, Perinereis* sp., *Syllis* sp., *Onuphis erennata and Lubriconereis latreilli)*, Amphipoda (*Elasmopus* sp. and *Bathyporeia* sp.), Anisopoda (*Apsuedes latreilei*) and bivalves (*Scrobicularia* sp. and *Corbula gibba*). The bottom sample at st.2 of Borollus was composed of polychaeta *Magelona papillicornis*, Capetilledes and *Polydora caeca* and Amphipoda. Balteem also composed of Oligochaeta, Harpactoids. The corresponding biomass was 64 and 52 gm/m^2. The bottom fauna at Sahl El-Tina and El-Arish were low in density at st.1. Abu-Khashaba and Borollus at depth ranged from 5-20 recorded 150-280 ind./m^2 at st.1 respectively, (Table 1).

3.4.2. Outer-Sublittoral zones (20-50 m depth)

At Rosetta and El-Arish the density and biomass of macrobenthos were high that attained 530 and 970 ind. /m^2 and 135 & 125 gm/m^2 respectively. Polychaeta (*Scolaricia* sp.), Harpactoids and Anisopoda (*Apsuedes latreilei*) were the main constituents. Other stations had low productivity 260 ind. /$m^{2\ at}$ Balteem, 160 ind. /m^2 at Borollus at st.2, 90 ind. /m^2 at Abu-khashaba at st.1 and 0 ind./m^2 at Damiatta (Figure 4).

3.4.3. Off-Shore zones (50-100 m depth)

Table (1) and Figure 4 show that the species with a great density and biomass were at Rosetta (430 ind. /m^2, 105 gm/m^2) and Sahl El-Tina (780 ind. /m^2, 110 gm/m^2). Nematoda, Oligochaeta, Polychaeta, Amphipoda and bivalves were the common groups recorded among the identified species. Five species of Polychaeta are more frequent at Rosetta namely *Polydora* sp., *Cirratulus* sp., *Nephthys hombergi*, *Goniadae novegica* and *Lumbriconereis latreilli* with the total of 430 ind. /m^2. Amphipoda and Ophoiroidae at Rosetta at 50-100m depth recorded 50 and 30 ind. /m^2 respectively, (Table 1&2). Damiatta was devoid of any benthos but at El-Arish was very low density in benthos.

3.4.4. Oceanic zones (100-200 m depth)

The general picture of the density of bottom fauna is poor at these great depth stations. The density of fauna ranged from 40 to 140 ind. /m^2 at st.4 of Balteem. The biomass of benthos was quite appeared only at the previous station yielding 45 gm/m^2 in which embraced of Polychaeta, *Magelona papillicornis* and *Lumbriconereis latreilli* respectively.

3.5. Regional distribution of macrobenthos species during autumn 2008

During autumn 2008 a total of 31 species were identified from the different bottom samples. These species as listed in Table 3 included the following living groups namely, Algae (2 species), Bryozoa (2 species), Nematoda (1 species), Oligochaeta (1 species), Polychaeta (13 species), Harpactoids (1 species), Crustacea (Amphipoda, 4 species; Isopoda, 2 species and Anisopoda 1, species), Penaeidae (1 species), Bivalvia (2 species) and Ophoiroidae (1 species). Besides many species represented by empty shells of Gastropoda, bivalves, Echinoidae and unidentified species of Polychaeta.

3.5.1. Inner-Sublittoral zones (10-20 m depth)

The density number of individuals of bottom fauna was 1360 ind. /m^2 at Rosetta at st.1 as shown in Table (6). It reveals the regional differences in the densities of macrobenthos species. At Balteem, the density of macrobenthic communities attained 1730 ind. /m^2 and weighed 128 gm/m^2, while, it was 2310 ind. /m^2 and 187 gm/m^2 at El Arish as shown in Figure 2. While at El Arish and Balteem the bottom dwelling is less productive (150 and 170 ind. /m^2) with 30 and 2 gm/m^2.

3.5.2. Outer-Sublittoral zones (20-50 m depth)

The density and biomass of benthos increased greatly at Rosetta at st.2 attained 1570 ind./m^2 with 153 gm/m^2 that composed mainly from five groups namely; Nematoda (130 ind./m^2), Oligochaeta (160 ind./m^2), Polychaeta (770 ind./m^2), Amphipoda (140 ind./m^2), Anisopoda (120 ind./m^2) and Bivalves (250 ind./m^2), Table 4. At El Arish station , a high density and a high biomass of benthos yielded 2310 ind./m^2 and 187 gm/m^2, which composed of Polychaeta (350 ind./m^2) that included of *Prionospio cirrifera*, *Scolaricia* sp., *Perinereis* sp. *Lubriconereis latreilli* and *Onuphis erennata*, Harpactoids (660 ind./m^2). Amphipoda (530 ind. /m^2) that composed of *Elasmopus* sp., *Corophium* sp. and *Bathyporeia* sp. Crustacea, order Anisopoda (650 ind. /m^2) included *Apsuedes latreilei* at this station. They were 1430 ind. and 105 gm/m^2 at Gamasa, 1320 ind. and total biomass ranged between 130 and 132 gm/m^2 at sts. 2&3 of Sahl El-Tina and 270 ind. with 52 gm/m^2 at Abu-Khashaba (Tables 3&4).

3.5.3. Off shore zones (50-100 m depth)

The species composition and density of bottom fauna differed entirely at the different stations as shown in Table 3. At Gamasa station it shows highest number of Nematoda (500 ind./m^2), Polychaetes (300 ind./m^2) and Oligochaeta (180 ind./m^2) with 980 of the density number of ind./m^2 with 98 gm/m^2 of biomass as shown in Figure 3. The maximum density of macrobenthos groups at Rosetta was 1300 ind. /m^2 and biomass weighed 120 gm/m^2 from depth (65m). The number of different groups was 220, 210, 610, 150 and 110 for Nematoda, Oligochaeta, Polychaeta, Amphipoda and Ophoiroidae respectively. At Damiatta, the maximum density and biomass of benthic fauna were 700 ind. and 81 gm/m^2. It was embraced of Oligochaeta (100 ind.), Polychaeta (250 ind.) included Capetilledes, *polydora caeca* (60 ind.), *Serpula* sp. (40 ind.), *Sabella fabricii* (100 ind.) and 50 ind. of *Perinereis* sp., bivalves (350 ind.) included 200 ind. of *Scrobicularia* sp. and 150 ind. of *Corbula gibba*, (Table 3).

3.5.4. Oceanic zones (100-200 m depth)

At the Oceanic zone through the different sectors the density and composition of bottom dwelling invertebrates decreased greatly due to the depth and distance from the shore. The maximum density and biomass were 260 ind. and 52g/m^2 at Balteem. At Abu-Khashaba station, the sample did not contain any living organisms. At Rosetta it was failed to collect bottom samples at this sector.

4. Species diversity of benthic fauna

Shannon-s-Wiener index values (H^-) for the species diversity of macrobenthos showed a regular pattern at the different stations (Table, 7) and Figure 6. It was high at Balteem during summer which recorded H^-=0.09 and H^-=0.11 at Abu Khashaba during autumn, while it was low at Borollus during summer and autumn that attained H^-=0.02. If N is replaced by Nv which is the mean the total number of individuals in the different samples then the index values will be widely comparable with the correlation values between stations.

4. Discussion

The study area is subjected to a considerable amount of fresh water discharged from two main Nile Branches (Rosetta and Damiatta) and three main lakes (Edku, Borollus and Manzalah). Besides to several drains and waste products discharged directly to sea water namely, Gamasa, Damiatta, Sahl El-Tina and El-Arish. Therefore, the density and species composition of a marine ecosystem greatly varied along the eastern coast of Alexandria.

Samaan (1977) reported that the density of zooplankton was high during summer at Rosetta and Abu Qir and during autumn at the other sections. On the other hand, phytoplankton appeared in great density during autumn at Abu Qir sections and during the summer at the rest sections. According to El-Komi (1992) the inshore neritic waters of Abu Qir and Rosetta at less than 50m depths during December 1988, were more productive areas yielding an average of 1980 org/m^3, 113 mg/m^3 and 2943 org/m^3, 282 mg/m^3

respectively. Overall the zooplankton crop decreased at offshore 50-200 m and lowest at the oceanic zones (more than 200m). The present observation shows that the pattern of macrobenthos distribution was the same as in plankton. Their density is great in neritic zones (depth up to 100 m) and less in oceanic zones (depth of more than 100 m) and the macrobenthic communities are more productive during autumn rather than in summer at the eastern coast of Alexandria. The density and biomass of bottom benthos at the area extended from Matrouh to Al Arish were studied by El-Komi and Beltagy (1997) reporting that a total of 76 species of bottom invertebrate animals and 19 species of macro benthic algae were found during October 1994 and April 1995, while the dominant macro benthic species were represented by polychaetes (*Nereis, Glycera* and *Paraninoe),* bivalves *(Donax, Corbula* and *Macoma),* and echinoderm *(Ophiura).* Bottom fauna and flora were in general, denser in Abu Qir, Borollus and Damiatta sectors. They found that the densities of bottom fauna ranged between 13 and 167 ind./m^2 at the western region and 115 to 260 ind./m^2 at the eastern region during the fall and spring respectively. On the other hand, the corresponding biomass fluctuated from 3.2 to 8.5 g/m^2 at the western region and from 4.5 to 16.2 g/m^2 at the eastern one. The density was high in the neritic zones at depths of 10 to 100 meters and was low in the oceanic zones of more than 100 meters depth. The western region is less productive in macro benthic communities than in the eastern one due to type of sediments, lack of continental input and to the steep slope in continental shelf. The present work shows that the average densities of bottom fauna ranged among 30 and 970 ind./m^2 in summer and 150 to 2310 ind./m^2 in autumn. The corresponding biomass fluctuated from 24 to 135 gm/m^2 in summer and from 2 to 187 gm/m^2 in autumn. At Israel coast the biomass of benthos reached 8.16 g/m^2, (Gilat, 1964) while it attained 22 g/m^2 in the Baltic Sea (Anderson *et al*., 1976) and it ranged between 73 and 370 g/m^2 in Adriatic Sea (Fedra, 1976).

The soft bottom sandy mud is favorable for occurrence of epifauna, meiofauna and infauna forms. Borg and Schemberi (1995) emphasized that the biotype is the main factor determines the fauna constituent and density of different benthic communities and the responses of biotic and abiotic factors are secondary effecting. Sarda (1990) found that polychaetes zonation associated to the substrate by algae rather than of the direct influence of physical factors.

The effect of the environment factors on the distribution of three edible bivalves' species on the coast of New Caledonia was studied by Baron and Clavier (1992). This work shows that the composition of the substrate is greatly associated with their density and biomass values and mentioned that the temporal variation in the environmental limits has a marked in the intertidal zone.

Barnes (1982) concluded that the stability of the marine environment is greatly due to wave action, tides and vertical and horizontal ocean currents producing a continual mixing of sea water where dissolved gases and salts fluctuate little. Azov (1991) considered the levant basin is the most oligotrophic part of the Mediterranean Sea except too few coastal areas such having primary productivity ranged from 10 to 45 g C/m^2 day. He mentioned that the nutrients reservoir is very limited and layer mixing in east of the Mediterranean is very slowly. Affected on the primary productivity and the fisheries near Egyptian coasts decreased after the construction of the Aswan High Dam in 1965.

On the other hand, Somerfield *et al*., (1994) found that the overflow of waste water did not affect the benthic infauna in the estuary. Many epibenthic and tube-dwelling species may be responding differently to pollution events the endobenthic species. The difference in the monthly macrofauna and copepod is more obvious than on nematodes of natural population than the effects of the waste discharge. However, Pearce (1970) reported several species around the sludge deposits occurring in grater abundance than in natural communities, e.g., deposits feeder bivalve, *Nucula* and polychaetes, *Nephthys* and *Prionospio*.

Table 1: Regional distribution of macrobenthos density (ind./m^2) collected from the sampling sites at the Eastern coast of Alexandria during summer 2008.

		Rosetta				Abu-Khashaba		Borollus		
		St. 1	**St. 2**	**St. 3**	**St. 4**	**St. 1**	**St. 2**	**St. 1**	**St. 2**	**St. 3**
Depth		10	20	50	110	15	30	15	25	65
Groups	**Species**									
Algae	*Jania runeus*	c	c	-	-	c	-	f	-	-
	Ceramium rubrum	-	-	f	r	-	-	-	a	-
Bryozoa	*Bowerbankia gracilis*	-	-	c	-	r	-	c	-	-
	Scrupocellaria scruposa	-	c	-	f	-	c	-	f	-
Nematodes		-	60	90	-	-	-	-	-	-
Oligochaeta		50	60	80	-	-	-	-	-	-
Polychaeta	*Aricia* sp.	-	-	-	-	-	-	-	-	-
	Nainereis laevigata	-	-	-	-	-	-	-	-	-
	Prionospio cirrifera	-	-	-	-	-	-	-	50	-
	Scolaricia sp.	-	-	-	-	-	-	-	-	-
	Magelona papillicornis	-	-	-	-	-	30	20	30	-
	Capetilledes	-	60	60	-	-	-	50	-	-
	Polydora caeca	-	-	-	-	80	-	30	-	-
	Cirratulis sp.	-	-	30	-	-	-	-	-	-
	Serpula sp.	-	-	-	-	-	-	-	-	-
	Sabella fabricii	-	-	-	-	-	-	-	-	-
	Aphrodite aculeata	-	-	-	-	-	-	-	-	-
	Nephthys hombergii	30	50	40	-	-	-	-	-	-
	Glycera convoluta	-	-	-	-	-	-	-	-	-
	Goniada norvegica	-	-	20	-	-	-	-	-	-
	Perinereis sp.	-	-	-	-	-	-	-	-	-
	Syllis sp.	-	-	-	-	-	-	-	-	-
	Onuphis erennata	-	70	-	-	-	-	-	40	-
	Lubriconereis latreilli	-	80	30	-	70	-	-	-	-
Harpactoids		-	-	-	-	-	-	180	-	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	60	-	-	-
	Elasmopus sp.	190	50	50	-	-	-	-	-	-
	Corophium sp.	-	-	-	-	-	-	-	-	-
	Bathyporeia sp.	40	-	-	-	-	-	-	-	-
Isopoda	*Cirolena boreales*	-	-	-	-	-	-	-	40	-
	Anthura sp.	-	-	-	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	60	30	-	-	-	-	-	-	-
Penaeidae	Luciferidae	-	-	-	-	-	-	-	-	-
Bivalvia	*Scrobicularia* sp.	140	40	-	-	-	-	-	-	-
	Corbula gibba	-	30	-	-	-	-	-	-	-
Ophoiroidae	*Ophiopsila* sp.	-	-	30	-	-	-	-	-	-
No. of species		5	10	9	0	2	2	4	4	0
Density no. ind./m^2		510	530	430	0	150	90	280	160	0
Biomass gm/m^2		110	135	105	0	67	54	83	77	0

Table 1: Continued,

		Balteem				Gamasa			Damiatta		
		St.1	St.2	St.3	St.4	St.1	St.2	St.3	St. 1	St. 2	St.3
Depth		12	20	55	120	13	20	65	10	25	108
Groups	**Species**										
Algae	*Jania runeus*	-	c	-	-	c	c	-	c	-	-
	Ceramium rubrum	a	-	f	-	-	r	-	-	-	f
Bryozoa	*Bowerbankia gracilis*	c	-	-	r	c	-	-	-	f	-
	Scrupocellaria scruposa	-	c	-	-	-	r	-	c	-	-
Nematodes		-	-	-	-	560	330	230	120	-	-
Oligochaeta		60	-	-	-	110	120	80	-	-	-
Polychaeta	*Aricia* sp.	-	-	-	-	-	-	-	-	-	-
	Nainereis laevigata	-	-	-	-	-	-	-	-	-	-
	Prionospio cirrifera	20	-	-	-	-	-	-	-	-	-
	Scolaricia sp.	50	-	-	-	-	-	-	40	-	-
	Magelona papillicornis	30	110	-	40	-	50	-	-	-	-
	Capetilledes	-	30	-	-	-	-	-	-	-	-
	Polydora caeca	-	30	-	-	-	-	-	-	-	-
	Cirratulis sp.	-	-	-	-	-	-	-	-	-	-
	Serpula sp.	-	-	-	-	-	-	-	-	-	-
	Sabella fabricii	-	-	-	-	-	-	-	-	-	-
	Aphrodite aculeata	-	-	-	-	-	-	-	-	-	-
	Nephthys hombergii	-	-	-	-	-	-	90	-	-	-
	Glycera convoluta	-	-	-	-	-	-	-	-	-	-
	Goniada norvegica	-	-	-	-	-	-	-	-	-	-
	Perinereis sp.	-	-	-	-	-	-	-	-	-	-
	Syllis sp.	-	40	-	-	-	-	-	-	-	-
	Onuphis erennata	-	-	-	-	100	40	-	-	-	-
	Lubriconereis latreilli	-	50	-	140	-	-	-	-	-	-
Harpactoids		120	-	-	-	-	-	-	-	-	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	-	-	-	-	-
	Elasmopus sp.	-	-	-	-	-	-	-	-	-	-
	Corophium sp.	-	-	-	-	-	-	-	-	-	-
	Bathyporeia sp.	-	-	-	-	-	-	-	-	-	-
Isopoda	*Cirolena boreales*	-	-	-	-	-	-	-	-	-	-
	Anthura sp.	-	-	-	-	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	-	-	-	-	-	-	-	-	-	-
Penaeidae	Luciferidae	-	-	-	-	-	-	-	-	-	-
Bivalves	*Scrobicularia* sp.	-	-	-	-	-	-	-	-	-	-
	Corbula gibba	-	-	-	-	-	-	-	-	-	-
Ophoiroidae	*Ophiopsila aranea*	-	-	-	-	-	-	-	-	-	-
No. of species		5	5	0	2	3	4	3	2	0	0
Density no. ind./m^2		280	260	0	180	770	540	400	160	0	0
Biomass gm/m^2		64	52	0	45	114	80	57	32	0	0

Table 1: Continued

		Sahl El-Tina			El Arish		
		St. 1	**St. 2**	**St. 3**	**St. 1**	**St. 2**	**St. 3**
Depth		15	30	50	12	35	75
Groups	**Species**						
Algae	*Jania runeus*	C	f	-	c	f	-
	Ceramium rubrum	-	c	-	-	C	-
Bryozoa	*Bowerbankia gracilis*	C	c	-	c	f	-
	Scrupocellaria scruposa	-	f	-	-	C	-
Nematodes		-	190	520	170	-	-
Oligochaeta		-	80	-	-	-	-
Polychaeta	*Aricia* sp.	-	-	-	-	-	-
	Nainereis laevigata	-	-	-	-	-	-
	Prionospio cirrifera	-	-	-	-	-	-
	Scolaricia sp.	-	40	-	-	30	-
	Magelona papillicornis	-	70	-	-	-	-
	Capetilledes	-	-	-	-	-	-
	Polydora caeca	-	-	100	-	-	-
	Cirratulis sp.	-	-	-	-	-	-
	Serpula sp.	-	-	-	-	-	-
	Sabella fabricii	-	-	-	-	-	-
	Aphrodite aculeata	-	-	-	-	-	-
	Nephthys hombergii	-	60	-	-	-	-
	Glycera convoluta	-	30	90	30	-	-
	Goniada norvegica	-	-	30	-	-	-
	Perinereis sp.	-	-	-	-	-	-
	Syllis sp.	-	-	-	-	-	-
	Onuphis erennata	-	-	-	-	-	-
	Lubriconereis latreilli	-	-	-	-	-	-
Harpactoids		-	70	-	-	460	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	-
	Elasmopus sp.	-	-	-	-	-	-
	Corophium sp.	-	-	-	-	-	-
	Bathyporeia sp.	-	-	-	-	-	-
Isopoda	*Cirolena boreales*	-	-	40	-	-	-
	Anthura sp.	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	280	150	-	320	460	-
Penaeidae	Luciferidae	-	-	-	30	-	-
Bivalves	*Scrobicularia* sp.	-	-	-	-	-	-
	Corbula gibba	-	-	-	-	-	-
Ophoiroidae	*Ophiopsila aranea*	-	-	-	-	20	30
No. of species		1	7	5	4	4	1
Density no. of ind./m^2		280	690	780	550	970	30
Biomass gm/m^2		80	103	110	91	125	24

a: Abundant, c: Common, f: Frequent, r: Rare Density no. of ind./m^2 : no. ind./m^2 Biomass gm/m^2: wet weight (gm/m^2)

Table 2: Regional distribution of macrobenthos density (ind. /m^2) collected from the sampling sites at the Eastern coast of Alexandria during summer 2008.

	Rosetta			Abu-khashaba			Borollus			Balteem		
	St.1	St.2	St.3	St.4	St.1	St.2	St.1	St.2	St.3	St.1	St.2	St.3
Groups/depth	10	20	50	110	15	30	15	25	65	12	20	55
Algae	c	c	f	r	c	-	f	a	-	a	c	f
Bryozoa	-	c	c	f	r	c	c	f	-	c	c	-
Nematodes	-	60	90	-	-	-	-	-	-	-	-	-
Oligochaeta	50	60	80	-	-	-	-	-	-	60	-	-
Polychaeta	30	260	180	0	150	30	100	120	0	100	260	0
Harpactoids	-	-	-	-	-	-	180	-	-	120	-	-
Amphipoda	230	50	50	-	-	60	-	-	-	-	-	-
Isopoda	-	-	-	-	-	-	-	40	-	-	-	-
Anisopoda	60	30	-	-	-	-	-	-	-	-	-	-
Penaeidae	-	-	-	-	-	-	-	-	-	-	-	-
Bivalvia	140	70	-	-	-	-	-	-	-	-	-	-
Ophoiroidae	-	-	30	-	-	-	-	-	-	-	-	-
total ind./m^2	510	530	430	0	150	90	280	160	0	280	260	0
total gm/m^2	110	135	105	0	67	54	83	77	0	64	52	0
No. of species	5	10	9	0	2	2	4	4	0	5	5	0

	Gamasa			Damiatta			Sahl El-Tina			El Arish			Average	%
	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3	ind./m^2	
Groups/depth	13	20	65	10	25	108	15	30	50	12	35	75		
Algae	c	c	-	c	-	f	c	c	-	c	c	-		
Bryozoa	c	r	-	c	f	-	c	c	-	c	c	-		
Nematodes	560	330	230	120	-	-	-	190	520	170	-	-	94.58	28.2%
Oligochaeta	110	120	80	-	-	-	-	80	-	-	-	-	26.67	8.0%
Polychaeta	100	90	90	40	0	0	0	200	220	30	30	0	92.08	27.5%
Harpactoids	-	-	-	-	-	-	-	70	-	-	460	-	34.58	10.3%
Amphipoda	-	-	-	-	-	-	-	-	-	-	-	-	16.25	4.9%
Isopoda	-	-	-	-	-	-	-	-	40	-	-	-	3.33	1.0%
Anisopoda	-	-	-	-	-	-	280	150	-	320	460	-	54.17	16.2%
Penaeidae	-	-	-	-	-	-	-	-	-	30	-	-	1.25	0.4%
Bivalvia	-	-	-	-	-	-	-	-	-	-	-	-	2.92	0.9%
Ophoiroidae	-	-	-	-	-	-	-	-	-	-	20	30	3.33	1.0%
total ind./m^2	770	540	400	160	0	0	280	690	780	550	970	30	335.0	100.0%
total gm/m^2	114	80	57	32	0	0	80	103	110	91	125	24		
No. of species	3	4	3	2	0	0	1	7	5	4	4	1		

Table 3: Regional distribution of macrobenthos density ((ind./m^2) collected from the sampling sites at the Eastern coast of Alexandria during autumn 2008.

		Rosetta				Abu-Khashaba		Borollus		
		St. 1	**St. 2**	**St. 3**	**St. 4**	**St. 1**	**St. 2**	**St. 1**	**St. 2**	**St. 3**
Depth		10	20	50	110	15	30	15	25	65
Groups	**Species**									
Algae	*Jania runeus*	a	-	f	-	C	-	c	-	-
	Ceramium rubrum	c	-	f	-	-	c	-	F	f
Bryozoa	*Bowerbankia gracilis*	-	c	-	-	-	c	-	-	-
	Scrupocellaria scruposa	-	-	r	-	-	-	c	F	-
Nematodes		-	130	220	-	-	-	-	-	-
Oligochaeta		150	160	210	-	-	-	-	-	-
Polychaeta	*Aricia* sp.									
	Nainereis laevigata									
	Prionospio	-	-	-	-	-	-	-	-	-
	cirrifera	-	-	-	-	-	-	-	-	-
	Scolaricia sp.	-	-	-	-	-	-	-	-	-
	Magelona	-	-	-	-	-	-	-	-	-
	papillicornis	110	-	-	-	-	100	90	110	-
	Capetilledes	-	150	140	-	-	-	130	-	-
	Polydora caeca	130	-	-	-	170	-	120	-	-
	Cirratulis sp.	-	-	80	-	-	-	-	-	-
	Serpula sp.	-	140	-	-	-	-	-	-	-
	Sabella fabricii	-	-	-	-	-	-	-	-	-
	Aphrodite aculeata	-	-	-	-	-	-	-	-	-
	Nephthys	120	170	160	-	110	-	-	-	-
	hombergii	-	-	-	-	-	-	-	-	-
	Glycera convoluta	-	-	120	-	-	-	-	-	-
	Goniada	-	-	-	-	-	-	-	-	-
	norvegica	-	-	-	-	-	-	-	-	-
	Perinereis sp.	-	160	-	-	-	-	-	130	-
	Syllis sp.	-	150	110	-	170	30	100	120	-
	Onuphis erennata									
	Lubriconereis latreilli									
Harpactoids		-	-	-	-	-	-	270	-	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	140	-	-	-
	Elasmopus sp.	300	140	150	-	-	-	-	-	-
	Corophium sp.	-	-	-	-	-	-	-	-	-
	Bathyporeia sp.	130	-	-	-	-	-	-	-	-
Isopoda	*Cirolena boreales*	-	-	-	-	-	-	-	140	-
	Anthura sp.	-	-	-	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	170	120	-	-	-	-	-	-	-
Penaeidae	Luciferidae	-	-	-	-	-	-	-	-	-
Bivalvia	*Scrobicularia* sp.	250	130	-	-	-	-	-	-	-
	Corbula gibba	-	120	-	-	-	-	-	-	-
Ophoiroidae	*Ophiopsila* sp.	-	-	110	-	-	-	-	-	-
No. of species		8	11	9	0	3	3	5	4	0
Density no. ind./m^2		1360	1570	1300	0	450	270	710	500	0
Biomass gm/m^2		135	153	120	0	70	52	65	66	0

Table 3: Continued

		Balteem				Gamasa			Damiatta		
		St. 1	St. 2	St. 3	St. 4	St. 1	St. 2	St. 3	St. 1	St. 2	St.3
Depth		12	20	55	120	13	20	65	10	25	108
Groups	**Species**										
Algae	*Jania runeus*	c	-	f	-	-	r	R	C	-	-
	Ceramium rubrum	-	a	-	-	-	-	-	-	c	f
Bryozoa	*Bowerbankia gracilis*	a	c	-	-	c	-	C	R	-	-
	Scrupocellaria scruposa	-	-	f	-	-	c	-	-	r	f
Nematodes		-	-	-	-	850	600	500	350	-	-
Oligochaeta		150	270	-	-	200	230	180	430	-	100
Polychaeta	*Aricia* sp.	-	-	-	-	-	-	-	-	-	-
	Nainereis laevigata	-	-	-	-	-	-	-	-	-	-
	Prionospio cirrifera	80	-	-	-	-	-	-	-	-	-
	Scolaricia sp.	100	-	-	-	-	-	-	90	-	-
	Magelona papillicornis	130	140	-	60	-	90	-	-	-	-
	Capetilledes	-	60	-	-	-	-	-	120	-	-
	Polydora caeca	60	50	-	-	-	120	-	-	-	60
	Cirratulis sp.	70	-	-	-	-	-	-	110	-	-
	Serpula sp.	120	-	-	-	-	110	-	-	-	40
	Sabella fabricii	-	-	-	-	-	-	-	-	-	100
	Aphrodite aculeata	-	-	-	-	-	-	-	-	-	-
	Nephthys hombergii	-	140	-	-	-	-	210	-	-	-
	Glycera convoluta	-	-	-	-	-	-	-	-	-	-
	Goniada norvegica	-	-	-	-	-	-	-	-	-	-
	Perinereis sp.	-	100	-	-	-	-	-	-	-	-
	Syllis sp.	-	70	-	-	-	-	-	-	-	50
	Onuphis erennata	-	-	-	-	120	80	-	-	-	-
	Lubriconereis latreilli	100	110	-	200	100	90	90	400	-	-
Harpactoids		160	-	-	-	-	110	-	-	-	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	-	-	-	-	-
	Elasmopus sp.	250	-	170	-	-	-	-	-	-	-
	Corophium sp.	180	-	150	-	-	-	-	-	-	-
	Bathyporeia sp.	200	-	-	-	-	-	-	-	-	-
Isopoda	*Cirolena boreales*	-	-	100	-	-	-	-	-	-	-
	Anthura sp.	130	-	-	-	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	-	-	-	-	-	-	-	-	-	-
Penaeidae	Luciferidae	-	-	-	-	-	-	-	-	-	-
Bivalves	*Scrobicularia* sp.	-	-	-	-	-	-	-	-	-	200
	Corbula gibba	-	-	-	-	-	-	-	-	-	150
Ophoiroidae	*Ophiopsila aranea*	-	-	-	-	-	-	-	-	-	-
No. of species		13	10	1	2	5	7	4	5	0	7
Density no. of ind./m^2		1730	1190	170	260	1270	1430	980	1140	0	700
Biomass gm/m^2		128	110	2	52	117	105	98	96	0	81

Table 3: Continued

		Sahl El-Tina			El Arish		
		St. 1	**St. 2**	**St. 3**	**St. 1**	**St. 2**	**St. 3**
Depth		15	30	50	12	35	75
Groups	**Species**						
Algae	*Jania runeus*	c	-	f	c	-	f
	Ceramium rubrum	-	c	r	C	-	R
Bryozoa	*Bowerbankia gracilis*	c	-	f	c	-	f
	Scrupocellaria scruposa	-	c	-	-	r	-
Nematodes		-	230	640	240	-	-
Oligochaeta		-	210	-	-	-	-
Polychaeta	*Aricia* sp.	-	-	-	-	-	-
	Nainereis laevigata	-	-	-	-	-	-
	Prionospio cirrifera	-	-	-	-	110	-
	Scolaricia sp.	-	90	-	-	70	-
	Magelona	-	150	-	-	-	-
	papillicornis	-	-	-	-	-	-
	Capetilledes	-	-	160	-	-	-
	Polydora caeca	-	-	-	-	-	-
	Cirratulis sp.	-	-	-	-	-	-
	Serpula sp.	-	-	-	-	-	-
	Sabella fabricii	-	-	-	-	-	-
	Aphrodite aculeata	-	130	-	-	-	-
	Nephthys hombergii	-	80	150	90	-	-
	Glycera convoluta	-	-	80	-	-	-
	Goniada norvegica	-	-	-	-	50	-
	Perinereis sp.	-	-	-	-	-	-
	Syllis sp.	-	-	-	-	50	-
	Onuphis erennata	-	-	-	-	70	-
	Lubriconereis latreilli						
Harpactoids		130	-	-	-	660	-
Amphipoda	*Gammarus* sp.	-	-	-	-	-	-
	Elasmopus sp.	100	-	-	-	130	-
	Corophium sp.	200	-	-	-	210	-
	Bathyporeia sp.	170	-	-	-	190	-
Isopoda	*Cirolena boreales*	-	-	120	-	-	-
	Anthura sp.	-	-	-	-	-	-
Anisopoda	*Apsuedes latreilei*	370	280	-	510	650	-
Penaeidae	Luciferidae	-	-	-	110	-	-
Bivalves	*Scrobicularia* sp.	-	-	-	-	-	-
	Corbula gibba	-	-	-	-	-	-
Ophoiroidae	*Ophiopsila aranea*	-	-	-	-	120	150
No. of Species		5	7	5	4	10	1
Density no. of ind./m^2		970	1170	1150	950	2310	150
Biomass gm/m^2		120	132	130	110	187	30

a: Abundant, c: Common, f: Frequent, r: Rare
Density no. of ind./m^2: no. ind./m^2 Biomass gm/m^2: wet weight (gm/m^2)

Table 4: Regional distribution of macrobenthos density (ind./m^2) collected from the sampling sites at the Eastern coast of Alexandria during autumn 2008.

	Rosetta				**Abu-khashaba**		**Borollus**			**Balteem**			
Groups/depth	**St.1** 10	**St.2** 20	**St.3** 50	**St.4** 110	**St.1** 15	**St.2** 30	**St.1** 15	**St.2** 25	**St.3** 65	**St.1** 12	**St.2** 20	**St.3** 55	**St.4** 120
Algae	a	-	f	-	c	c	c	f	f	a	a	f	-
Bryozoa	-	c	r	-	-	c	-	-	-	a	c	-	-
Nematodes	-	130	220	-	-	-	-	-	-	-	-	-	-
Oligochaeta	150	160	210	-	-	-	-	-	-	150	270	-	-
Polychaeta	360	770	610	0	450	130	440	360	0	660	670	0	260
Harpactoids	-	-	-	-	-	-	270	-	-	160			
Amphipoda	430	140	150	-	-	140	-	-	-	430	-	320	-
Isopoda	-	-	-	-	-	-	-	140	-	200	-	-	-
Anisopoda	170	120	-	-	-	-	-	-	-	130	-	-	-
Penaeidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Bivalvia	250	250	-	-	-	-	-	-	-	-	-	-	-
Ophoiroidae	-	-	110	-	-	-	-	-	-	-	-	-	-
Density no. ind./m^2	1360	1570	1300	0	450	270	710	500	0	1730	1190	170	260
Biomass gm/m^2	135	153	120	0	70	52	65	66	0	128	110	2	52
No. of species	8	11	9	0	3	3	5	4	0	13	10	1	2

	Gamasa			**Damiatta**			**Sahl El-Tina**			**El Arish**			**Average**	**%**
	St.1	**St.2**	**St.3**	**St.1**	**St.2**	**St.3**	**St.1**	**St.2**	**St.3**	**St.1**	**St.2**	**St.3**	Ind./m^2	
Groups/depth	13	20	65	10	25	108	15	30	50	12	35	75		
Algae	-	c	c	c	-	f	c	-	f	c	-	f		
Bryozoa	c	-	c	r	-	-	c	-	f	c	-	f		
Nematodes	850	600	500	350	-	-	-	230	640	240	-	-	150.4	18.5%
Oligochaeta	200	230	180	430	-	100	-	210	-	-	-	-	91.6	11.2%
Polychaeta	220	490	300	720	0	250	0	450	390	90	350	-	318.8	39.1%
Harpactoids		110				-	130	-	-	-	660	-	53.2	6.5%
Amphipoda	-		-	-	-	-	-	-	-	-	530	-	85.6	10.5%
Isopoda	-	-	-	-	-	-	-	-	120	-	-	-	18.4	2.3%
Anisopoda	-	-	-	-	-	-	370	280	-	510	650	-	89.2	10.9%
Penaeidae	-	-	-	-	-	-	-	-	-	110	-	-	4.4	0.5%
Bivalvia	-	-	-	-	-	200	-	-	-	-	-	-	28	3.4%
Ophoiroidae	-	-	-	-	-	150	-	-	-	-	120	150	21.2	2.6%
Density no. ind./m^2	1270	1430	980	1140	0	700	970	1170	1150	950	2310	150	815	100%
Biomass gm/m^2	117	105	98	96	0	81	120	132	130	110	187	30		
No. of species	5	7	4	5	0	7	5	7	5	4	10	1		

Table 5: Regional variations of benthic density, biomass and number of species during summer, 2008.

Stations	Depth (m)	Density No. ind./m^2	Biomass gm/m^2	No. of species
Rosetta				
1	10	510	110	5
2	20	530	135	10
3	50	430	105	9
4	110	0	0	0
Abu-Khashaba				
1	15	150	67	2
2	30	90	54	2
Borollus				
1	15	280	83	4
2	25	160	77	4
3	65	0	0	0
Balteem				
1	12	280	64	5
2	20	260	52	5
3	55	0	0	0
4	120	180	45	2
Gamasa				
1	13	770	114	3
2	20	540	80	4
3	65	400	57	3
Damiatta				
1	10	160	32	2
2	25	0	0	0
3	108	0	0	0
Sahl El-Tina				
1	15	280	80	1
2	30	690	103	7
3	50	780	110	5
El Arish				
1	1	550	91	4
2	35	970	125	4
3	75	30	24	1

Table 6: Regional variations of benthic density, biomass and number of species during autumn, 2008.

Stations	Depth (m)	Density No. ind./m^2	Biomass gm/m^2	No. of species
Rosetta				
1	10	1360	135	8
2	20	1570	153	11
3	50	1300	120	9
4	110	0	0	0
Abu-Khashaba				
1	15	450	70	3
2	30	270	52	3
Borollus				
1	15	710	65	5
2	25	500	66	4
3	65	0	0	0
Balteem				
1	12	1730	128	13
2	20	1190	110	10
3	55	170	2	1
4	120	260	52	2
Gamasa				
1	13	1270	117	5
2	20	1430	105	7
3	65	980	98	4
Damiatta				
1	10	1140	96	5
2	25	0	0	0
3	108	700	81	7
Sahl El-Tina				
1	15	970	120	5
2	30	1170	132	7
3	50	1150	130	5
El Arish				
1	1	950	110	4
2	35	2310	187	10
3	75	150	30	1

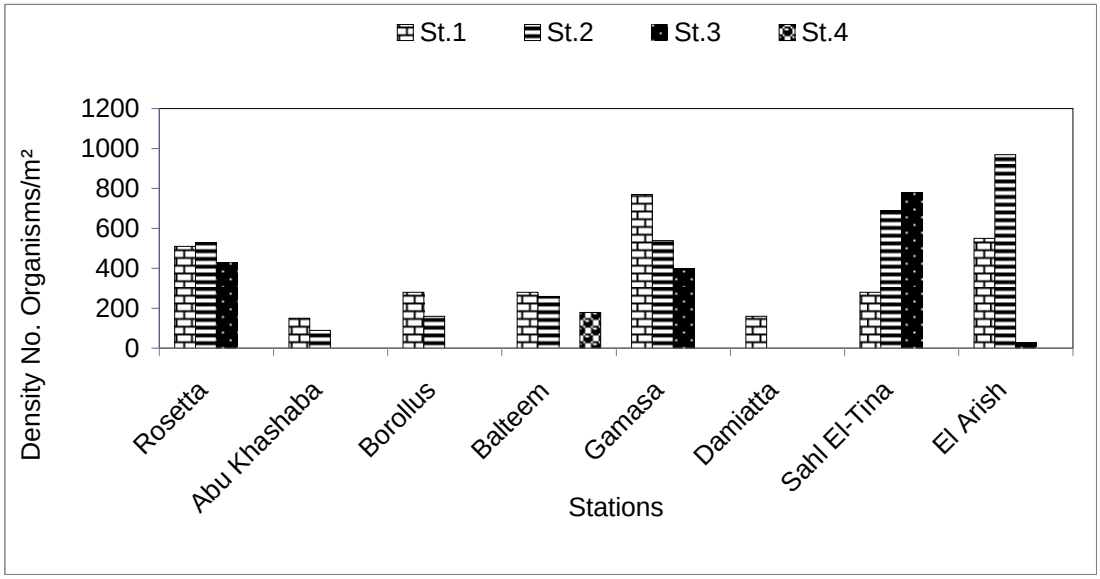

Figure 2: Regional distribution of macrobenthos density (no. of ind./m^2) at the different stations during summer, 2008.

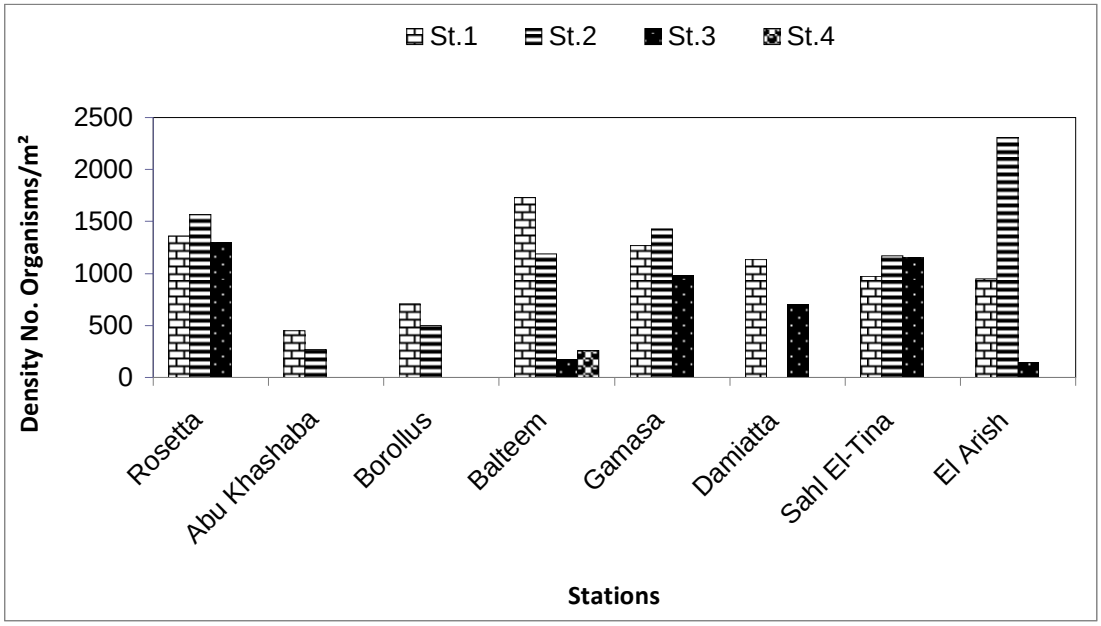

Figure 3: Regional distribution of macrobenthos density (no. of ind./m^2) at the different stations during autumn, 2008.

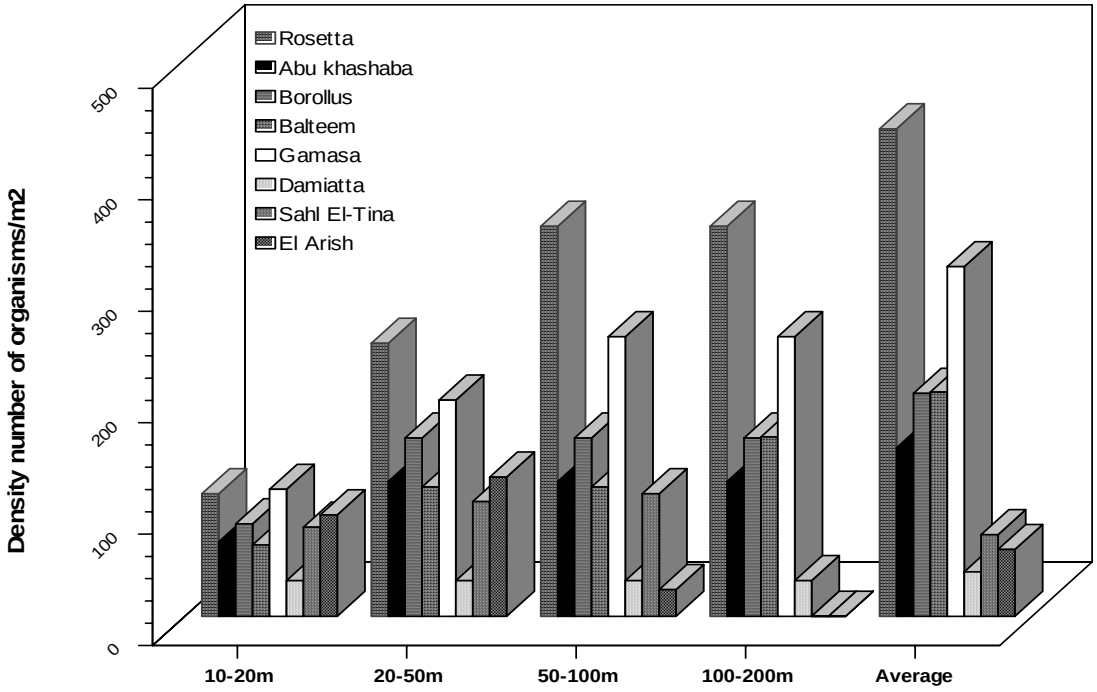

Figure 4: Regional distribution of macrobenthos biomass (gm/m^2) at the different stations during summer 2008.

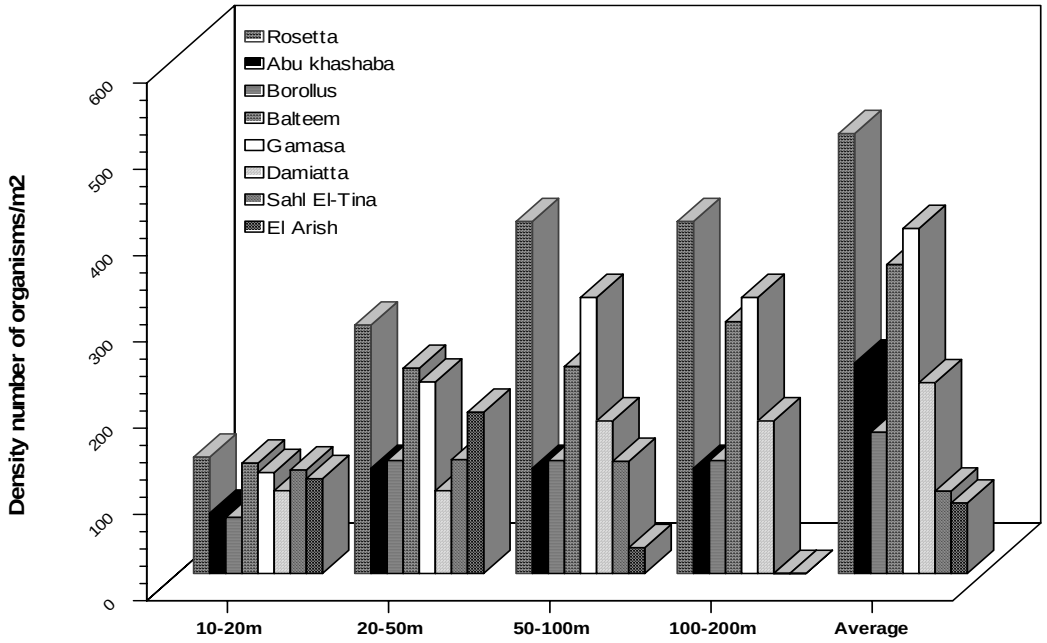

Figure 5: Regional distribution of macrobenthos biomass (gm/m^2) at the different stations during autumn 2008.

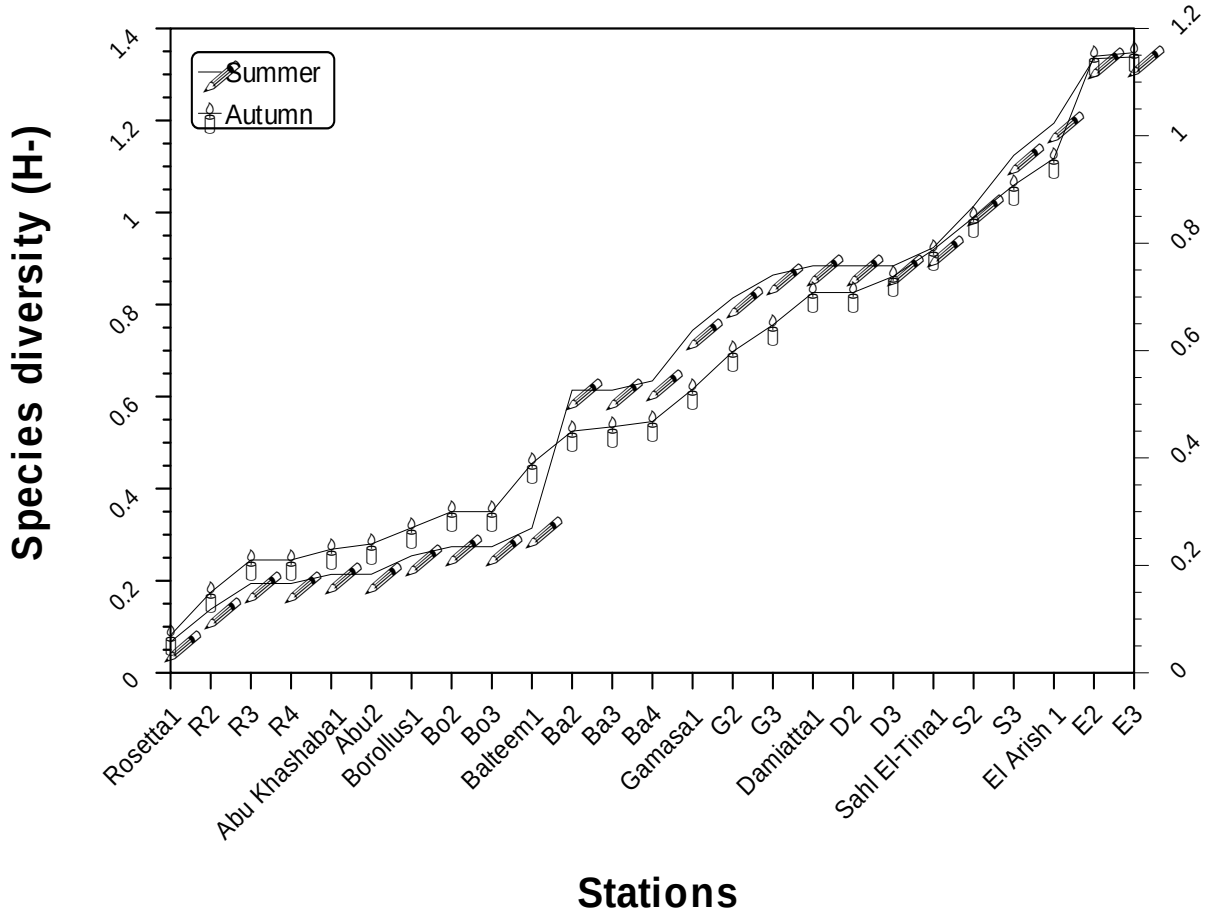

Figure 6: Shannon-Wiener index for the species diversity of benthos at the different stations during summer and autumn, 2008.

Table 7: Shannon-Wiener index (H^-) for the species diversity of benthos at the different stations during summer and autumn, 2008 of the Eastern coast of the Mediterranean Harbour.

Parameter	Depth (m)	Species diversity (H^-)	
Stations		Summer	Autumn
Rosetta			
R1	10	0.067	0.07
R2	20	0.071	0.08
R3	50	0.056	0.06
R4	110	0	0
Abu-Khashaba			
Abu1	15	0.02	0.02
Abu2	30	0.0001	0.01
Borollus			
Bo1	15	0.04	0.03
Bo2	25	0.02	0.03
Bo3	65	0	0
Balteem			
Ba1	12	0.04	0.09
Ba2	20	0.3	0.06
Ba3	55	0	0.008
Ba4	120	0.02	0.01
Gamasa			
G1	13	0.11	0.06
G2	20	0.07	0.07
G3	65	0.05	0.05
Damiatta			
D1	10	0.02	0.06
D2	25	0	0
D3	108	0	0.03
Sahl El-Tina			
S1	15	0.04	0.05
S2	30	0.09	0.06
S3	50	0.11	0.06
El Arish			
E1	1	0.07	0.05
E2	35	0.14	0.19
E3	75	0.004	0.007

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دراسات بيئية عن كائنات القاع البحرية بالساحل الشرقي بالإسكندرية - مصر

أحمد محمد عمارة

المعهد القومى لعلوم البحار والمصايد فرع خليجى السويس والعقبة

لقد تناولت الدراسة التوزيع الموسمي والتغيرات البيئية على مستوى سيادة وانتشار الأنواع المختلفة بالإضافة إلى التباين النوعى لكائنات القاع البحرية بالساحل الشرقي بالإسكندرية حيث تم تجميع العينات من 8 محطات مختلفة وهى: رشيد- أبو خشبة- البرلس- بلطيم- جمسة- دمياط - سهل الطينة- العريش خلال موسمي الصيف والخريف 2008م.

لوحظ أن كائنات القاع البحرية فى موسم الخريف كانت إلى حد ما هى الأكثر من حيث عدد الأنواع حيث سجلت 31 نوعا من 11 مجموعة مختلفة من القاعيات

(Oligochaeta, Polychaeta, Harpactoids, Amphipoda, Bryozoa, Nematoda, Isopoda, Anisopoda Penaeidae, Bivalvia, and Ophoiroidae)

بما فيه من نوعين من الطحالب القاعية، أما فى موسم الصيف فقد تميزت هذه الكائنات بقلة فى الكثافة النوعية والعددية حيث سجلت 27 نوعا من القاعيات البحرية مشتملا على نوعين من الطحالب القاعية فى الثمانية محطات المختلفة بمنطقة الدراسة.

وقد أظهرت الدراسة وجود الأنواع السائدة التالية من هذة الكائنات فى منطقة الدراسة والتى شملت الديدان عديدة الأشواك وهى:

(Prionospio cirrifera, Scolaricia sp., *Magelona papillicornis;* **Capetilledes,** *Polydora caeca, Cirratulis* sp., *Serpula* sp., *Sabella fabricii, Aphrodite aculeate, Nephthys hombergii, Glycera convoluta, Goniada norvegica, Perinereis* sp., *Syllis* sp., *Onuphis erennata and Lubriconereis latreilli).* ونوعين من الرخويات من فصيلة ذوات المصرعين وهما *Scrobicularia* sp. and *Corbula gibba* *والجلدشوكيات ممثلة بنوع واحد وهو Ophiopsila aranea*. وقد أظهرت الدراسة أن كلا من محطتي جمسة وسهل الطينة هما الأكثر كثافة لكائنات القاع البحرية فى موسم الصيف وكلا من محطتي رشيد وجمسة فى موسم الخريف. أما محطة العريش فإن كثافتها تراوحت بين 30 and 970 ind./m^2 فى موسم الصيف وبين 150 to 2310 ind./m^2 فى موسم الخريف بالساحل الشرقي بالإسكندرية 2008م. فقد كانت الكثافة الكلية عالية فى المنطقة الساحلية

الفرعية الداخلية والخارجية على عمق يتراوح بين 10 و 100 متر ومنخفضة فى المنطقة المحيطية لأكثر من 100 متر عمق.

أما بالنسبة لمجموعات كائنات القاع البحرية فقد تراوح التباين النوعي فى المحطات المختلفة فكان عاليا فى محطة بلطيم حيث سجلت H^{-}=0.09 خلال موسم الصيف وأيضا فى محطة أبو خشبة حيث سجلت H^{-} =0.11 فى موسم الخريف، ومنخفضا فى محطة البرلس حيث سجلت H^{-}=0.02 فى موسمي الصيف والخريف 2008م.