

Polychaete Study in Northeastern Mediterranean Coast of Egypt

Faiza A. Abd-Elnaby

National Institute of Oceanography and Fisheries, Alexandria, Egypt

Abstract: Within the frame work, organized by the National Institute of Oceanography and Fisheries, Alexandria, Egypt. 15 quantitative samples collected by using Van Veen grab from the soft bottom, depth ranging from 12m to 106 m and distributed over two seasons (spring and summer, 2008) were collected during two trips to the Northeastern coast of the Egyptian Mediterranean waters, from El Tina Bay, Balteem, Abokhashaba and Gamasa. The analysis of samples resulted 108 Polychaete species belonging to 25 families and 61 genera. More than 50 species were considered new for Egyptian Mediterranean waters. Data were analyzed with univariate techniques (Diversity, Richness and Evenness or Equitabilty). Results showed that, species richness and abundance were lower in the deeper samples and higher in spring than in summer season. The feeding guild classification was examined. Also the relation between different depths and feeding guild were reported. A total of nine main feeding categories were identified. There were more significant associations between feeding guild and depth. Also the analysis revealed the dominance of surface deposit feeding with slightly fewer Omnivores and micro herbivores. This work, indicating that the polychaetes of the study area are quite diverse and poorly in number of individuals and great number of newly recorded species was reported.

Key words: Polychaetes % Northeastern Coast of Egypt % Univariate analysis % Biodiversity % Feeding Guild

INTRODUCTION

Polychaetes occur in almost all benthic marine and estuarine sediments [1] and are often the dominant component of the macrobenthos both in terms of number of species and individuals [2, 3]. Polychaetes also accounted for most of the diversity and abundance of the infauna communities at the sandy site, but were less numerically important at the muddy site [4].

Polychaetes research in the Mediterranean started at the beginning of 19th century with the works of Savigny and Phillip. Until now, the Med. Sea hosts an estimate of 1037 polychaete species, account for 10% of the total world polychaetes [5]. Polychaetes research in the Eastern Med. largely focused on the family Serpulidae and the phenomenon of Lessepsian migration [6], while polychaetes investigations in the Egyptian Med. coast were concentrated on Alexandria region and Northwestern coast of Egypt. The first study has been done on the collections made by Steuer in 1933 and published by Fauvel [7], then polychaetes were identified by Selim [8] from the Eastern Harbour Alexandria, followed by other studies by Selim and Abd ElNaby [9,10] and other publications by the same authors.

Polychaetes in both soft and hard bottom of the Northeastern coast of Egypt were not studied

before, therefore seasonal trips organized by National Institute of Oceanography and Fisheries, Alexandria branch were done to study this new area to fill this gap. This researches will help also to re-valuate taxonomy as a central discipline for the study of biodiversity [11].

Polychaetes are often classified according to their diverse feeding guilds. They play a major role in the functioning of benthic communities in terms of recycling and reworking of benthic sediments bioturbating sediments and in the burial of organic matter. Some species form dense tubicolous colonies which can radically change recruitment patterns of other infaunal organisms. Polychaetes, by their burrowing and feeding activity, may considerably enhance various sedimentary processes [3].

Many areas in Egypt were not studied before, therefore, this paper aims to investigate about the polychaetes in the Northeastern coast of Egypt in relation to their feeding category.

MATERIAL AND METHODS

Sediment samples were collected by Van Veen grab from the northeastern coastal waters of Egypt; from El Tina Bay, Balteem, Abokhashaba and Gamasa (Fig.1).

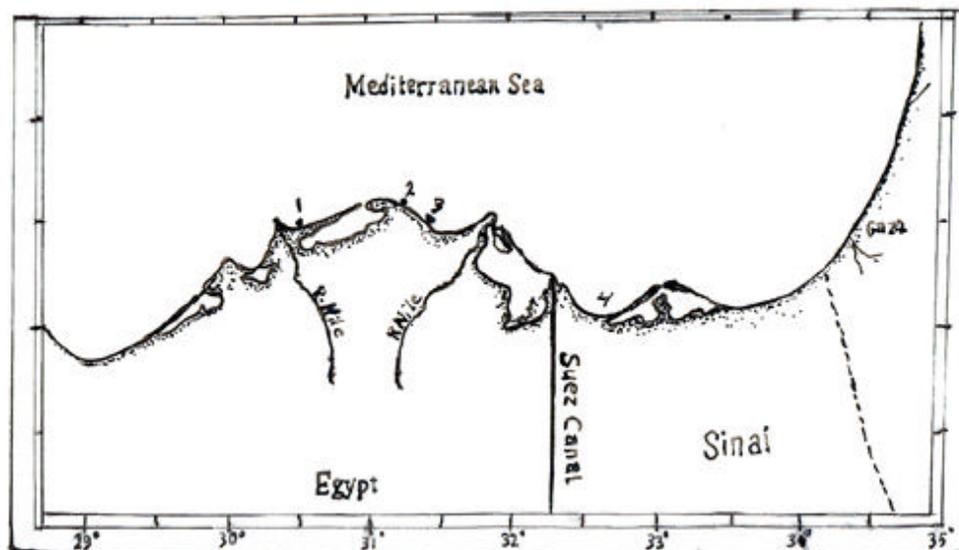


Fig. 1: Map of north Egypt showing the locations of sampling sites. 1= Abokhashaba, 2= Balteem, 3= Gamasa and 4= El Tina Bay

Within two seasons Spring and Summer 2008. This study is part of a programme concerning studying the Mediterranean coast of Egypt, the trips were carried out on board the R/V " Salsabeel". Sediment samples were washed and sieved through 0.5 mm sieve, then sorted by using stereo microscope. The extracted polychaete species were fixed in 10% formaldehyde-sea water solution. Each was identified as possible to species level; univariate techniques (Diversity, Richness and Evenness or Equitability), these were calculated on the basis of the Shannon Wiener [12], Margalef's equation [13] and Pielou [14] respectively. The feeding guild classification was reported according to the classification of [15].

RESULTS

A total of 1986 individuals of polychaetes belonging to 108 taxa, 61 genera within 25 families, from the total samples were collected which representing one of the most dominant groups. More than 57 species were considered new records to Mediterranean Egyptian waters (Table 1).

The most common families were Maldanidae, Paraonidae, Spionidae and Lumbrineridae both in terms of abundance and species richness. Maldanidae was the most diversified family, comprising 12 species followed by Spionidae 11 species, Capitillidae and Paraonidae, both have 10 species. Also, Cirratulidae and Nephtyidae

were represented by 7 species. Some new families were recorded for the first time in the Egyptian waters such as Onuphidae, Owenidae, Pilargidae, Pectinaridae and Flabelligeridae. They were represented by low number of species in such study area. About 53 species appeared once a time once in each site and not repeated again such as *Aricidea wassi*, *Prionospio (prionospio) steenstrupi* and *Aricidea (Acmira) lopezi*. Some species were constant throughout the period of study, while others were transient in one or more stations.

Lumbrineris inflata, *L. latreilli* and *Aricidea wassi* showed a high diversity and they were the most abundant species which made this genus dominant, their abundance may indicate a high reproductive potential of such species throughout the year.

Polychaetes were represented by small numbers of species in most sites and their numerical density was markedly low. Clear differences in species richness of polychaetes were reported among the sampled sites. Number (15), El Tina Bay (with depth 30 m) was the most diversified site (38 species), followed by number 6 (depth 34 m), with 23 species and the diversity index values ranged from 0.637 to 3.545 (Fig. 3, Table 2).

Richness fluctuated widely between 0.346 to 6.286. the variation is (Fig. 5, Table 2) approximately similar to that of diversity index, except it slight decrease in site (3, 8 and 10). Values of equitability fall within the range of 0.619-0.676 and showed a narrow variations (Fig. 4, Table 2).

Table 1: Distribution of Polychaetes in Different Stations with the Period of Study and their Feeding Guild

Family/Species	Feeding Guild	Summer 2008									Spring 2008					
		Abu Khashaba			Gamasa			Baltim			Tina Bay			Tina Bay		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1- Family Ampharetidae Malmgren, 1866																
<i>*Melinna palmate</i> Grube, 1870	CM															5
<i>*Melinna cristata</i> (Sars, 1851)	CM															7
<i>Melinna monocerooides</i> Fauvel, 1936	CM															
2- Family Arnicolidae Johnston, 1835																
<i>Branchiomaldane vincenti</i> Langerhans, 1881	CM															12
<i>Arenicola marina</i> Saint- Joseph, 1894.	CM								7							
3- Family Capitillidae Grube, 1862																
<i>*Pulliella armata</i> Fauvel, 1929	SDF															18
<i>Heteromastus filiformis</i> (Claparede, 1864)	SDF															12
<i>*Capitella jonesi</i>	SDF															6
<i>*Notomastus lineatus</i> Claparede, 1868	SDF					12										6 6
<i>*Noenotomastus bioculatus</i>	SDF					24										12
<i>*Notomastus profundus</i> Eisig, 1887	SDF															12
<i>*Notomastus latericeus</i> Sars, 1851	SDF															18
<i>*Pseudoleiocapitella fauveli</i> Day, 1955	SDF			12			3									
<i>Capitella giardi</i> Mesnil, 1897	SDF						6	9	6							
<i>*Leiocapitellides analis</i> Hartmann-Scroder, 1960.	SDF															
4- Family Cirratulida Ryckholdt, 1851																
<i>Cirriformia tentaculata</i> (Montagu, 1808)	SDF															30
<i>Cirriformia filigera</i> (Delle Chiaje, 1825)	SDF															18 12
<i>Chaetozone setosa</i> Malmgren, 1867	SDF			12												
<i>Caulleriella bioculatus</i> keferstein, 1862	SDF						42									
<i>Monticellina dorsobranchialis</i> kirkegaard, 1959	SDF	6														
<i>Cirratulus chrysoderma</i> Clapare`de, 1870	SDF						6									
<i>Tharx killariensis</i> Southern, 1914	SDF			5												
5- Family Eunicidae																
<i>*Eunice</i> sp.	C			6												
<i>*Marphysa Bellii</i> (Audouin & Milne-Edwards, 1833)	C															12
6-Family Flabelligeridae																
<i>Piromis roberti</i>	SDF			7												
7- Family Glyceridae Grube, 1850																
<i>*Glycera sphyrabrancha</i> Schmarda, 1861	CM															6
<i>*Glycera tessellata</i> Grube, 1863	CM															12 6
<i>Glycera unicornis</i> Savigny in Lamarck, 1818	CM															18
<i>Glycera convolute</i> Keferstein, 1862	CM			18												
8- Family: Lumbrineridae (Schmarda, 1861)																
<i>Lumbrineris inflata</i> (Moore, 1911)	OM						42								42	18
<i>Lumbrineris coccinea</i>	OM						6	24								
<i>Lumbrineris latreilli</i> (Audouin&Milne-Edwards, 1833)	OM					24	12	30				5		6	6	
<i>Lumbrineris impatiens</i> (Claparede, 1868)	OM					30						12	13			
9- Family Magelonidae Cunningham and Ramage, 1888																
<i>*Magelona papillicornis</i> Muller, 1858	SDF							18								24
<i>*Magelona capensis</i> Day, 1961	SDF							12						12		
<i>*Magelona rosea</i> Moore, 1907	SDF	6														

Table 1: Continued

10- Family Maldanidae Malmgren, 1867										
<i>*Euclymene santanderensis</i> (Rioja, 1917)	SDF									12
<i>*Praxillella affinis</i> (M. Sars in G.O. Sars, 1871)	SDF									24
<i>*Praxillella lophoseta</i> (Orlandi, 1898)	SDF								6	6
<i>*Johnstonia clymenoides</i> Quatrefages 1865	SDF							6		
<i>*Micromaldane ornithochaeta</i> Mesnil, 1897	SDF						6			6
<i>*Axiothella constricta</i> Clapare`de 1868	SDF									12 6
<i>*Clymenura clypeata</i> (Saint Joseph,1894)	SDF								6	
<i>Euclymene lombricoides</i> (Quatrefages, 1866)	SDF	6						24		6
<i>*Euclymene oerstedii</i> (Claparede, 1863)	SDF							18		
<i>*Lumbriclymene minor</i> Ardwidsson, 1906	SDF									6
<i>Euclymene capensis</i>	SDF	6								
<i>Maldane sarsi</i> Malmgren, 1865.	SDF							12		6 6
11- Family Nephtyidae Grube, 1850										
<i>Nephtys picta</i>	C	6								
<i>Nephtys caeca</i> (Fabricius, 1870)	C		12		6		6	7		4
<i>*Nephtys agilis</i> (Langerhans,1879)	C									12
<i>*Nephtys capensis</i>	C							11		8
<i>Nephtys simoni</i> Perkins, 1980	C				6					
<i>Aglaophamus rubella</i> Michaelsen,1897	C				24					
<i>Aglaophamus paucilamellata</i>	C							12		12
12- Family Nereididae										
<i>Perinereis Arete tenuisetis</i>	C	6								
<i>Ceratocephale</i> sp.	C							5		
13- Family Onuphidae										
<i>Onuphis eremite</i> Audouin and Milne- Edwards,1833	CM							4		
<i>Hyalinoecia tubicola</i> O.F.Muller,1776	CM									
14- Family Opheliidae										
<i>*Armandia cirrhosa</i> (Filippi,1861)	SDF				6					12
<i>Travisia forbesii</i> Johnston, 1840	SDF							7		
15- Family Orbiniidae Hartman, 1942										
<i>Scoloplos (Leodamas) rubra</i> (Webster, 1879)	C							6		
<i>Leitoscoloplos fragilis</i>	C				6					
16- Family Owenidae Rioja, 1917										
<i>Myriowenia</i> sp	C									6
17- Family Paraonidae Cerruti, 1909										
<i>Aricidea cerrutii</i> Laubier, 1966	SDF		19				13			12 12
<i>Aricidea (Acmira) lopezi</i> Berkeley and Berkeley, 1956	SDF			12			6	8	6	12
<i>Aricidea wassi</i> Pettibone, 1965	SDF	14	6				6	10	12	6 6
<i>Aricidea simplex</i> Day, 1963	SDF							6	12	6 6
<i>Aricidea succica</i> Eliason,1920	SDF	10	5			6				24
<i>Levinsemia gracilis</i> Tauber, 1879	SDF	6		6		6				
<i>Aricidea claudiae</i> Laubier, 1967	SDF		7		12		20			
<i>Aricidea belgicae</i> Fauvel,1936	SDF	18			6		10			
<i>Levinsemia reduta</i> Hartman,1965	SDF	13			6		6			
<i>Aricidea (Acmira) catherinae</i> Laubier, 1966	SDF									
18- Pectinariidae Quatrefages, 1866										
<i>*Pectinaria (Lagis) koreni</i> Malmgren, 1865	DF									12
<i>*Pectinaria (amphictene) auricoma</i> (O.F. Muller, 1776)	DF				11					6

Table 1: Continued

19- Family Phyllocoridae Orsted, 1843															
<i>Eulalia</i> sp	C				6										
<i>Eteone lacteal</i> Clapare`de, 1868.	C				6								6		
20-Family pilargidae															
<i>Sigambra tentaculata</i> Treadwell, 1941	C		1	2		2	6			3					
<i>Ancistrosyllis groenlandica</i> Mc Intosh, 1879	C					6									
21- Family Sabellidae (Malmgren, 1867)															
* <i>Chone minor</i>	FF													6	
* <i>Chone Filicaudata</i> Southern, 1914	FF		21											6	12
* <i>Potamilla stichophthalmos</i> Grube, 1863	FF													12	12
<i>Chone usticensis</i> Giangrande, Licciano and Castriota, 2006	FF												6		
<i>Jasmeneira caudate</i> Langerhans, 1880	FF												12		
<i>Euchone southerni</i> Banse, 1970	FF										18			12	
22- Family Serpulidae Johnston, 1865															
<i>Hydroides elegans</i> (Haswell, 1883)	FF		7												6
23- Family Spionidae Grube, 1850															
* <i>Prionospio saldanha</i> Day, 1961	SDF														6
<i>Prionospio (Aquilaspio) aucklandica</i> (Augener, 1923)	SDF									22					12
<i>Prionospio (Prionospio) steenstrupi</i> Malmgren, 1867	SDF		10			6	5		9					6	2
* <i>Spiophanes missionensis</i> Hartman, 1941	SDF										12				7
<i>Spiophanes kroeyeri</i> Grube, 1860	SDF										6				6
<i>Scoelepis carunculata</i> Blake and Kudenov, 1978	SDF														8
<i>Prionospio (Prionospio) heterobranchia</i> Moore, 1907.	SDF														
<i>Prionospio Minuspio cirrifer</i> Wire`n, 1883.	SDF		15						13						
<i>Prionospio (Prionospio) dubia</i> Maciolek, 1985	SDF		13												
<i>Prionospio multibranchiata</i> Berkeley, 1926	SDF		19												7
<i>Apropionospio pygmaea</i> Hartman, 1961.	SDF									12					
24- Family Syllidae Grube, 1850															
* <i>Typosyllis rosea</i> (Langerhans, 1879)	Cm													6	
<i>Brania arminii</i>	hem													6	
<i>Grubeosyllis tenacirrata</i> (Claparede, 1864)	hem		3											18	
* <i>Sphaerosyllis thomasi</i>	hem													14	
* <i>Pionosyllis weismanni</i> Langerhans, 1879	Cm													12	
<i>Parapionosyllis labronica</i> Cognetti, 1965.	hem													10	
25- Family Terebellidae Malmgren, 1867															
* <i>Terebellides stroemi</i> Sars, 1835	SFF								6						
<i>Parathelepus collaris</i> Southern, 1914.	SFF													12	
<i>Lanice conchilega</i> Pallas, 1766.	SFF													18	
<i>Pista cristata</i> O.F. Muller,1776	SFF													12	

SDF=Surface deposit Feeder, CM=Macro Carnivores, cm= micro Carnivores, C= Carnivores,

OM= Omnivores, hem= micro herbivores, SFF= surface filter feeder.

C*= New recorded species in the present study

Table 2: Showing Diversity, Species richness and Evenness or Equitability in different sites

Family / Species	Summer 2008										Spring 2008				
	Abu Khashaba			Gamasa			Baltim			Tina Bay		Tina Bay			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Diversity index	2.897	2.668	1.040	2.420	1.983	3.026	1.983	1.277	1.427	0.637	1.992	1.427	1.965	2.925	3.545
Evenness or Equitability (E)	0.670	0.667	0.656	0.619	0.625	0.660	0.625	0.639	0.615	0.637	0.664	0.615	0.620	0.666	0.676
Species richness (SR)	3.614	3.044	0.629	2.714	1.689	4.077	1.689	0.803	1.003	0.346	1.607	1.003	1.610	3.761	6.286

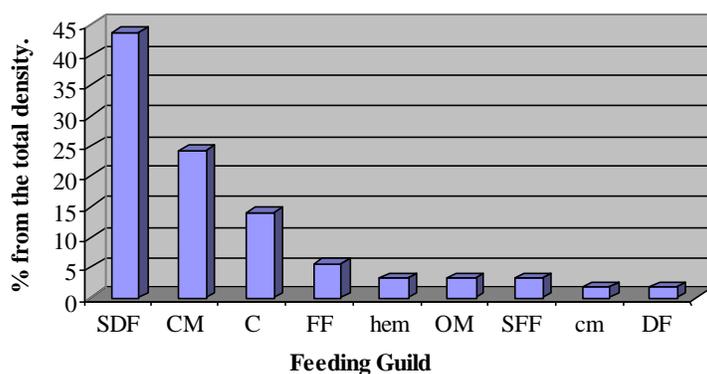


Fig. 2: Percentage of polychaetes in relation to their feeding guild

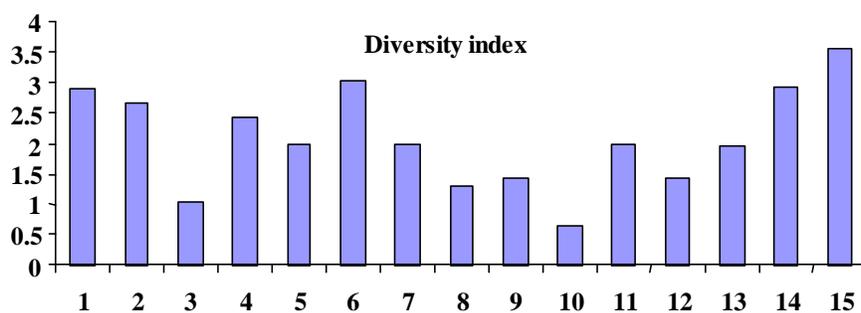


Fig. 3: Diversity Index (H) of the investigated stations during Spring and Summer 2008

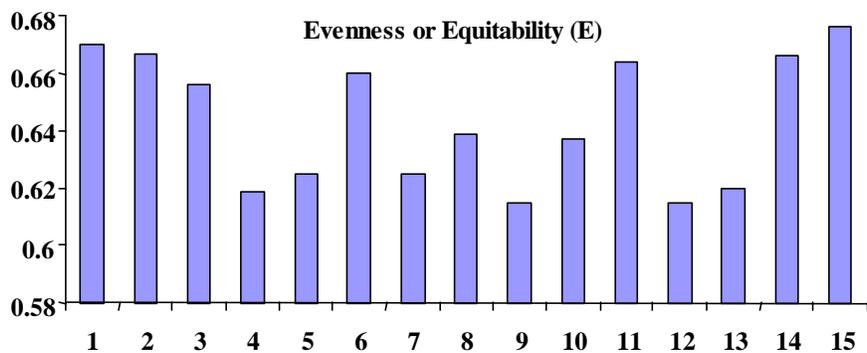


Fig. 4: Evenness or Equitability (E) of the investigated stations during Spring and Summer 2008

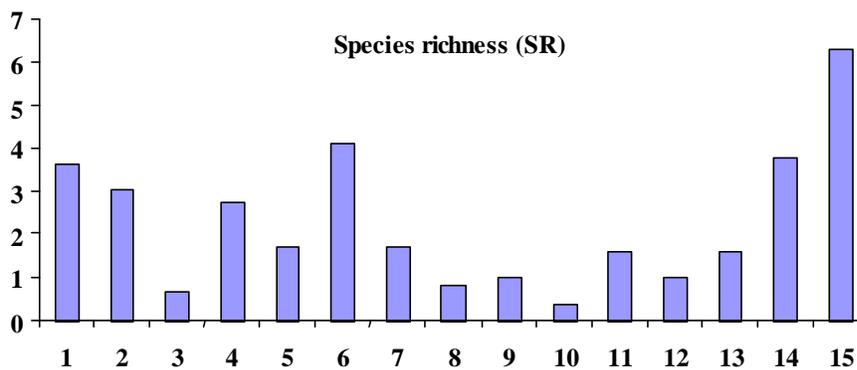


Fig. 5: Species richness (SR) of the investigated stations during Spring and Summer 2008

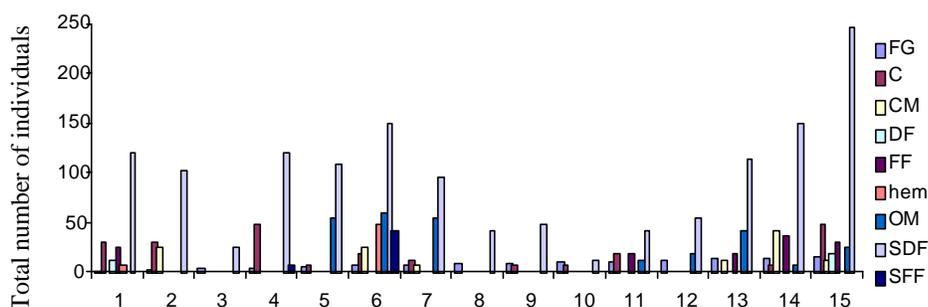


Fig. 6: Stations of the study area with different depths in relation with feeding guild. St. 1=30.5 m, St. 2= 20 m, St. 3= 13.7 m, St. 4= 34m, St. 5= 23.0 m, St.6= 13.7 m, St. 7= 31.6 m, St. 8= 20.5 m, St. 9= 12.1m, St. 10= 33 m, St. 11= 24.2 m, St. 12= 13 m, St. 13= 106 m, St. 14= 54 m, St. 15= 30 m

The percentage of the number of individuals belonging to the different types of feeding is shown in Fig. (2). A review of feeding strategies of species identified in table (1) reveals that the subtidal polychaetes in the study area are dominantly surface deposit feeders with high values of the total density more than 40% of the total density and Macro Carnivores, while micro carnivores and deposit feeders by less percentage 1.56% from the total polychaetes. The abundance of the feeding type was positively correlated with sites of low depth (Fig. 6).

DISCUSSION

The present study revealed low biodiversity of benthic polychaetes where only 108 polychaete species were recorded from the study area, This may be attributed to the increased stress in the Mediterranean region [16], which make short or long-term changes as mentioned by Simbura and Zenetos [17].

Despite of the large recorded number of polychaete families (25 families), family Capitillidae, Maldnidae, Paraonidae and Spionidae were the most diversified families due to increasing number of its representatives during the present study. Also, they were considered the most abundant families in Mediterranean which agrees with the results of Muniz and Pires [18] in Southeastern Brazil. Giangrande *et al.* [19] who noticed that increasing abundance and domination of species with small biomass indicator of habitat subjected to water pollution stress.

Inspite of, low biodiversity of the polychaetes over the whole area of the study, El Tina Bay was considered with the highest abundance and diversified community (59 species), while Balteem comparatively was low

diversified 12 species. It seems to be due to that the first one are semicircular area with less physical disturbance, that agrees with the opinion of Cosentino and Giacobbe [20], that physical disturbance includes a wide typology of natural processes which impact on the benthic environment and may determine a rapid sediment movement and re-suspension, especially in sub-tidal sedimentary environments. Also these observations are supported by those of Giangrande *et al.*, [19] who found that protected area influenced by the positive impact may show no high variation in species number, but the highest density value. The same authors supposed that changes in abundance more than changes in diversity could be an indicator of the effect of protection. The quantitative cycles of polychaetes reported, showed different patterns at the sampled sites. 53 species appeared once a time and not appeared in any site again and few species were responsible for the bulk of numerical abundance such as: *Aricidea wassi*, *A. lopezi*, *Lumbrineris laterilli*, *L. inflata* and *Caulleriella bioculatus*. The recruitment of polychaete population depend on the wide variations in physico-chemical factors that play an important role in determining this recruitment of population. More than 57 species also were recorded for the first time in the Egyptian Med. waters, that may be due to these areas were not studied before.

Since polychaetes are often the numerically dominant macrobenthos group and show diverse modes of feeding, they have been shown to be good indicators of species richness and community patterns in benthic invertebrate assemblages [19].

The major descriptors (density, species richness and diversity) showed that the highest density, richness and diversity were recorded in spring season while the lowest recorded were in summer season, this agrees with

Gambi *et al.* [21], that the existence of low richness and diversity values during summer was registered in the Mediterranean polychaete.

Most of polychaete fauna corresponded to sedentary forms typical of soft bottoms with low biodiversity and decreased in number by depth which agrees with the results of Brito *et al.* [22] and Quijon and Snelgrove [5], who mentioned that polychaetes were at least three times more abundant and two times more diverse in sandy than in muddy sediments also agrees with Gage *et al.* [23], who mentioned that there is strong pattern of declining biomass and faunal abundance with increasing depth. Most of the species are burrowing species, such as Maldanidae and pectenaridae and boring type such as spionidae which burrowing into sediment both for protection or searching for food and others actively swallow mud and deposited particulate matter [24, 25]. The most polychaete species were recorded were sessile form, these results are supported by the opinion of Maurer and Leathem [26], who mentioned that sessility is generally associated with less dynamic, more stable sedimentary conditions encountered in deeper water.

Some significant relationships between feeding guild and depth. Provisional attempts at defining feeding strategies among benthic polychaetes were made by Fauchald and Jumars [15]. According to them, surface deposit feeder were represented by 43.75% of total number of individuals, followed by Macro Carnivores 24.22%, the less percentage were the micro carnivores and deposit feeding type. Hutchings [3] mentioned that polychaetes are classified according to their diverse feeding guild. Spionids are found distributed throughout a wide range of depths which agrees with the result of Fauchald and Jumars [15].

In the present study, El Tina Bay was the most diversified site, samples collected in station number 13 (106 m depth) had smaller number of individuals than other stations of El Tina Bay (number 14 and 15), this site located in waters deeper than 100 m depth, yielded fine, soupy muds with a consistency of "black yogurt" and were essentially devoid of macroinvertebrates and less polychaete numbers, This agrees with the result reported by Dean [27], who recorded six stations with more than 100 m depth were devoid of macroinvertebrates, believed to be due to the result of low oxygen concentration and the deeper stations in Golfo Dulce reflects the low current velocities which act to restrict oxygen renewal in stagnant bodies of water. In the present study, such results nearly agree with the findings obtained in El Tina Bay. Also his review of feeding strategies of the identified

species reveals that the subtidal polychaetes in Golfo Dulce are predominantly surface deposit feeders or carnivores, also agrees with the new result in the northeastern coast of Egypt.

From the present study, it was concluded that biodiversity of polychaetes in the Northeastern coast of Egypt was poor. Species number and total number of individuals were very low and surface deposit feeders were the engineering species. Also Atlas cruise indicates that there is still much more work to be done in order to characterize the benthic fauna of Mediterranean and Red Sea coasts of Egypt.

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