Seasonal distribution of the littoral interstitial meiofauna in the northern Red Sea, Egypt

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ABSTRACT

Meiofaunal composition, distribution and seasonal abundance in the northern Egyptian Red Sea were studied during the period from spring 2006 to winter 2007. Significant seasonal variation in the density was recorded (P<0.001) and ranged between 100 and 130 organisms/10 cm^2. The meiofaunal assemblage in the area of study was well diversified including 141 species. The principal taxonomic groups were free living Nematoda (68%) followed by Harpacticoida (12%), Polychaeta (10%) and Ostracoda (4%) in term of their densities. The exposure to wave actions and the sediment characteristics were the most important factors for structuring the meiofaunal community.

Key words: Meiofauna, seasonal abundance, Red Sea, Egypt.

INTRODUCTION

The Red Sea region has diverse economic activities; these activities include offshore oil exploration, phosphate mining, and fishing on a limited scale. Starting from the early 1990s, the Red Sea region has been targeted for massive tourism development in Egypt (Shaalan, 2005). In 2000, the existing number of rooms was 10,549. The target for 2012 is to achieve 140,000 rooms primarily by constructing new resorts and secondly by expanding the existing ones. The majority of the resorts were built along a coastal stretch of about 300 km with about 50-200m coastal setback depending on the shoreline conditions (JICA, 1999). All of these activities might alter the benthic environment in general and the meiobenthic communities in particular.

Sandy beaches are not just piles of sand; they support a range of under-appreciated biodiversity. A single beach can harbour several hundred of small forms of invertebrates (i.e. meiofauna) (Armonies and Reise, 2000). Meiofauna plays an important role as a trophic link between bacteria and larger fauna (Hicks 1984), in addition, they are also known as sensitive indicators of environmental disturbance and have great potential as pollution indicators (Soule 1988; Coull, 1990; Montagna & Kalke 1992; Shaw & Jenkins, 1992).

The quantitative distributions of the meiobenthos in the Egyptian Red Sea beaches have never been studied before. All of quantitative studies in the Red

Sea were dealt with the meiofauna in the Jordanian coast (Huling, 1975; Grelet *et al.*, 1983 and 1987). Meiobenthic studies in the Egyptian Red Sea focused on taxonomy, particularly for harpacticoid copepods (Nicholls, 1944; Noodt, 1964; Por, 1967 & 1979).

The current study aims to study the seasonal variations in the community structure and distribution strategies of meiobenthic organisms in the Northern Red Sea as well as the impact of the sediment characteristics and the hydrographic features of the selected sites on the meiobenthic communities.

MATERIALS AND METHODS

STUDY AREAS

All selected sites are located at the coast of Red Sea Governorate; which extends for almost 1080 Km shoreline. In total, 12 sites were sampled; 10 inshore sites and 2 sites on the offshore islands of Abu-Menqar and Wadi El Gemal (Fig. 1).
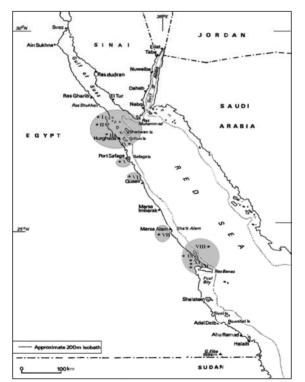

Fig. 1: Map of the northern Red Sea showing the sampling sites (I. Gabal El Zeit, II. Al Gemsha, III. Sama Beach, IV. Abo Menqar Island, V. Safaga, VI. Al Hamraween VII. Marsa Alam, VIII. Wadi El Gemal Island, IX. Sharm El Luli, X. Um El Abas, XI. Al Qulaan and XII Hamata) at which meiobenthic investigations have been conducted.

MEASUREMENTS OF PARAMETERS
Water Temperatures, the granulometric analysis and total organic matters (TOMs)

Water temperature was measured by inserting a glass mercury thermometer (110 ºC) graduated to 0.5 ºC into the surface layer of at each zone for 2 minutes. Sediment samples (100 g of sediments) were taken by hand metal corer at each zone per site for grain size analysis of sediments followed methods described in Folk (1974), the mean grain size and other granulometric statistics were calculated using Folk and Ward methods (Folk and Ward, 1957). TOMs for each site determined by combustion of 1 g of fine sediment (Mz =+2φ) was dried at 60 ºC for approximately 12 hours. Organic matters were then assessed as the percentage weight loss in the samples after combustion at 500 ºC for 24 Hours (Holme and McIntyre,1984).

Meiofaunal analysis

Meiofaunal samples were collected using hand made metal corer with an internal diameter of 3.6 cm and a total inner area of 10 cm^2. 18 samples per site were collected seasonally from spring 2006 to winter 2007. The sampling regime was designed to cover different littoral zones (Supralittoral, Eulittoral and Sublittoral zones). At each zone, 3 core samples were taken and the obtained sediment was divided immediately into two subsamples of 0-5 cm and 5-10 cm. Samples were preserved in 4% neutralized formaldehyde solution with Rose Bengal stain (0.5 g/l). In the laboratory, they were passed through two sieves; the top one with a mesh size of 500 μm (captured the macrobenthos) while bottom one had a mesh size of 50 μm. Organisms retained on the lower sieve were considered as meiobenthos (Heip *et al.,* 1979). All samples were counted under binocular stereomicroscope (Prior, S2000) at magnification of 10 X.

Identification of meiobenthic organisms were performed using the keys of Riedl (1969); Ben-Ellliahu (1972); Glynn (1972); Lerner-Seggev (1972); Por (1972); Tarjan (1980); Norenburg (1988); Platt and Warwick (1988) and Huys *et al*. (1996).

Data analysis

Multi-Ways analysis of variance was used to test the significance differences in abundances of meiobenthos between sites, seasons, zones and depths. The interactions between these factors were applied, using SYSTAT program (V.10.2.05, 2002). Diversity indices and cluster analyses (Bray-Curtis similarity) were carried out, using the PRIMER software package (PRIMER V.5.2, 2002).

RESULTS

Water temperature and sediment characteristics of the study area

Small variation in the seasonal water temperatures were observed in the study sites. The southern sites had slightly higher values than those recorded in the northern site (Table 1). The highest seasonal temperature was recorded in

Wadi El Gemal Island (25.6ºC±0.9), while the lowest was recorded in Gabal El Zeit with average water temperature value of 24.3ºC ±1.13. The maximum average temperature (28.64°C) while the minimum was 21.32°C (Fig. 2).

Table 1: Water Temperature, sediment characteristics and type of shore according to the exposure to wave of the studied sites (2006-2007)

Site Parameter	Water Temperature ºC	TOMs (mg/g)	Mz (φ)	Sorting	Exposure to wave action
	Mean±SD	Mean±SD	Mean±SD		
Gabal El-Zeit	24.3±1.13	5.8±0.4	0.17±0.9	poorly sorted	protected
Al-Gemsha	24.4±0.9	5.9±1.2	0.03±0.6	moderately sorted	Semi protected
Sama Beach	24.9±1.07	5.1±0.8	0.07±0.6	poorly sorted	Semi protected
Abo-Menqar Island	24.5±1	5.8±0.3	-0.03±0.7	moderately sorted	exposed
Safaga	24.9±0.6	6.0±1.2	0.43±0.4	poorly sorted	protected
Al-Hamraween	24.9±0.85	5.7±0.4	-0.57±1	moderately sorted	exposed
Marsa Alam	25.1±1.1	4.1±1	-0.93±1.3	moderately well sorted	exposed
Wadi El-Gemal Island	25.6±0.93	6±0.8	-0.6±1.4	moderately sorted	Semi protected
Um El-Abas	25.3±0.9	6±1.4	0.37±0.2	moderately sorted	Semi protected
Sharm El-Luli	25.3±0.9	5±1	-1.1±1.2	poorly sorted	protected
Al-Qulaan	25.3±1	7.5±1	-0.97±0.5	poorly sorted	protected
Hamata	25.5±1.16	6.4±0.5	-0.53±0.4	moderately sorted	exposed

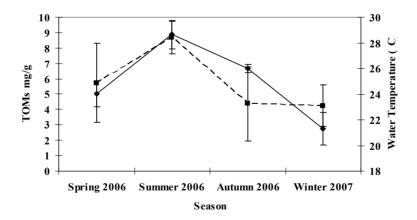Legend: SD=Standard deviation and shadowed cells indicates the maximum values.

Fig. 2: Seasonal variation in water temperature (ºC) and TOMs in the area of study.

* The dotted line represent TOMs values while the solid line represent water temperature values.

TOMs, median grain size (Mz) and sorting indices for all sites are listed in Table (1). The recorded variations in TOMs between sites were found to be limited. The highest value (7.5±1 mg/g) was recorded at Al Qulaan, while Marsa Alam had the lowest value (4.1±1 mg/g). On seasonal basis, TOMs increased in spring to reach the maximum in summer (8.7±1.1 mg/g), then decreased during the following seasons (Fig. 2).

At all sites, sediments exhibited coarsy nature. Sharm El Luli showed the coarser median grain size with an average median grain size of -1.1±1.2. In contrast, Safaga had a relatively fine value (0.43±0.4). In general, sheltered sites exhibited poorly sorting of sediments. In contrast, the exposed sites to wave and current exhibited moderate sorted sediments (Table 1).

Meiofaunal composition and abundance

Free living Nematoda, harpacticoid copepoda, Polychaeta and Ostracoda represented the most important interstitial meiobenthic taxa, forming 93% of total meiobenthic count in the study area (Fig. 3). Oligochaeta, Gnathostomulida, Nemertea, Kinorhyncha, Cumacea, Isopoda and Amphipoda were recorded with extremely low densities (Appendix 1). Nematoda represented the most abundant group, contributing with 67% of total count. The species *Ptycholaimellus ponticus, Theristus clax* and *Aulolalaimus oxycephalus* showed higher densities among the overall represented nematode species. Harpacticoid copepods comprised 15 species and dominated by *Canuella perplexa* (formed 15.3 % of total copepod counts). Polychaeta was represented by 25 species belonging to 14 families and were dominated by *Exogone* sp. (15 % of total polychaete count). Finally, Ostracoda was ranked fourth in term of abundance and was represented by 5 species. Among them; *Xestoloberis* sp. was the most abundant. Other groups accounted for 7% of total meiofaunal density.
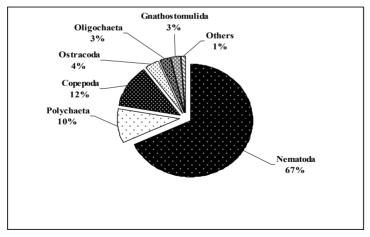

Fig. 3: Percentages of the different interstitial meiobenthic groups.

Meiofaunal abundance was found to be influenced significantly by season, sites, littoral zones and sediment depths significantly ($P<0.001$). All interactions between variables were significant (Table 2). The highest value of 166.1 ± 91.4 organisms/10 cm^2 was recorded at Safaga. In contrast, Gabal El Zeit showed the lowest density values with an overall mean of 38.2 ± 22.2 organisms/10 cm^2 (Fig.4).

Table 2: Multiple ANOVA performed on the effects of site, season, zone and depth on the meiofaunal abundance.

Source of variation	F-ratio	P value
Site	62.205	0.000*
Season	25.546	0.000*
Zone	4.451	0.012*
Depth	121.791	0.000*
Site*Season	38.018	0.000*
Site*Zone	30.113	0.000*
Site*Depth	4.459	0.000*
Season*Zone*Depth	16.576	0.000*
Season*Zone	7.924	0.000*
Season*Depth	8.801	0.000*
Zone*Depth	10.045	0.000*
Site*Season*Zone	6.447	0.000*
Site*Season*Depth	6.258	0.000*
Site*Zone*Depth	3.867	0.001*
Site*Season*Zone*Depth	5.157	0.000*
Error		

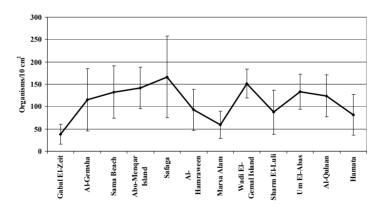*Indicates that this value was significant at level of 0.05.

Fig. 4: Overall means of meiofaunal densities recorded at all studied sites

Meiofaunal densities peaked in summer with an overall mean value of 130.1 ± 101.6 organisms/10 cm^2, densities fluctuated between 100.5 ± 84.6 organisms/10 cm^2 (in autumn) and 107 ± 110.7 organisms/10 cm^2 (in winter).

In warm seasons (spring, summer and autumn), the meiofaunal organisms inhibited the eulittoral zone more densely. In contrast, meiofauna inhibited the sublittoral zone more densely in winter. Regarding zone and season, the highest density of meiobenthos was recorded in the eulittoral zone in summer (average 151.3 ± 101.9 organisms/10 cm^2), while the lowest was recorded in the sublittoral zone in autumn (average 79.9 ± 67.4 organisms/10 cm^2) (Fig. 5).

Generally, meiobenthos occupied the upper layers of sediment more densely than the lower layers at all seasons with an overall means value of 131 organisms/10 cm^2 and 85 organisms/10 cm^2 respectively. Regarding seasons and depths, the highest density of meiobenthos was recorded in the upper sediment layers in summer (average 153 ± 107.2 organisms/10 cm^2). In contrast, the lowest density was estimated in the lower layer of sediment in winter (average 73.7 ± 56.1 organisms/10 cm^2) (Fig. 6).
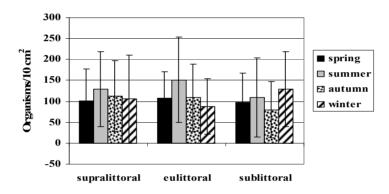

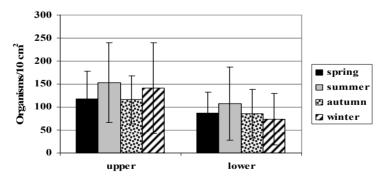Fig. 5: Overall means of seasonal abundance of meiobenthos estimated in the different littoral zones.

Fig. 6: Seasonal averages of meiobenthos in the upper (0-5 cm) and lower (5-10 cm) sediment layers.

It is noticed that meiofauna was estimated irregularly and patchly at all sites, especially at Al Gemsah and Gabal El Zeit. However, organisms were evenly distributed in Wadi El Gemal Island and Um El Abas sites.

Diversity of meiobenthic assemblages

Overall 141 of interstitial species belonging to 125 genera were identified belonging to 6 phyla, 8 classes; each phylum was represented by only one class except nematodes and annelids, where each was represented by two classes, namely Adenophorea and Secernentea for Nematoda and, Oligochaeta and Polychaeta respectively. Crustacea was represented only by class Maxillopoda, included orders, Harpacticoida, Ostracoda, Amphipoda, Isopoda and Cumacea (Table 3).

Meiobenthic communities showed an obvious variation among the investigated sites. Spatially, Al Qulaan site attained the highest number of species (31 species). In contrast, Marsa Alam site was attained the lowest value (11 species) (Table 3).

Table 3: Diversity of meiobenthos in the area of study (2006-2007).

Phylum / taxa	Class	Order	Family	Genera	species
Nematoda	2	5	32	61	85
Crustacea	1	5	21	28	28
Annelida	2	5	12	22	24
Gnathostomulida	1	2	2	2	2
Nemertina	1	1	1	1	1
Kinorhyncha	1	1	1	1	1
Total	8	19	69	125	141

High values of species eveness estimated for different sites (>0.8) indicated the lack of strong dominance among any meiobenthic populations. The highest species eveness value was calculated for Sharm El Luli site (E=0.94) while the lowest value of 0.81 was calculated to Marsa Alam site (E=0.81) (Table 4). The highest values for Shannon-Winner index (H) and species richness index (D), the highest values were estimated for Sharm El Luli being 3.07 and 5 respectively. In comparisons, Safaga displayed the lowest value of species richness being 3.3 (Table 4).

The cluster analysis for the common meiobenthic species recorded at the different sites (Fig. 7), showing one main cluster included 6 sites representing 3 subclusters. The first was formed by Sharm El Luli and Al Qulaan sites (69.3%), while Abu Menqar Island and Um El Abas site constituted the second subcluster with a similarity value of 66.9%. The third subcluster was formed by Wadi El Gemal Island and Sama Beach sites (64.2%).

Table 4: Average value for each of total number of species (S), Eveness (E) and Shannon-Weaver Index (H) and species richness (D) of meiobenthic organisms for all sites in the area of study (2006-2007).

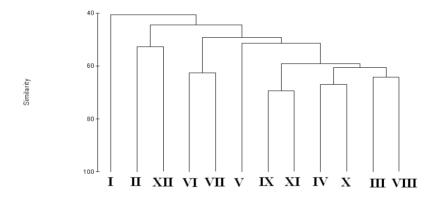| Site	S	E	H	D
I. Gabal El Zeit	13	0.91	2.53	3.6
II. Al Gemsha	19	0.84	2.55	3.5
III. Sama Beach	23	0.9	2.94	4.3
IV. Abu Menqar Island	23	0.93	2.9	3.9
V. Safaga	17	0.84	2.63	3.6
VI. Al Hamraween	20	0.84	2.7	4.1
VII. Marsa Alam	11	0.81	2.35	3.3
VIII. Wadi El Gemal Island	23	0.9	2.83	3.9
IX. Sharm El Luli	26	0.94	3.07	4.5
X. Um El Abas	26	0.9	3.07	5
XI. Al Qulaan	31	0.92	2.86	4
XII. Hamata	14	0.82	2.5	4.1

Fig. 7: Dendrogram of the cluster analysis of meiobenthic communities at the studied sites where; I. Gabal El Zeit, II. Al Gemsha, III. Sama Beach, IV. Abo Menqar Island, V. Safaga, VI. Al Hamraween VII. Marsa Alam, VIII. Wadi El Gemal Island, IX. Sharm El Luli, X. Um El Abas, XI. Al Qulaan and XII Hamata.

DISCUSSION

In the present study, densities of meiobenthos were very close to that recorded by Hulings (1971) in sandy beaches along the coast of Jordan. Sheltered sites namely; Al Gemsha, Safaga, Wadi El Gemal Island, Sharm El Luli and Al Qulaan were observed to harbor higher densities of meiobenthic organisms rather than those were found in exposed sites (Marsa Alam and Al

Hamraween). This is in agreement with studies concerned with the effect of agitation on the meiobenthic abundance (Giere, 2009).

Grain size plays a dominant role in meiofaunal distribution and can serve as the integrative key factors that characterize the habitat of these organisms. (Giere, 2009). The highest abundance of meiofauna was recorded in the sites that attained higher content of silt and clay (Safaga). Sites which attained lower of fine sediment had lower abundance of inhabited meiobenthic organisms (i.e. Abo Tartoor).

TOMs was observed to be of significant influence on the meiofaunal abundance of the investigated sites. Sites with high TOMs attained high densities of meiobenthos overall investigated sites (Al Gemsha, Safaga and Al Qulaan). Tietgen, (1980) and Warwick (1989) stated that the content of organic matter has a significant influence on the distribution of meiofauna. Along the coasts of South Africa, meiofauna abundance was positively correlated with detritus content of sediment (McLachlan *et al*., 1981).

Horizontally, meiofauna are known to exhibit a patchy distribution in sediments that appear to be homogeneous (Heip and Engless, 1977). The meiobenthic abundance of the selected sites appeared patchy in term of their distribution. True causes of the patchiness phenomenon are not known but several ideas have been discussed. Gerlach (1977) suggested that the random placement of a macrofaunal carcass (dead fish, dead crab) and its subsequent leaking of organic matter may attract meiofauna and that the patches may thus be the result of attraction to an organic point source. Others suggested that the foods of meiofauna (bacteria and microflora) are patchily distributed and that certain attractive food sources, being so localized, can then determine the horizontal distribution of the meiofauna. (Lee *et al*., 1977). Selective predation on meiofauna could also cause patchy distribution. Meiofaunal predators might remove particular taxa (or size classes), this localized removal could then result in a discordant distribution (Levin and Paine, 1974).

In the current study, meiobenthic organisms inhibited the sublittoral zones with relatively denser values than other zones. This might be due to the relatively fine median grain size occurring in this zone compared to other littoral zones. Similar findings were reported by Schmidt and Westheide (1969) who studied the macrofauna and meiofauna of tidal beaches on the Island of Sylt in the North Sea and stated that densities of meiofauna diminished from low water mark (sublittoral) towards the high water mark (supralittoral).

In the present study, significant differences in meiofaunal densities were noticed between the different sediment layers, meiobenthos were inhabited the upper layer densely. Total of 62% of meiobenthos organisms were found at the upper layer 0-5cm. Giere (2009) reported that in a vertical sediment profile, the upper few centimeters usually harbor more meiofauna than the deeper horizons. This relates to the richer supply with oxygen and food particles (Yingest, 1978).

The meiobenthic assemblage in the area of study is well diversified and dominated by nematodes, harpacticoid copepods, polychaetes and ostracodes. Similar results were observed by many studies (Hulings, 1975; Sivaleela, 2009; Semprucci, 2010). Sites with moderately well sorted sediment were inhabited by relatively high number of meiobenthic species (Al Gemsha, Abo Menqar, Wadi El Gemal Island and Al Qulaan) than those with poorly sorted sediments (Safaga and Hamata). Giere (2009) reported that moderately well sorted medium sand harbored the most diverse meiofauna. He explained that species numbers remained relatively high but population density may decrease in coarse sandy beaches.

Results of this study confirmed the presence of distinct difference in overall community structure between sites. Community structures of sandy shores were characterized by lower densities and the higher evenness compared to other shore types. This is due to the fact that the numerical dominance is shared between the represented species at each site which leads to higher species diversity. Similary, Lie (1968) found high species diversity in coarse sediment at Pauget Sound off the coast of Washington.

Dexter (1980 & 1989) stated that Red Sea beaches are characterized by higher diversity indices than those estimated for the benthic animals of the intertidal beaches of the Mediterranean Sea. In the current study, Al Qulaan site was found to be the most diversified site and rich in meiofaunal communities. This is mainly related to several reasons including; the location of site within Wadi El Gemal Protected Area which contains the most productive habitats, namely; mangrove, seagrass and large beds of seaweed beds, therefore, more availability of food for the meiobenthos as well a the lack of significant negative human impact. Gibbons (1991) stated that the healthiness of the meiofaunal community might be related to its location in areas being away enough from any human impact of any sort, which might significantly enhance the species richness of meiofaunal communities

Meiofauna varied seasonally, with highest abundance in summer and the lowest in autumn. Fishar (2000) studied the monthly fluctuation of the meiofauna of Lake Qarun and reported considerable monthly fluctuations in abundance and biomass of meiofauna over the year with sudden decline in autumn due to strong wind. Such detrimental effects of wind on meiobenthos have been reported by several workers on the Indian coast (Reddy and Hariharan, 1985; Kondalaroio and Murty, 1988; Ansari and Parulekar, 1993). Rudnick *et al*. (1985) stated that meiofauna and macrofauna varied seasonally in Narragansett Bay, with the highest abundances in late spring and lowest in late summer and autumn. They suggested that spring time increases were attributable to excess food resources and that the timing of the increase was triggered by a rapid rise in temperature.

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Appendix 1: List of recorded species in the present study

Phylum: Nematoda
Enoplus sp.
Enoplolaimus longicaudatus Southern, 1914
Enoplolaimus subterraneus Gerlach, 1952
Enoploides littoralis Schulz, 1936
Enoploides brunettii Gerlach, 1953
Anoplostoma viviparum Bastian, 1865
Phanoderma albidium Bastian, 1865
Crenopharynx marioni (Southern, 1914)
Dolicholaimus marrioni De Man, 1888
Trissonchulus obtusus Bresslau and Stekhoven, 1935
Syringolaimus filicaudatus Vitiello, 1970
Syringolaimus smarigdus Cobb, 1923
Syringolaimus striatocaudatus De Man, 1888
Thoracostoma microlobatum Allgen, 1947
Oxystomina elongate (Butschli, 1874)
Halalaimus gracilis De Man, 1888
Halalaimus isaitshikovi (Filipjev, 1927)
Halalaimus longicaudatus Filipjev, 1927
Metoncholaimus scanicus (Allgen, 1935)
Metoncholaimus intermedius
Oncholaimus attenuatus Dujardin, 1845
Oncholaimus bachycercus De Man, 1888
Oncholaimus oxyuris Ditelevsen, 1911
Oncholaimus campylocercoides De Coninck and Stekhoven, 1933
Viscosia abyssorum (Allgen, 1933)
Viscosia cobbi Filipjev, 1918
Viscosia elegans (Kreis, 1924)
Viscosia glabra (Bastian, 1865)
Viscosia viscosia (Bastian, 1865)
Pontonema vulgare (Bastian, 1865)
Eurystomina sp.
Pareurystomina sp.
Cryptonchus abnormis Algen, 1933
Onchulus longicauda Daday, 1899
Tobrilia imberbis Andrassy, 1953
Tobrilus sp.
Tripyla sp.
Bathylaimus arthropappus Wieser and Hopper, 1967
Tripyloides gracilis (Ditlevsen, 1918)
Tripyloides marinus (Butschli, 1878)
Rhabdodemania major (Southern, 1914)
Rhabdodemania minor (Southern, 1914)
Chromadorina laeta De Man, 1876
Euchromadora gaulica Inglis, 1962
Neochromadora poecilosoma (De Man, 1893)
Ptycholaimellus ponticus (Filipjev, 1922)
Laimella vera Vitiello, 1971
Sabatieria pulchra (Schneider, 1906)
Filitonchus ewensis Platt, 1982
Esola longicauda Edwards, 1891
Euterpina sp.
Tisbe sp.
Porcellidium sp.
Order: Ostracoda
Loxoconcha ghardaqensis, Hartmann 1964.
Roundstonia macchesneyi Brady and Crosskey, 1871
Xestoleberis sp.
Cyprideis sp.
Sarsicytheridea sp.
Order: Isopoda
Microcerberus sp.
Angelliera sp.
Order: Cumacea
Cumella sp.
Cumopsis longipes Dohm, 1869
Order: Amphipoda
Ampelisca sp.
Grandidierella sp.
Monoculodes sp.
Urothoe sp.
Phylum: Annelida
Class: Oligocheata
Aktedrilus sp.
Clitellio sp.
Grania sp.
Class: Polychaeta
Autolytus sp.
Brania sp.

Cyatholaimus prinzi (Marion, 1870)
Marylynnia sp.
Paracyatholaimus sp.
Cheironchus sp.
Gammanema sp.
Halichoanolaimus dolichurus Ssaweljev, 1912
Halichoanolaimus minor Ssaweljev, 1912
Halichoanolaimus robustus (Bastian, 1865)
Catanema macintyrei Platt and Zhang, 1982
Chromaspirina sp.
Spirina schneideri.(Villot, 1875)
Epsilonema sp.
Draconema sp.
Dracogalerus sp.
Aponema torosa (Lorenzen, 1973)
Monoposthia anonoposthia
Monoposthia costata (Bastian, 1865)
Haliplectus sp.
Ceramonema sp.
Ceramonema yunfengi Platt and Zhang, 1982
Dasynemoides albaensis (Warwick and Platt, 1973)
Desmoscolex sp.
Quadricoma sp.
Retrotheristus sp.
Theristus longus Platt, 1973
Theristus sp.
Xyala sp.
Xyala riemann Boucher and Helleauet, 1977
Sphaerolaimus maeoticus Filipjev, 1918
Sphaerolaimus macrocirculus Filipjev, 1918
Terschellingia sp.
Axonolaimus sp.
Aulolaimus oxycephalus De Man, 1988
Class: Secernentea
Rhabditis marina Bastian, 1865

Phylum: Crustacea
Class: Maxilopoda
Sub-class: Copepoda
Order: Harpacticoida
Longipedia weberi Scott, 1909
Cletodes sp. Brady, 1872
Canuella perplexa T & A. Scott, 1893
Ameira sp. Boeck, 1865
Nitokra sp. Boeck, 1865
Ectinosoma sp. Boeck, 1865
Arenosetella sp. Wilson, 1932
Stenhelia sp. Boeck, 1865
Typhlamphiascus sp. Lang, 1944
Harpcticus littoralis Sars, 1911
Laophonte inornata Scott, 1902
Exogone sp.
Phyllodocida sp.
Sphaerosyllis capensis Hartmann-Schroder, 1960
Typosyllis sp.
Hesione splendida Savigny, 1818
Glycera convolatus Keferstein, 1962
Glycera tesselata Grube, 1850
Armandia maculate Webster, 1884
Polyphthalmus sp.
Capitella capitata Fabricius, 1780
Capitilla giardi Mensnil, 1897
Ophryotrocha sp.
Pisionidens sp.
Caulleriella sp. Chamberlin, 1919
Cirratulus cirratus Muller, 1776
Dodecaceria sp.
Prionospio sp.
Magelona sp.
Rhaphidrilus sp.
Protodrilus brevis Jouin, 1970
Phylum: Gnathostomulida
Gnathostomula sp.
Haplognathia sp.
Phylum: Nemertea
Ototyphlonemertes sp.
Phylum: Kinorhyncha
Zelinkaderes klepali Nebelscick, 1995