Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 26(6): 525 – 542 (2022)
www.ejabf.journals.ekb.eg

Meiobenthic Community Structure in Some Seagrass Beds in the Southern Egyptian Red Sea Coast with Special Reference to Free Living Nematodes

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ARTICLE INFO

Article History:
Received: Oct. 5, 2022
Accepted: Nov. 8, 2022
Online: Dec. 7, 2022

Keywords:
Meiofauna,
Seagrass,
Nematodes,
Unvegetated sediments,
Red Sea,
Egypt

ABSTRACT

Meiofauna from three seagrass beds in the southern Egyptian Red Sea coast were quantitatively studied. Sediment samples were collected in May 2021 at a depth of 1.5-2 m meters from the sand underneath the seagrass and their adjacent unvegetated sediments at two sites. In the two habitats under study, Marsa Assalya and Marsa Mobarak, the former showed the highest abundance of meiofauna, whereas the latter attained the lowest densities. Meiofaunal communities in the seagrass beds were more diversified than in the adjacent unvegetated sediments which contrarily showed more individual counts. 14 major taxa were recorded; Nematoda was the most common taxa in seagrass beds, while Copepoda was the abundant group in the unvegetated sediments. Significant correlations were found between sediment characteristics and some major meiofaunal taxa. A total of 21 nematode genera were determined. Epistrate feeding was the dominant type and *Daptonema* was the most abundant genus in both habitats. The different structures of meiofaunal communities distinguish each habitat within the same sites rather than their geographical distribution.

INTRODUCTION

Seagrass beds distribute widely in the photic zones of all coastal areas except the polar, they are one of the most productive ecosystems **(Duarte & Chiscano, 1999; Naufal & Padmavati, 2018)**. Seagrass vegetation can stabilize the sediment, enhance organic matter accumulation, and thus increases the availability of food **(Atilla *et al.*, 2005; Baden *et al.*, 2010)**. Their shoots, roots, and rhizomes provide associated organisms microhabitats and supply a shelter for both the adult and juvenile of marine organisms **(Osenga & Coull, 1983; Orth *et al.*, 1984; Castel *et al.*, 1989)** Also, they enhance the complexity of the interstitial fauna compositions **(Hall & Bell, 1993; Danovaro *et al.*, 2002)**.

Several studies referred to the high density and diversity of fauna inhabiting seagrass meadows **(Kikuchi, 1980; Hemminga & Duarte, 2000; Baden & Böstrom, 2001)**. However, the vast majority focused on macrobenthic fauna **(Webster *et al.*, 1998;**

Heiss *et al.*, 2000; Kharlamenko *et al.*, 2001; Gacia *et al.*, 2003; Atilla *et al.*, 2005; Bos *et al.*, 2007; Bouma *et al.*, 2009) and significantly less on meiofauna **(De Troch *et al.*, 2005)**. While, only a few studies included microflora **(Danovaro *et al.*, 1994)**. In seagrass beds, free-living nematodes are usually the most abundant taxa although seagrass studies of meiofauna have primarily focused on epifauna **(Hall & Bell, 1993; De Troch *et al.*, 2001; Da Rocha *et al.*, 2006)**. Species composition of nematofauna changed consistently with ambient bottom textures **(Liao *et al.*, 2015)**. Among meiobenthic organisms, free living nematodes exhibited a rapid response to the different causes of changes in the ambient environments. Due to their dense occurrence, generic and trophic diversity, Nematoda is an ideal tool to investigate the relationships between biodiversity and ecosystem processes **(Pusceddu *et al.*, 2014)**.

The unvegetated area around seagrass patches supports the infaunal dispersions, but limited studies have focused on these regions **(Boström *et al.*, 2006)**. Notably, the abundance and community structure of nematodes show substantial differences between vegetated and bordering unvegetated sites **(Fonseca *et al.*, 2011; Leduc & Probert, 2011)**. Yet, no difference between both habitats has been reported **(Ndaro & Ólafsson, 1999)**.

Previous studies on the Egyptian Red Sea meiobenthic community structure focused on the littoral zones **(Ahmed *et al.*, 2011; Hanafy *et al.*, 2011; El-Serehy *et al.*, 2015; El-Serehy *et al.*, 2016)**. Only one study was conducted on a site at Nabq protected area at the Egyptian side, the Gulf of Aqaba (**Pusceddu *et al.*, 2014)**. This is the first study undertaken to elucidate the community structure of meiofauna, particularly nematodes in the southern Egyptian Red Sea coast in order to show the difference between seagrass beds and adjacent unvegetated sediments.

MATERIALS AND METHODS

Study area and sediment's sampling

In May 2021, three sites were visited along the western coast of the Egyptian Red Sea and selected to represent the seagrass habitats; Marsa Mobarak, Marsa Abou Dabbab and Marsa Assalaya, all of which are located in the north of Marsa Alam city, the Red Sea, Egypt (Fig. 1). The YSI 650 multi-parameter instrument (YSI, Yellow Springs, OH, USA) was used to measure water temperature and salinity (expressed as total dissolved salts, TDS) in the field. The vegetation of seagrass beds varied among sites in terms of their vegetation densities and species composition. Marsa Assalaya revealed higher vegetation of seagrass than the other ones. Four different seagrass species found in the visited sites; *Halophila stipulacea, H. ovalis, Halodule uninervis* and *Cymodocea rotundata*. *H. stipulacea* and *H. ovalis* were common in Marsa Assalaya, while *H. uninervis* was common in Marsa Mobarak and Marsa Abou Dabbab though entirely undetected in Marsa Assalaya. In addition, *C. rotundata* was only found in Marsa Mobarak. Three sediment replicates were collected from a depth between 1.5- 2 meters from each seagrass bed and another three from the adjacent unvegetated area at a distance that did not exceed more than 0.5m. Sediment samples were taken via SCUBA diving using a cylindrical core of $10cm^2$ (3.5cm diameter, 10cm high) and collected in plastic bottles containing 5% of neutral formalin.

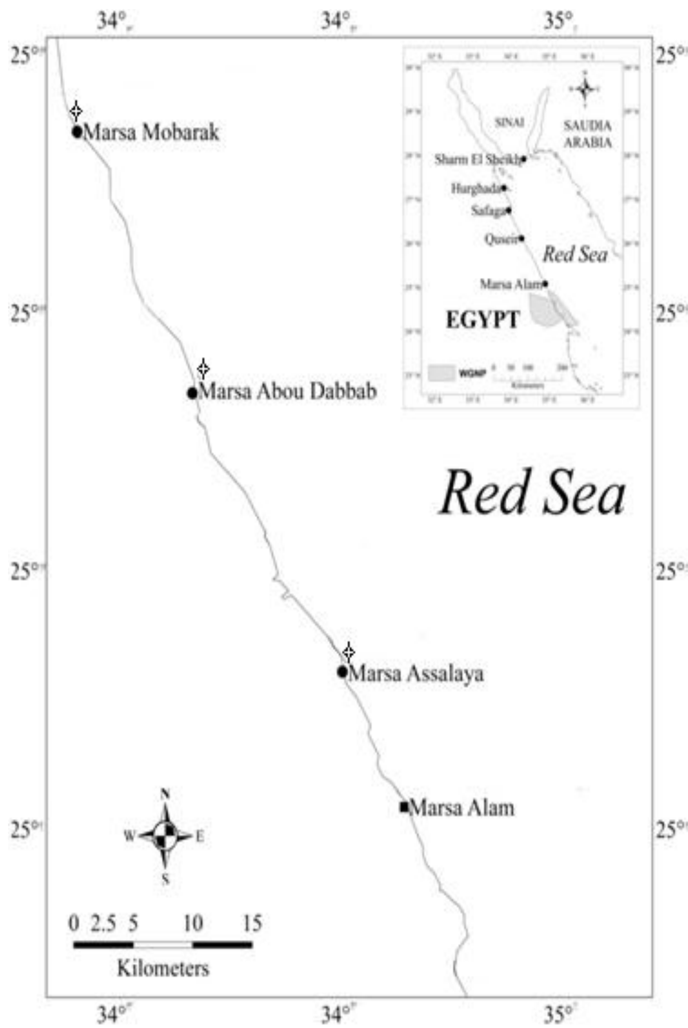

Fig. 1. A Map showing the studied sites along the Egyptian Red Sea coast

Sample analysis

In the laboratory, the collected sediments were stained with 0.5g/ l Rose Bengal for 1h then washed through sieves of 1mm and 50µm mesh size in the laboratory. All meiofauna retaining on the 50µm sieve were collected, sorted and counted to the major groups using a stereomicroscope (Prior S 2000, magnification 100x). Nematodes were picked out and transferred to glass vials containing pure glycerol. They were mounted onto permanent slides, examined under a compound microscope (Carl Zeiss 1000x magnification) and identified to the genus level using the pictorial keys of **Tarjan (1980)**, **Platt and Warwick (1983)**, **Plat and Warwick (1988)** and **Warwick *et al.* (1998)**.

Nematodes were categorized into four different feeding types (1A, 1B, 2A and 2B) by means of the morphology of their buccal cavities **(Wieser, 1953)**.

For granulometric analysis, additional sediment samples were washed with tap water to remove salt, dried at 60°C for 24h, then placed on top of a series of sieves with mesh size 1,000, 500, 250, 125 and 62µm. The sediments that retained on top of each sieve were weighed then classified to different grain size categories according to the method of **Holme and McIntyre (1984)**: silt-clay, very fine sand, fine sand, medium sand and coarse sand and gravel. Sediment sorting indices were determined according to **Gray (1981)**.

From each sediment sample, 1g of fine sediment with mean grain size (Mz)= 200 µm were taken and dried at 60°C for 24 hours in laboratory. Total organic matter (TOM) was assessed as the percentage weight loss in the samples after combustion at 550°C for 24 hours **(Jorgensen, 1977).**

Data analysis

Difference of meiofaunal abundance and other major groups among different sites was analyzed using one-way analysis of variance (ANOVA) with 95% confidence limits. Pearson correlation analysis was performed to determine the relationships between the total meiofaunal abundance and the other major taxa with the studied sediment characteristics. The above analyses were carried out using the statistical software SPSS 18.0 (2002). PRIMER v6.0 software **(Clarke & Gorley 2006)** was used for univariate measures of the meiofauna taxa for each site including all diversity indices. Moreover, the similarity of meiofauna among sites was determined by using the Bray-Curtis similarity index.

RESULTS

Physico-chemical parameter and sediment characteristics

Water temperature salinity displayed very limited variations among sites (Table 1). Sediments of seagrass beds in all sites exhibited high silt content percentages, total organic matter and low median grain size; whereas, the unvegetaed sediments showed opposite results (Table 1).The highest silt content and TOMs were found in Marsa Assalya seagrass bed (9.3% and 9.5mg/ g, respectively) while the lowest was recorded for Marsa Mobarak unvegetated sediments (0.9% and 1.6mg/ g). The texture of latter area attained the largest median grain size Mz (315 µm). In contrast, that of Marsa Assalya seagrass bed showed the least value (Table 1). All sediments were classified as "well sorted" ones.

Table 1. Water temperature, salinity, silt content %, sediment median grain size (Mz), total organic matter (TOMs) and sorting index at the investigated sites (S. B. =seagrass beds and U. S. = unvegetated sediments).

	Marsa Abou Dabbab		**Marsa Assalaya**		**Marsa Mobarak**	
Parameter	**S. B.**	**U. S.**	**S.B.**	**U. S.**	**S. B.**	**U. S.**
Temperature	25.2	25.3	25.2	25.5	25.8	26
Salinity	39.7	39.7	39.8	39.8	39.5	39.5
Silt content %	6.3	1.4	9.3	2.2	5.5	0.9
Mz (µm)	240	290	220	275	260	315
TOMs mg/g	9.2	2.5	9.5	2.8	7.3	1.6
Sorting Index	Well sorted					

Meiobenthic community structure

A total of 14 major meiobentic taxa were recorded in the studied sites. In seagrass beds, Nematoda was the most abundant taxa, contributing with 74% of the total individual counts, with an average density of 831.6±178 individual/ 10cm^2, followed by Copepoda (13%) and Polychaeta (6%) (Figs. 2, 4). In unvegetated sediments, Copepoda was the most common (47%), with an average density of 620.7±145 individual/ 10cm^2. Nematoda was ranked the second and contributed with 35% of total meiobenthic counts (Figs. 3, 4).

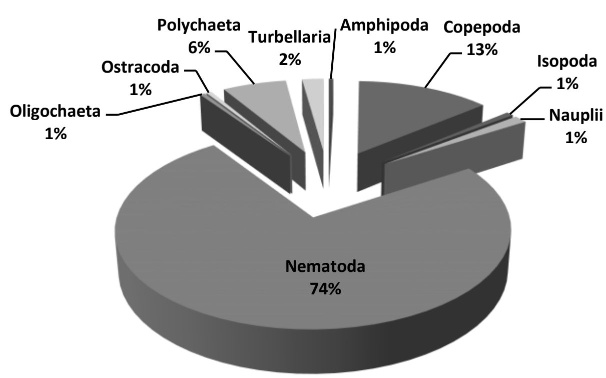

Fig. 2. Percentages of major meiobenthic taxa recorded in the seagrass beds

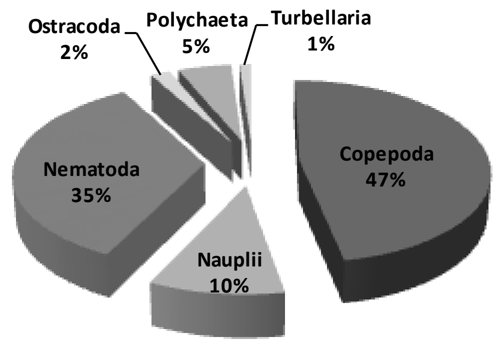

Fig. 3. Percentages of major meiobenthic taxa recorded in the unvegetated sediments

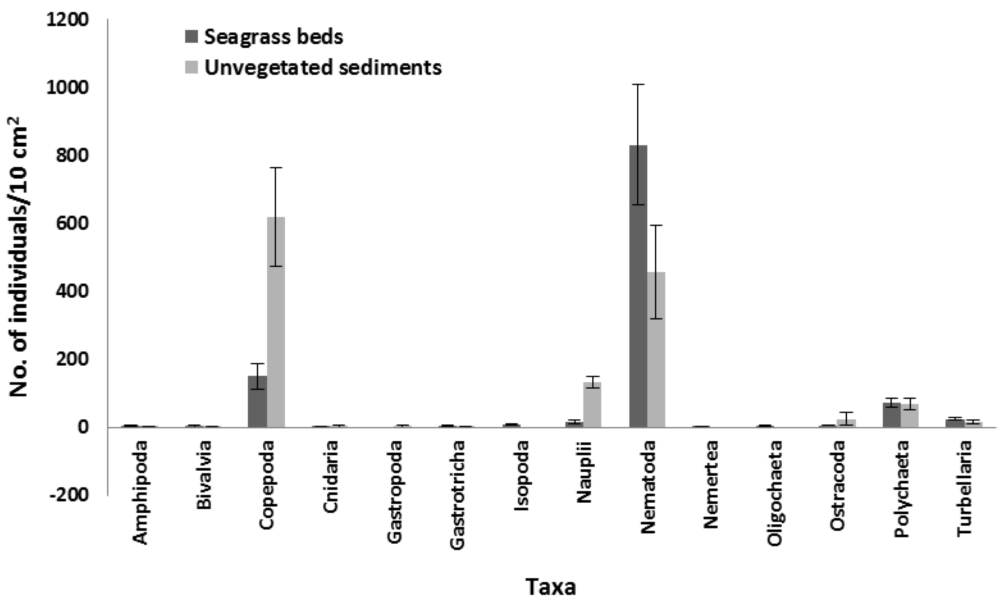

Fig. 4. Average abundance of meiofaunal taxa in the studied habitats

Percentages of the meiobenthic taxa were quite similar in both habitats; Nematoda ranged between 73.13% and 74.17% in the seagrass bed and 31.04% and 36.46% in unvegetated sediments, respectively. On the other hand, Copepoda showed a percentage of 12.47%-13.69%, 46.4 %-46.52 % in seagrass bed and unvegetated area, respectively (Fig. 5).

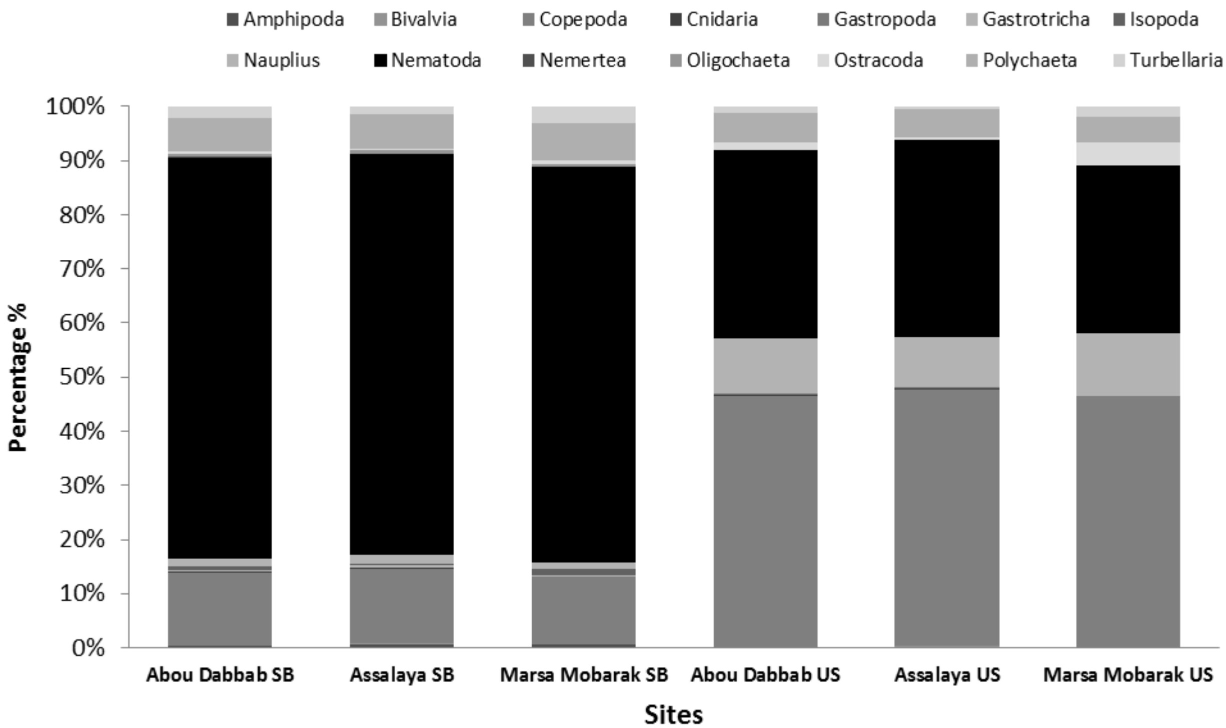

Fig. 5. Percentages of major meiobenthic taxa recorded in the studied sites. (SB=seagrass beds and US= unvegetated sediments).

Unvegetated areas in all the sites showed higher abundances of total meiofauna than those determined for the seagrass bed of the same site (Table 2). The highest average total meiofaunal density was recorded in the unvegetated sediment of Mara Assalya with mean density of 1603±240.3 individual/ 100cm^2. In contrast, the lowest was recorded in the seagrass beds of Marsa Mobarak 871.7±170.1 individual/ 10cm^2 (Table 2). The highest density was recorded for Nematoda in the seagrass beds of Marsa Assalya (999.7±150.2 individual/ 10cm^2), while the lowest was 1.2 ±0.6 individual/ 10cm^2 for Amphipoda in the unvegetated sediments of Marsa Abou Dabbab. Meiofaunal taxa showed a non-significant variation among sites (F= 0.73, *P*= 0.482); whereas, a high significant variation was detected among habitats (F= 66.38, *P*< 0.001).

Table 2. Densities of major taxa in the studied sites expressed as No. of individuals/ $10cm^2$. (S. B. =seagrass beds and U. S. = unvegetated sediments).

	Marsa Abou Dabbab		Marsa Assalaya		Marsa Mobarak	
Taxa	**S. B. (mean±SD)**	**U. S. (mean±SD)**	**S. B. (mean±SD)**	**U. S. (mean±SD)**	**S. B. (mean±SD)**	**U. S. (mean±SD)**
Amphipoda	3.3±1.5	1.2±0.6	6.7±4.2	2.3±2.5	5.3±1.5	-
Bivalvia	2.3±1.5	1.7±1.5	4.7±2.5	3.3±1.5	-	-
Copepoda	155.3±17.2	598.3±72.5	184.7±17	741.7±80.4	100±9.2	486.7±87.9
Cnidaria	1.3±1.2	2.3±2.1	1.7±1.5	5.3±4.5	-	-
Gastropoda	-	3.3±1.5	-	4.7±2.1	-	-
Gastrotricha	4.3±3.1	1.7±1.5	7.3±3.5	-	2.0±1	2.3±2.5
Isopoda	7.7±7.4	-	4.7±0.6	-	12.0±2.6	-
Nauplii	15±4.4	128.7±16	20±14.2	146.7±25.2	10.3±5.5	121.3±19.8
Nematoda	851.3±57.5	454.3±44.1	999.7±150.2	596.7±34	644.7±59.2	324.7±36.1
Nemertea	1.3±0.6	-	2.3±1.2	-	-	-
Oligochaeta	5.7±2.5	-	8.3±4	-	2.7±0.6	-
Ostracoda	5.7±3.1	19.7±2.5	4.7±2.9	10.0±2	7±1	45.3±7.8
Polychaeta	70.7±13.6	71.7±29.5	85±7	81.0±10.1	59.7±14.6	50.3±9.6
Turbellaria	25.3±11.2	15.3±3.5	20±7.5	11.3±1.5	28±6.2	20.3±8.3
Total averages	**1149.3±225.4**	**1298.3±189.4**	**1349.7±264.8**	**1603±240.3**	**871.7±170.1**	**1051±147.6**

Pearson correlation analysis showed strong significant values between all sediment parameters: silt content %, median grain size (Mz) and total organic matter (TOMs) (Table 3). Copepoda showed reasonable positive significant correlation with median grain z (r= 0.47, P< 0.05) and negative ones with silt content % and TOMs (r= -0.46, P= 0.05 and r= -0.52, P= 0.03, respectively). Nematoda displayed reasonable positive significant correlation with silt content % and TOMs (r= 0.62, P= 0.02 and r= 0.56, P= 0.02, respectively) and high significant negative correlation with Mz (r= -0.7, P= 0.01). The other correlation values between the sediment characteristics, Polychaeta and total meiofauna were not significant (Table 2).

Table 3. Pearson correlation coefficients between sediment parameters: the median grain size (Mz), silt content percentage %, total organic matter (TOMs), abundance of total meiofauna and the other major taxa

Parameter	Silt content %	Mz	TOMs
Mz	**-0.96 (0.003)**		
TOMs	**0.96 (0.002)**	**-0.94 (0.05)**	
Copepoda	**-0.46 (0.05)**	**0.47 (0.05)**	**-0.52 (0.03)**
Nematoda	**0.62 (0.02)**	**-0.7 (0.01)**	**0.56 (0.02)**
Polychaeta	0.24 (0.65)	-0.3 (0.56)	0.079 (0.88)
Total meiofauna	0.034 (0.95)	-0.085 (0.87)	- 0.098 (0.85)

P values are given between parentheses.

Diversity indices and similarities of meiobenthic communities

The total number of recorded taxa (13 taxa) were at the seagrass beds of Marsa Abou Dabbab and Marsa Assalya, while the lowest one was (7) for the unvegetated sediments of Marsa Mobarak (Table 4). The highest value of Shannon-Wiener index (H') was estimated for the unvegetated sediments of Marsa Abou Dabbab (1.3); while for species richness (SR), it was recorded for the seagrass beds of the afore- mentioned site (1.7). Evenness indices exhibited low values for the seagrass beds of all sites (0.37-0.43). In contrast, unvegeted sediments displayed high values (0.49- 0.54) (Table 4).

Table 4. Total recorded taxa (S), total individual count expressed as No. of individual/ 10 cm^2(N), Shannon- Wiener (H'), Species Richness (SR) and Evenness (J') of the studied sites

Site/ Parameter	S	N	H'	SR	J'
Marsa Abou Dabbab S. B.	13	1146	0.95	1.7	0.37
Marsa Assalya S. B.	13	1351	0.96	1.66	0.38
Marsa Mobarak S. B.	10	882	1	1.33	0.43
Marsa Abou Dabbab U. S.	11	1293	1.3	1.4	0.54
Marsa Assalya U. S.	10	1640	1.21	1.22	0.53
Marsa Mobarak U. S.	7	1047	0.96	0.86	0.49

S. B.=seagrass beds, and U. S.= unvegetated sediments.

High similarity values were estimated for sites representing the same habitats (Fig. 6). The dendrogram revealed two main clusters; the first was for the seagrass bed areas with values between 77.5% and 91.1%, while values between 74.4 % and 91.1% were recorded for the second cluster comprising the unvegetated areas (Fig. 6).

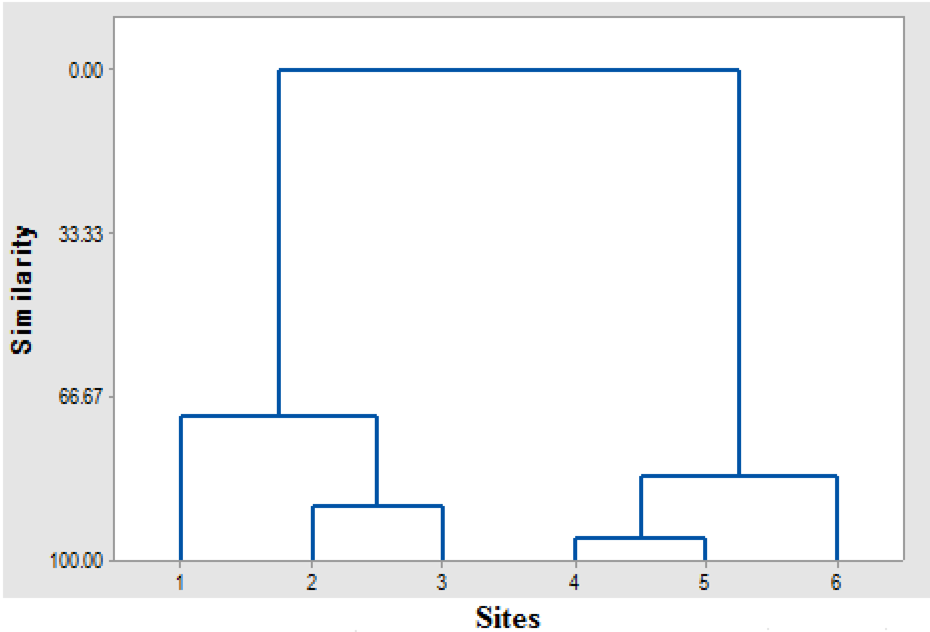

Fig. 6. Dendrogram showing the cluster analysis of the meiobentic taxa in the studied sites: (1: Marsa Abou Dabbab seagrass bed; 2: Marsa Assalaya seagrass bed; 3: Marsa Mobarak seagrass bed; 4: Marsa Abou Dabbab unvegetated sediment; 5: Marsa Assalaya unvegetated sediment, and 6: Marsa Mobarak unvegetated sediment)

Nematofauna

A total of 21 genera of nematodes were recorded in the studied habitats (Table 5); 18 genera in each habitat and 15 in both habitats. *Halalaimus, Leptolaimus* and *Phanoderma* were restricted to the seagrass bed habitats, while *Graphonema*, *Longicyatholaimus* and *Mesacanthion* were only recorded in the unvegetated areas. The total individual count of nematodes in seagrass beds was higher than that estimated for unvegetated areas (858±50.2 and 460.6±33.5 individuals/ 10cm^2, respectively). *Daptonema* showed the highest density in both habitats (23%, 196.1±21. 3 individuals/ 10cm^2 and 27%, 122.5±20.3 individual/ 10cm^2 in seagrass beds and unvegetated sediments, respectively) (Table 5). *Dismolaimus* and *Theristus* contributed with 0.5% of the total nematode count in all sites (Table 5).

Table 5. Abundance of nematode genera (expressed as No. of individuals/ $10cm^2$, contribution percentages and feeding type in the studied habitats

	Seagrass beds		**Unvegetated sediments**		**Feeding type**
Genus	**Individual count** (Mean±SD)	**%**	**Individual count** (Mean±SD)	**%**	
Epsilonema	**23.4±5.4**	**2.7**	**12.5±4.4**	**2.7**	1A
Halalaimus	**22±6.5**	**2.5**	**-**	**-**	1A
Leptolaimus	**9±2.8**	**1.1**	**-**	**-**	1A
Daptonema	**196.1±21.3**	**23**	**122.5±20.3**	**27**	1B
Dismolaimus	**20.6±7.4**	**2.5**	**2.2±0.5**	**0.5**	1B
Paralinhomeus	**85.7±42.4**	**10**	**16.3±5.3.**	**3.5**	1B
Theristus	**47.6±15.8**	**5.5**	**2.1±1**	**0.5**	1B
Chromadorita	**77.3±8.5**	**9**	**14.1±7.7**	**3**	2A
Desmodora	**128.1±54.2**	**15**	**5.7±1.1**	**1**	2A
Graphonema	**-**	**-**	**23.1±7.5**	**5**	2A
Longicyatholaimus	**-**	**-**	**90.4±28.5**	**20**	2A
Metachromadora	**43.1±11.9**	**5**	**5.8±0.7**	**1**	2A
Phanoderma	**4.2±0.5**	**0.5**	**-**	**-**	2A
Pomponema	**11±2.3**	**1.3**	**13.2±3.4**	**2.8**	2A
Pseudochromadora	**68.2±32.3**	**8**	**11.1±1.7**	**2.5**	2A
Spilophorella	**43.3±10.4**	**5**	**32.4±18.4**	**7**	2A
Spirinia	**9.5±1.8**	**1**	**68.7±16.8**	**15**	2A
Halicoanolaimus	**9.3±3.3**	**1**	**9.5±.3.3**	**2**	2B
Mesacanthion	**-**	**-**	**14.3±4.5**	**3**	2B
Oncholaimus	**36±21.1**	**4.2**	**11.5±2.2**	**2.5**	2B
Viscosia	**23.2±8.5**	**2.7**	**5.2±0.3**	**1**	2B
Total average count	**858±50.2**		**460.6±33.5**		

Epistrate feeding (2A) was the most abundant type in both habitats (57% in the unvegetated sediment and 45% in the seagrass beds) (Fig.7). 10 of 21 of nematodes are epistrate feeders, followed by 4 genera of non-selective deposit feeders (1B), 4 genera of predator/omnivore (2B), and 3 genera of selective deposit feeders. (Table 5). In the seagrass bed habitats, epistrate feeders and non-selective deposit ones showed very similar occurrences (Fig. 7).

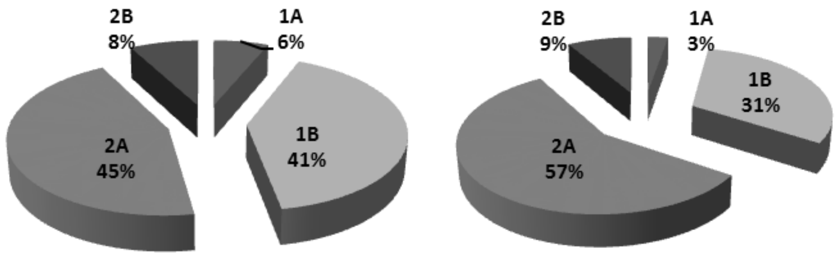

Fig. 7. The contribution of trophic types of nematodes in the studied habitats; sea grass beds (on the left) and unvegetated sediments (on the right).

DISCUSSION

The density of meiofauna in the studied sites were within the range of several tropical seagrass beds. **Pusceddu *et al.* (2014)** studied the meiofauna in three tropical ecosystems; namely, the Caribbean Sea, Mexico; the Red Sea, Egypt, and the Celebes Sea, Indonesia and found similar values. Additionlly, **Ansari and Parulekar (1994)** in the Arabian Sea and **Ndaro and Ólafsson (1999)** in Zanzibar found quite similar abundances.

High densities of meiofauna were found in the unvegetated sediment areas of the studied sites. This could be attributed to the high abundance of Copepoda and their nauplii in these habitats in comparison with those in seagrass beds at each site. This finding coincides with that of **Liao *et al.* (2015)** who found that, copepod densities in the seagrass bed are lower than those in the unvegetated sediments in Taiwan. This concurs with the findings of **Castel *et al*. (1989)** in the Arcachon Bay on the south west coast of France, **Danovaro *et al.* (2002)** in the west Mediterranean Sea, **Hourston *et al.* (2005)** in Australia, and **Leduc and Probert (2011)** in southern New Zealand. In contrast, the abundance of Copepoda was higher in seagrass beds of Tahunanui, Nelson New Zealand **(Hicks, 1986)**, in the Arabian Sea **(Ansari & Parulekar, 1994)**, in Zanzibar **(Ndaro & Ólafsson, 1999)** and in Gazi Bay, Kenya **(De Troch *et al.*, 2001)**.

Copepoda are very important for seagrass meadows. Copepod is valuable taxa in the seagrass beds; they contribute to the reduction of epiphytes due to grooming which provides benefits to the seagrass shoots **(Naufal & Pamavati, 2018)**.

In the current study, copepod densities were positively correlated to the median grain size of sediments although those underneath the seagrasses exhibited smaller median grain sizes than those of the unvegetated areas, matching with the findings of **Coull (1985)** in South Carolina USA. **Leduc *et al*. (2009)** and **Leduc and Probert (2011)** in New Zealand reported that, dense vegetation of seagrasses inhibit the growth of microflora in these soft bottom habitats, which are the main food items of copepods. **Giere (2009)** reviewed that, the interstitial Copepoda favored the well oxygenated sediments. Therefore, the dense occurrence of this group in unvegetated sediments of the study areas could be referred to the coarse texture of the sediment particles which is more fitted to keep the oxygen saturation level in their pore waters higher than the seagrass beds.

Commito and Tita (2002) concluded that, the high dispersal rates of Copepoda and their nauplii in comparison with nematodes affect the local distribution patterns in the seagrass habitats of Main, USA. These organisms are active and could forage for foods in the margin of unvegetated sediments but still close to seagrass beds **(Orth *et al.*, 1984)**. This explanation supports my conclusion for the high occurrence of Copepoda whether in the sediments underneath the seagrass beds or in the unvegetated areas.

High densities of nematodes in seagrass beds were higher, compared to those in the adjacent unvegetated sediments. The high abundance of nematodes in these habitats is mainly due to their high organic matter and fine fraction contents. The same findings were reported in the study of **Castel *et al*. (1989)** in the west Mediterranean Sea, **Danovaro *et al.* (2002)** in Australia, **Hourston *et al.* (2005)** in New Zealand, **Leduc and Probert (2011)** in Taiwan and **Liao *et al.* (2015)**. **Giere (2009)** stated that the abundance of nematodes was positively correlated with fine sediment texture and rich organic contents within the inhabited sediments.

21 genera of nematodes were recorded herein. Of them, 10 genera were epistrate feedes which is in accordance with several studies in the seagrass habitats (in Zanzibar, Ndaro and Ólafsson 1999; in west Mediterranean Sea, **Danovaro and Gambi, 2002**; in Australia, **Fonseca *et al,*. 2011**). Epistrate feeding type (2A) was the most abundant between the recorded nematodes. This might be referred to the sediment texture that is dominated by different categories of sand. However, non-selective deposit feeding type (1B) came second in abundance in seagrass areas which displayed a smaller median grain sizes than that determined for unvegetated ones. This finding is in accordance with **Alongi (1986)** who concluded that epistrate nematodes were very common in medium coarse sands with a very poor fine fraction in tropical habitats in Australia.

Daptonema, was the most abundant nematodes in both habitats. This is in agreement with **Ndaro and Ólafsson (1999)** in Zinzibarm eastern Africa; **Hourston *et al.* (2005)** in Australia; **Fonseca *et al.* (2011)** in Australia; **Liao (2015)** in Taiwan. They found this genus to be very common in the widespread seagrass habitats, particularly in sandy sediments. Although *Daptonema* is a non-selective deposit feeder, various ecological studies have established that they also feed on diatoms at the surface of sediment grains and can act as epistrate feeders (Moens and Vincx 1997 in Netherlands). **Sabeel and Vanreusel (2015)** found that *Daptonema* was occurred in all sediment samples of the mangroves along the Sudanese coast of the Red Sea. They referred that to its ability to tolerate unfavorable conditions in addition to considering it as a fast growing, opportunistic genus which can reproduce early in any habitats.

In the current study, some genera were found to be restricted to the seagrass habitats while others showed the opposite. *Longicyatholaimus* was restricted to unvegetated areas and ranked second in abundance. In the southeastern coast of Taiwan, **Liao *et al.* (2015)** found that this genus was dominant in unvegetated sediments than those adjacent seagrass bed in the southeastern coast of Taiwan. **Monthum and Aryuthaka (2006)** found that *Paralongicyatholaimus*; is the dominant genus in seagrass beds and adjacent unvegetated regions in Thailand.

CONCLUSION

Meiobenthic community structure varied among habitats rather than sites and sediment characteristics played an apparent role in constituting these communities. Nematoda and Copepoda exchanged dominance in the studied habitats. Free living nematodes were the most abundant group in the seagrass bed areas and epistrate feeding was the dominant feeding type. Further studies are recommended to examine other components (i. e. macrofauna and micro-phytobenthos) in the seagrass communities along the Egyptian Red Sea coast. Their relationships with meiobenthic organisms need to be studied in order to give us an integrated knowledge on these valuable habitats.

ACKNOWLEDGMENTS

I wish to thank Dr. Ahmed Shawky for his help with the collection of sediment samples and Dr. Wafaa Sallam for revising the manuscript.

REFERENCES

Ahmed, A.; Mohammed, D. and Hanafy, M. (2011). Distribution and species composition of the littoral interstitial free living nematodes in the northern Red Sea, Egypt. E*gypt.* Egypt. J. Aquat. Biol. & Fish., 15(2): 159-177.

Al-Sofyani, A. and Al-Sherbiny, M. (2018). Meiobenthic assemblage of the grey mangrove (Avicenniamarina) along the Saudi Arabian coast of the Red Sea with emphasis on free-living nematodes. Oceanolog. and Hydrobiolog.al St.**,** 47(4): 359-375.

Alongi, D. (1986). Population structure and trophic composition of the free-living nematodes inhabiting carbonate sands of Davies Reef, Great Barrier Reef, Australia. Aust. J. Mar. Freshwat. Res., 37: 609-619.

Ansari. Z. and Parulekar, A. (1994). Meiobenthos in the sediment of seagrass meadows of Lakshadweep atolls, Arabian Sea. Vie Milieu., 44: 185–190.

Atilla, N.; Fleeger, J. and Finelli C. (2005). Effects of habitat complexity and hydrodynamics on the abundance and diversity of small invertebrates colonizing artificial substrates. J. Mar. Res., 63:1151–1172.

Baden, S. and Böstrom, C. (2001). The leaf canopy of seagrass beds: faunal community structure and function in a salinity gradient along the Swedish coast. In: Reise K (ed) Ecological comparisons of sedimentary shores, ecolog. St., 151. Springer-Verlag, Berlin, 213–236 pp.

Baden, S. Böstrom, C.; Tobiasson, S.; Arponen, H. and Moksnes P. (2010). Relative importance of trophic interactions and nutrient enrichment in seagrass ecosystems: a broad-scale field experiment in the Baltic-Skagerrak area. Limnol Oceanogr., 55: 1435–1448.

Bongers, T. and Ferris, H. (1999). Nematode community structures as a bioindicator in environmental monitoring. Trends Ecol. Evol., 14: 224–228.

Bos A.; Bouma, T.; de Kort, G. and van Katwijk, M. (2007). Ecosystem engineering by annual intertidal seagrass beds: Sediment accretion and modification. Estuar., Coast. and Shelf Sci., 74: 344–348.

Boström C, Jackson E. and Simenstad, C. (2006). Seagrass landscapes and their effects on associated fauna: a review. Estuar Coast. Shelf Sci., 68: 383–403.

Bouma, T.; Ortells, V. and Ysebaert, T. (2009). Comparing biodiversity effects among ecosystem engineers of contrasting strength : macrofauna diversity in Zostera noltii and Spartina anglica vegetations. Helgol Mar. Res., 63: 3–18.

Castel J, Labourg, P.; Escaravage, V.; Auby, I. and Garcia, M. (1989). Influence of seagrass beds and oyster parks on the abundance and biomass patterns of meio- and macrobenthos in tidal flats. Estuar. Coast. Shelf Sci., 28: 71–85.

Clarke, K and Gorley R. (2006). Primer v6: User Manual/Tutorial. Primer E Ltd. Plymouth.

Commito, J. and Tita, G. (2002) Differential dispersal rates in an intertidal meiofauna assemblage. J. Exp. Mar. Biol. Ecol., 268: 237–256.

Coull, B. (1985). Long-term variability of estuarine meiobenthos: an 11 year study. Mar. Ecol. Prog. Ser., 24: 205–218.

Danovaro, R. and Gambi, C. (2002). Biodiversity and trophic structure of nematode assemblages in seagrass system: evidence for a coupling with changes in food availability. Mar. Biol., 141: 667–677.

Danovaro, R.; Gambi, C. and Mirto, S. (2002). Meiofaunal production and energy transfer efficiency in a seagrass *Posidonia oceanica* bed in the western Mediterranean. Mar. Ecol. Prog. Ser., 234: 95–104.

Da Rocha, C.; Venekey, V.; Bezerra, T. and Souza, J. (2006).Phytal marine nematode assemblages and their relation with the macrophytes structural complexity in a Brazilian tropical rocky beach. Hydrobiol., 553: 219–230.

De Troch, M.; Gurdebeke, S.; Fiers, F. and Vincx, M. (2001). Zonation and structuring factors of meiofauna communities in a tropical seagrass bed (Gazi Bay, Kenya). J. Sea Res., 45: 45–61.

De Torch, M.; Vandepitte, L.; Raes, M.; Suarez-Morales, E. and Vincx, M. (2005). A field colonization experiment with meiofauna and seagrass mimics: effect of time, distance and leaf surface area. Mar. Biol., 148(1): 73-86.

Duarte, C. and Chiscano, C. (1999). Seagrass biomass and production: a reassessment. Aquat. Bot., 65: 159–174.

El-Serehy, H.; Al-Misned, F. and Al-Rasheid, K. (2015). Population fluctuation and vertical distribution of meiofauna in the Red Sea interstitial environment. Saudi J. of Biol. Sci., 22: 459-465.

El-Serehy, H.; Al-Rasheid, K.; Al-Misned, F.; Al-Talasat, A. and Gewik, M. (2016). Microbial-meiofaunal interrelationships in coastal sediments of the Red Sea. Saudi J. of Biol. Sci., 23: 327-334.

Fonseca, G.; Hutchings, P. and Gallucci, F. (2011). Meiobenthic communities of seagrass beds (Zostera capricorni) and unvegetated sediments along the coast of New South Wales, Australia. Estuar. Coast. Shelf Sci., 91: 69–77.

Gacia, E.; Duarte, C.; Marba, N.; Terrados, J.; Kennedy, H.; Fortes, M. and Tri, N. (2003). Sediment deposition and production in SE-Asia seagrass meadows. Estuarine, Coast. and Shelf Sci., 56: 909–919.

Giere, O. (2009) Meiobenthology: the microscopic motile fauna of aquatic sediments, 2nd edn. Springer-Verlag, Berlin.

Hall, M, and Bell, S. (1993). Meiofauna on the seagrass Thalassia testudium population characteristics of harpacticoid copepods and associations with algal epiphytes. Mar. Biol., 116: 137–146.

Hanafy, M.; Mohammed, D. and Ahmed, A. (2011). Seasoanl distribution of the littoral interstitial meiofauna in the northern Red Sea, Egypt. Egypt. J. Aquat. Biol. & Fish., 15(2): 35-51.

Hedfi, A.; Ben Ali, M.; NourEl-Deen, A.; Albogami, B.; Hassan, M.; Saif., T. and Boufahja, F. (2018). Distribution and abundance of benthic meiofauna in the eastern Red Sea coasts (Jeddah, Saudi Arabia). Anim. Resear. and Rev. in Biol., 26(2): 1-12.

Heip, C.; Vincx, M. and Vranken, G. (1985). The ecology of marine nematodes. Oceanogr. Mar. Biol. Ann. Rev., 23: 399–489.

Heiss, W.; Smith, A. and Probert, P. (2000) Influence of the small intertidal seagrass Zostera novazelandica on linear water flow and sediment texture. New Zealand J. of Mar. and Freshwater Resear., 34: 689–694.

Hemminga, M. and Duarte, C. (2000) Seagrass Ecology. Cambridge Unviersity Press, New York, pp. 199-239.

Hicks, G. (1986). Distribution and behaviour of meiofaunal copepods inside and outside seagrass beds. Mar. Ecol. Prog. Ser., 31:159–170.

Hodda, M. (1990) Variation in estuarine littoral nematode populations over three spatial scales. Estuar. Coast. Shelf. Sci., 30: 325–340.

Holme, N. and McIntyre, A. (1984). Methods for the Study of Marine Benthos, Second ed. Blackwell, Oxford, pp. 387.

Hopper, B. and Meyers, S. (1967). Population studies on benthic nematodes within a subtropical seagrass community. Mar. Biol., 1: 85–96.

Hourston, M.; Warwick, R.; Valesini, F. and Potter, I. (2005). To what extent are the characteristics of nematode assemblages in nearshore sediments on the west Australian coast related to habitat type, season and zone?. Estuar. Coast. Shelf Sci., 64: 601–612.

Leduc, D. and Probert, P. (2011). Small-scale effect of intertidal seagrass (Zostera muelleri) on meiofaunal abundance, biomass, and nematode community structure. J. Mar. Biol. Ass .UK., 91: 579–591.

Leduc, D.; Probert, P. and Duncan, A. (2009). A multi-method approach for identifying meiofaunal trophic connections. Mar. Ecol. Prog. Ser., 383: 95–111.

Liao, J.; Yeh, H. and Mok, H. (2015). Meiofaunal communities in a tropical seagrass bed and adjacent unvegetated sediments with note on sufficient sample size for determining local diversity indices. Zoolo. St., 54(14): 1-10.

Kharlamenko, V.; Kiyashko, S.; Imbs, A. and Vyshkvartzev, D. (2001). dentification of food sources of invertebrates from the seagrass Zostera marina community using carbon and sulfur stable isotope ratio and fatty acid analyses. Mar. Ecol. Progress Ser., 220: 103–117.

Kikuchi, T. (1980). Faunal relationships in temperate seagrass beds, In R. C. Phillips and C. P. McRoy (eds.), Handbook of Seagrass Biology: an ecosystem perspective. Garland STPM, New York, pp. 153-172.

McLachlan, A.; Erasmus, T. and Furstenberg, J. (1977) Migrations of sandy beach meiofauna. Zool. Afr., 12: 257–277.

Mills, V. and Berkenbusch, K. (2009). Seagrass (*Zostera muelleri*) patch size and spatial location influence infaunal macroinvertebrate assemblages. Estuar Coast. Shelf Sci**.,** 81: 123–129.

Moens, T. and Vincx, M. (1997). Observations on the feeding ecology of estuarine nematodes. J. Mar. Biol. Ass. UK., 77: 211–227.

Monthum, Y. and Aryuthaka, C. (2006). Spatial distribution of meiobenthic community in Tha Len seagrass bed, Krabi Province, Thailand. Coast. Mar. Sci., 30:146-153.

Naufal, P. and Padmavati, G. (2018). Meiofaunal distribution and abundance from the intertidal seagrass patches of Chidiyatapu, Port Blair. Ind. J. of Geo Mar. Sci., 47(02): 357-364.

Ndaro, S. and Ólafsson, E. (1999). Soft-bottom fauna with emphasis on nematode assemblage structure in a tropical intertidal lagoon in Zanzibar, eastern Africa: I. Spatial variability. Hydrobiol., 405: 133–148.

Orth, R.; Heck, K. and Montfrans. J. (1984). Faunal communities in seagrass beds: a review of the influence of plant structure and prey characteristics on predator–prey relationships. Estua., **7**: 339–350.

Osenga, G. and Coull, B. (1983). *Spartina alterniflora* root structure and meiofaunal abundance. J. Exp. Mar. Biol. Ecol., 67: 221–225.

Platt, H. and Warwick, R. (1988). Free-living marine nematodes. Part II. British chromadorids, Brill/Backhuys, Leiden Sanders HL (1968) Marine benthic diversity: a comparative study. Am. Nat., 102: 243–282.

Pusceddu, A.; Gambi, C.; Corinaldesi, C.; Scopa, M. and Danovaro, R. (2014). Relationships between meiofaunal biodiversity and prokaryotic heterotrophic production in different tropical habitats and oceanic regions. PLOS ONE, 9(3): 1-17.

Sabeel, R. and Vanreusel, A. (2015). Potential impact of mangrove clearance on biomass and biomass size spectra of nematode along the Sudanese Red Sea coast. Mar. Enviro. Resear., 103: 46-55.

Soetaert K, Heip C (1990). Sample-size dependence of diversity indices and the determination of sufficient sample size in a high-diversity deep-sea environment. Mar. Ecol. Prog. Ser., 59: 305–307.

Steyaert, M.; Vanaverbeke, J.; Vanreusel, A.; Barranguet, C.; Lucas, C. and Vincx, M. (2003). The importance of fine-scale, vertical profiles in characterising nematode community structure. Estuar. Coast. Shelf Sci., 58: 353–366.

Tarjan, A. (1980). Illustrated guide to the marine nematodes. IFAS, Univ. of Florida, Gainesville. 135 pp.

Warwick, R.; Platt, H. and Somerfield, P. (1998). Free-living marine nematodes part III- Monhysterids. In: Barnes, D. K. A., Crothers, J. H. (Eds.), Pictorial key to world genera and notes for the identification of British species. The Linnean Society of London, London.

Webster, P.; Rowden, A. and Attrill, M. (1998). Effect of shoot density on the infaunal macro-invertebrate community within a *Zostera marina* seagrass bed. Estuar Coast. Shelf Sci., 47: 351–357.

Wieser,W. (1953). Die Beziehung zwischen Mundhöhlengestalt, Ernährungsweise und Vorkommen bei freilebenden marinen Nematoden. Arkiv. Zoologi., 4: 439-484.