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Meiofauna and nematode diversity in some Mediterranean subtidal areas of the Adriatic and Ionian Sea

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SUMMARY: Sediments of three different subtidal areas (15-705 m depth) of the Italian coasts (Manfredonia, Brindisi and Gallipoli) were investigated to study meiofauna and nematode composition. The nematodes were identified to the genus level and their abundances compared using multivariate analysis. Our data showed an evident depth gradient in meiofauna abundance: the shallowest sites had more diverse and abundant meiobenthic communities than the deeper ones. Nematodes were the dominant taxon (83-100%) at all sites, followed by Copepoda (0.5-8%). *Sabatieria*, *Astomonema*, *Dorylaimopsis*, *Terschellingia* and *Daptonema* were among the dominant nematode genera in the three areas. Nematode genus H' diversities were not significantly dissimilar, though at community level some differences were detected among the study areas. The greatest differences were observed in the comparison of the communities from Manfredonia and Gallipoli. Furthermore, there was a difference between shallow (<200 m) and deep sites due to high differential abundances of common genera (i.e. *Astomonema*, *Dorylaimopsis*, *Sabatieria* and *Terschellingia).*

Keywords: meiobenthos, nematodes, community structure, subtidal area, Mediterranean Sea.

RESUMEN: Meiofauna y diversidad de nemátodos en algunas áreas submareales mediterráneas de los mares Adriático y Jónico. – Los sedimentos de tres áreas submareales (15-705 m de profundidad) de la costa italiana (Manfredonia, Brindisi, Gallipoli) se investigaron para estudiar la meiofauna y composición de nemátodos. Los nemátodos se identificaron a nivel de género y sus abundancias se compararon usando análisis multivariantes. Nuestros datos mostraron un evidente gradiente de profundidad en la abundancia de la meiofauna: los lugares más someros tuvieron comunidades del meiobentos más diversas y abundantes que los más profundos. Los nemátodos fueron el taxon dominante (83-100%) en todos los lugares, seguido por los copépodos (0.5-8%). *Sabatieria*, *Astomonema*, *Dorylaimopsis*, *Terschellingia* y *Daptonema* fueron los géneros de nemátodos dominantes en las tres áreas. Las diversidades de géneros de nemátodos (H') no fueron significativamente disimilares; incluso a nivel de comunidad se detectaron algunas diferencias entre areas de estudio. Las mayores diferencias se observaron cuando se compararon comunidades de Manfredonia y Gallipoli. Además, hubo diferencia entre sitios someros (<200 m) y profundos debido a las grandes diferencias en la abundancia de géneros comunes (i.e. *Astomonema*, *Dorylaimopsis*, *Sabatieria*, *Terschellingia).*

Palabras clave: meiobentos, nemátodos, estructura de comunidad, área submareal, Mediterráneo.

INTRODUCTION

Many studies on meiobenthic communities have been carried out in the western Mediterranean (Soyer *et al*., 1987; Soyer, 1971; Boucher, 1972, 1980; de Bovée, 1987, 1988) and more recent investigations have focused on deep-sea areas (de Bovée *et al*., 1990; Soetaert *et al*., 1991; Soetaert and Heip, 1995; Danovaro *et al*., 1995a).

However, knowledge of the structure, composition and diversity of the meiofauna along the southern Italian coast is rather scarce and fragmentary.

Data generally relate to the intertidal zone and focus on particular taxa or on effects of anthropogenic disturbances on the whole community (Sandulli and de Nicola-Giudici, 1990; Sandulli and de Nicola, 1991). Studies on meiofauna of the southern Adriatic Sea and northern Ionian Sea are even scarcer. Some information about the distribution of meiofauna along the Apulian coasts (southern Italy) was given by de Zio Grimaldi *et al*. (1999), and Sandulli *et al*. (2002), who showed a strict relationship between meiofauna community composition and abundance and depth and sediment texture (with a clear preference for medium and medium-fine sands at 10-20 m depths). In previous studies, Mediterranean muds (below 50 m depth) have been shown to harbour a less diverse meiofauna than sandy habitats (Danovaro *et al*., 1995a, 1995b, 2000; Sandulli *et al*., 2003, 2004).

The aim of the present study was to gather further information on the structural characteristics of the meiobenthic and nematode communities along the southern Italian coasts located in the southern Adriatic Sea and northern Ionian Sea (Manfredonia, Brindisi and Gallipoli).

In particular, the major aims of this paper are: (1) to analyse the composition and biodiversity of the meiofauna and nematodes (up to genus level) of each Apulian area; and (2) to evaluate any similarities/dissimilarities between the three areas.

MATERIALS AND METHODS

Study area

The study area (Fig. 1) includes three different zones along the Apulian coast: Manfredonia and Brindisi (Adriatic Sea) and Gallipoli (Ionian Sea).

The first study area, located inside the Gulf of Manfredonia, is sheltered and rather shallow, with depths never exceeding 100 m. It is characterised by low hydrodynamic conditions and increased phytoplankton sedimentation rates (Viel and Zurlini, 1986; Vaccarella and Paparella, 1998). The bottoms are essentially composed of silty sand sediments close to the shoreline (2-4 m depth), and muds in the central part of the Gulf (>8 m depth) and in the deeper zones (Colantoni and Gallignani, 1975).

The second area is located on the northwest of the Marine Protected Area of Torre Guaceto (Brindisi), between 60 and 300 m depth. From the shoreline to the open sea a sequence of different

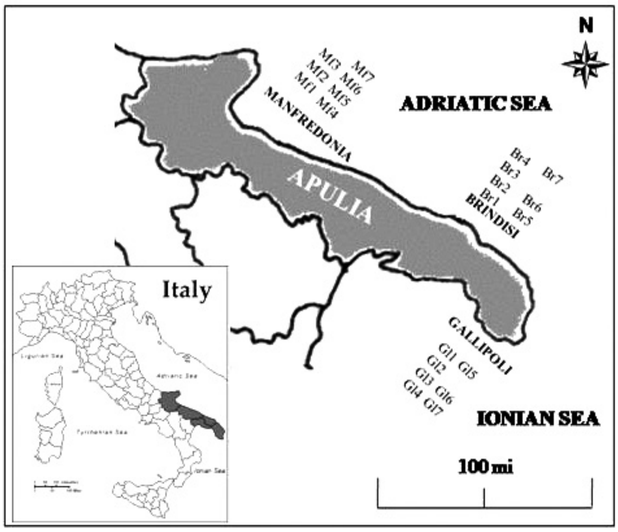

FIG. 1. – Study area showing position of transects and sampling sites.

habitats is evident: sandy sediments occur down to 5-6 m depth, followed by meadows of *Posidonia oceanica* and coralligenous sediment (12-22 m depth). Muddy sediments prevail from 25 m depth onwards (Parenzan, 1979).

The deepest (200-700 m) and least sheltered area investigated is Gallipoli, situated on the northern Ionian Sea. Here, coastal sediments consist of coarse sand; followed by coralligenous sediment between 40 and 80 m depth, and silty mud down to 200 m. Deeper sediments consist of oligothrophic bathyal mud, according to Pérès and Picard (1964).

Sampling method and treatment of samples

Sediment sampling was carried out during three cruises from April to July 2004 aboard the oceanographic vessel *Universitatis* (CoNISMa). All samples were collected between 15 and 705 m depth. Seven sites within each area were selected (Fig. 1, Table 1).

Samples were obtained using a modified Van Veen grab. At each location, the grab was deployed three times. Sediment redox potential was measured immediately after sampling, using a microelectrode (Hanna Instruments 3131) connected to an Eh-pH-meter (Hanna Instruments 9023). Redox potential was measured from the top to 8 cm depth within the sediments. Subsamples for meiofaunal analysis were collected in triplicate using a Perspex core (6.2 cm^2) to a depth of 5 cm.

Samples were fixed in 5% neutral formaldehyde seawater solution. Meiofauna was extracted from muddy sediment by centrifugation with LUDOX AM

Table 1. – Sampling data: location, water depth and redox potential (0-2 cm depth) for all sites.

Localities	Sites	Lat. (N)	Long. (E)	Depth (m)	Eh (mV)
Manfredonia	Mf1	41°39.692’	16°11.857’	15	346
	Mf2	40°41.022’	16°23.254’	50	441
	Mf3	41°41.598’	16°27.027’	72	363
	Mf4	41°36.875’	16°12.783’	17	434
	Mf5	41°38.199’	16°24.111’	53	186
	Mf6	41°31.632’	16°28.002’	73	203
	Mf7	41°39.426’	16°39.589’	105	390
Brindisi	Br1	40°48.662’	17°39.107’	61	308
	Br2	40°52.460’	17°42.356’	102	245
	Br3	40°59.236’	17°48.185’	145	393
	Br4	41°01.138’	17°50.823’	320	422
	Br5	40°47.544’	17°42.810’	61	165
	Br6	40°58.488’	17°51.931’	132	310
	Br7	41°00.235’	17°54.325’	272	360
Gallipoli	Gl1	39°53.943’	17°48.317’	256	253
	Gl2	39°51.872’	17°44.381’	405	383
	Gl3	39°50.047’	17°42.712	575	389
	Gl4	39°50.109’	17°40.677’	705	403
	Gl5	39°50.194’	17°48.795’	263	343
	Gl6	39°48.318’	17°45.418’	573	382
	Gl7	39°48.031’	17°44.802’	673	369

solution (McIntyre and Warwick, 1984), retained on a 43 μm sieve and stained with Rose Bengal; finally the organisms were sorted and counted under a stereomicroscope (Higgins and Thiel, 1988).

Up to a maximum of 100 nematodes per sample were picked out randomly from the most abundant replicate sample, and permanent mounts in glycerol were made. Nematodes were identified to the genus level, using mainly the NeMys online identification key (Steyaert *et al*., 2005) and other relevant literature (i.e. Platt and Warwick, 1983, 1988; Soetaert and Vincx, 1987; Soetaert and Decraemer, 1989; Warwick *et al*., 1998).

Structural characteristics of meiofauna

The Shannon-Wiener index (H’) and Pielou index (J) were calculated to describe the diversity and evenness of the meiofauna and nematode communities. The genus nematode diversity data were analysed using the Kruskal-Wallis test by ranks since data did not meet the assumptions for ANOVA, even after transformation.

Non-metric multidimensional scaling (MDS) on relative nematode abundances was applied to spatial grouping based on the Bray-Curtis similarity index. Significance of differences among nematode genus composition between the three sampling areas were tested using the ANOSIM (analysis of similarities) according to Clarke and Green (1988) and Clarke (1993). The contribution of individual genera (cumulative contribution of 90%) to the average Bray-Curtis dissimilarity among ween the three areas was determined using the SIMPER “similarity percentages” routine (Clarke and Warwick, 1994). All multivariate analyses were performed using the Primer® v.6 software package (Clarke and Warwick, 1994; Clarke and Gorley, 2006).

RESULTS

All examined samples were composed of silty mud sediment. Redox potentials of the upper two

Table 2. – Total density and diversity indices of meiofauna, and percentage of taxa in the three Apulian areas. The average values between three replicate samples are represented.

	Manfredonia							Brindisi							Galliopoli						
Sites	Mf1	Mf2	Mf3	Mf4	Mf5	Mf6	Mf7	Br1	Br2	Br3	Br4	Br5	Br6	Br7	Gl1	Gl2	Gl3	Gl4	Gl5	Gl6	Gl7
Nematoda	89	83	96	93	96	94	95	95	87	98	95	96	89	84	90	100	93	100	97	93	100
Copepoda	4	3	2	2	2	1	3	0.5	2	1	2	1	5	8	3		7		2	2	
Nauplii	0.1	3	0.5	0.3		1	1					0.4	1		5					1	
Annelida	0.9	2	1	0.7	1	1	0.5	2		1	1	0.7	2							3	
Ostracoda						0.5															
Kinorhyncha	3	6	0.1	3	0.5	2		0.5			1	0.4		3							
Turbellaria	3	2	0.3	1		0.5		2	11		1		2		2					1	
Isopoda												0.6		3							
Amphipoda							0.5														
Tanaidacea		1			0.5							0.6		2					1		
Cnidaria			0.1									0.3									
Acarina													1								
Total Density	692	428	335	1084	285	558	144	314	34	73	46	170	79	20	22	13	15	9	40	67	5
SE	217	101	104	195	22	70	21	25	12	23	28	44	53	6	2	1	4	4	11	11	1
H’	0.5	0.6	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.1	0.1	0.1	0.3	0.4	0.3	0	0.1	0	0.1	0.3	0
J	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.1	0.1	0.1	0.2	0.3	0.2	0	0.2	0	0.2	0.3	0

TABLE 3. – Nematode genera identified in the three Apulian areas. Numbers represent abundance percentage per sample.

GENUS	Mf1	Mf2	Mf3	Mf4	Mf5	Mf6	Mf7	Br1	Br2	Br3	Br4	Br5	Br6	Br7	Gl1	Gl2	Gl3	Gl4	Gl5	Gl6	Gl7
Parironus								2					7							1	
Halalaimus	2	1	2		1		4	3							13						
Viscosia				1			3						4								
Filoncholaimus														3							
Adoncholaimus							1						1	3							
Mononcholaimus				1																	
Anticoma				1																	
Tripyloides										5			3								
Pandolaimus										5											
Chromadora		1							5												
Rhips													2								
Chromadorina				2																	
Prochromadorella								1													
Dichromadora																				2	
Chromadorella																				1	
Chromadorita					1								1								
Prochromadorita								1													
Euchromadora	1							1													
Spilophorella												6									
Innocuonema						1						1								1	
Neochromadora			2	1									1								
Neotonchoides		1	1																		
Comesa					3							6	4						1		
Gomphionema				9																	
Metacyatholaimus			10										1								
Paralongycyatholaimus							1							3	13						
Paracyatholaimus												1									
Longicyatholaimus														3							
Pomponema						1	2														
Nannolaimoides				2																	
Richtersia	1			2																	
Choniolaimus								1													
Synonchium				1																	
Halichoanolaimus							1						1						1	4	
Synonchyella						1	1						1	3						1	
Dorylaimopsis	23	25	40	11	57	37	9	7	13	5		27	4							2	
Laimella					1	1						1		3	13					1	
Comesoma								1								10					
Paracomesoma																				1	
Metacomesoma																		34			
Hopperia				2	3	1	2	3		10	60	9	4	3					3	14	
Vasostoma	5		2					3			20	2					13				
Setosabatieria	6		2			26	20			5		4	7							5	13
Pierrickia		3	1													10			4	1	
Sabatieria	11	25	26	5	6	10	21	24	36	37		10	22	19					16	12	
Cervonema							1												4	5	
Paramesonchium					1																
Desmodora	3			1																	
Metachromadora																	12				
Molgolaimus													1								
Sigmophoranema	1																				
Microlaimus													1				12				
Antomicron								1					1								
Leptolaimus													1						1		
Desmoscolex	1						1	2				2	4								
Theristus	3	2		6	4		3	9	5	5		5	3	15					1	1	
Stylotheristus															19						
Pseudotheristus								2	8												
Daptonema	4	12		10	1	15	5	4	5			12	5	10	14	10			8	4	
Paramonhystera	2							1	5							10		66			
Promonhystera				2																	
Linhystera		5		1			2					2	2	3	28				7	2	
Metadesmolaimus																	12				
Amphimonhystrella								1			20										
Rhynchonema												1									
Elzalia		3		1			3						3							4	
Monhystera			2	1			1	4	5												
Doliolaimus	1	1	1					1									13			3	
Sphaerolaimus	4	4	5	1	3	7	15	5	5	5		4	6							25	13
Paraspherolaimus																				1	
Subsphaerolaimus		1																			
Astomonema							3			18			8	26		60	25		50	6	74
Terschellingia	25	15	6	33	18			14	13			3		3					1	1	
Metalinhomoeus				2			1							3			13		3	1	
Campylaimus								1		5		2									
Araeolaimus					1			1													
Diplopeltula								4													
Parodontophora	5			4																	
Axonolaimus												2	2							1	

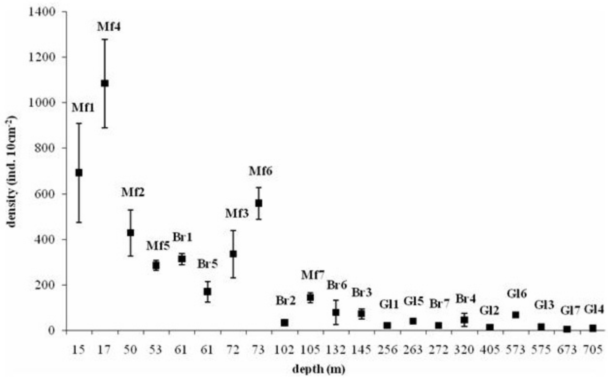

FIG. 2. – Total meiofauna density (±SE) versus depth (m) in the three study areas.

centimetres were positive at all sites (Table 1), while Eh was always negative below 2 cm sediment depth. A total of 11 major taxa were found: 9 taxa were present in Manfredonia and Brindisi, and 5 taxa were observed in the Gallipoli area (Table 2).

Generally, meiobenthic densities decreased with depth (Fig. 2). The highest values were recorded in Manfredonia (average density ranges from 144 to 1084 ind. 10 cm^{-2}). Lower values were observed both in the Gallipoli (from 5 to 67 ind. 10 cm^{-2}) and Brindisi areas (from 20 to 314 ind. 10 cm^{-2}).

Nematodes were the dominant taxon in all samples (83-100%), followed by Copepoda including nauplii (0.5-8%). The remaining taxa recorded include Annelida, Ostracoda, Kinorhyncha, Turbellaria, Amphipoda, Isopoda, Tanaidacea, Cnidaria and Acarina, which were present in lower densities (Table 2). Nematodes were the only taxon present in several samples of Gallipoli (Gl2, Gl4 and Gl7).

A total of 79 genera of nematodes were identified in all samples (Table 3): 49 in Manfredonia, 54 in Brindisi and 37 in Gallipoli. The dominant families in Manfredonia and Brindisi were Comesomatidae, Xyalidae and Linhomoeidae, while Syphonolaimidae, Xyalidae and Comesomatidae were the most common ones in Gallipoli. The dominant nematode genera present in all three areas were *Sabatieria* (5-38%), *Astomonema* (3-74%), *Dorylaimopsis* (2-57%), *Terschellingia* (1-33%), *Daptonema* (1-15%), *Hopperia* (1-60%) and *Sphaerolaimus* (1-25%).

Figure 3 shows the average nematode diversity indices measured, Shannon diversity (H') and Pielou evenness (J), and average density per area. The Shannon diversity was not significantly different among areas (Kruskal Wallis test: p=0.083). The Pielou index values were high, between 0.6 and 1 (Fig. 3).

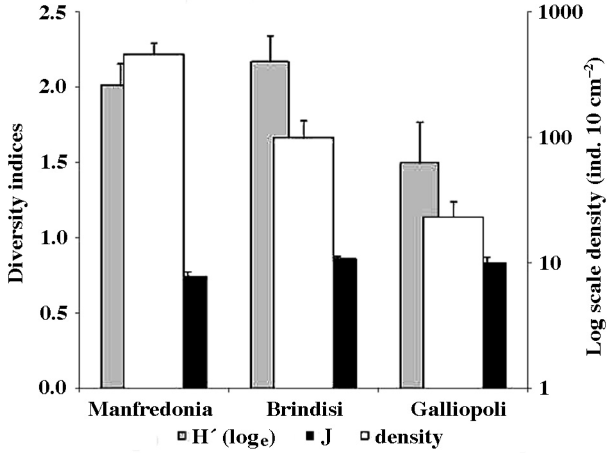

FIG. 3. – Nematode density and diversity indices in the three study areas.

Multivariate analyses of nematodes

The multivariate analyses were performed to assess the variability of nematode communities in the different areas and at different depth ranges. All sites of the three study areas were in fact grouped into two categories: shallow sites (above the continental slope, 200 m depth) and deep sites (below 200 m depth).

The MDS plot reveals that differences in nematode fauna could be explained by sampling area and bathymetric depth (Fig. 4). Results of a one-way ANOSIM procedure for area groups confirm that there is a significant difference in nematode communities among the three areas (Global R=0.334; P=0.001). The R values of the pairwise comparison show lower difference within the groups Manfredonia-Brindisi (R=0.238) and Brindisi-Gallipoli (R=0.264) than between the Manfredonia and Gallipoli areas (R=0.501). SIMPER analysis of

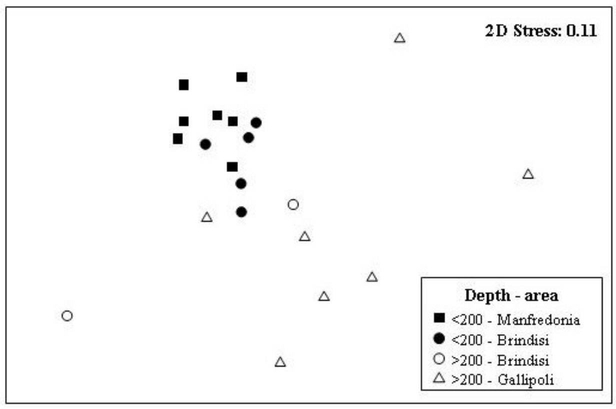

FIG. 4. – 2D-MDS ordination of Nematoda genera in the three study areas.

TABLE 4. – SIMPER analysis of raw abundance data showing the contribution (% cumulative=90%) of each genus to the mean Bray-Curtis dissimilarity.

	Average abundance (ind. 10 cm^{-2}) sites above 200 m	sites below 200 m	Bray-Curtis dissimilarity	% Contribution to dissimilarity	%Cumulative
Astomonema	2.4	26.8	13.1	15.3	15.3
Dorylaimopsis	21.5	0.2	10.6	12.4	27.7
Sabatieria	19.4	5.2	8.1	9.4	37.1
Terschellingia	10.6	0.6	5.2	6.1	43.2
Hopperia	2.9	8.9	4.9	5.7	48.8
Paramonhystera	0.7	8.4	4.4	5.1	54.0
Sphaerolaimus	5.4	4.2	3.6	4.2	58.2
Setosabatieria	5.9	2.0	3.2	3.7	61.9
Daptonema	6.1	5.1	2.9	3.4	65.7
Linhystera	1.0	4.4	2.3	2.7	68.0
Theristus	3.8	1.9	2.2	2.6	70.6
Vasostoma	1.0	3.7	2.1	2.5	73.1
Metacomesoma	0.0	3.8	1.9	2.2	75.3
Halalaimus	1.1	1.4	1.2	1.4	76.6
Amphimonhystrella	0.1	2.2	1.2	1.3	77.9
Metalinhomoeus	0.3	2.2	1.1	1.3	79.3
Stylotheristus	0.0	2.1	1.1	1.2	80.5
Doliolaimus	0.4	1.8	1.0	1.2	81.6
Laimella	0.3	1.9	1.0	1.2	82.8
Pierrickia	0.4	1.7	0.9	1.1	83.9
Paralongycyatholaimus	0.1	1.8	0.9	1.1	84.9
Microlaimus	0.1	1.3	0.7	0.8	85.7
Metachromadora	0.0	1.3	0.7	0.8	86.5
Metadesmolaimus	0.0	1.3	0.7	0.8	87.3
Comesoma	0.1	1.1	0.6	0.7	88.0
Comesa	1.1	0.1	0.6	0.7	88.3
Monhystera	1.1	0.0	0.6	0.7	89.3
Elzalia	0.9	0.4	0.6	0.6	89.9
Cervonema	0.1	1.0	0.5	0.6	90.5

the nematode community shows that the average dissimilarity of the Manfredonia-Brindisi group (66%) is due to 30 genera (cumulative contribution of 90%) out of the 72 common recorded genera, among which are *Dorylaimopsis* (17%), *Sabatiera* (10%), *Terschellingia* (9%), *Hopperia* (9%) and *Setosabatiera* (6%). The genus contribution of the Brindisi-Gallipoli group to average dissimilarity (84%) is attributable to 29 of the total 64 genera, with *Astomonema* (17%), *Sabatiera* (11%), *Hopperia* (8%), *Paramonhystera* (7%), *Dorylaimopsis* (5%), and *Sphaerolaimus* (4%) being the most representative. A total of 23 genera out of 63 contribute to the average dissimilarity (88%) of the Manfredonia-Gallipoli group, represented mainly by *Astomonema* (17%), *Dorylaimopsis* (16%), *Terschellingia* (8%), *Sabatiera* (7%), and *Paramonhystera* (6%).

The ANOSIM results for depth groups show that bathymetry could explain the dissimilarity between the two groups (Global R=0.559; P=0.001). The SIMPER analysis (Table 4) shows that the observed differences between these two groups are mainly due to the marked difference in the abundances of six common genera, *Astomonema*, *Dorylaimopsis*, *Sabatieria*, *Terschellingia*, *Hopperia* and *Paramonhystera*.

DISCUSSION

Our knowledge of the distribution of meiobenthos in the bathyal zone of the Mediterranean Sea is mainly due to studies conducted in the Cretan, Aegean and northern Adriatic Seas (Danovaro *et al*., 1995b, 2000; Lampadariou, 2001), in the Gulf of Lion (de Bovée *et al*., 1990; Soetaert *et al*., 1991; Danovaro *et al*., 1999) and in Corsica (Soetaert *et al*., 1991). In the present study, qualitative and quantitative information is obtained on subtidal meiobenthic communities from less investigated areas of the Mediterranean, such as the southern Adriatic and northern Ionian Seas.

There are no data available from other studies on the meiobenthos in the southern Adriatic Sea, apart from data reported by Sandulli *et al*. (2002), who recorded average meiofaunal densities ranging between 180 ind. 10 cm^{-2} (50 m depth) and 5180 ind. 10 cm^{-2} (20 m depth) in sandy sediments.

In the Ionian Sea the only data on bathyal meiofauna are those provided by Danovaro *et al*. (1995), who reported densities of 290 ind. 10 cm^{-2} at 600 m depth, decreasing significantly with depth down to 4 ind. 10 cm^{-2} at 1700-1800 m. Some sites of the western and eastern Ionian Sea (600-1735 m depth) were investigated by Tselepides *et al*. (2004), who reported meiobenthic densities ranging from 220 to 797 ind. 10 cm^{-2} and from 93 to 218 ind. 10 cm^{-2}, respectively. Similar values were recorded off the Gulf of Taranto by Tselepides and Lampadariou (2004).

Densities and diversities of meiofauna in our study areas show rather low values. These results are consistent with previous data concerning coastal (Sandulli *et al*., 2002) and deep eastern Mediterranean areas (Danovaro *et al*., 1995b; Tselepides and Lampadariou, 2004; Tselepides *et al*., 2004; Lampadariou and Tselepides, 2006), where densities as low as 4 ind. 10 cm^{-2} are reported. On the other hand, our data show lower values than those recorded in the western Mediterranean (Soetaert *et al*., 1991), the western Atlantic (Tietjen, 1971), the northeast Atlantic (i.e. Vincx *et al*., 1994), the Pacific Ocean (Shirayama, 1984; Shirayama and Kojima, 1994; Brown *et al*., 2001), the Arabian Sea (Sommer and Pfannkuche, 2000) and the Coral Sea in Australia (Alongi and Pichon, 1988). These authors report average densities ranging between 100 and 3500 ind. 10 cm^{-2}.

From the literature, there is evidence of a decreasing trend in meiobenthos abundance with depth (de Bovée *et al*., 1990; Tietjen, 1992; Vincx *et al*., 1994; Sommer and Pfannkuche, 2000). In fact, our results are consistent with previous data. Thus, the shallower sites of Manfredonia show a more diverse and abundant meiofauna while the deeper sites of Gallipoli have low meiofauna densities and a low number of taxa. In the Brindisi area, at sampling sites at a depth range common to both Manfredonia and Gallipoli, meiofauna composition was partly similar to that of the other two areas. The Manfredonia area is in fact characterised by a higher taxa diversity due to the contribution of Copepoda, Annelida, Kinorhyncha and Turbellaria. The same taxa are also present in Brindisi and at some sites of Gallipoli, but with a lower contribution to total diversity. Moreover, at three Gallipoli sites (Gl2, Gl4 and Gl7) only nematodes are present in very low densities. This might be due to the greater bathymetric depths of these sites (405-705 m depth), all below the continental shelf, where organic inputs from coastal areas are less relevant. The higher meiofaunal diversity recorded in Manfredonia could be attributable to the more sheltered and shallower environment, allowing a higher sedimentation rate and therefore a higher organic matter input in the sediment (Viel and Zurlini, 1986). The Brindisi area and—to a greater extent—the Gallipoli area are deeper and less sheltered than the Manfredonia area, showing greater hydrodynamism, which translates into lower sedimentation and organic accumulation rates (Parenzan, 1979).

In Manfredonia and Brindisi the dominant families of nematodes are Comesomatidae, with the genera *Sabatieria* and *Dorylaimopsis*; Xyalidae, with the genus *Theristus*; and Linhomoeidae, with the genus *Terschellingia*. In Gallipoli the dominant family is Syphonolaimidae, mostly represented by *Astomonema*. All these genera are typically present in enriched muddy sediments and show generally low abundances in sands (Vitiello, 1974). It is known that the ecological properties of sediments may be inferred on the basis of nematodes inhabiting them (Heip *et al*., 1985). The genus *Astomonema*, for example, is mostly present in association with reduced sulphur or methane seep sediments. This habitat, probably similar to our deep sites, would be a suitable environment for sulphur-oxidising bacteria symbiotic with *Astomonema* (Dando *et al*., 1991; Austen *et al*., 1993; Giere *et al*., 1995). Moreover, many species of the genera *Theristus* and *Terschellingia* are often found in muddy sediments rich in hydrogen sulphide (Warwick and Gee, 1984); the former genus lives even in the proximity of methane seepages (Jensen, 1995), and the latter is a known representative of the "thiobios" with *Astomonema* and *Sabatieria* (Giere, 1993).

One-way ANOSIM indicates a significant dissimilarity among the three Apulian areas. The dissimilarity is due to different abundance percentages of the most representative and common genera. This is more evident when sites in Manfredonia are compared with those in Gallipoli. Moreover, it is interesting to note that the dissimilarity between these two areas is mainly attributable to the contribution of two genera, *Astomonema* and *Dorylaimopsis*, the former being particularly dominant at the deeper sites of Gallipoli (0.43% in Manfredonia and 30.71% in Gallipoli) and the latter at the shallower sites of Manfredonia (28.86% in Manfredonia and 0.29% in Gallipoli). ANOSIM also shows that the nematode community structure between shallow sites (above 200 m depth) and deep sites (below 200 m depth) differs significantly, with *Astomonema* dominating the deep sites and *Dorylaimopsis*, *Sabatieria* and *Terschellingia* dominating the shallower sites. These four are the most abundant genera, representing an average of 60% of the total nematode community.

Our results are consistent with previous data by Vezzulli and Fabiano (2006) showing that the oligotrophic state of the sediment characteristic of the whole study area is responsible for the low meiofauna abundance and the genus composition of the nematode assemblage. Nevertheless, at a more detailed level, results of multivariate analysis show differences among the Manfredonia, Brindisi and Gallipoli sites, which may be mostly due to other environmental variables, such as depth, hydrodynamism and sedimentation rates. In particular, depth seems to be a relevant factor for explaining the structure of nematode assemblages since there is a significant distinction between shallow communities (above 200 m depth) and deep communities (below 200 m depth). Shallow sites are located within the continental shelf, where coastal influences are more relevant, while deep sites are all related to the continental slope, where terrigenous inputs are assumed to be much less important.

In the Mediterranean Sea, the knowledge of deep meiofauna is rather scarce compared to other areas, particularly with regard to the nematode community structure. Most studies on nematodes concentrate on the western part of the Mediterranean (Vitiello, 1976; Soetaert and Heip, 1995; Soetaert *et al*., 1995) and the eastern basin, particularly in the Aegean Sea (Lampadariou *et al*., 1997; Lampadariou, 2001; Buchholz and Lampadariou, 2002). Therefore, all data presented herein add further information on the subtidal Mediterranean meiofauna, and in particular provide valuable knowledge on the biodiversity of the nematode community of newly studied deep and oligotrophic sediment systems.

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