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Meiobenthic Assemblages from the Southwestern Coast of the Black Sea, İğneada (Turkey)

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Abstract: Meiobenthic organisms were sampled for the first time from İğneada coasts, Turkey (Western Black Sea) in order to provide a base-line study on the meiobenthic community structure of the sampling area. Meiobenthos was found to be composed of 12 higher taxonomical groups: Nematoda, Harpacticoida, Polychaeta, recent hard-shelled Foraminifera, soft-shelled Foraminifera, Bivalvia, Gastropoda, Ostracoda, Turbellaria, Oligochaeta, Nemertea and Acari. Meiobenthic community was dominated by nematodes, harpacticoid copepods and hard-shelled foraminifera in the study area. Fifty two species of Nematoda, fifteen species of Harpacticoida and twelve species of living hard-shelled Foraminifera were identified. Six nematode species (*Bathylaimus australis, Bolbolaimus murinae, Neochromadora poecilosomoides, Neochromadora sabulicola*, *Oncholaimellus mediterraneus* and *Onyx perfectus*) are reported for the first time from Turkey although they are known to occur at the central Turkish Black Sea. Total density of the meiobenthos ranged between 67–757 ind. 10 cm^{-2} at stations. Nematodes showed densities ranging from 61 to 350 ind. 10 cm^{-2} which represented 25–92% of the total meiobenthos. Since the terrestrial part of the region is protected as a National Park and the coastal part has been proposed as a marine protected area, research should be intensified on the fauna of İğneada coastal waters to clarify the biodiversity of the area.

Key words: meiobenthos; Nematoda; Harpacticoida; hard-shelled Foraminifera; species composition; Marine Protected Area (MPA)

Introduction

The term meiobenthos includes metazoan meiofaunal organisms and also ecologically relevant protozoans such as foraminiferans inhabiting benthic environments (Urban-Malinga 2014). The history of research on meiobenthos along the coasts of Turkey is relatively young. Several previous meiobenthic samplings were conducted in the 1950s-1960s, mainly at the Bosporus Strait, yielding several reports (Băcescu & Margineanu 1959; Caraion 1959; Băcescu 1960; Marinov 1962; Didkowsky 1969; Sergeeva 1973a, b, 1974, 1977). On the Black Sea coast of Turkey, studies were generally focused on the meiobenthic composition of the oxic/anoxic interface (Luth 2004; Brennan et al. 2013; Ürkmez et al. 2015). Kharkevych & Sergeeva (2013), Sergeeva et al. (2013), Sergeeva & Zaika (2013), Sergeeva & Kopytina (2014) and Sergeeva & Mazlumyan (2015) also presented data about meiobenthos of the oxic/anoxic interface at the Bosporus strait. First systematic meiobenthic sampling of the shallow soft bottoms on the coast of Turkey was carried out at Sinop Bay (Southern Black Sea) providing first data on the composition and spatio-temporal variation of meiobenthic taxa (Ürkmez et al. 2016). As a result, 25 higher meiobenthic groups have been recorded from the shallow soft bottoms of the study area.

İğneada is a port and a seaside resort located on the western coast of the Turkish Black Sea, near the border with Bulgaria. Terrestrial part of İğneada is a protected area due to its coastal sand dunes and floodplains (Longoz forests). The area serves as a significant habitat to a high diversity of flora and fauna. Anthropogenic stress is limited in the region due to low human population. Since the region is close to the Bulgarian Marine Protected Area (MPA), and may connect the two MPAs, it has recently been proposed as a transboundary protected area between Bulgaria and Turkey (Öztürk et al. 2013).

Here, we aim to present a preliminary study on the meiobenthic assemblages of İğneada coast focusing on the taxonomic composition of free-living nematodes, harpacticoid copepods and recent living hard-shelled foraminiferans. This study stands as the first data available from the western coast of the Turkish Black Sea (İğneada) reporting the composition of meiobenthos.

Material and methods

Study area and sampling

İğneada is located in the north-western part of Turkey, being a small town within the district of Demirköy in Turkey's

Fig. 1. Study area with the locations of sampling stations on three transects.

Table 1. Coordinates, depth and physicochemical parameters of the sampling stations.

	Sampling stations							
	I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3
Latitude	41°52′10″ N	41°52′05″ N	41°53′25″ N	41°53′04″ N	41°52′24″ N	41°52′50″ N	41°52′39″ N	41°52′14″ N
Longitude	27°59′10″ E	27°59′24″ E	28°00′25″ E	28°00′45″ E	28°01′13″ E	28°02′43″ E	28°02′40″ E	28°02′44″ E
Depth (m)	5	10	5	10	20	5	10	20
Biotope	FS+CS	CS+FS+ shells	FS+Silt	FS+ shells	CS+FS +Shells	Silt	FS+CS+ shells	FS+CS
Temp (°C)	14.78	14.87	14.9	15.03	15.1	15.25	15.25	15.25
S (ppt)	17.78	17.85	17.93	17.95	17.99	18.04	18.04	18.04
pH	8.29	8.31	8.31	8.31	8.31	8.27	8.27	8.27
DO (mg L^{-1})	8.78	8.52	8.57	8.42	8.37	8.34	8.3	8.24

Explanations: FS – Fine sand; CS – Coarse sand; ; S – Salinity; DO – Dissolved Oxygen.

Kırklareli Province. Southern and western parts of İğneada lies at the lower slopes of the Strandja (Yıldız) Mountains with its highest point at 1035 m a.s.l. İğneada and its vicinity have the Black Sea type climate characters. The area includes different ecosystems and a wide range of biodiversity, making it one of the Turkey's most important areas. The sandy beaches at İğneada coasts are remarkable and its beaches are composed of coarse and fine sand, mollusc shells and fragments. İğneada relatively lacks human-induced disturbance or degradation however the constructions of summer houses and touristic facilities threaten the ecosystem. Sediment samples were collected at the coastline of İğneada by subsampling from a Van Veen grab in November 2012 at 8 stations located on 3 transects (Fig. 1).

Physicochemical properties of the bottom water were recorded in situ by means of a multiparameter probe (YSI 6600V) (Table 1). Per station, three metal cores (surface area 12.56 cm^2) were pushed down into the sediment for 10 cm. Core samples were preserved in 75% ethanol on board. Material was washed through sieves of 1 mm, 500 µm and 63 µm mesh sizes and those captured on 500 and 63 µm sieves were analysed for meiobenthos. Rose Bengal was added to the samples and all animals were counted and sorted under a dissecting stereomicroscope (NIKON SMZ745). Meiofauna was identified to higher taxa except for Nematoda, Harpacticoida and living hard-shelled (Rose-Bengal stained) Foraminifera for which genus or species level identifications were made where possible following Platt & Warwick (1983) for free-living marine nematodes, Lang (1948), Apostolov & Marinov (1988), Wells (2007) for harpacticoids, and Cimerman & Langer (1991) and Yanko & Vorob'eva (1991) for hard-shelled Foraminifera.

The trophic classification of Wieser (1953) was used for the estimation of the trophic structure of the nematode community. Four trophic groups are described by this classification: selective deposit feeders (1A), non-selective deposit feeders (1B), epistratum feeders (2A) and predator/omnivores (2B).

Table 2. Densities of main meiobenthic taxa at the sampling stations.

Taxon	Sampling stations							
	I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3
Density (ind. 10 cm^{-2})								
Acari				2.39				28.66
Bivalvia	34.23		0.80	5.57	18.31			5.57
Foraminifera (Hard- shelled)	19.90		42.19	57.31	11.14	1.59	4.78	3.98
Foraminifera (Soft- shelled)				3.18		2.39		
Gastropoda	11.14		3.18	12.74	27.86	2.39	3.18	6.37
Harpacticoida	112.24	3.18	15.92	440.19	7.96	36.62		152.83
Nauplii				12.74				
Nematoda	166.36	61.29	152.04	188.65	350.24	87.56	85.17	195.02
Nemertea				0.80				0.80
Oligochaeta								27.06
Ostracoda	3.18		1.59	6.37	2.39			
Polychaeta		2.39		7.96	1.59			29.45
Turbellaria	2.39			14.33		1.59		2.39
Unidentified	3.98		0.80	4.78	1.59		0.80	8.76
Total	353.42	66.86	216.51	757.00	421.08	132.14	93.93	460.88

Results

In İğneada, meiobenthic densities ranged between 67–757 ind. 10 cm^{-2} and the maximum density was recorded at station I-2-2 (see Fig. 1), where also the taxonomic composition was the most diverse including 12 higher taxonomical groups: Nematoda, Harpacticoida, Polychaeta, living hard-shelled and soft-shelled Foraminifera, Bivalvia, Gastropoda, Ostracoda, Turbellaria, Oligochaeta, Nemertea and Acari (Table 2). The most diverse stations in terms of the number of higher meiobenthic taxa were station I-2-2 (fine sand + shell, 10 m) with 11 taxa and station I-3-3 (fine sand + coarse sand, 20 m) with 10 taxa. Stations I-1-2 and I-3-2 were represented only by three higher meiobenthic taxa. Generally, meiobenthic community was dominated by nematodes, harpacticoid copepods and hard-shelled foraminifera in the study area. Nematodes showed a density ranging from 61 to 350 ind. 10 cm^{-2} which represented 25–92% of the total meiobenthos. The lowest densities were recorded at stations I-1-2, I-3-2 and I-3-1 while the highest values were found at station I-2-3. The second dominant taxon, Harpacticoida, revealed densities ranging from 3 to 440 ind. 10 cm^{-2} constituting 5–58% of the total meiobenthos and reached to the highest density (more than twice the amount of nematodes), particularly at station I-2-2 (Fig. 2). Living hard-shelled Foraminifera was the third dominant taxon, and showed a density ranging between 2–57 ind.10 cm^{-2} (1–20% of the total meiobenthos). Acari were only found at two stations, with a high value (29 ind. 10 cm^{-2}) at station I-3-3. Juveniles of Bivalvia were mostly recorded at station I-1-1. Juveniles of Gastropoda were recorded at all the stations except I-1-2 and were abundant at station I-2-3. Individuals of soft-shelled Foraminifera were found at stations I-2-2 and I-3-1 with densities ranging from 2 to 3 ind. 10 cm^{-2}. Oligochaetes were only found at station I-3-3 (27 ind. 10 cm^{-2}) where polychaetes reached their highest value (30 ind. 10 cm^{-2}). Density of Turbellaria ranged from 2–14 ind. 10 cm^{-2}, and mainly found abundant at station I-2-2. Ostracoda revealed low (2–6 ind. 10 cm^{-2}) densities and Nemertea was represented with only a few individuals in the core samples.

Free-living marine nematodes found to comprise a significant portion of the meiobenthos and observed at all the sampling stations, and its contribution decreased below 50% only at two stations, *viz.* I-2-2 and I-3-3 (Fig. 2). Station I-1-2, which was represented by a mixture of coarse + fine sand and shell fragments, revealed the highest (92%) relative nematode abundance in total meiobenthos. The density of nematodes ranged between 61–350 ind. 10 cm^{-2}. The highest nematode density was recorded at station I-2-3 (350 ind. 10 cm^{-2}) with a sediment characteristic of shell fragments and fine sand + coarse sand mixture. A total of 52 nematode species belonging to 39 genera and 17 families were identified in İğneada samples. The species composition, percentage of each species in total meiobenthos of the stations and average percentages are shown in Table 3. In the study area, Desmodoridae was the dominant family accounting for 24% of total individuals and it was followed by Xyalidae (16%) and Oncholaimidae (16%). Dominant species were *Desmodora pontica* (15%), *Viscosia* sp. 1 (9%), *Neochromadora sabulicola* (8%) and *Sabatieria* sp. 1 (7%) (Fig. 3).

All trophic groups were found at the sampling area (Table 3). Trophic group 2A (epistrate feeders) were the most abundant feeding group with a dominance of 47%. Second abundant feeding group was predator/omnivors (2B) with a dominance of 29%. Station I-1-2 with a coarse sand + fine sand and shell biotope showed the highest percentages of the trophic group 2A (41%) and 2B (25%). Trophic group 1B (non-selective deposit feeders) was mostly found (22%) at the station I-2-1 with sediments characterized by fine sand + silt. Selective deposit feeders (1A) were totally absent in four of the eight stations.

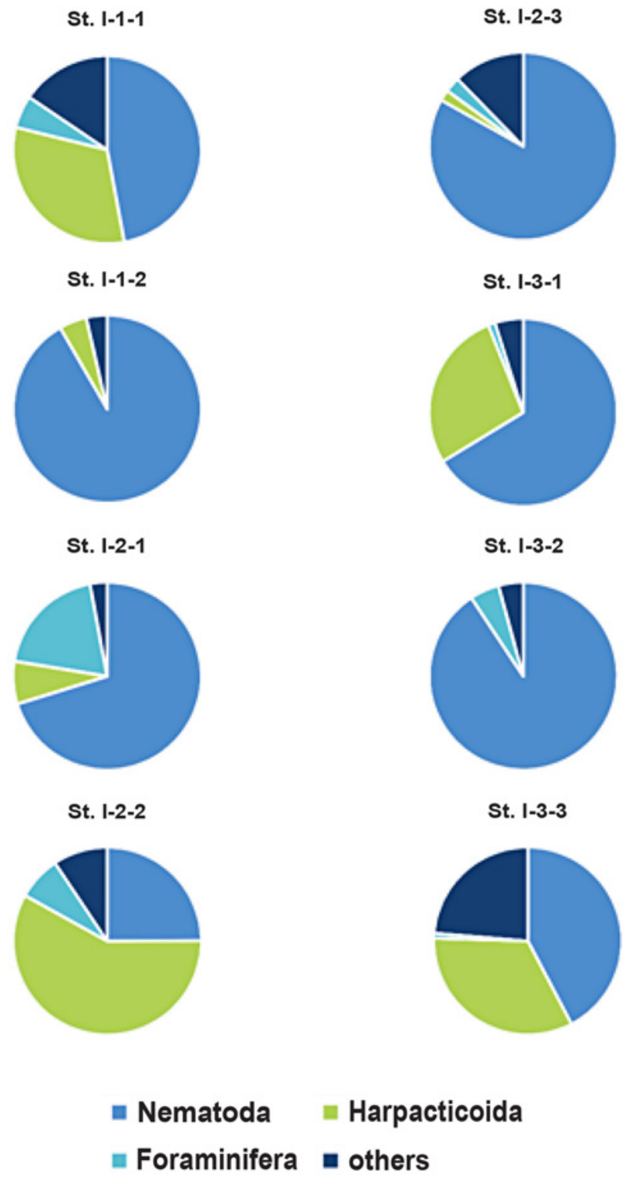

Fig. 2. Representation of Nematoda, Harpacticoida and hard-shelled Foraminifera at the sampling stations.

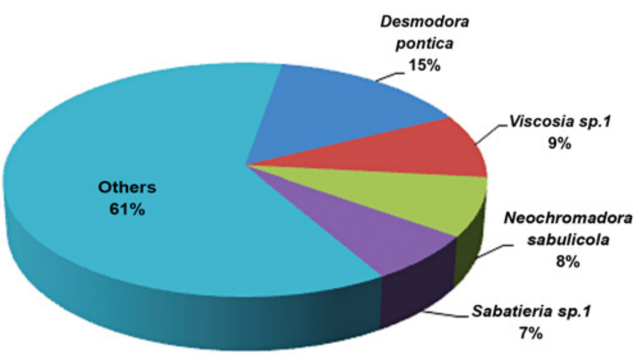

Fig. 3. Dominant nematode species by number of individuals in total samples.

Harpacticoid copepods were the second dominant group in the samples. Their species composition and percentages in total meiobenthos are given in Table 4.

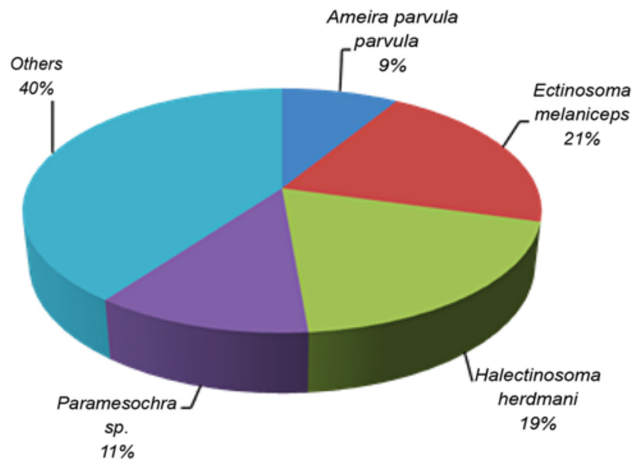

Fig. 4. Dominant harpacticoid species by number of individuals in total samples.

The relative abundance of harpacticoid copepods in total meiobenthos was particularly high (58%) at station I-2-2, and also considerable at the stations I-1-1, I-3-1 and I-3-3 (Fig. 2). The highest density (440 ind. 10 cm^{-2}) was recorded at station I-2-2 and the lowest (3 ind. 10 cm^{-2}) at station I-1-2. A total of 15 species belonging to 16 genera and 10 families were identified. Among the families, Ectinosomatidae was the dominant group in terms of number of individuals accounting for 48% of the total, followed by Miraciidae (16%), Paramesochridae (11%) Ameridae (10%), and Laophontidae (5%). The dominant species in the area were *Ectinosoma melaniceps* (21% of total individuals), *Halectinosoma herdmani* (19%), *Paramesochra* sp. 1 (11%) and *Ameira parvula parvula* (9%), all comprising 60% of total specimens (Fig. 4). Interstitial harpacticoid copepods (which inhabit the space between sediment particles) are represented by the families Ectinosomatidae, Paramesochridae and Laophontidae, and made up 64% of the total number of individuals.

The protozoan meiobenthic taxon, the recent living hard-shelled Foraminifera represented the third dominant group at the sampling area. Their relative abundance was particularly high (20%) at station I-2-1 with sediments characterized by fine sand + silt (Fig. 2). The highest density (57 ind. 10 cm^{-2}) of the hard-shelled Foraminifera was recorded at the station I-2-2 and the lowest (2 ind. 10 cm^{-2}) at the station I-3-1. However, hard-shelled Foraminifera revealed a low diversity in the area. A total of 12 species belonging to 6 genera and 3 families were recorded (Table 5). *Ammonia* was represented by four species: *Ammonia compacta*, *Ammonia tepida*, *Ammonia parkinsoniana* and *Ammonia* sp. 1 and *Elpihidium* by three species: *Elphidium crispum*, *Elphidium macellum* and *Elphidium aculeatum*. The dominant species in the sampling area were *Ammonia* sp. 1 (15%), *A. tepida* (12%) and *E. crispum* (10%) (Fig. 5). Individuals of *Ammonia* and *Elphidium* were generally encountered at the stations with 20 m depth.

Table 3. Nematode species composition, trophic groups and percentages at the stations.

Species	TG	Sampling stations								av. %
		I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3	
Order Enoplida										
Family Anoplostomatidae										
Anoplostomatidae gen. sp.	1B	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.05
Family Thoracostomopsidae										
Enoploides sp. 1	2B	0.00	5.95	0.37	0.21	0.19	0.00	0.00	0.00	0.84
Enoplolaimus sp. 1	2B	4.28	0.00	0.37	0.00	0.00	1.81	0.00	0.17	0.83
Mesacanthion sp. 1	2B	0.45	2.38	0.00	0.11	5.29	0.00	0.00	0.00	1.03
Family Oxystominidae										
Halalaimus sp. 1	1A	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.05
Family Oncholaimidae										
**Oncholaimellus mediterraneus* Schuurmans Stekhoven, 1942	2B	0.90	0.00	2.57	0.00	0.00	0.60	0.00	0.00	0.51
Oncholaimus sp. 1	2B	5.63	5.95	0.00	0.32	0.00	0.00	0.00	0.00	1.49
Viscosia sp. 1	2B	2.70	5.95	3.68	0.32	2.46	1.20	4.24	0.69	2.65
Enchelidiidae										
Eurystomina sp. 1	2B	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Polygastrophora sp. 1	2B	0.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.15
Family Tripyloididae										
**Bathylaimus australis* Cobb, 1894	1B	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Order Chromadorida										
Family Chromadoridae										
Chromadoridae gen. sp. 1	2A	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.69	0.10
Chromadoridae gen. sp. 2	2A	3.60	0.00	0.74	0.00	0.19	0.00	0.85	0.00	0.67
Chromadoridae gen. sp. 3	2A	0.00	2.38	3.31	0.00	0.00	0.00	0.00	0.00	0.71
Euchromadora striata (Eberth, 1863) de Man, 1886	2A	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.01
**Neochromadora poecilosomoides* Filipjev, 1918	2A	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	0.07
**Neochromadora sabulicola* (Filipjev, 1918)	2A	0.00	0.00	0.00	5.15	0.00	0.00	0.00	0.00	0.64
Spilophorella sp. 1	2A	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Family Selachinematidae										
Halichoanolaimus sp. 1	2B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02
Order Desmodorida										
Family Desmodoridae										
Desmodoridae gen.sp. 1	2A	0.00	0.00	0.00	0.00	0.00	0.00	5.08	0.00	0.64
Desmodora pontica Filipjev, 1922	2A	0.00	14.29	0.00	0.53	0.00	0.00	0.00	12.78	3.45
Desmodora sp. 2	2A	0.00	15.48	0.00	0.63	0.00	0.00	0.00	3.11	2.40
Desmodora sp. 3	2A	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.01
Metachromadora sp.	2A	0.90	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.26
**Onyx perfectus* Cobb, 1891	2B	0.00	3.57	0.00	0.42	0.00	0.00	0.00	0.00	0.50
Family Microlaimidae										
Microlaimidae gen. sp. 1	2A	0.00	0.00	0.00	0.00	0.00	0.60	1.69	0.00	0.29
**Bolbolaimus murinae* (Sergeeva, 1976) Jensen, 1978	2A	0.00	0.00	0.74	0.00	0.00	0.00	2.54	0.00	0.41
Microlaimus sp. 1	2A	0.00	0.00	0.74	0.00	0.19	1.81	2.54	0.00	0.66
Microlaimus sp. 2	2A	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.09
Order Monhysterida										
Family Xyalidae										
Xyalidae gen. sp. 1	1B	1.13	1.19	0.74	0.21	0.00	12.05	0.85	0.00	2.02
Xyalidae gen. sp. 2	1B	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Xyalidae gen. sp. 3	1B	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.08
Xyalidae gen. sp. 4	1B	0.00	0.00	0.00	0.00	0.00	3.01	0.00	0.00	0.38
Xyalidae gen. sp. 5	1B	0.00	0.00	0.00	0.00	0.00	1.20	0.00	0.00	0.15
Xyalidae gen. sp. 6	1B	0.00	0.00	0.00	0.00	0.00	0.00	1.69	0.00	0.21
Xyalidae gen. sp. 7	1B	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.04
Scaptrella sp. 1	2B	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.01
Cobbia sp. 1	1B	0.00	1.19	0.00	0.84	0.38	0.00	0.00	0.00	0.30
Daptonema sp. 1	1B	0.23	0.00	3.31	0.00	2.27	0.00	0.00	0.00	0.73
Paramonhystera sp. 1	1B	0.00	4.76	3.31	0.00	0.00	0.00	0.00	0.00	1.01
Theristus sp.1	1B	0.00	0.00	0.37	0.32	0.00	0.00	0.00	0.52	0.15
Family Linhomoeidae										
Linhomoeus sp. 1	1A	0.00	0.00	0.00	0.11	0.19	0.00	0.00	0.00	0.04
Order Araeolaimida										
Family Axonolaimidae										
Axonolaimidae gen. sp. 1	2A	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.07
Axonolaimidae gen. sp. 2	2A	0.00	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.45
Axonolaimus setosus Filipjev, 1918	2A	0.90	1.19	0.00	0.00	0.38	0.00	0.00	0.52	0.37
Odontophora angustilaimus (Filipjev, 1918)	2A	0.23	2.38	1.84	0.11	0.00	0.00	3.39	0.00	0.99

Table 3. (continued)

Species	TG	Sampling stations								av. %
		I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3	
Family Comesomatidae										
Sabatieria sp.1	1B	0.00	0.00	13.97	0.32	0.00	0.00	0.00	0.00	1.79
Family Diplopeltidae										
Diplopeltidae gen. sp. 1	1A	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.11
Diplopeltidae gen. sp. 2	1A	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00	0.11
Diplopeltidae gen. sp. 3	1A	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.05
Order Plectida										
Family Paramicrolaimidae										
Paramicrolaimus sp. 1	2A	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.05
Family Leptolaimidae										
Halaphanolaimus sp. 1	1A	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.02

Explanations: TG – Trophic group, av. – average, *new records for the marine fauna of Turkey.

Table 4. Harpacticoid copepods species composition and percentages at the stations.

Species	Sampling stations								av. %
	I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3	
Harpacticoida									
Family Ameiridae									
Ameira parvula parvula (Claus, 1866)	6.53	0.00	0.00	0.00	0.00	1.81	0.00	0.00	1.04
Ameira copepodid	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Family Canthocamptidae									
Stenocaris sp. 1	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.35	0.06
Family Canuellidae									
Canuella sp. 1	0.00	1.19	0.74	0.11	0.00	0.00	0.00	0.00	0.25
Canuella copepodid	0.00	2.38	2.21	0.00	0.00	0.00	0.00	0.00	0.57
Family Cletotidae									
Enhydrosoma sp. 1	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.01
Family Cylindropsyllidae									
Cylindropsyllidae sp. 1	0.00	0.00	0.00	0.21	0.00	0.00	0.00	1.73	0.24
Cylindropsyllidae sp. 2	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Family Ectinosomatidae									
Ectinosoma melaniceps Boeck, 1865	0.00	0.00	0.37	4.31	0.19	0.00	0.00	5.70	1.32
Ectinosoma copepodid	0.00	0.00	0.00	1.05	0.00	0.00	0.00	0.86	0.24
Halectinosoma herdmani (Scott T. & A., 1896)	6.76	0.00	4.04	0.00	0.76	15.66	0.00	0.00	3.40
Halectinosoma copepodid	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Ectinosomatidae sp. 1	0.00	1.19	0.00	0.21	0.00	0.00	0.00	0.35	0.22
Family Harpacticidae									
Harpacticus sp. 1	0.00	0.00	0.00	0.00	0.00	3.01	0.00	0.00	0.38
Family Laophontidae									
Laophontidae sp. 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.28	0.41
Family Miraciidae									
Amphiascus sp.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.76	0.35
Robertgurneya oligochaete Noodt, 1955	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56
Robertsonia sp. 1	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.12
Miraciidae copepodid	1.13	0.00	0.00	0.00	0.00	0.00	0.00	2.25	0.42
Family Paramesochridae									
Paramesochra sp. 1	0.00	0.00	0.00	4.42	0.00	0.00	0.00	0.00	0.55

Explanation: av. – average.

Discussion

A preliminary quantitative survey of meiobenthos along the coast of İğneada has been conducted for the first time. It has been observed that meiobenthos was represented by 12 major taxonomic groups namely Nematoda, Harpacticoida, hard-shelled and soft-shelled Foraminifera, Polychaeta, Bivalvia, Gastropoda, Ostracoda, Nemertea, Oligochaeta, Turbellaria and Acari. However, this number is lower compared to the number of meiobenthic taxa recorded at the shallow waters of the Central Turkish Black Sea (Ürkmez et al. 2016). The highest density of total meiobenthos was also lower compared to the results of the aforementioned study.

The dominant group at the sampling area was Nematoda, followed by Harpacticoida and hard-shelled Foraminifera. A similar observation was also reported for shallow waters (Ürkmez et al. 2016) and deep waters (Ürkmez et al. 2015) of the central Turkish Black Sea (Sinop Bay). This pattern is recorded in many meiobenthos studies (Gheskiere et al. 2002; Sergeeva 2003; Armenteros et al. 2009; Semprucci et al. 2011,

Table 5. Hard-shelled Foraminifera species composition and percentages at the stations.

Species	Sampling stations								
	I-1-1	I-1-2	I-2-1	I-2-2	I-2-3	I-3-1	I-3-2	I-3-3	av. %
Foraminifera									
Family Hauerinidae									
Hauerinidae spp.	0.00	3.57	2.94	0.32	0.00	0.00	0.00	0.00	0.85
Adelosina longirostra (d'Orbigny, 1846)	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.05
Quinqueloculina sp. 1	0.00	2.38	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Spiroloculina sp. 1	0.23	2.38	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Spiroloculina depressa d'Orbigny, 1826	0.90	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.19
Family Rotaliidae									
Ammonia compacta (Hofker, 1969)	0.23	0.00	0.37	0.00	0.00	0.00	0.00	0.17	0.10
Ammonia tepida (Cushman, 1926)	0.23	0.00	0.00	0.21	0.76	0.00	0.00	0.00	0.15
Ammonia parkinsoniana (d'Orbigny, 1839)	0.00	0.00	0.00	0.21	0.19	0.00	0.00	0.17	0.07
Ammonia sp. 1	0.23	0.00	1.10	0.11	0.76	0.00	0.00	0.00	0.27
Family Elphididae									
Elphidium crispum (L., 1758)	0.23	0.00	1.10	0.00	0.19	0.60	0.00	0.00	0.26
Elphidium macellum (Fichtel & Moll, 1798)	0.00	0.00	0.37	0.11	0.00	0.00	0.00	0.00	0.06
Elphidium aculeatum (d'Orbigny, 1846)	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.09
Porosononion subgranosus (Egger, 1857)	0.00	0.00	0.37	0.11	0.00	0.00	0.00	0.00	0.06

Explanation: av. – average.

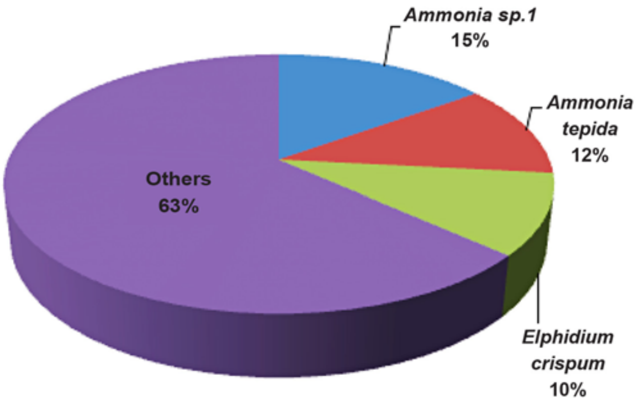

Fig. 5. Dominant species of the living hard-shelled Foraminifera by number of individuals in total samples.

2013). The other taxonomic groups displayed an irregular distribution at the sampling area. Several taxa such as Acari, soft-shelled Foraminifera and Nemertea were recorded at a few stations. Rare taxa such as Kinorhyncha, Tardigrada and Gastrotricha were not found in the samples although several specimens of kinorhynchs and tardigrades were recorded at the central part of the Turkish Black Sea coast (Ürkmez et al. 2016). Studies on tardigrades of the Black Sea are available by Kharkevych (2013) and Kharkevych & Sergeeva (2013).

Nematoda was represented by 52 species, belonging to 39 genera and 17 families. Ürkmez et al. (2015) also reported a similar number of (53) nematode species at the oxic site of the sampling area located at the oxic/anoxic interface off Sinop shores. The authors also mentioned Desmodoridae among the dominant families at the oxic site. Consistently, dominant families in the present study were Desmodoridae, Xyalidae and Oncholaimidae which are generally found at muds or fine sands worldwide (Heip et al. 1985; Sandulli et al. 2014). *Desmodora pontica*, *Viscosia* sp. 1, *Neochromadora sabulicola* and *Sabatieria* sp. 1 were observed to be abundant at the area. *Bathylaimus australis, Bolbolaimus murinae, Neochromadora poecilosomoides, Neochromadora sabulicola, Oncholaimellus mediterraneus* and *Onyx perfectus* are reported for the first time from Turkey although they are known to occur at the central Turkish Black Sea (Ürkmez 2015, unpublished data).

When the feeding types of nematodes are examined in the present study, the trophic groups 2A and 2B are found to be dominant, mostly at the station I-1-2. The high presence of 2A trophic group may be attributed to the presence of a granulometric structure mostly including coarse sand with a much lower amount of silt content at most of the sampling stations. Coarse sand particles provide a grazing surface for 2A group of nematodes indicating a sign for the availability of phytobenthos (Ürkmez et al. 2011). These results are typical findings of habitats presenting with coarse sand /low organic matter (Wieser 1953; Semprucci et al. 2010, 2014). In the present study, the highest density of nematodes was found to be lower than that was recorded in Sinop Bay (Ürkmez et al. 2015). When a transect-wise comparison is considered in İğneada, the total density of nematodes was higher at transect I-2 compared to the other transects, however it should be noted that one station is lacking from the transect I-1 due to unfavourable weather conditions for sampling.

As it is documented by other studies (Soltwedel 2000; Frontalini et al. 2014; Ürkmez et al. 2016), harpacticoid copepods follow nematodes in terms of abundance in meiobenthos. Although generally true for the sampling stations of the present study, this was not the case for the station I-2-2 where they reached a density twice as much of nematodes indicating a relatively clear habitat (Raffaelli & Manson 1981; Sezgin et al. 2013). On the contrary, the density of nematodes was 43 times more than that of harpacticoid copepods at the station I-2-3, showing a tendency for a polluted environment (Ersoy-Karaçuha et al. 2011; Semprucci et al. 2016). In the present study, 15 species of harpacticoid copepods belonging to 16 genera and

10 families were recorded. Ectinosomatidae and Miraciidae were the dominant families found at the area. Similarly, Ersoy-Karaçuha & Sezgin (2013) reported the dominance of Miraciidae at the shallow waters of Sinop Bay. Dominant species found in the present study were typical species frequently encountered in the Black Sea such as *Ectinosoma melaniceps*, *Halectinosoma herdmani*, *Paramesochra* sp. 1 and *Ameira parvula parvula*.

Hard-shelled Foraminifera showed a low diversity of 12 species at the area. The poor foraminiferan diversity can be attributed to the general sediment feature of the area being coarse sand. Du Châtelet et al. (2009) also mentioned a low diversity in sediments including a high percentage of coarse sand. *Ammonia* and *Elphidium* species from the family Rotalidae were found to be abundant as it is expected in the Black Sea. The dominant hard-shelled foraminiferan species recorded in the present study were *Ammonia* sp. 1, *Ammonia tepida* and *Elphidium crispum*. Similarly, the study of Temelkov (2008) at the Bulgarian coast showed that the species of *Ammonia* and *Elphidium* were dominant almost at all kinds of sediment types. Balsamo et al. (2012) summarized the foraminiferal responses to different pollution resources and accordingly, the assemblages dominated by *A. tepida* indicates availability of environmental stress at our sampling area (Debenay et al. 2009). Öksüz et al. (2011) reported dominance of *Ammonia*, particularly in sediments with medium to coarse sand at the central Turkish Black Sea and identified 5 species of the genus from Sinop Bay. The species listed in the table are reported for the first time as recent living benthic hard-shelled foraminifera at least from the Black Sea coast of Turkey.

This study provides first data on the meiobenthic assemblages of western coasts of the Turkish Black Sea presenting particularly the nematode, harpacticoid and hard-shelled foraminiferan composition of the area. This attempt aims to fill a gap in the knowledge of biodiversity on the coasts of İğneada, which has been proposed as a transboundary marine protected area. Establishment and improvement of regional databases are of great significance in monitoring biodiversity, particularly at marine protected areas, since this serves as a basis for planning conservational actions.

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References

Apostolov A. & Marinov T. 1988. Copepoda, Harpacticoida, Fauna Bulgarica, 18. In: Aedibus Acad. Scient. Bulgaricae, Sofia **18:** 1–384.

Armenteros M., Ruiz-Abierno A., Fernández-Garcés R., Pérez-García J.A., Díaz-Asencio L., Vincx M. & Decraemer W. 2009. Biodiversity patterns of free-living marine nematodes in a tropical bay: Cienfuegos, Caribbean Sea. Estuarine, Coastal and Shelf Science **85 (2):** 179–189. DOI: 10.1016/j.ecss.2009.08.002

Băcescu M. 1960. Cîteva animale necunoscute înca în Marea Neagra si descrierea unor Malacostracei noi (*Elaphognathia monodi* n.sp. si *Pontotanais borceai* n.g. n.sp.), provenind din apele pontice prebosforice [Some still unknown animals in the Black Sea and description of Malacostraca (*Elaphognathia monodi* n.sp. and *Pontotanais borceai* n.g. n.sp.) from the prebosphoric Pontic waters]. Academia Republicii Populare Romîne, Studii si Cercetari de Biologie seria Biologie Animala **12:** 107–124.

Băcescu M. & Mărgineanu C. 1959. Éléments méditerranéens nouveaux dans la faune de la Mer Noire, rencontrés dans les eaux de Roumélie (Nord-Ouest-Bosphore). Données nouvelles sur le problčme du peuplement actuel de la Mer Noire. Archivio di Oceanografia e Limnologia **11 (Suppl.):** 63–74.

Balsamo M., Semprucci F., Frontalini F. & Coccioni R. 2012. Meiofauna as a tool for marine ecosystem biomonitoring, Chapter 4, pp. 77–104. DOI: 10.5772/34423. In: Cruzado A. (ed.), Marine Ecosystems, InTech Publisher 4, 322 pp. ISBN: 978-953-51-0176-5, DOI: 10.5772/2131

Brennan M.L., Davis D., Roman C., Buynevich I., Catsambis A., Kofahl M., Ürkmez D., Ian Vaughn J., Merrigan M. & Duman M. 2013. Ocean dynamics and anthropogenic impacts along the southern Black Sea shelf examined by the preservation of premodern shipwrecks. Continental Shelf Research **53:** 89–101. DOI: 10.1016/j.csr.2012.12.010

Caraion F.E. 1959. Ostracode noi in Marea Neagră (apele bosforice) [New Ostracodes of the Black Sea (Bosphorus waters)]. Comunicările Academia Republicii Populare Romine **9:** 265–273.

Cimerman F. & Langer M.R. 1991. Mediterranean Foraminifera. Slovenska Akademia Znanosti, Ljubljana, 118 pp. ISBN: 8671310531, 9788671310536

Debenay J.P., Della Patrona L., Herbland A. & Goguenheim H. 2009. The impact of Easily Oxidized Material (EOM) on the meiobenthos: Foraminifera abnormalities in Shrimp ponds of New Caledonia, implications for environment and paleoenvironment survey. Marine Pollution Bulletin **59 (8-12):** 323–335. DOI: 10.1016/j.marpolbul.2009.08.012

Didkowsky V.Y. 1969. Foraminifery pribosforskogo raĭona Chernogo morya [Foraminifera of the near Bosporus area of the Black Sea], pp. 70–72. In: Vinogradov K.A., Vinogradova Z.A. & Zaitsev Yu.P. (eds), Biologicheskie problemy okeanografii yuzhnykh moreĭ [Biological Problems of Oceanography of the Southern Seas], Naukova Dumka, Kiev, 198 pp. ISBN: 200002060855

Du Châtelet É.A., Bout-Roumazeilles V., Riboulleau A. & Trentesaux A. 2009. Sediment (grain size and clay mineralogy) and organic matter quality control on living benthic foraminifera. Contrôle du sédiment (granulométrie et minéralogie des argiles) et de la qualité de la matière organique sur les foraminifères benthiques vivants. Rev. Micropaléontol. **52 (1):** 75–84. DOI: 10.1016/j.revmic.2008.10.002

Ersoy-Karaçuha M. & Sezgin M. 2013. The changes in the diversity and abundance of the harpacticoid copepods (Crustacea) distributed in the upper-infralittoral zone of the Black Sea (Sinop, Turkey), pp. 69–70. In: Proceedings of the 4th Bi-annual Black Sea Scientific Conference 2013, Constanta, Romania.

Ersoy-Karaçuha M., Sezgin M. & Gökkurt Baki O. 2011. The relationship between the distribution of harpacticoid copepods with the environmental factors and the sediment characteristics in the Black Sea (Sinop, Turkey), pp. 207–208. In: Abstracts: 3rd Bi-annual Black Sea Scientific Conference and Up-Grade BS-Scene Project Joint Conference 2011, Odessa 1–4 November 2011, Ukraine.

Frontalini F., Semprucci F., Armynot du Châtelet E., Francescangeli F., Margaritelli G., Rettori R., Spagnoli F., Balsamo M. & Coccioni R. 2014. Biodiversity trends of the meiofauna and foraminifera assemblages of Lake Varano (southern Italy). Proc. Biol. Soc. Wash. **127 (1):** 7–22. DOI: 10.2988/0006-324X-127.1.7

Gheskiere T., Hoste E., Kotwicki L., Degraer S., Vanaverbeke J. & Vincx M. 2002. The sandy beach meiofauna and free-living nematodes from De Panne (Belgium), pp. 43–49. In: Peeters M. & Van Goethem J.L. (eds), Belgian Fauna and Alien Species, Bulletin van het Koninklijk Belgisch Instituut voor Natuurwetenschappen 72 (Suppl.), Brussel, 297 pp.

Heip C., Vincx M. & Vranken G. 1985. The ecology of marine nematodes. Oceanography and Marine Biology: an Annual Review **23:** 399–489.

Higgins R.P. & Thiel H. 1988. Introduction to the study of meiofauna. Smithsonian Institution Press, Washington DC, 488 pp. ISBN: 0874744881, 9780874744880

Kharkevych Kh.O. 2013. Species composition and ecology of tardigrades of the Black Sea. Natura Montenegrina **12 (2):** 357–368.

Kharkevych Kh.O. & Sergeeva N.G. 2013. Deep-water Tardigrada of the Istanbul Strait's (Bosporus) outlet area of the Black Sea. Vest. Zool. **47 (3):** 17–27. DOI: 10.2478/vzoo-2013-0021,

Lang K. 1948. Monographie der Harpacticiden. Håkan Ohlssons Boktryckeri, Lund, Sweden, 1682 pp. ISBN: 3874290891, 9783874290890

Luth U. 2004. The benthos of the oxic/anoxic interface in the western Black Sea: comparative macro- and meiofauna investigations on transects from the Ukrainian, Romanian and Turkish shelf, pp. 2–69. In: Öztürk B., Mokievsky V.O. & Topaloğlu B. (eds), Proceedings of the International Workshop on Black Sea benthos, 19–23 April 2004, Istanbul, Turkey, 245 pp. ISBN: 975-8825-04-6

Marinov T. 1962. Über die Muschelkrebs-Fauna des westlichen Schwarzmeerstrandes. Academie Bulgarie des Sciences, Section de Biologie. Bulletin de l'Institut Central de Recherche Scientifique de Pisciculture et de Pecherie, Varna **2:** 81–108.

Öksüz İ., Sezgin M., Kırcı-Elmas E. & Gündoğdu A. 2011. Seasonal changes of *Ammonia* (Foraminifera) inhabiting the southern Black Sea (Sinop Bay, Turkey), p. 62. In: In: Abstracts: 3rd Bi-annual Black Sea Scientific Conference and Up-Grade BS-Scene Project Joint Conference 2011, Odessa 1–4 November 2011, Ukraine.

Öztürk B., Topaloğlu B., Kıdeyş B., Bat L., Keskin Ç., Sezgin M., Amaha Öztürk A. & Yalçıner A.C. 2013. A proposal for new marine protected areas along the Turkish Black Sea coast. J. Black Sea/Mediterranean Environment **19 (3):** 365–379.

Rafaelli D.G. & Manson C.F. 1981. Pollution monitoring with meiofauna, using the ratio of nematodes to copepods. Mar. Pollut. Bull. **12 (5):** 158–163. DOI: 10.1016/0025-326X(81)90227-7

Sandulli R., Semprucci F. & Balsamo M. 2014. Taxonomic and functional biodiversity variations of meiobenthic and nematode assemblages across an extreme environment: a study case in a Blue Hole cave. Ital. J. Zool. **81 (4):** 508–516. DOI: 10.1080/11250003.2014.952356

Semprucci F., Balsamo M. & Frontalini F. 2014. The nematode assemblage of a coastal lagoon (Lake Varano, Southern Italy): ecology and biodiversity patterns. Scientia Marina **78 (4):** 579–588. DOI: 10.3989/scimar.04018.02A

Semprucci F., Balsamo M. & Sandulli R. 2016. Assessment of the Ecological quality (EcoQ) of the Venice lagoon using the structure and biodiversity of the meiofaunal assemblages. Ecological Indicators **67:** 451–457. DOI: 10.1016/j.ecolind.2016.03.014

Semprucci F., Colantoni P., Baldelli G., Rocchi M. & Balsamo M. 2010. The distribution of meiofauna on back-reef sandy platforms in the Maldives (Indian Ocean). Marine Ecology: An Evolutionary Perspective **31 (4):** 592–607. DOI: 10.1111/j.1439-0485.2010.00383.x

Semprucci F., Colantoni P., Sbrocca C., Baldelli G., Rocchi M. & Balsamo M. 2011. Meiofauna in sandy back-reef platforms differently exposed to the monsoons in the Maldives (Indian Ocean). J. Mar. Syst. **87 (3-4):** 208–215. DOI: 10.1016/j.jmarsys.2011.04.002

Semprucci F., Frontalini F., Covazzi-Harriague A., Coccioni R. & Balsamo M. 2013. Meio- and Macrofauna in the marine area of the Monte St. Bartolo Natural Park (Central Adriatic Sea, Italy). Scientia Marina **77 (1):** 189–199. DOI: 10.3989/scimar.03647.26A

Sergeeva N.G. 1973a. Novye vidy svobodozhivushchikh nematod Chernogo morya iz otryada Chromadorida [New species of free-living Nematodes of the order Chromadorida in the Black Sea]. Zool. Zh. **52 (8):** 1238–1241.

Sergeeva N.G. 1973b. Novye vidy svobodozhivushchikh nematod otryada Enoplida iz Chernogo morya. Soobshchenie 1. [New species of free-living Nematodes of the order Enoplida from the Black Sea]. Zool. Zh. **52 (11):** 1710–1714.

Sergeeva N.G. 1974. Novye vidy svobodozhivushchikh nematod otryada Enoplida iz Chernogo morya. Soobshchenie 2. [New free-living Nematodes (Enoplida) from the Black Sea]. Zool. Zh. **53 (1):** 120–125.

Sergeeva N.G. 1977. Novye dlya Chernogo morya svobodozhivushchie nematody [Free-living Nematoda, new for the Black Sea]. Vest. Zool. **1:** 36–44.

Sergeeva N.G. 2003. Meĭobentos v raĭone sipingovykh istochnikov [Meiobenthos in the region with the methane gas seeps], pp. 258–267. In: Eremeev V.N. & Gaevskaya A.V. (eds), Sovremennoe sostoyanie bioraznoobraziya pribrezhnykh vod Kryma (chernomorskiĭ sektor) [Modern condition of biological diversity in near-shore zone of the Crimea (the Black Sea sector)], EKOSI – Gidrophizika, Sevastopol, 511 pp. ISBN: 966-02-3133-4

Sergeeva N.G. & Kopytina N.I. 2014. The first marine filamentous fungi discovered in the bottom sediments of the oxic/anoxic interface and in the bathyal zone of the Black Sea. Turk. J. Fish. Aquat. Sci. **14 (2):** 497–505. DOI: 10.4194/1303-2712-v14_2_21

Sergeeva N.G. & Mazlumyan S.A. 2015. Deep – water hypoxic meiobenthic Protozoa and Metazoa taxa of the Istanbul Strait's (Bosporus) outlet area of the Black Sea. Ecologica Montenegrina **2 (3):** 255–270.

Sergeeva N.G., Mazlumyan S.A., Çağatay M.N & Lichtschlag A. 2013. Hypoxic meiobenthic communities of the Istanbul Strait's (Bosporus) outlet area of the Black Sea. Turk. J. Fish. Aquat. Sci. **13 (1):** 33–41. DOI: 10.4194/1303-2712-v13_1_05

Sergeeva N.G. & Zaika V.E. 2013. The Black Sea Meiobenthos in Permanently Hypoxic Habitat. Acta Zool. Bulg. **65 (2):** 139–150.

Sezgin M., Ürkmez D. & Ersoy-Karaçuha M. 2013. Application of Nematode/Copepod Index in the Black Sea: Any indication for use in monitoring of organic pollution? pp. 41–42. DOI: 10.13140/RG.2.1.2567.8568. In: Abstracts: 4th Bi-annual Black Sea Scientific Conference, Black Sea – Challenges towards good environmental status, Constanta, Romania.

Soltwedel T. 2000. Metazoan meiobenthos along continental margins: A Review. Progress in Oceanography **46**: 59–84. DOI: 10.1016/S0079-6611(00)00030-6

Temelkov B.K. 2008. Ecological Characteristics of the Foraminiferal Founa (Protozoa: Foraminifera) of the Bulgarian South Black Sea Area. Acta Zool. Bulg. **2:** 275–282.

Urban-Malinga B. 2014. Meiobenthos in marine coastal sediments, pp. 59–78. DOI: 10.1144/SP388.9. In: Martini I.P. & Wanless H.R. (eds), Sedimentary Coastal Zones from High to Low Latitudes: Similarities and Differences, Special Publications, Vol. 388, Geological Society, London, 587 pp.

Ürkmez D. 2015. Dynamics of the meiobenthic nematode fauna in Sinop Bay (Southern Black Sea) with a focus on the taxonomy and ecology of Chromadoridae. PhD. Thesis, Sinop University, Sinop, Turkiye.

Ürkmez D., Brennan M.L., Sezgin M. & Bat L. 2015. A brief look at the free-living Nematoda of the oxic/anoxic interface with a new genus record (*Trefusia*) for the Black Sea. Oceanol. Hydrobiol. Stud. **44 (4):** 539–551. DOI: 10.1515/ohs-2015-0051

Ürkmez D., Sergeeva N.G., Sezgin M. & Gökkurt Baki O. 2011. Trophic diversity of free-living marine nematodes in relation to several abiotic factors in Sinop Bay (Turkey), p. 228. DOI: 10.13140/RG.2.1.4665.0088. In: Proceedings of the 3rd Bi-annual Black Sea Scientific Conference and UP-grade BS-scene Project Joint Conference 2011, Odessa, Ukraine.

Ürkmez D., Sezgin M., Ersoy Karaçuha M., Öksüz İ., Katağan T., Bat L., Dağlı E. & Şahin F. 2016. Within-year spatio-temporal variation in meiofaunal abundance and community structure, Sinop Bay, the Southern Black Sea. Oceanol. Hydrobiol. Stud. **45 (1):** 55–65. DOI: 10.1515/ohs-2016-0006

Wells J.B.J. 2007. An annotated checklist and keys to the species of Copepoda Harpacticoida (Crustacea). Zootaxa **1568**: 1–872. ISBN: 978-1-86977-109-6

Wieser W. 1953. Die Beziehung zwischen Mundhohlengestalt, Ernahrungsweise und Vorkommen bei freilebenden marinen Nematoden. Arkiv för Zoologi (Ser. 2) **4:** 439–484.

Yanko V.V. & Vorob'eva L.V. 1991. Foraminifery pribosforskogo raĭona Chernogo morya [Foraminifera of the Bosphorus region of the Black Sea]. Ekologiya Moriya **39:** 47–50.

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