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ROLE OF ENVIRONMENTAL PARAMETERS IN THE DISTRIBUTION OF MEIOBENTHIC FAUNA (OSTRACODA AND FORAMINIFERA) IN THE ROMANIAN BLACK SEA SHELF

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Abstract

With limited research undertaken on the distribution and biodiversity of meiobenthic fauna (living Ostracoda and Foraminifera) in the Black Sea, the present study has focused to create the baseline data for the Romanian Black Sea continental shelf. For this purpose, 9 short core samples were collected using a multi-corer in water depth ranging from 27.8 m to 41.8 m in May 2018 around the Sf. Gheorghe area (map sheet L35-120B). A total of 14 species were found belonging to Ostracoda (7 families), Cercozoa (one family), Foraminifera (5 families). The highest density of meiobenthic species was correlated with the highest concentration of $CaCO_3$ where the substrate is dominated by a clayey silt or sandy silt while TOC concentrations were negatively correlated with the low densities occurring in the western part of the perimeter silt clay substrate is found. The density of soft-shelled foraminifera has a positive correlation with the concentration of salinity in the bottom water samples, and depth and a negative correlation with the bottom water temperature. The density of Ostracoda has a positive correlation with temperature and depth but a negative correlation with salinity in the bottom water samples. The relationships between high concentrations of $CaCO_3$ and increased abundances of meiobenthic fauna and high concentrations of TOC and low meiofauna abundances, respectively, reinforce the hypothesis according to which the dispersal of meiofaunal species is strongly influenced by environmental gradients. The data collected from Romanian Black Sea Shelf (Sf. Gheorghe Area) in the perimeter of the map sheet L35-120B, suggest another record of soft shelled monothalamous Foraminifera and Gromiidae group.

***Key words**: Black Sea, Cercozoa, Foraminifera, Ostracoda.*

INTRODUCTION

Meiofaunal organisms have high turnover rates and short generation times allowing them to quickly respond to environmental change (Giere, 1993). They are basal components of the trophic web and key to the degradation and the mineralization of organic matter (Jones et al., 1994). Despite their importance, meiobenthic biota and assemblages are not well known particularly in the Black Sea. The available literature reveals that only a few research works on living Ostracoda and Foraminifera from the Romanian Black Sea shelf have been carried out to understand the faunal diversity, their relationship with the substrate and with other ecological parameters. In this study we assess meiobenthic fauna - Ostracoda and Foraminifera of the Sf Gheorghe area and aim to identify driving mechanisms explaining distribution.

We will:

- assess the abundance and taxonomic composition of the meiobenthic fauna - Ostracoda and Foraminifera;
- assess how physico-chemical and chemical water parameters, depth and sediment characteristics explain the distribution of both Ostracoda and Foraminifera.

MATERIAL AND METHODS

The study area is located in the upper littoral of the continental shelf of the Romanian Black Sea, between 8.7 (north, 29°45') to 11.6 (south) km from the mouth of the Sf. Gheorghe arm of the Danube River (45.0004°N/29.7498°E, 45.0004°N/29.9885°E, 44.8331°N/29.7493°E and 44.8331°N/29.9885°E) (Figure 1). The square surface (map sheet L35-120B) is 343 km^2, with a side of 18.5 km (10 nautical miles).

The area is heavily influenced by natural erosion and deposition, currents and terrigenous inflow from the Danube River. Furthermore, it is impacted by anthropogenic processes such as shipping, fishing and tourism (Zaitsev, 1992; Gomoiu, 2001; Pojar et al., 2021; Vasiliu et al., 2021; Black Sea State of Environment Report 2009-2014/5). The entire area, including the shallow seabed, is constantly evolving due to the predominant North South currents and sedimentation-input from the Danube. The north and west parts of this area belong to the ROSCI-0066 Danube Delta - Marine Protected Area, part of the Natura 2000 network, and ROSCI-0413. Accordingly, the whole area has a very high interest for biological diversity, and includes marine habitats, flora and fauna of national interest (Băcescu et al., 1965; Gomoiu, 1976; 1982; Begun et al., 2010; Dobrin et al., 2013). Regarding the fauna, the analyzed perimeter is situated on the circalittoral level with terrigenous alluvial and coquina muds, marking the transition between two major habitats present on the Romanian continental shelf in the Sf. Gheorghe area (the habitat of *Melinna palmata* represented by tubicolous polychaeta on terrigenic alluvial mud sediments and a *Mytilus galloprovincialis* habitat on coarse mixed sediments and sandy mud associated with tube-building polychaete *Dipolydora quadrilobate*) (Teaca et al., 2020). The bathymetry in the study area ranges between 27.8 and 41.8 m (between H001 and H069 stations).

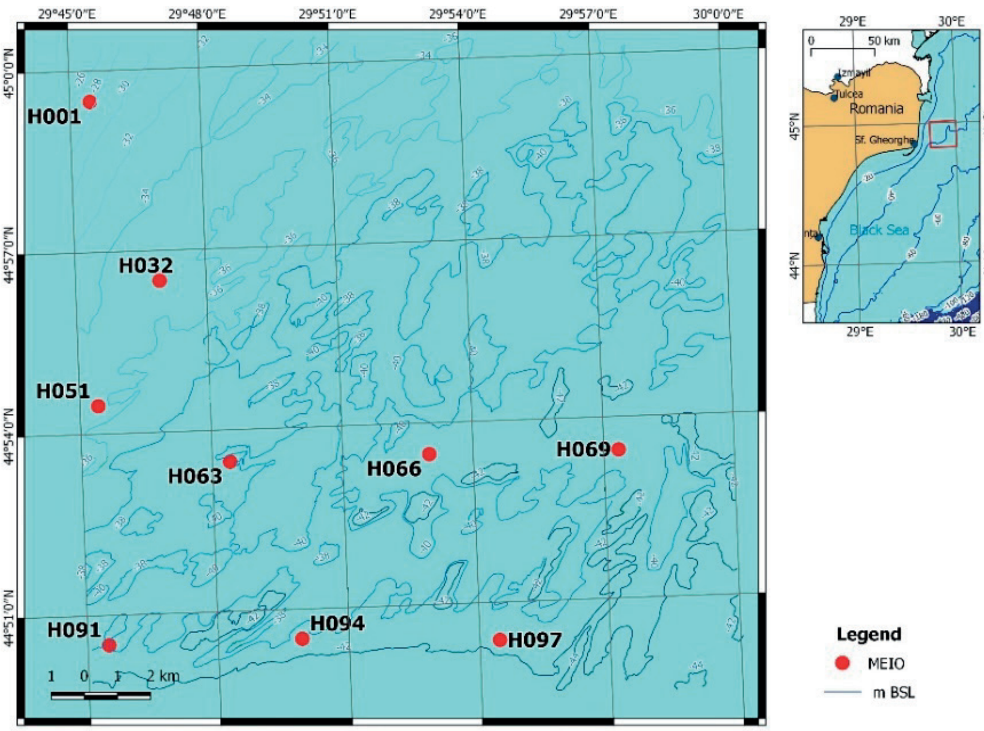

Figure 1. Map of the studied area from Romanian Black Sea Shelf (Sf. Gheorghe Area)
(Red points meiobenthic fauna samples)

We sampled nine quantitative meiobenthic samples on the Romanian Black Sea shoreline, in May 2018, on board of the *Mare Nigrum* research vessel (Table 1). Meiobenthic samples were collected by taking the superficial sediment layer (5cm) from a tube with a 0.00785 m^2 opening (∅ 10cm) from Mark - 400 multicores (MC). Meiofauna samples were washed through a 90 µm sieve to remove the fine sediments, anesthetized with a 7% magnesium chloride aqueous solution, fixed with a 4% formaldehyde solution buffered in seawater, and stained with a Rose Bengal aqueous solution (Holme and McIntyre, 1971). The organisms were sorted at the lowest taxonomic rank possible under a Zeiss Stemi 508 stereomicroscope following World Register of Marine Species (WoRMS). The density data was represented in square metres (indv. m^{-2}).

Table 1. Sampling stations collected in the perimeter of sheet L35-120B

Station	Depth [m]	Bottom Salinity ‰	Bottom Temperature °C	Coordinates		Meiofauna samples
				Lat. N	Long. E	Multicores
H001	27.8	18.1	6.1	44°59.492’	29°45.466’	1
H051	35.7	18.1	6	44°54.461’	29°45.425’	1
H091	39.8	18.8	6	44°50.508’	29°45.486’	1
H032	35.0	18.3	6.5	44°56.501’	29°46.932’	1
H063	39.6	18.2	6.4	44°53.473’	29°48.407’	1
H094	40.7	18.2	5.8	44°50.507’	29°49.926’	1
H066	40.0	18.3	6	44°53.483’	29°52.991’	1
H097	41.7	18.5	5.6	44°50.375’	29°54.461’	1
H069	41.8	18.4	5.5	44°53.451’	29°57.345’	1

Other MC tubes were used to collect nine samples for granulometric and geochemical analysis. $CaCO_3$ and Total organic carbon (TOC) contents were determined using a titrimetric method (Black, 1965; Gaudette et al., 1974).
The sediments were then classified according to calcium carbonate concentrations as: non-carbonated terrigenous ($CaCO_3$ < 10%); low calcareous terrigenous (10-30% $CaCO_3$); calcareous terrigenous (30-50% $CaCO_3$); carbonated biogenic (50-70% $CaCO_3$), and strongly carbonated biogenic ($CaCO_3$ > 70%). Granulometry was analyzed by diffractometry with a Mastersizer 2000E Ver.5.20 laser granulometer (Malvern) with 1% of precision and 99% of reproducibility.
This allowed to distinguish the sand, silt and clay fractions according to the Udden-Wentworth logarithmic scale, completed by three additional fractions at the 1φ interval in the clay field (Table 2).

Table 2. The particle size composition from Romanian Black Sea Shelf (Sf. Gheorghe Area) stations

Stations	Interval Sediment core	Particle size composition			Shepard classification	Median (φ)	Mz (φ)	Stand. Dev.	Asymmetry	Kurtosis
		Sand %	Silt %	Clay %						
H001	0-1	0.715	56.141	43.144	Clayey silt	7.73	7.78	1.66	0.14	1.24
	1-2	0.907	66.852	32.241	Clayey silt	7.38	7.44	1.51	0.13	1.17
	2-4	1.633	64.044	34.323	Clayey silt	7.45	7.48	1.50	0.09	1.14
	4-6	0.815	68.495	30.69	Clayey silt	7.08	7.12	1.74	0.09	0.98
H032	0-1	2.889	42.491	54.62	Silty clay	8.16	8.06	2.07	-0.01	1.26
	1-2	0.823	47.027	52.15	Silty clay	8.05	8.07	1.85	0.09	1.31
	2-4	1.721	46.668	51.611	Silty clay	8.03	7.98	1.97	0.03	1.27
	4-6	1.787	48.55	49.663	Silty clay	7.95	7.95	1.87	0.08	1.26
H051	0-1	3.221	60.728	36.051	Clayey silt	7.30	7.32	1.88	0.05	1.06
	1-2	0.24	47.634	52.126	Silty clay	8.06	7.95	1.93	0.04	1.08
	2-4	0.26	47.313	52.427	Silty clay	8.08	8.00	1.98	0.04	1.12
	4-6	0.18	47.336	52.484	Silty clay	8.09	8.11	1.92	0.08	1.24
H063	0-1	0.69	54.933	44.377	Clayey silt	7.72	7.73	1.86	0.08	1.02
	1-2	0.57	52.172	47.258	Clayey silt	7.84	7.87	1.78	0.10	1.10
	2-4	2.779	54.132	43.089	Clayey silt	7.67	7.69	1.94	0.08	1.21
	4-6	27.684	53.916	18.4	Sandy silt	6.30	5.73	2.53	-0.26	0.78
H066	0-1	6.468	62.147	31.385	Clayey silt	7.37	7.39	2.05	0.02	1.45
	1-2	6.882	51.918	41.2	Clayey silt	7.62	7.55	2.12	-0.06	1.40
	2-4	15.412	46.48	38.108	Clayey silt	7.32	6.94	2.74	-0.14	1.14
	4-6	2.858	59.21	37.932	Clayey silt	7.55	7.55	1.65	0.09	1.21
H069	0-1	18.908	46.882	34.21	Clayey silt	7.14	6.62	2.86	-0.21	1.19
	1-2	27.987	52.973	19.04	Sandy silt	6.41	5.97	2.56	-0.20	0.88
	2-4	57.573	29.382	13.045	Silty sand	3.45	4.38	2.62	0.49	0.79
	4-6	38.947	45.021	16.032	Sandy silt	5.62	5.32	2.66	-0.09	0.74
H091	0-1	1.645	56.61	41.745	Clayey silt	7.67	7.69	1.68	0.10	1.20
	1-2	0.44	55.621	43.939	Clayey silt	7.73	7.71	1.74	0.07	1.24
	2-4	0.38	48.285	51.335	Silty clay	8.02	8.04	1.76	0.10	1.39
	4-6	0.28	47.668	52.052	Silty clay	8.04	7.94	1.72	0.02	1.15
H094	0-1	16.645	53.432	29.923	Clayey silt	6.96	6.56	2.61	-0.21	1.23
	1-2	35.104	47.791	17.105	Sandy silt	6.25	5.49	2.77	-0.29	0.70
	2-4	61.585	20.867	17.548	Silty sand	2.49	4.01	3.01	0.68	0.65
	4-6	61.895	24.035	14.07	Silty sand	2.91	4.17	2.74	0.62	0.75
H097	0-1	4.259	67.606	28.135	Clayey silt	7.20	7.20	1.63	-0.02	1.22
	1-2	9.22	60.807	29.973	Clayey silt	7.19	7.08	2.06	-0.09	1.40
	2-4	1.541	62.833	35.626	Clayey silt	7.48	7.50	1.60	0.11	1.19
	4-6	3.398	62.23	34.372	Clayey silt	7.27	7.23	1.91	0.03	1.09

All statistical analyses were performed using PRIMER 7 with PERMANOVA + add-on software package (Anderson et al. 2008) and xlSTAT 7.5.2. Software (AddinSoft, 2020). The densities of Ostracoda and Foraminifera were analysed with a dendrogram based on the Bray-Curtis similarity (Bray and Curtis, 1975). Pearson correlation and Principal Component Analysis (PCA) were used to assess the relationships between the abundance of Ostracoda and Foraminifera and environmental factors (i.e., depth, salinity, temperature and sediment geochemistry), based on the principal components (PCs) with eigenvalues greater than one.

RESULTS AND DISCUSSIONS

Water surface salinity (range: 10-17.3‰) and temperature (range: 12-13°C) varied considerably, while bottom temperature (5.8-6.5ºC) and salinity (18.1-18.8‰) were relatively stable (Table 1).

The primary origin of calcium from the carbonate constituent is continental, but its precipitation and deposition are linked to chemical and biological factors specific to the marine environment (Middelburg et al., 2020). $CaCO_3$ is transported and introduced into the sea almost exclusively. $CaCO_3$ concentrations in our samples ranged from 11% to 55%, suggesting the absence of carbonate-free terrigenous sediments. Under the Black Sea specific pH conditions (pH = 7.5-8.5), $CaCO_3$ can precipitate directly from the solution as its precipitation limit being at pH = 7.8, with an optimal pH of 8-8.3, a common value in the surface and shallow Black Sea waters. Direct precipitation, controlled by the partial pressure of CO_2 in marine and interstitial water, is proven by the presence of recent $CaCO_3$ crusts on relict shells. Surface sediments showed TOC concentrations ranging between 0.32% and 2.29% (1.19% on average) indicating moderate biological productivity. The western half of the study site showed TOC concentrations > 1%, while they were generally < 1% in the calcareous terrigenous sediments of the eastern half. However, TOC concentrations >2% were measured in the low terrigenous sediments of H032, H043, H052 stations. The studied area is characterized by low calcareous terrigenous sediments, especially in the western part where the mud rich in *Melinna* predominates, with the exception of the southern part, where the high abundance of *Mytillus* causes terrigenous calcareous sediments (Teaca et al., 2020). $CaCO_3$ concentration values greater than 50% were measured only sporadically (two values in the H094 station, in the sedimentation intervals 1-2 and 2-4). This fact can be correlated with the study period, which coincided with a strong algal blooming (Petranu, 1997). The amount of organic matter deposited on sediments surface was not important except for the western part, where the Danube influence was more pronounced for the organic matter contribution. In our samples, fine sediments dominated as shown by the high values of clayey silt and low median diameter (most values in the range 6.50-8.00φ). This is indicative of predominant suspension-deposition, possibly related to the activity of some planktonic organisms. The standard deviation that illustrates the degree of particle sorting also provides information on sediment dynamics. In conditions where the transport agent is intense and acts over long distances, the sorting of particles is good (standard deviation has values low below 0.7). In our case, the degree of sorting of sediments varies in the range of 1.50-3.50 (weak and very weak sorting domains). Poor sorting is a common feature in sediments deposited from suspensions in relatively calm environments being determined by the phenomenon of particle agglomeration that prevents selective deposition. The presence in several locations of "silty clay" type sediments does not indicate a special environment as the percentage values were at the limit between the "silty clay" and "clayey silt" fields on the Shepard diagram. The lower values of the median diameter (often close to 6φ) characteristic of "sandy silt" type sediments are due to the coarser particles. The percentages of sand, usually bioclastogenic and less lithic, do not have a special dynamic importance because its source is very likely the frequent mollusk shells in the area. The low sorting values comparable to those of the "clayey silt" type sediments indicate the lack of a long transport. Asymmetry values are generally indicative of deposition (positive domain) or erosion (negative domain) processes. In the present case, although the variation range is relatively wide (-0.50 + 0.60), most values are close to 0, which can be interpreted as a balance between deposition and erosion processes. The values in the negative range do not mean erosion but being the result of the presence in sediments of bioclastogenic particles formed *in situ*.

The uniformity, with minor exceptions, of the particle size composition and the textural parameters along the core length shows that the sedimentation environment has not changed over time (Melinte-Dobrinescu et al., 2019). During our investigations in May 2018 on the Romanian continental shelf (Sf. Gheorghe area), 14 species were found belonging to Ostracoda (7 families), Cercozoa (one family), Foraminifera (5 families) (Table 3).

Among the Ostracoda, 8 species from 7 families were identified. The average density of Ostracoda was 109725 ind. m^{-2}, with the dominant species being *L.* (*C.*) *diffusa* (30058 ind. m^{-2}) and *P. granulata* (20378.5 ind. m^{-2}) (Table 3).

Table 3. Qualitative and quantitative structure of Ostracoda and Foraminifera populations from Romanian Black Sea Shelf (Sf. Gheorghe Area)

Species	Ab	D %	Noc	F %	Davg	Deco	W
Cercozoa							
Gromiidae Dujardin, 1835	93765	6.37	8	88.89	10418.3	11720.625	23.80
Foraminifera							
Allogromiidae Rhumbler, 1904	11172	0.76	1	11.11	1241.3	11172	2.90
Saccaminidae - Psammophaga sp.	169176	11.50	6	66.67	18797.3	28196	27.69
Eggerelloides scaber Williamson, 1858	113981	7.75	7	77.78	12664.6	16283	24.55
Cribroelphidium poeyanum d'Orbigny, 1839	89775	6.10	5	55.56	9975.0	17955	18.41
Ammonia tepida Cushman, 1926	5586	0.38	2	22.22	620.7	2793	2.90
Ostracoda							
Leptocythere (Callistocythere) diffusa Mueller, 1894	270522	18.39	5	55.56	30058.0	54104.4	31.96
Palmoconcha granulata Sars, 1866	183407	12.47	7	77.78	20378.6	26201	31.14
Pseudopsammocythere similis Mueller, 1894	34846	2.37	3	33.33	3871.8	11615.3	8.89
Semicytherura sp. Wagner, 1957	14098	0.96	3	33.33	1566.4	4699.3	5.65
Hiltermannicythere rubra Mueller, 1894	85652	5.82	4	44.44	9516.9	21413	16.09
Xestoleberis cornelii Caraion, 1963	172634	11.74	4	44.44	19181.6	43158.5	22.84
Leptocythere multipunctata Seguenza, 1883	132069	8.98	5	55.56	14674.3	26413.8	22.33
Cytheroma variabilis Mueller, 1894	94297	6.41	8	88.89	10477.4	11787.125	23.87

*(Total Abundance - Ab, Dominance - D%, Occurrence number - Noc, Frequency - F%, Average density - Davg ind.m^{-2}, Ecological density - D_{eco} ind.m^{-2}, Ecological significance index - W)

Ostracoda are one of the dominant meiofauna groups. Both the lifestyle and spread of Ostracoda are directly influenced by the substrate nature and its concentration in organic matter, by the depth and by the salinity (Rajkumar et al., 2020). Some are euryhaline species that adapted to low salinity with fluctuations from freshwater areas (*Leptocythere*, *Hiltermanicythere*, etc.). On the Romanian Black Sea shelf, two different ostracod assemblages associated with either shallow or deep waters can be observed (Briceag & Ion, 2014). The ostracod assemblages found is made up exclusively of Atlantic-Mediterranean immigrated species, represented by *P. granulata, H. rubra, L. multipunctata* and *X. cornelii* species. These species inhabit areas with a water depth comprised between 20-200 m, with a mud-sand substrate (Caraion, 1967). Temperature is another important factor that influences the distribution of Ostracoda (Boomer et al., 2010). This explains the presence in the deep-water areas (maximum 120 m) of the Romania shelf of the species of northern origin *P. granulata* in mud substrate areas where the temperature is lower. *P. granulata* and *C. variabilis* are the most common and widespread species all along the Romanian shelf. These species live in the bathymetric range of 18-135 m (Caraion, 1967). Another marine species is *L. (C.) diffusa*, with depth preferences ranging between 30-70 m, which is currently found on the French coasts of the Atlantic Ocean, the Mediterranean Sea and the Black Sea (Opreanu, 2006). While between 1995-2005 the average density amongst ostracod populations was represented by 2652 ind. m^{-2} (Opreanu, 2006), the current data show that the total average density of all ostracod species reaches considerably higher values of 109725 ind. m^{-2}.

Another group, rich in species consisting of single-celled eukaryotes, is Rhizaria. Monothalamous soft-shelled Foraminifera were encountered in most of the samples. These species are benthic with one single chamber (i.e., *Psammophaga* sp.), which retains mineral particles in their cytoplasm (Anikeeva, 2005). The spatial distribution of monothalamous Foraminifera depends on granulometric composition, depth, organic matter and salinity (Sabbatini et al., 2013). Moreover, they consume bacteria and are considered as eutrophiccation indicator (Sergeeva et al., 2017). Although the diversity and abundance of calcareous Foraminifera fauna from the Romanian Black Sea shelf are low, the following two associations could be separated: the association with *Ammonia* and the association with *Elphidium*. There are still missing data regarding the distribution of soft-shelled monothalamous Foraminifera and the selective minerals accumulation mechanism in their cytoplasm.

Among the Rhizaria group, Gromiidae are characterized by unicellular organisms with a soft test full of stercoma (consisting of organic material and clay minerals from ingested sediments) (Rothe et al., 2009). In the current study, the Gromiidae sp. average density was 10418.3 ind. m^{-2}. Other monothalamous soft-shelled Foraminifera showed average densities of 1241.3 ind. m^{-2} for Allogromiidae sp., and 18797.3 ind. m^{-2} for *Psammophaga* sp. Studies conducted by Pavel et al., 2021 on the Romanian Black Sea Shelf, showed similar densities (Gromiidae 16758 ind. m^{-2}, for Allogromiidae sp. 17689 ind. m^{-2} for *Psammophaga* sp. 12103 ind. m^{-2}). For the agglutinated Foraminifera, represented by *Eggerelloides scaber* Williamson, 1858, the average density was 12664.5 ind. m^{-2}. In contrast, the average densities of the calcareous Foraminifera *Cribroelphidium poeyanum* d'Orbigny, 1839 and *Ammonia tepida* Cushman, 1926, were 9975 ind. m^{-2} and 620.6 ind. m^{-2} respectively. The total density of Ostracoda and Foraminifera varied from 17024 ind. m^{-2} at H051 to 578816 ind. m^{-2} at H066 and the total number of individuals counted was 1470980. The highest densities for Saccamminidae were reached at water depths between 41-50 m and 51-60 m and for Gromiidae and Allogromiidae in shallow waters < 20 m, and in the bathymetric ranges 51-60 m and 91-100 m, respectively. The species with the highest frequency (>50%) were represented by Gromiidae*, C. variabilis, E. scaber, P. granulata, Psammophaga* sp., *Elphidium* spp., L. (*C.) diffusa, L. multipunctata* (Table 3). From the 14 identified species in the studied area, only 8 are more abundant (*L.* (*C.*) *diffusa, P. granulate, X. cornelii, Psammophaga* sp.*, L. multipunctata, E. scaber, C. variabilis* and Gromiidae) making over 80% of the total average density.

The stations H066 and H069 showed the highest abundance, followed by H097 and H094. The rest of the stations had lower abundances recorded. The high abundances from the first two stations are related to the sampling areas depth (> 40 m) and Danube lower influence. The distribution of meiobenthic communities varied significantly. The western part (H001, H051, H063, H091, H032) showed lower densities than the eastern part (H097, H094, H069, H066) (Figure 2).

The highest density of meiobenthic species was correlated with the highest concentration of $CaCO_3$ (eastern part of the perimeter: H094, H069, H066) while TOC concentrations were negatively correlated with the low densities occurring in the western part of the perimeter (H032, H051, H011). Also, the two first eigenvectors cover 64% from the Eigenvalues, variability and cumulative in the Principal Component Analysis (PCA) matrix (Figure 3).

The association of highest density of meiobenthic species with $CaCO_3$ indicates the major contribution of shell fragments to the sediment fraction found in the study area. In addition to the clayey silt substrate, the presence of calcium carbonate may be due to the presence of biogenous sediments (tests of planktonic, benthic Foraminifera, or shells from *Mytilus*) noticed.

Organic matter content in the sediments is inversely proportional to the calcium carbonate content and directly proportional to the water depth, in which the core samples have been collected in the study area (Rajkumar et al., 2020). Horne, 1983 and Sabbatini et al., 2013 stated that temperature and salinity are important controlling factors for the population of ostracod and foraminifera.

Water parameters such as temperature and salinity were correlated with ostracod and foraminifera fauna distributed in the top layer (0-5 cm) of the multi-core samples. The density of soft-shelled Foraminifera has a positive correlation with the concentration of salinity in the bottom water samples, and depth and a negative correlation with the bottom water temperature. The density of Ostracoda has a positive correlation with temperature and depth but negative correlation with concentration of salinity in the bottom water samples. However, water depth is also considered as one of the important factors in controlling the population of ostracod and foraminifera in the study area. Ostracod species showed the highest densities, followed by soft-shelled monothalamous Foraminifera.

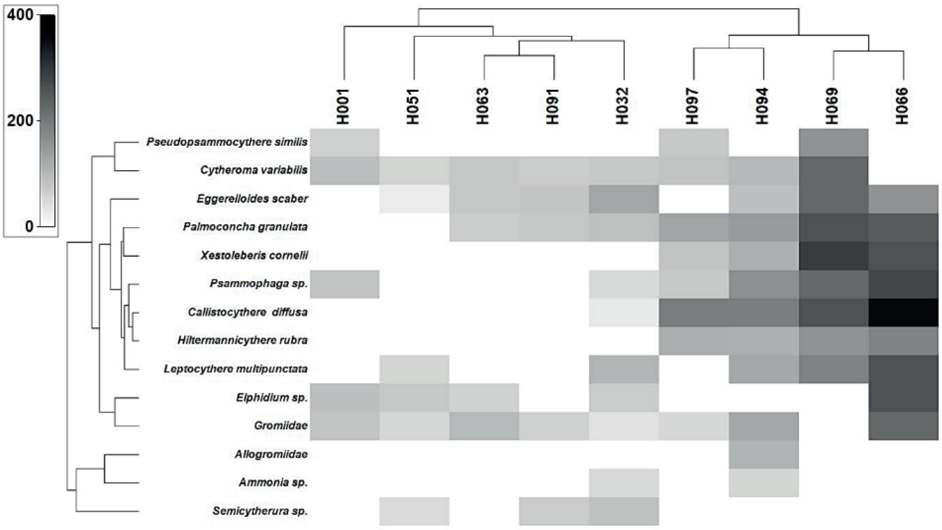

Figure 2. The association index between densities of the Ostracoda and Foraminifera species (vertically) and the stations based on the Bray-Curtis similarity (data transformed square root) (horizontally) from Romanian Black Sea Shelf (Sf. Gheorghe Area) in the perimeter of the map sheet L35-120-B

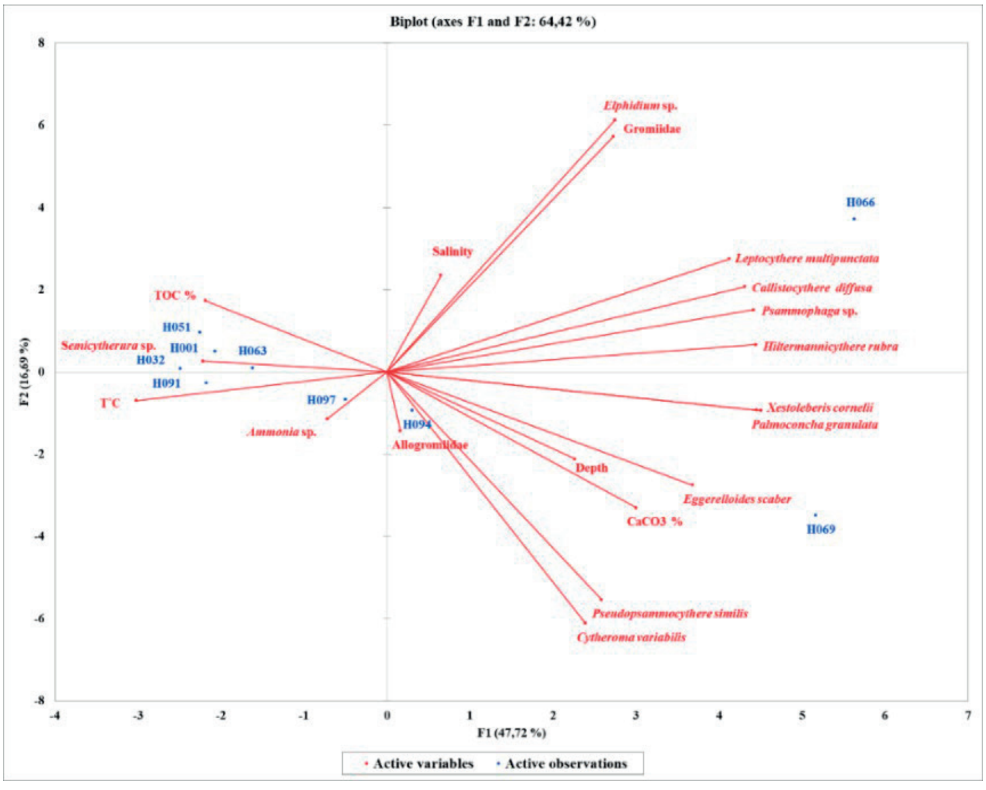

Figure 3. Principal Component Analysis on the species densities with Salinity, Temperature, Depth, TOC, $CaCO_3$ concentrations

The most dominant and ubiquitous species of Ostracoda were *C. variabilis, P. granulata, Hiltermanicythere rubra* Mueller, 1894*, X. cornelii,* L. (*C.*) *diffusa*. From the analysis of the meiobenthic population's distribution, in relation to different sub-areas (of depth or substrate nature), the highest densities were recorded in the stations H069 and H066 where the water depths are greater (> 40 m depth) and the substrate is dominated by a clayey silt or sandy silt. The low abundances were recorded in areas with water depths above 35 m and with silt clay substrate. The latter are closer to the Danube influence area, with a significant freshwater supply, thus affecting specific marine populations, shifted with euryhaline organisms. The meiobenthic communities (Ostracoda and Foraminifera) in the Romanian Black Sea shelf (Sf. Gheorghe area) can be characterized as a community composed of a limited number of species occurring in remarkably high densities. It appears that the benthic invertebrate fauna is relatively well represented in such habitats with high diversity, supply by in situ primary production, whereas small meiobenthic animals (Ostracoda and Foraminifera) are relatively scarce in diversity but high in densities.

CONCLUSIONS

The relationships between high concentrations of $CaCO_3$ and increased abundances of meiobenthic fauna and high concentrations of TOC and low meiofauna abundances, respectively, reinforce the hypothesis according to which the dispersal of meiofaunal species is strongly influenced by environmental gradients (Rajkumar et al., 2020). However, further investigations need to be carried out by monitoring the environmental parameters and their biotic components for a better understanding of the meiobenthic organism's distribution. In addition, the influence of the Danube water has made its mark on the meiobenthic organisms, changing the meiofauna composition, tolerant species supporting wide salinity variations. Also, the data collected from Romanian Black Sea Shelf (Sf. Gheorghe Area) in the perimeter of the map sheet L35-120B, suggest another record of soft shelled monothalamous Foraminifera and Gromiidae group.

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