Recent Data on Benthic Populations from the Sandy Bottom Community in the Marine Zone of the Danube Delta Biosphere Reserve (ROSCI0066) *(Camelia Dumitrache, Adrian Filimon, Valeria Abaza, Tania Zaharia)*	"Cercetări Marine" Issue no. 43 Pages 219-231	2013

RECENT DATA ON BENTHIC POPULATIONS FROM THE SANDY BOTTOM COMMUNITY IN THE MARINE ZONE OF THE DANUBE DELTA BIOSPHERE RESERVE (ROSCI0066)

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ABSTRACT

ROSCI0066 Danube Delta - marine zone, a Community importance site, under the Habitats Directive 92/43/EEC requirements adopted by Decision 2009/92/EC, besides the SCI status, also has protected area status in the national network, it is RAMSAR site, UNESCO site and coresponds to the geographical unit of the Danube Delta Biosphere Reserve - Black Sea marine zone, from the Danube mouth - Chilia branch to Cape Midia, to the south and up to the 20 m isobath, to the east.

The marine zone of the Danube Delta is particular due to the major influence of Danube waters and sediments deposited by them, and here are found sedimentary habitats unique at the Romanian littoral. The habitats identified in *ROSCI0066 Danube Delta - marine zone* are: 1110 - *Sandbanks which are slightly covered by sea water all the time*; 1130 - *Estuaries*; 1140 - *Mudflats and sandflats not covered by seawater at low tide*.

The paper presents the results of research conducted in ROSCI0066 concerning the qualitative and quantitative aspects of the benthic community that characterizes the sedimentary bottoms.

In order to conduct the study, samples were collected from 11 stations (Sulina - Vadu profiles), between 10 m and 17 m depths, during 2011-2012.

The analysis of structural indicators (species composition, frequency, abundance, biomass) allowed to underline some conclusions concerning the ecological status of the macrozoobenthos from the considered biocoenosis.

KEYWORDS: zoobenthos, structural indicators, Danube Delta - marine zone

AIMS AND BACKGROUND

Marine protected areas (MPAs) are generally defined as areas reserved by law or other effective means to protect part or the entire enclosed environment. The Romanian Black Sea spans over a coast length of 245 km (6% of the total Black Sea coast), with a shelf area of 30,000 km^2 (16%) and an EEZ of 30,000 km^2.

The Romanian MPA network consists of 8 sites and has a total area of 1,162.86 km^2, which amounts to 4.65% of the EEZ and 3.88% of the Romanian shelf zone, while the marine part of the Danube Delta Biosphere Reserve represents 88.57% of it.

In accordance with the stipulations of Government Ordinance no. 57 from 20 June 2007, regarding the regime of protected areas, the preservation of natural habitats, of the wild flora and fauna (Official Gazette no. 442 from 29 June 2007), as well as of 79/409/EEC and 92/43/EEC European Directives, the following natural protected areas were established in the Romanian Black Sea area: ***ROSPA0076 Black Sea, ROSCI0269 - Vama Veche - 2 Mai***, ***ROSCI0094 - The Sulphur Seeps in Mangalia, ROSCI0197 - Submerged beach from Eforie North - Eforie South***, ***ROSCI0273 - Marine area from Cape Tuzla***, ***ROSCI0237 - Submerged methanogenic carbonate structures of Sf. Gheorghe***, ***ROSCI0066 - Danube Delta - marine zone*** (Micu, D., 2007; Zaharia T., 2007)

ROSCI0066 Danube Delta - marine zone, a Community importance site, under the Habitats Directive 92/43/EEC requirements adopted by Decision 2009/92/EC, besides the SCI status, also has protected area status in the national network, it is RAMSAR site, UNESCO site and coresponds to the geographical unit of the Danube Delta Biosphere Reserve - Black Sea marine zone, from the Danube mouth - Chilia branch to Cape Midia, to the south and up to the 20 m isobath, to the east.

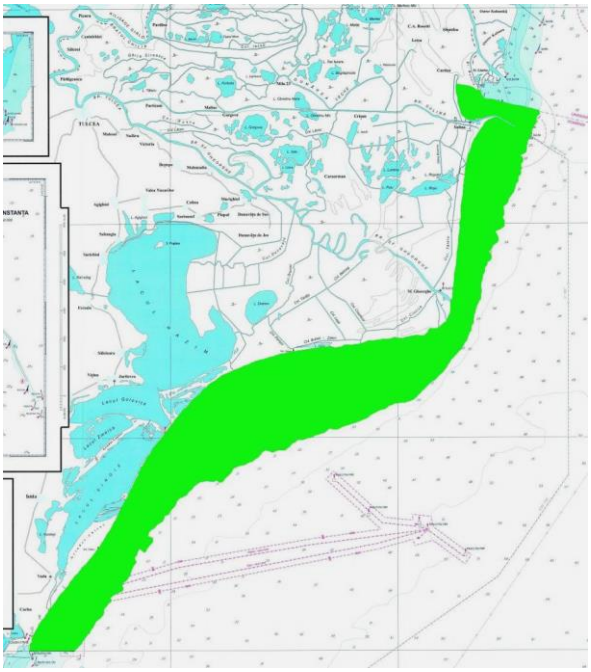


Fig. 1 - Location map of ROSCI0066 Danube Delta - marine zone

Zoobenthos study has a major importance in biodiversity conservation strategy of benthic habitats, especially for understanding the changes that occur in the quality parameters of communities, and the habitats under the influence of anthropogenic pressures. The importance of this ecological group in the functioning of ecosystems of water bodies makes it necessary to regularly monitor and assess the state of benthic organism communities.

MATERIAL AND METHODS

In order to conduct the study, 48 benthic samples were collected from 11 stations (Sulina - Vadu profiles), between 10 m and 17 m depths, during 2011-2012.

The procedures of collection onboard and laboratory processing of samples were accomplished according to the standard methods for sampling and treatment of soft bottom macrozoobenthos samples (Todorova and Konsulova, 2005). Macrobenthic samples were collected using the van Veen grab with sampling area of 0.1 m^2. Sediment samples were washed using a 1.0 x 1.0 mm and 0.5 x 0.5 mm mesh sieve. All organisms retained on the sieves were collected and preserved in 4% neutralized formaline seawater solution and the containers were appropriately labeled for the further identification of the samples. Sorting, taxonomic identification, abundance and biomass determination were performed in the Marine Ecology Laboratory. Organisms were identified up to species level or group (where applicable) using the STEMI 2000-C stereomicroscope (ZEISS). For quantitative analysis, individuals of each species or group were counted simultaneously with their sorting and identifying.

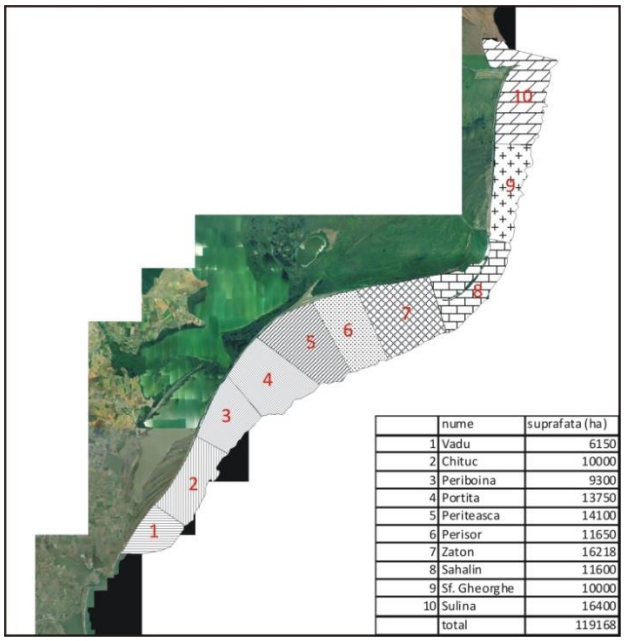
The densities were expressed in individuals per m^2 and the biomasses in g/m^2. Wet biomass was used, in which case, after the individuals of each species were counted, the biggest organisms were buffered with a filter paper to absorb the superficial water and weighed on an electronic analytical balance. For species too small and fragile to be handled and weighed, tables of weights were used.

The species nomenclature was checked following the World Register Species (Appeltans et al., 2010). The data were processed with Ocean Data View, Program version 4 (Schlitzer, 2004) with DIVA gridding and Microsoft Excel 2010.

The analysis of structural indicators (species composition, frequency, abundance, biomass) allowed to underline some conclusions concerning the ecological status of the macrozoobenthos from the considered biocoenosis.

RESULTS AND DISCUSSION

The sands from the Danube mouths are extremely fine quartz sands, gray-brownish, being mixed with a variable share of mud. The high content of mud gives a specific character to the benthic psamophyle poulations off the Danube mouths. The composition of the substrate in the studied area (Sulina, Mila 9, Sf. Gheorghe, Sachalin, Zăton, Perișor, Periteașca, Portița, Periboina, Chituc, Vadu profiles - Fig. 2) beyond the 10 m isobaths is sandy-muddy, marking the passage from the sand facies to the mud facies. From the fauna point of view, this area is characterized by the parallel occurrence of species from deeper zones - iliophyle forms, whose presence is conditional upon the substantial increase of the alluvial mud percentage in the substrate - along with psamophyle species, among which the bivalve *Lentidium mediterraneum* is dominant.



	nume	suprafata (ha)
1	Vadu	6150
2	Chituc	10000
3	Periboina	9300
4	Portita	13750
5	Periteasca	14100
6	Perisor	11650
7	Zaton	16218
8	Sahalin	11600
9	Sf. Gheorghe	10000
10	Sulina	16400
	total	119168

Fig. 2 - Monitoring network stations from ROSCI0066 - Danube Delta - marine zone

During the studied period (2011-2012), the analysis of the species composition in the entire monitored area resulted in the identification of 44 macrozoobenthos species, divided in groups as follows: polychaete worms - 16 species (36%), molluscs (bivalves and gastropods) - 14 species (32%), crustaceans - 7 species (16%), other groups - 7 species (16%) (Table 1, Fig. 3).

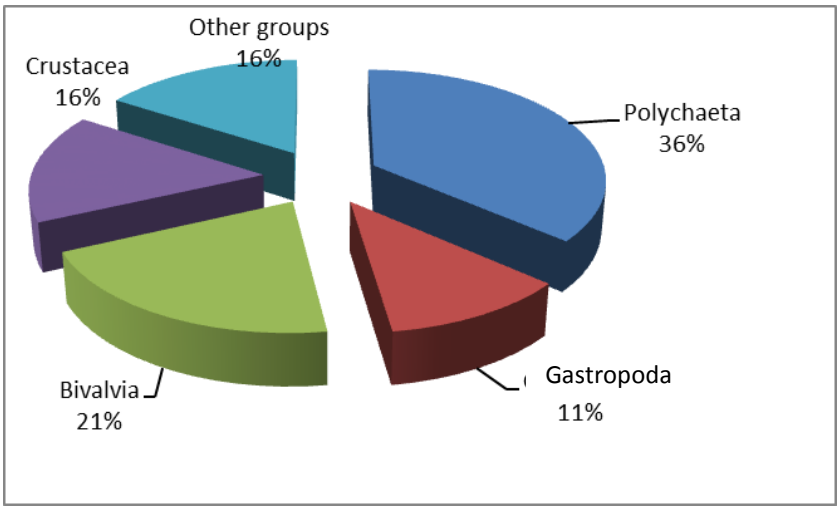


Fig. 3 - Population structure of benthic invertebrates (taxonomic groups) in ROSCI0066 Danube Delta - marine zone

Overall the studied area, the mollusc fauna was represented by 14 species, comprising a mixture of sand loving and mud loving species, the zone being the passage from the sand facies to muds proper.

Analyzing the biological statistics of the stations, the mixture of bodies with different ecological features was pointed-out, especially as far as molluscs are concerned. The simultaneus occurrence in some stations of the bivalve species *Lentidium mediterraneum, Cerastoderma edule* and *Cyclope neritea* - typical psamophyle species - and *Spisula subtruncata, Mytilus galloprovincialis, Abra prismatica, Mya arenaria, Retusa truncatula* - iliophyle species - points-out the transitional character of this coenosis, also taking into account the fact that in the Danube mouth area molluscs are those characterizing the coenoses.

Mytilus galloprovincialis was present in this intermediate area by small individuals, which indicates the survival potential of umbonal masses reaching this area in relation with the less variable salinities at these depths. The mussels in this benthic community are considered permanent indwellers, due to the continuous restoration of juvenile mussel stocks under the influence of the passive migration of mussel larvae in deeper areas.

A constant presence in the mollusc fauna was also the bivalve *Abra prismatica* (identified in six stations), endoiliobiontic species, typical for the muddy formations off the Danube mouths, with a low content in shell gravel.

In addition, the analysis of mollusc populations also revealed the constant presence of the opportunistic non-indigenous bivalve species *Mya arenaria* and *Anadara inaequvalvis*, which were reported in 10 of the 11 stations covered. Thus, the *Mya* population structure in the studied marine zone had a wide length class range, which indicates a good vitality of populations. The dominance of individuals ranging between 3-10 mm (50%) shows a young population structure, with still growing individuals. The *Anadara* population structure was also characterized by the presence of new generations which can permanently provide for the recovery of the populations in the area.

Among polychaete worms, *Polydora cornuta, Neanthes succinea, Melinna palmata* were present, opportunistic species which may thrive in adverse environmental conditions, contributing to the community composition in accordance with the organic growth (enrichment) or other disturbance sources. The polychaete *Nephtys hombergii*, eurihaline species with a wide distribution among polychaetes off the Danube mouths (considered in the 1960s an enclave within the *Spisula - Mytilus* sub-coenosis), was also a constant presenece in the samples.

Concerning the overall view of the crustacean fauna in the studied sector, it must be pointed-out that no numerous populations were encountered in any of the species identified. This phenomenon is explainable by the absence of the rocky substrate, ecological substrate preferred by more than 50% of all marine species in the Black Sea basin, along with the instability of physical-chemical factors. Among crustaceans, mainly the amphipods *Ampelisca diadema, Mediocorophium runcicorne,* the cumacean *Iphinoe elisae,* the cirriped *Balanus improvisus*, fixed of live or dead mollusc shells, were present, while *Perioculodes longimanus*, characteristic especially for communities populating the sandy facies in the southern part of the coast, was encountered only sporadically.

The isopod *Idothea baltica* and the decapod *Upogebia pusilla* enriched the crustacean species list, being encountered in only 2 stations, one individual each.

The biocoenoses off the Danube mouths are diversified living environments offering proper biotopes for a few nemertean species, some co-coenont, others with a wider distribution. Thus, *Amphiporus bioculatus*, *Micrura fasciolata* and *M. aurantiaca* were encountered, and the species *Amphiura stepanovi* - sporadical occurrence and in very small densities at these depths.

From the quantitative point of view, the mean densities and biomasses varied from one profile to another, ranging between a minimum density of 1,607 ind./m^2 (Periboina - 14 m) and a peak density of 8,925 ind./m^2 (Mila 9 - 17 m) and a maximum biomass value, respectively, of 1,000 g/m^2 (Perișor - 12 m) and a minimum of 16.75 g/m^2 (Sulina - 15 m) (Fig. 4, Fig. 5).

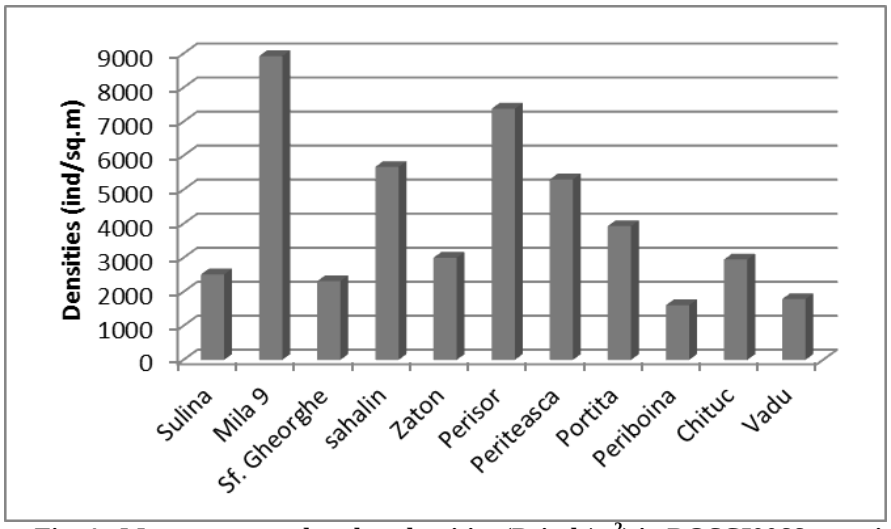


Fig. 4 - Mean macrozoobenthos densities (D-ind./m^2) in ROSCI0066 - marine zone (Sulina - Vadu profiles)

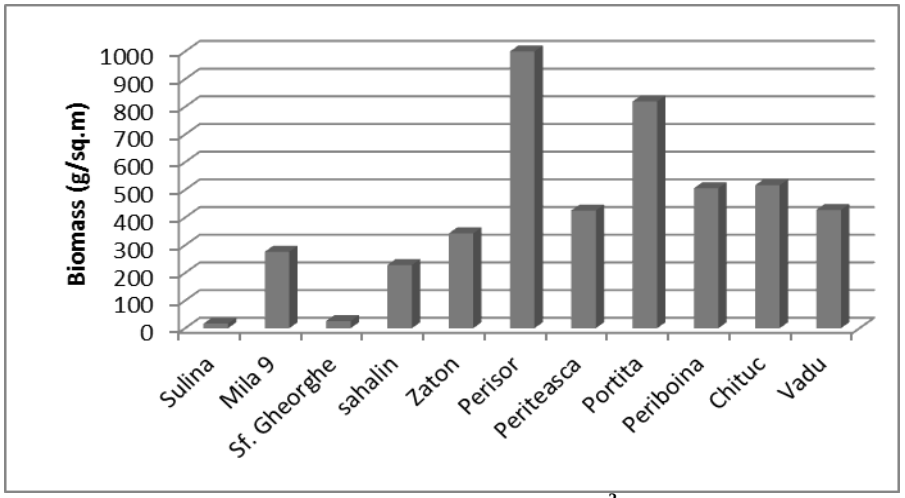


Fig. 5 - Mean macrozoobenthos biomasses (B=g/m^2) in ROSCI0066 - marine zone (Sulina - Vadu profiles)

The analysis of the quantitative density data of the main benthic invertebrate species comprised in the fauna array of the site ROSCI0066 pointed-out that polychaete worms are dominant (62% - of the total D_{total} = 45.188 ind/m^2). Among polychaetes, the dominant ones were *Polydora cornuta* and *Melinna palmata*, tube-like polychaete extremely wide-spread on the sedimentary substrate of the infralittoral and circalittoral (Fig. 6). Molluscs and crustaceans make-up 30% and 7%, respectively, of the total density (Fig. 7 - Density distribution maps).

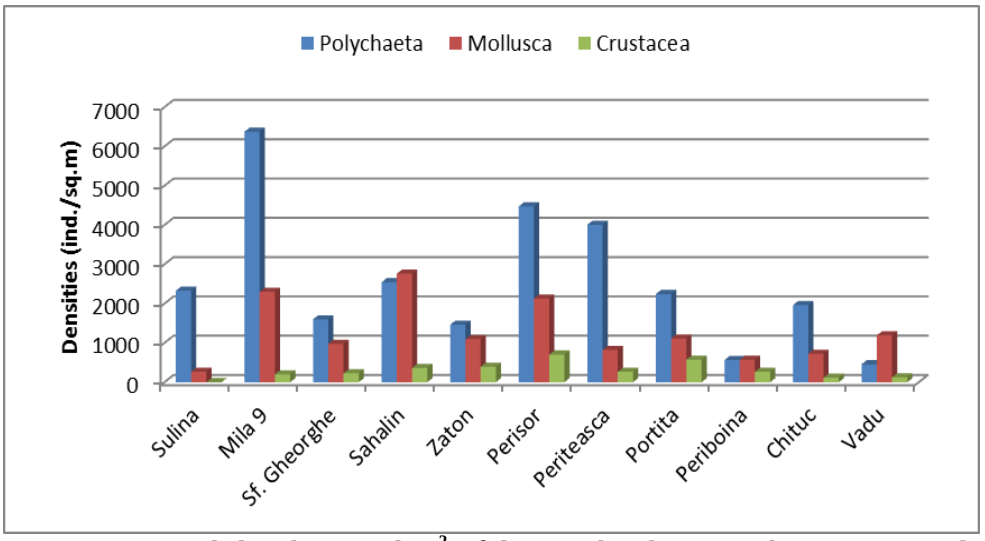


Fig. 6 - Numerical abundance (ind./m^2) of the main benthic invertebrate groups in the Sulina - Vadu sector

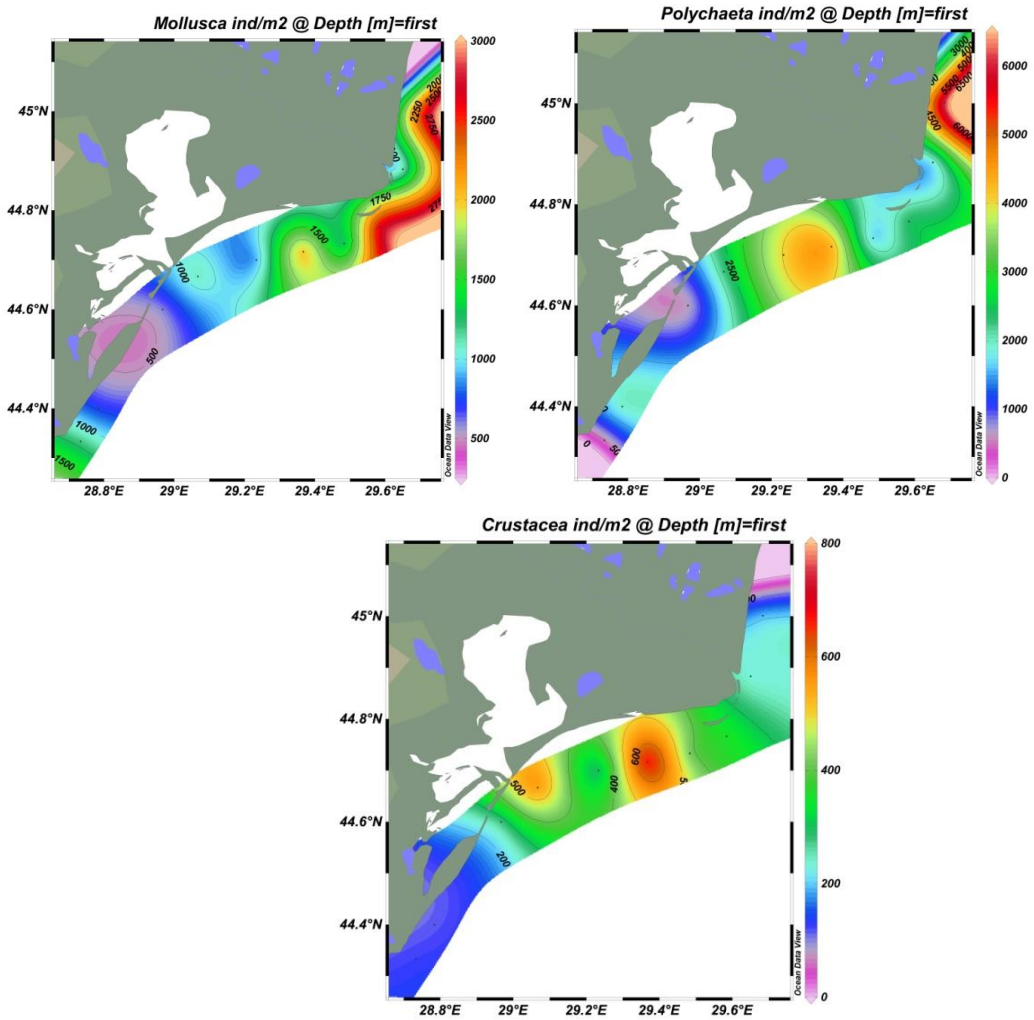


Fig. 7 - Density distribution maps of the main benthic invertebrate groups in ROSCI0066 - Danube Delta marine zone (mollusca, polychaeta, crustacea)

Regarding the studied biocoenosis overall, the general biomass of macrozoobethic organisms was 4.584 g/m^2, and, of this value, the contribution of molluscs, in percentages, was 93%; the contribution of the other main invertebrate species, polychaetes and crustaceans, was up to 7%. The biomass of crustaceans was generally below 1 g/m^2, due to the absence of large species.

The other animal groups (nemerteans, echinodermata, archiannelida) had lower biomasses.

Concerning the mollusc biomass value on each profile analyzed, it ranged between 28.647 g/m^2 (Sulina), representing 1% of the total biomass, and 771 g/m^2 (Portița), 18%. As regards the polychaetes, the biomasses recorded ranged between 0.63 g/m^2 (Sf. Gheorghe), 1%, and 39 g/m^2 (Perișor), 29% (Fig. 8, 9, 10, 11).

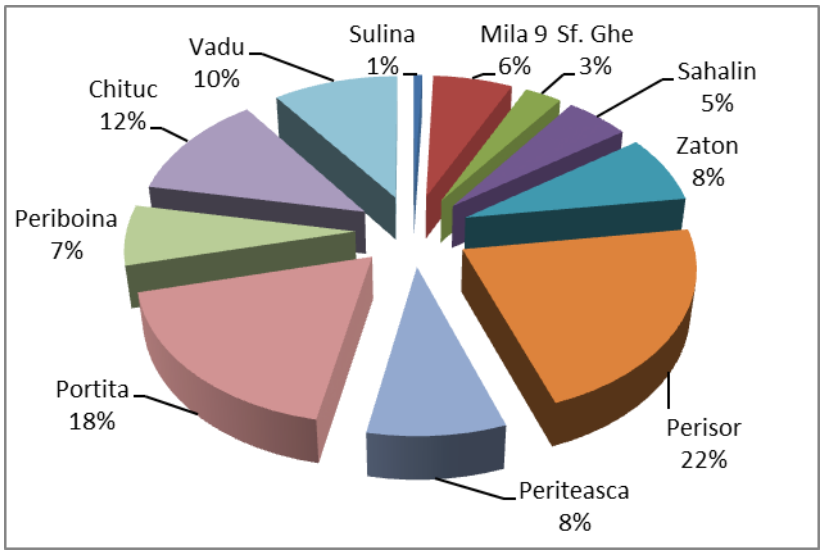


Fig. 8 - Percentage (%) of biomass distribution (mollusca) in ROSCI0066 - Danube Delta - marine zone (Sulina - Vadu profiles)

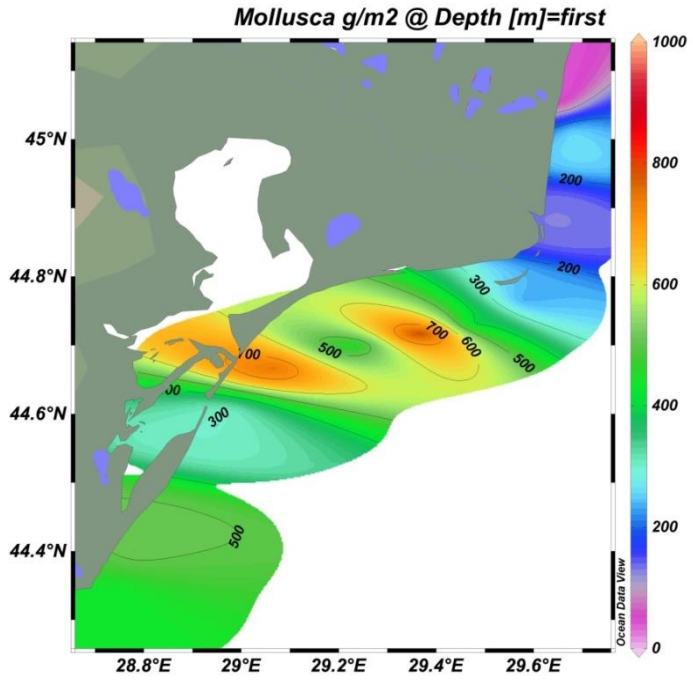


Fig. 9 - Biomass distribution map of molluscs in ROSCI0066 - marine zone (Sulina-Vadu profiles)

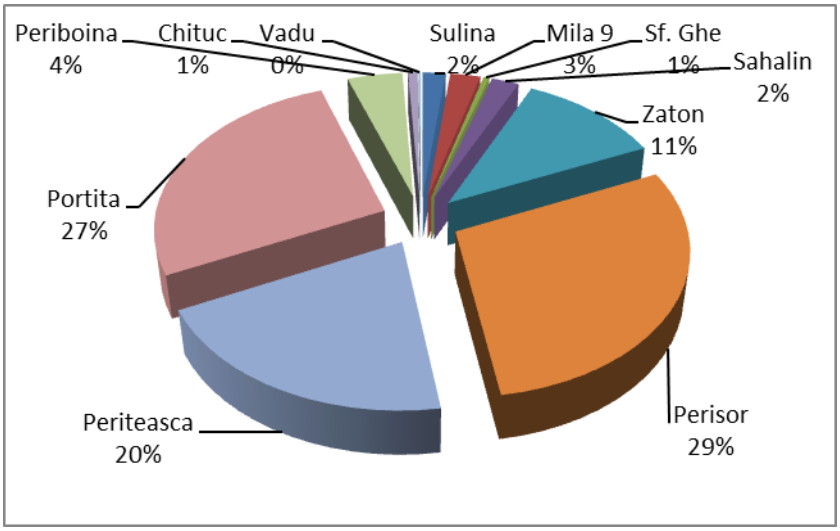


Fig. 10 - Percentage (%) of biomass distribution (polychaetes) in ROSCI0066 - Danube Delta - marine zone (Sulina - Vadu profiles)

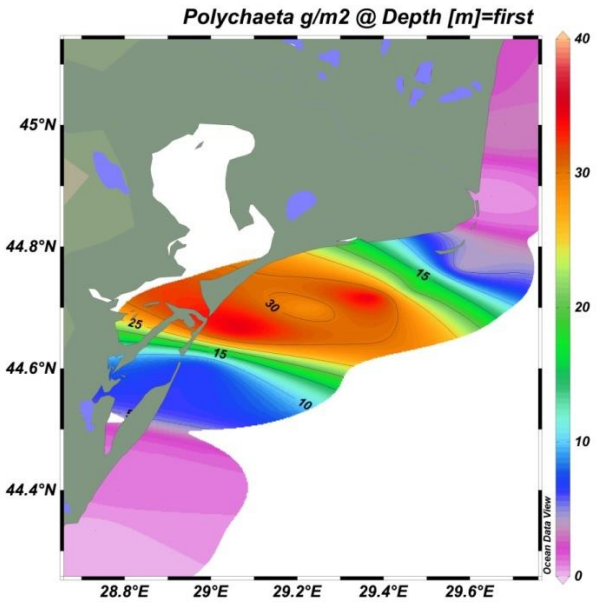


Fig. 11 - Biomass distribution maps of polychaetes in ROSCI0066 - Danube Delta marine zone (Sulina-Vadu profiles)

The ecological monitoring performed provided information on the current state of the zoobenthic biotic component in the site ROSCI0066 - Danube Delta marine zone, also enabling the early identification of trends with a significant role in predicting potential structural and functional changes, which would allow taking measures for the preservation thereof in due time.

The knowledge thus acquired based on the information within this study provides for a better understanding of the issues analyzed, which results in an enhancement of chances that decisions for the preservation of a favorable conservation state should be well documented and correct. Apart from practical applications, ecological monitoring also has a theoretical significance, the information thus obtained having an important role in deciphering the laws determining the structure, functions and dynamics of ecosystems.

CONCLUSIONS

The following conclusions were drawn after processing the 48 benthos samples collected during 2011-2012 within ROSCI0066 Danube Delta - marine zone:

- ✓ 44 benthic invertebrate species were identified, most of them polychaetes (36%);
- ✓ The polychaete fauna was represented by 16 species, the dominant ones being *Capitella capitata, Heteromastus filiformis, Melinna palmata, Polydora cornuta,* with increased density values on certain profiles;
- ✓ The mollusc fauna was represented by 14 species, a mixture between mud-loving and sand-loving species (*L. mediterraneum, Spisula subtruncata, Anadara inaequivalvis, Mya arenaria*);
- ✓ Opportunistic species, the bivalves *Mya arenaria* and *Anadara* had a constant presence in most stations analyzed, with a population structure dominated by young individuals, which can be support for maintaining the species balance in the area;
- ✓ The analysis of the quantitative density data of the main benthic invertebrate species comprised in the fauna array of the site ROSCI0066 pointed-out that polychaete worms are dominant (62% - of the total D_{total} = 45.188 ind./m^2), followed by molluscs (93% - of the total B_{total} = 4,854 g/m^2);
- ✓ The contribution to biomass of the two other main invertebrate groups, polychaetes and crustaceans, was up to 7%; the biomass of crustaceans was generally below 1 g/m^2, due to the absence of large species;
- ✓ The monitoring of the conservation state of species and habitats in the Natura 2000 sites is part of the measures taken for maintaining a favorable conservation status thereof, being an integral part of the management plan of a Community importance site, as well as the most feasible indicator of the management actions' efficiency;
- ✓ In order to maintain a favorable conservation status of benthic comnmunities of the ***ROSCI0066 Danube Delta - marine zone*** site, human activities impacting on the protected area (fisheries, shipping, eutrophication, pollution) must be well-managed, taking into account that low-tolerance sensitive species recover with greater difficulty when natural and/or anthropogenic pressures are higher.

Table 1 - Qualitative structure of macrozoobenthos in ROSCI0066 Danube Delta - marine zone during 2011-2012

MACROZOOBENTHIC SPECIES
POLYCHAETA
Alitta succinea (Leuckart, 1847)
Capitella capitata (Fabricius, 1780)
Heteromastus filiformis (Claparede, 1864)
Melinna palmata (Grube, 1870)
Mysta picta **(**Quatrefages, 1866)
Nephtys hombergii (Savigny, 1818)
Nephtys cirrosa (Ehlers, 1868)
Scolelepsis squamata (O.F. Muller,1806)
Polydora cornuta (Bosc, 1802)
Prionospio cirrifera (Wiren, 1883)
Pygospio elegans (Claparede, 1863)
Phyllodoce maculata (Linnaeus, 1767)
Spio decorates (Bobretzky, 1870)
Syllis gracilis (Grube, 1840)
Terebellides stroemii (Sars, 1835)
Pectinaria koreni
Spionidae varia
MOLLUSCA
Abra prismatica (Montagu, 1808)
Anadara inaequivalvis (Bruguière, 1789)
Chamelea gallina (Linnaeus, 1758)
Cyclope neritea (Linnaeus, 1758)
Cerastoderma edule (Linnaeus, 1758)
Ecrobia ventrosa (Montagu, 1803)
Lentidium mediterraneum (O. G. Costa, 1829)
Mya arenaria (Linnaeus, 1758)
Mytilus galloprovincialis (Lamarck, 1819)
Nassarius (Duméril, 1805)
Parvicardium exiguum (Gmelin, 1791)
Rapana venosa (Valenciennes, 1846)
Retusa truncatula (Bruguière, 1792)
Spisula subtruncata (da Costa, 1778)
CRUSTACEA
Amphibalanus improvisus (Darwin, 1854)
Ampelisca diadema (Costa, 1853)
Iphinoe elisae (Băcescu, 1950)
Idotea baltica (Pallas, 1772)
Mediocorophium runcicorne (Della valle, 1893)
Perioculodes longimanus (Bate & Westwood, 1868)
Upogebia pusilla (Petagna, 1792)
OTHER GROUPS
Amphiporus bioculatus (McIntosh, 1874)

Amphiura stepanovi (Chernyavskii, 1861)
Clunio marinus (Haliday, 1855)
Leucocephalonemertes aurantiaca (Grube, 1855)
Micrura fasciolata (Ehrenberg, 1828)
Micrura aurantiaca
Nemertea
Protodrilus flavocapitatus (Uljanin, 1877)
Thalassarachna basteri (Johnston, 1836)

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