

BIODIVERSITY OF MACROZOOBENTHOS OF THE SOUTHERN BULGARIAN BLACK SEA COASTAL AREA

Sonya Uzunova

Abstract: In 2011-2013, biodiversity of macrozoobenthos communities in the offshore area of the southern part of the Bulgarian Black Sea was studied. Dominants in species composition and abundance were Polychaeta. Maximum in abundance was recorded for 2013 with domination of Polychaeta, followed by “Varia”, due to exceptional development of populations of *Oligochaeta*, *Nematoda* (Varia) and *Aricideaclaudiae* (Polychaeta). Biggest weight in biomass structure was given to mollusks in both cases, but their role was obviously expressed in 2011, due to the presence of bivalvian species *Mytilusgalloprovincialis*.

Keywords: Sea biology, macrozoobenthos, biodiversity, abundance, biomass, the Black Sea

Резюме: През 2011 и 2013 г. беше изследвано биоразнообразието на макрозообентоса пред южния ни черноморски участък. Доминиращи във видовия състав бяха полихетите. Максиму по численост бу установен през 2013 г. отново с доминиране на полихети, следвани от групата “Varia”, поради изключителното развитие на популациите на *Oligochaeta*, *Nematoda* (Varia) и *Aricideaclaudiae* (Polychaeta). Най-голямо значение за структурата на биомасата имаха мекотелите и в двата случая, но тяхната роля беше много силно изразена в пробите от 2011, поради наличието на мекотелния вид *Mytilusgalloprovincialis*.

Introduction

The first investigations of the biocoenological distribution of zoobenthos in Bulgarian Black Sea waters covered the period 1954-1957 г. (Kuneva-Abadjieva&Marinov, 1960). Total 128 taxa were reported at that time, they were distributed in 4 communities of the sublittoral soft-bottom: “sandy bottom community”, “*Melinnapalmata* coastal mud community”, “*Mytilusgalloprovincialis* community” and “*Modiolulaphaseolina* mud community”. For the period 1996-1997 and 1998-2002, changes of benthic communities along the Bulgarian Black Sea coast were analyzed by Todorova&Konsulova, 2000, BSC, 2008).

Biodiversity is one of the most important descriptor for good environmental status of the marine ecosystem stated in the Water Framework Directive (Directive 2000/60/EC). For this reason the aim of the present work is to analyze the biodiversity, distribution and quantitative parameters of macrozoobenthos communities in the Southern Black Sea coastal area, during 2011-2013.

Material and methods

In summer period of 2011 and 2013 zoobenthos samples were collected from the southern Bulgarian Black Sea coastal area. The stations were situated at 1 mile distance away from the coast at depth range of 15 - 52 m (table 1). In the investigated area soft bottom habitats (mud and clay substrata) predominate, with exception of Dvoinitsa and Koketrice stations (sandy substrata). Sampling was carried out using Van Veen grab (opening 0,1 m²). On board RV “Prof. A. Valkanov” and RV “Akademik” samples were sieved and preserved in 4% formaldehyde solution, buffered with sea water. In laboratory sorting and taxonomic identification at species level were performed (except for the groups *Turbellaria*, *Nemertea*, *Nematoda*, and *Oligochaeta*). Three main groups of benthic organism were recorded, namely, Polychaeta, Mollusca, and Crustacea. The rest of the organisms found in the samples were included in the fourth group – “Varia”. Quantitative parameters (abundance (N) - ind.m⁻² and biomass (B) – g.m⁻²

²) were recalculated per square meter. Statistical analysis was performed by the PRIMER software package programs of the Plymouth Marine Laboratory.

Table 1

Co-ordinates and depth range of sampling points

Station	Latitude	Longitude	Depth
Dvoinitza	42°46,117	027°55,581	29,9
Nesebar	42°40,724	027°46,691	22,3
Koketrice	42°38,810	027°53,232	17,2
Sozopol	42°26,00	027°43,35	38,5
MaslenNos	42°20,170	027°49,15	47,1
Varvara	42°19,000	027°54,75	45,5
Veleka	42°4,966	027°59,983	51,8

Results and discussion

Species composition in 2013 reached 64 taxa and in 2011 – 40. Higher values recorded in 2013 were caused due to the bigger number of stations and habitats respectively. Taxonomic structure of macrozoobenthos in the investigated area (fig. 1) was dominated by Polychaeta, followed by Mollusca, Crustacea and “Varia” during both investigated years.

In 2011 4 taxa from Polychaeta, 3 from Mollusca, 2 from “Varia” and only 1 from Crustacea had occurrence more than 50% (table 2). For 2013 polychaet worms kept the same number, but with different dominant species. “Varia” representative were also very well presented by 3 taxa with a high level of occurrence, while Crustacea and Mollusca had 1 species each.

Table 2

Species with occurrence more than 50% along the Southern Black Sea area

Taxa	2011	2013
Nemertea	75	85,7
Nematoda	0	71,4
Oligochaeta	0	85,7
Phoronispsammophila, Corri, 1889	50	0

<i>Aricidea (Strelzovia) claudiae</i> Laubier, 1967	0	71,4
<i>Capitella minima</i> Langerhans, 1881	50	0
<i>Heteromastus filiformis</i> (Claparede, 1864)	50	85,7
<i>Nephtys hombergii</i> Savigny in Lamarck, 1818	75	85,7
<i>Prionospio cirrifera</i> Wiren, 1883	50	57
<i>Ampelisca diadema</i> (Costa, 1853)	75	71,4
<i>Abra alba</i> (Wood W., 1802)	50	0
<i>Abraprismatica</i> (Montagu, 1808)	50	71,4
<i>Calyptrae achinensis</i> (Linne 1758)	50	0

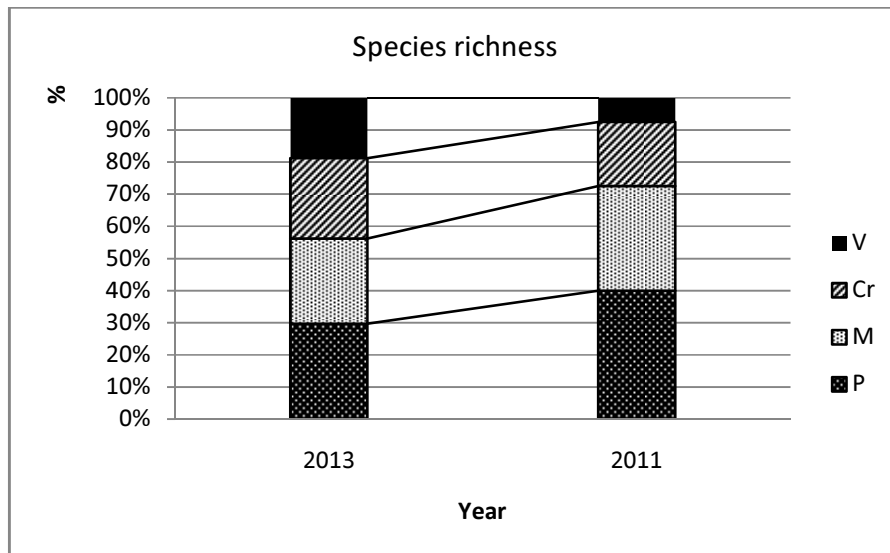


Fig.1 Taxonomic structure of macrozoobenthos from the Southern Black Sea area

Quantitative parameters

Abundance

Macrozoobenthos abundance in the Southern Bulgarian Black Sea area was dominated by polychaets during both investigated years, with maximum in 2013 (fig. 2). Same year high values of this parameter were recorded in “Varia” group, which takes subdominant position. Mollusks and crustaceans were with very similar values in 2013. During 2011 Mollusca were subdominants by abundance, followed by the two other groups.

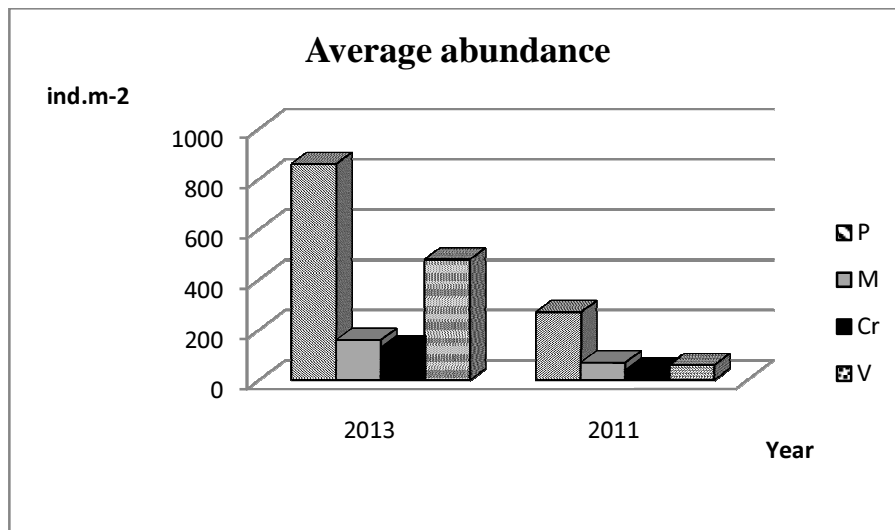
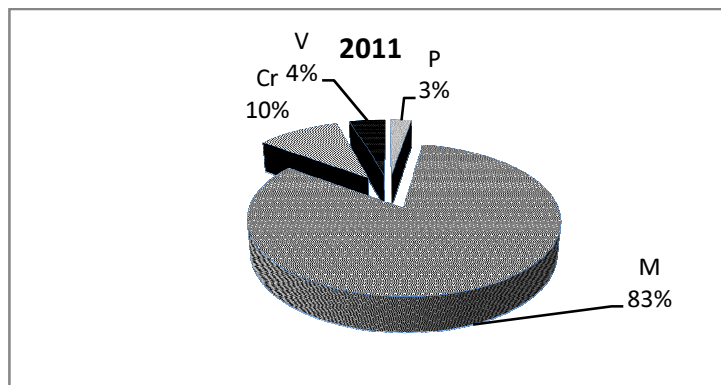
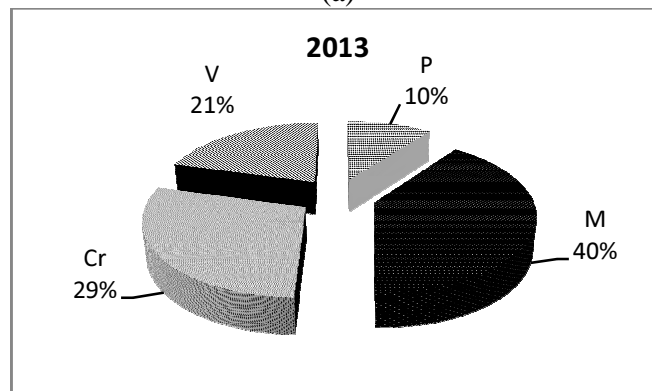


Fig.2 Average abundance of macrozoobenthos from the southern Black Sea area
Biomass

The average biomass of macrozoobenthos during investigated years was dominated by mollusks. In 2011 they took very high share in the biomass structure, caused by finding of *Mytilus galloprovincialis* in the samples from Cape Emine. Subdominants by biomass were crustaceans during 2013.



(a)



(b)

Fig.3 Share of macrozoobenthos groups in biomass formation (a) in 2011 and (b) - 2013

Diversity indices

To evaluate biodiversity in the studied area total species number (S), total individuals (N), Pielou's evenness (J), Shannon (H') and Simpson (D) were used (table 3). Highest level of J and H' were computed for samples from Dvoinitsa, Varvara and Veleka in 2013, while during 2011 the maximum was for Emine samples. In these cases predominance of a few species in the sample was not established, while in Nesebar and Koketrice samples small sized Polychaeta like Aricidea claudiae, Heteromastus filiformis and Prionospio cirrifera dominated together with Oligochaeta and Nematoda in 2013. Values of Simpson's index were higher in the area with lower biodiversity as expected. Out of all only three stations were possible to compare in time (Dvoinitsa, Koketrice and Nesebar) and results demonstrated weak improvement in biodiversity of macrozoobenthos in 2013.

Таблица 3

Diversity indices for the investigated area

Stations	S	N	J'	H'	Simpson
Dvoinitsa 2013	35	466	0,7636	2,71485	0,10111
Nesebar 2013	14	673	0,54197	1,43029	0,34145
Koketrice 2013	15	511	0,68368	1,85144	0,25772
Sozopol 2013	7	312	0,65673	1,27794	0,323
Cape Maslen 2013	16	323	0,56424	1,56442	0,36002
Varvara 2013	26	258	0,85332	2,7802	8,01E-02
Veleka 2013	25	164	0,80697	2,59753	0,10753
Dvoinitsa 2011	13	38	0,80288	2,05936	0,18975
Emine 2011	19	172	0,73232	2,15627	0,15677
Nesebar 2011	17	245	0,47756	1,35303	0,43797
Koketrice 2011	12	115	0,66764	1,65903	0,32098

Cluster analysis

Bray Curtis similarity of samples from studied region, after square root transformation of sample abundance is presented at fig. 3. Most of samples from 2013 and Emine and Nesebar samples from 2011 were agglomerated in one cluster group with similarity over 25%. At a level below 20% similarity Dvoinitsa sample from 2011 join the main cluster. Out of this group Koketrice samples from both investigated area form a small cluster at 20% of similarity. This sampling point has a very specific habitat with sandy substrata and respectively much different from the rest stations species composition.

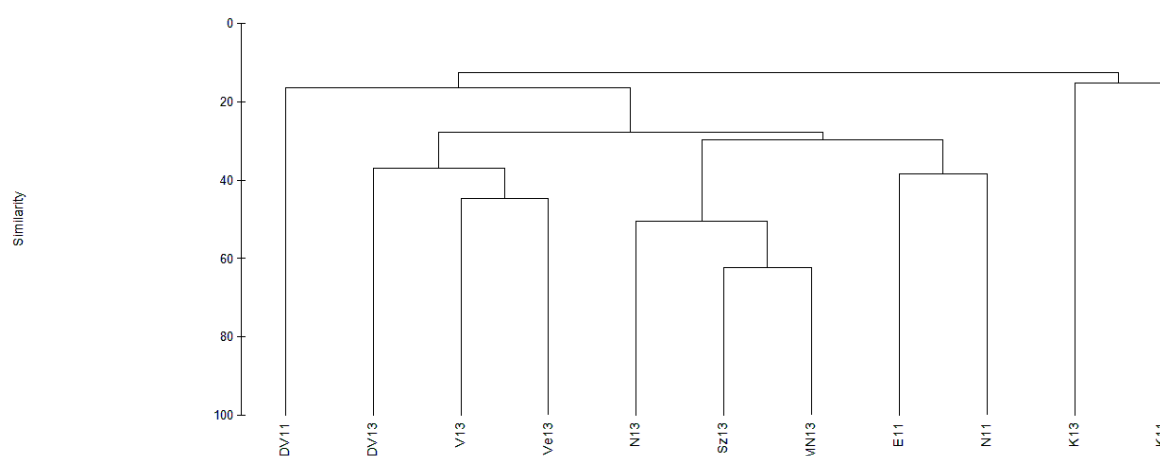


Fig. 3 Dendrogram of Bray-Curtis similarity in през 2011 and 2013 г.

Conclusions

During 2013 out of 64 macrozoobenthos taxa were recorded in the Southern Bulgarian Black Sea area and 40 for 2011. It is not possible to compare both investigated year, because of different sample quantity, but diversity indices used for the samples of same localities prove increase of biodiversity in 2013.

Abundance and biomass showed similar structure with domination of Polychaeta by abundance and Mollusca by biomass. Mean abundance for 2013 was estimated at 1630 ind.m^{-2} , due to exceptional development of *Oligochaeta*, *Nematoda* (Varia) and *Aricideaclaudiae* (Polychaeta). In 2011 these taxa were poorly presented or even missing in the samples and abundance was 440 ind.m^{-2} . In the mean biomass opposite trend was established. Biomass values for 2011 were higher ($20,267 \text{ g.m}^{-2}$), despite of the lower sample number, due to the presence of *Mytillusgalloprovincialis* in the samples. Mean biomass value for 2013 was $15,042 \text{ g.m}^{-2}$ and was relatively even distributed between mollusks and crustaceans.

References

1. BSC, 2008. State of the Environment of the Black Sea (2001-2006/2007). Ed. T. Oguz. Publications of the Commission of the Protection of the Black Sea Against Pollution (BSC) 2008-3, Istanbul, Turkey, 448 pp.
 2. Clarke, K. R., R. M. Warwick, 1994. Change in Marine communities: an approach to statistical analysis and interpretation, Natural Environmental Research Council, UK, 144 pp.
 3. Kaneva-Abadjieva V., T. Marinov, 1960. Zoobenthic distribution in the Bulgarian Black Sea area, Proc. Inst. Fish., 3, 117-161 [in Bulgarian].
 4. Konsulov, A. et al., *Black Sea Biological Diversity*, UN Publications, New York, 1998.
 5. Todorova., Ts. Konsulova, 2000. Long-term changes and recent state of Macrozoobenthic communities along the Bulgarian Black Sea coast, Mediterranean Marine Science, 1/1, 123- 131
 6. Marinov, T., *Zoobenthos of the Bulgarian sector of the Black Sea*. Bulg. Acad. Sci. Publ., Sofia, 1990.
- PRIMER-E Ltd., PRIMER v6, Plymouth, UK

За контакти:

Доц. д-р Соня Узунова, Институт по рибни ресурси – Варна
 Бул. Приморски 4, Варна, 9000, П.К. 72, e-mail: sonja_ouz@yahoo.com