ISSN 1314-3379

CHANGES OF BENTHIC COMMUNITIES IN VARNA BAY (BLACK SEA)

Sonya Uzunova

ПРОМЕНИ В БЕНОСНИТЕ СЪОБЩЕСТВА ВЪВ ВАРНЕНСКИ ЗАЛИВ (ЧЕРНО МОРЕ)

Соня Узунова

Резюме: *Варненският залив е един от най-силно изложените на антропогенно влияние по българското черноморие. Проследени са промените в макрозообентосните съобщества през периода пролет 2010-2013 и 2016 г. Клъстерният анализ показва ясно диференциране по численост и биомаса между първите три години и последните две години на изследването. Максимум по отношение на числеността и биомасата се установи през 2011 г.,последван от минимум (2012 г.) и плавно възстановяване на бентосните съобщества през 2016.*

Key words: *Sea biology, macrozoobenthos, changes,Varna Bay the Black Sea.*

INTRODUCTION

The Varna Bay is a typical case for the influence of urbanization over water systems.The ecosystem disturbances in the past century, caused by the man made activities, lead to apermanentchanges in the benthic coenoses (Marinov, Stoykov (1989), Marinov (1990), Konsulova et al. (1991), Konsulova (1992, 1993), Uzunova (1995). First attempt for recovering of benthic communities was reported at the end of 90-ies (Velikova et al., 2001), Ouzounova (1999),Uzunova (2005). Subsequent investigations in 2003 found a non-typical low species number and large areas in the bay with anthropogenic disturbance (Grishin, Uzunova, 2008). In 2007-2010 was established dominance of crustacean by biomass and recovery of populations of decapod species *Upogebiapusilla* (Petagna, 1792) and reduction in populations of mollusks: *Chameleagallina* (Linne, 1758) and *Mytilusgalloprovincialis* (Uzunova, 2008, 2010).

According to WFD 2000/60/EC the zoobenthos is one of the key indicators, presenting the negative changes of marine ecosystem in long-term range and is used for estimation of ecological quality state (EcoQS) of “water body”. The recent investigations of Uzunova (2011, 2013), Petrova-Pavlova (2014) and Trayanova (2015), assessed the ecological status in Varna Bay as moderate or even bad in the region near to influx of Varna Lake waters and good in the northern part of the bay. The aim of the present paper is to trace out the changes of macrozoobenthos in the last years.

MATERIAL AND METHODS

Sampling area

The Varna Bay is situated in the northern part of the Bulgarian Black Sea coast, locked between Cape Galata and Cape St. George. The bay has flat bottom, oblique to the east. Its maximum depth is 18.5 m. In the western part it is artificially linked with Varna-Beloslav Lake system, which impacts significantly biodiversity of both pools. Along the bay is the largest city on Bulgarian Black Sea coast – Varna, known with harbor, tourist and industrial activities.

Sampling

In spring 2010-2013 and 2016 macrozoobenthos samples were collected by ship from soft-bottom sediments, below the depth of 5 m, using "Van-Veen" grab (mouth opening 0.1 m^2). The samples collection, onboard and laboratory processing were according Todorova, Konsulova (2005) manual. Taxonomic identification to the lowest possible taxon level is accomplished by stereomicroscope Leica EZ4 and microscope Leica DM500. The established species were allocated in 4 groups– *Polychaeta*, *Mollusca*, *Crustacea* and the mixed "Varia"(the rest of taxa). Biomass (wet weight) was estimated by balance Ohaus Pioneer, with accuracy 0.0001.

Statistical analyses, based on abundance and biomass data were performed using program package Primer 5 (Plymouth Marine Laboratory).

RESULTS AND DISCUSSION

Species composition

During the investigated period total species number maximum was observedin 2011- 42 species, followed by abrupt decrease in 2012 and a second maximum in 2016 (fig.1). Taxonomic structure was dominated by polychaete worms during almost whole period with exception for 2013, when crustacean were co-dominants. Subdominants were *Crustacea*in 2010 and *Mollusca* in 2011– 2012 and 2016.

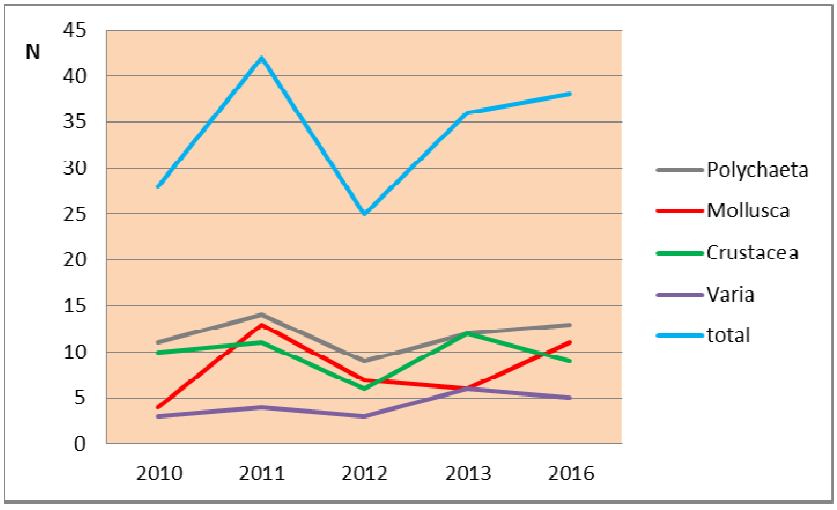

Fig. 1 Variations in species composition in Varna Bay during investigated years.

Abundance

Macrozoobenthos maximum abundance value was recorded in spring 2011. Highest significance in the abundance share were attributed to *Polychaeta*, followed by mollusks in 2011 and 2016, crustacean in 2010 and 2012-2013 (fig.2). For the same period thelowest level of the abundance was established in 2012.

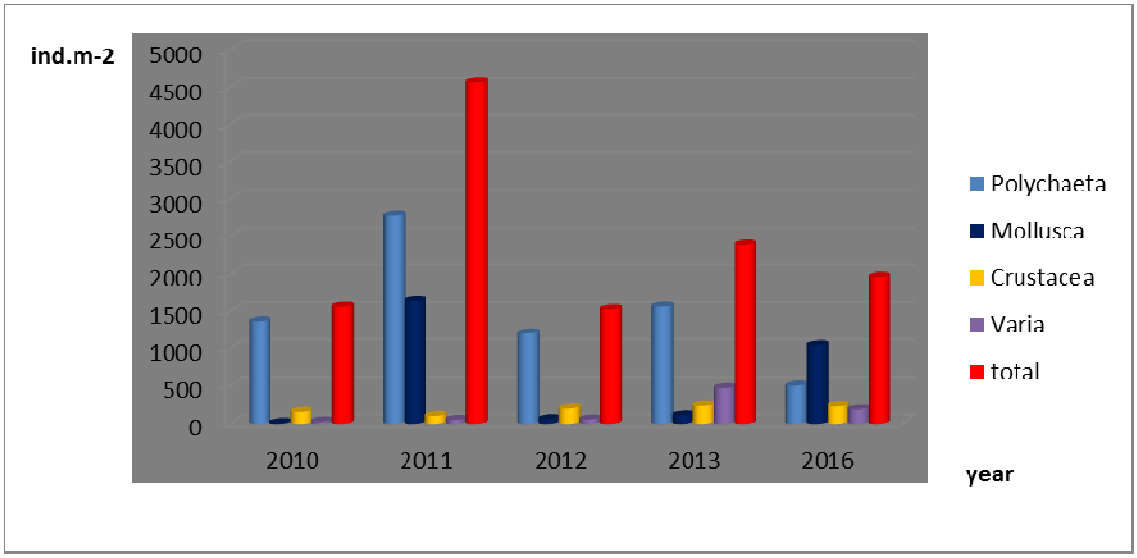

Fig.2 Distribution of average zoobenthos abundance by groups.

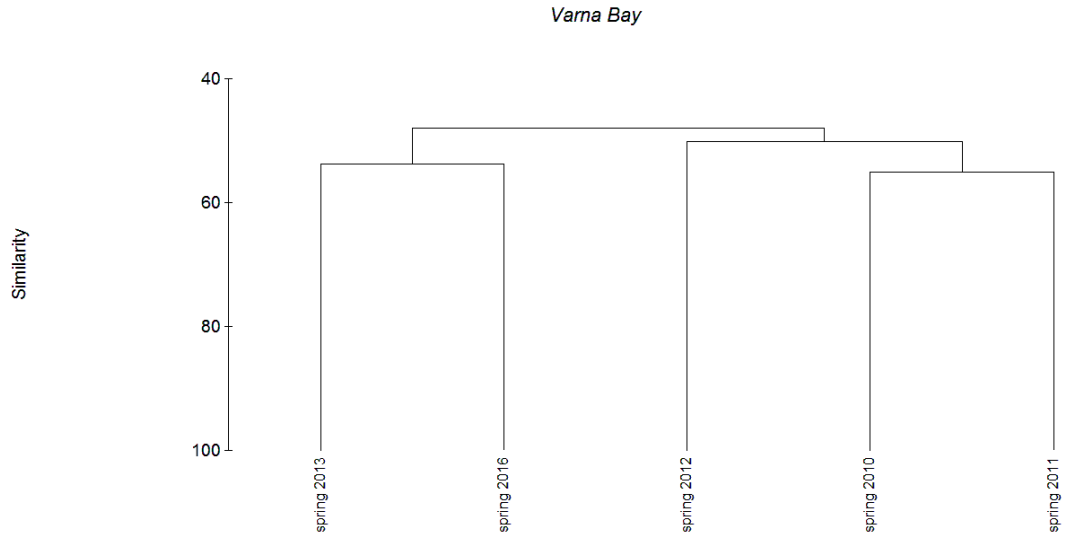

Fig. 3 Dendrogram for hierarchical clustering (group-average linking) of years based on Bray-Curtis similarities of log (x+1) transformed abundance of the macrozoobenthos from Varna Bay during spring 2010-2013 and 2016.

Results from hierarchical clustering (fig.3) show formation of two clearly distinguished groups in the frame of 50% similarity. The first one includes spring of 2010-2011 at 55,02% similarity level and 2012 tagged to them at 50,11%; and the second – 2013-2016 (53,67% of similarity). Both had a similar species composition and differed mainly by the high quantities of polychaete *Aricideaclaudiae* Laubier, 1967 and *Oligopchaeta*in 2013 and 2016.

Species number was in agreement with diversity indices and showed maximum in 2011, 2013 and 2016, when the state of environment could be considered as good and were lowest in 2012, when the ecosystem was moderately disturbed. These results respond to the cluster configuration.

Table 1. Total species number, species richness (d), Pielow'seveness and diversity (H') indices for Varna Bay, based on the abundance.

year	S	d	J'	H'(loge)
spring 2010	28	3,09	0,5727	1,908
spring 2011	42	4,013	0,6057	2,264
spring 2012	25	2,9	0,6189	1,992
spring 2013	36	3,729	0,6348	2,275
spring 2016	39	4,034	0,6283	2,302

Biomass

Biomass domination trend of mollusks was established, followed by crustacean (fig.4). Highest biomassvalues of Mollusca were defined mainly by bivalve species *Anadarainaequivalvis* (Bruguiere, 1789), *Chamelea gallina* (Linne, 1758) and the one of decapod crustacean *Upogebiapusilla* (Petagna, 1792) in 2011. Biomass minimum was in 2013, due to severe reduction of mollusk's species.

Hierarchical cluster on macrozoobenthos biomass, by analogy to the one of abundance, agglomerated the whole pool of investigated years at 41,93% similarity level and is subdivided to two smaller (fig.5). The first includes spring of 2010 to 2012 and the second one – 2013 and 2016, with similarity accordingly 49,38% and 49,36%.

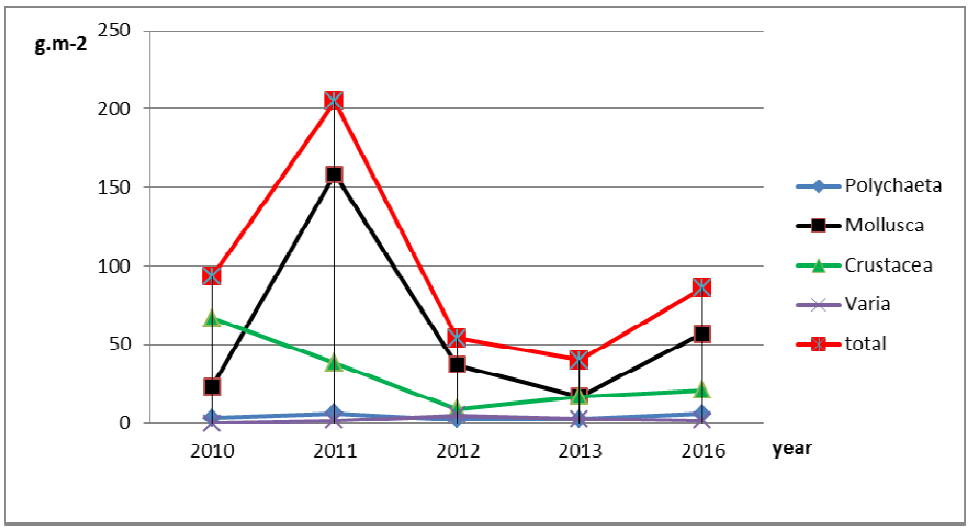

Fig. 4 Dynamics of the average biomass by groups.

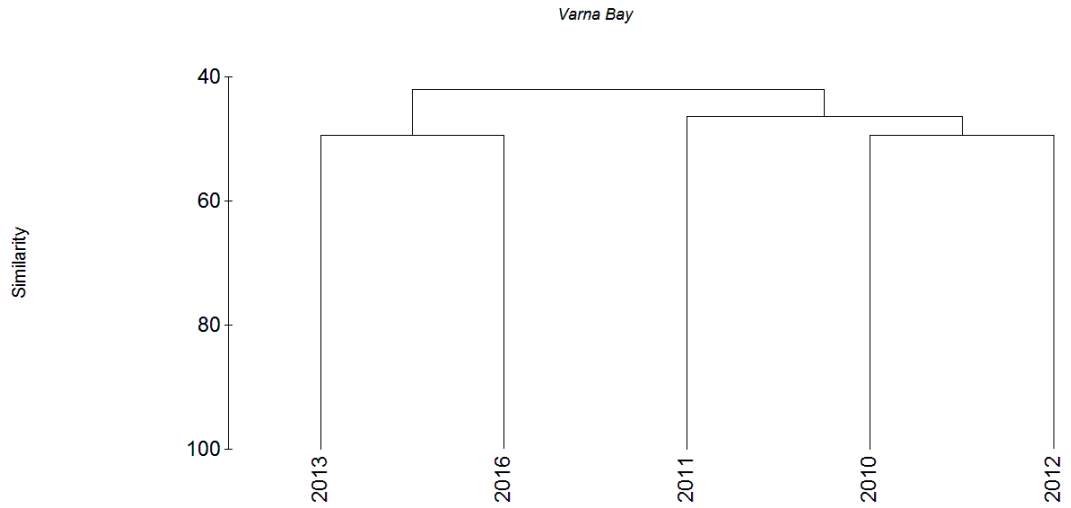

Fig. 5 Dendrogram for hierarchical clustering (group-average linking) of years based on Bray-Curtis similarities of log (x+1) transformed biomass of the macrozoobenthos from Varna Bay during spring 2010-2013 and 2016.

REFERENCES

1. Гришин А.Н, Узунова С. 2008. Биоиндикация экологических аномалий в морских водоёмах например Варненского залива. РибнегосподарствоУкраіни. 4 (57), 25-31.
2. Маринов, Т., 1990. Зообентосът от българския сектор на Черно море, Издателство БАН, 1-195.
3. Маринов Т.,Ст. Стойков, 1989. Зообентосът от сублиторалното пясъчно и тинесто дъно на Варненския залив, Доклади на Научно-Практическа конференция "Състояние, рационално усвояване и защита на природните ресурси на Варненския регион" – Варна, 178-187.
4. Узунова С. 1995. Преглед на крустацейната фауна във Варненски залив. Известия на института по рибни ресурси – Варна, 23, 158-168.
5. Узунова С., 2009. Състояние на зообентоса във Варненски залив през юни 2007-2009 г.,Известия на Съюза на учените – Варна, 2'2008/1'2009, 73-76.
6. Узунова С., 2011. Развитие на дънните ценози във Варненски залив през периода 2008-2010 г. И з в е с т и я на Съюза на учените – Варна, Серия „Морски науки"'2011, 77-84.
7. KonsulovaTs., A. Konsulov, S. Moncheva, 1991. Ecological characteristic of Varna Bay (Black Sea) coastal ecosystem under summer "bloom" conditions. Comp.Rend. de l'Academie bulgare des Sciences, 44/8, 115-117.
8. KonsulovaTs., 1992. Seasonal structure and ecological status of Varna Bay (Black Sea) sandy and muddy macrozoobenthic coenoses, Rapp. Com.Mer Meditt. 33, 42.
9. KonsulovaTs., 1993. Marine macrozoobenthic communities structure and ecological status in relation to some environmental factors, Compt. Rend. Acad. Bulg., Sci., 44,8, 113-117.
10. Ouzounova S., 1999. Species diversity of Benthic Crustaceans in the Varna and Burgas Bays, Black Sea, In : Crustaceans and the Biodiversity Crisis, Proceedings of the Fourth International Crustacean Congress, Amsterdam, The Netherlands, vol.1, 583-589.

11. Петрова-Павлова Е., 2014. Биоразнообразие на макрозообентоса във Варненски залив (Черно море) във връзка с екологичното състояние на морската среда през 2011-2014 г., И з в е с т и я на съюза на учените – Варна, Серия „Морски науки”, 75-79.
12. Todorova V. &Konsulova T., 2005. Manual for collection and treatment of soft bottom macrozoobenthos samples. Online: http://bsc.ath.cx/documents/ ExpertNetwork/docs/Expert%20Network%20%20Zoobenthos/Todorova%20Manual_zoobenthos.doc
13. Trayanova A., V. Todorova, Ts. Konsluova, 2007. Benthic Invertebrate Fauna: Identification of reference (high status) and bad status values, Development of classification tool for the selected metrics, Initial assessment of the ecological status of the coastal waters, Final Report of Project “Evaluation of the impact from land-based activities on the marine & coastal environment, ecosystems & biodiversity in Bulgaria”, Ecolas NV, 17 pp.
14. Trayanova A., 2015. Ecological status assessment of Varna Bay based on benthic invertebrate fauna, И з в е с т и я на Съюза на учените – Варна, Серия „Морски науки”, 66-72.
15. Velikova V., D. Petrova, V. Mihneva, S. Dineva, S. Ouzounova, 2001. Recent state of the Bulgarian Black Sea – signs of improvement of the ecosystem, Proc. of the V International Conference on the Mediterranean coastal environment. HAMMANED TUNISIA, Ed. Erdal Ozhan, 2, 893-905.
16. Uzunova S., 2005. Shifts and dynamics of benthic crustaceans from the Bulgarian Black Sea (Varna Bay), Proceedings of the UNESCO workshop: “Large scale disturbances (regime shifts) and recovery in aquatic ecosystems: challenges for management towards sustainability” Velikova, V. and N. Chipev (Eds.), Unesco-Roste/BAS Workshop on Regime Shifts, 14 -16 June 2005, Varna.
17. Uzunova S.,2013. Динамика на макрозообентоса през пролетния сезон на 2011-2013 г., И з в е с т и я на Съюза на учените – Варна, Серия „Морски науки”, 59-65.

За контакти:
доц., д-р Соня Узунова
Институт по рибни ресурси – Варна, ССА
бул. „Приморски” 4,
гр. Варна, 9000, П.К 72
e-mail: sonja_ouz@yahoo.com