ZOOBENTHOS FROM VARNA-BELOSLAV LAKE SYSTEM DURING THE PERIOD 2007-2009

S. Uzunova

Абстракт

Варненско-Белославската езерна система отразява най-добре взаимодействието между човек и природа. Дългогодишната експлоатация на този регион доведе до драстична смята на фауната и дори унищожаването на някои видове през втората половина на миналия век.

През периода 2007-2009 се проведоха изследвания на макрозообентоса във Варненско-Белославската езерна система, с цел да се установи състоянието на екосистемата в постеутрофикационния период. Направените проучвания показват, че през лятото и есента на 2007 г. видовият състав, и количествените характеристики са най-високи. През 2008 г. изследваните параметри рязко спадат и през ноември 2009 г. достигат нулеви стойности, вероятно причинени от постцъфтежна ситуация или активната драгажна и пясъкодобивна дейност в региона.

INTRODUCTION

Varna - Beloslav Lake system is a good example for the negative interactions between man and nature. At the beginning of past century Varna and Beloslav Lakes were still independent freshwater basins with typical limnic fauna, containing relict species.

After 1909 the first channel between Varna Lake and Varna Bay was dredged and the lake salinity increased considerably (8-13‰) (Konsulova, 1992). In 1923 a channel connection between Beloslav and Varna Lakes was created. Second navigation channel connected Varna Lake and Varna Bay in 1976, to facilitate the maritime transport. As a result thermal regime, water quality and ecosystem of the lakes changed irreversibly, causing replacement of freshwater zoobenthic species with brackish ones.

The improved transport conditions allowed fast development of industrial and harbour activities, including thermo-pawer stations. As a result during second half of the past century large amount of rich organic matter, pesticides and other pollutants are supplied causing eutrophication (Shtereva G., A. Krastev, O. Hristova, 2000). H2S gas accumulation at the bottom layers, due to decomposition processes and strong thermal stratification lead to hypoxia and anoxia situations, causing mass mortality of macrobenthic fauna (Konsulova, 1992). Thus eutrophication became the major ecological problem for coastal Black Sea ecosystem and adjacent water bodies like Varna and Beloslav lakes and resulted in dramatical alterations in biological and chemical regims (Mee, 1992, Zaitzev, 1992). According Moncheva et al. (2001) this area is considered as hypereutrophic.

More recently Trayanova (2003 a,b) reported improvement of the Varna-Beloslav Lake system, based on materials collected in autumn 1999 and March 2000.

The role of the zoobenthic communities, and especially of their sessile component as indicators of the environmental quality has been successfully implemented worldwide in pollution assessment studies and monitoring programs (Dauer D. M., R. M. Ewing, J. A. Ranasinghe, 1989; Pearson T. H. and R. Rosenberg, 1978; Rees H., C. Heip, M. Vincx, M. M. Parker, 1991; Warwick R. M., T. H. Pearson, Ruswahyuni, 1987). The quantity of conservative species indicates the environmental quality

over a period of time rather than reflecting conditions just at the time of sampling (Gray J. S., A. D. McIntire and J. Stirn, 1992).

The aim of the present paper is to investigate the state of the ecosystem during the posteutrophication period.

MATERIALS AND METHODS

During the period 2007-2009 total of 41 macrozoobenthic samples were collected under standart schedule of stations, situated in the area of Beloslav and Varna (Fig.1).

Fig. 1. Schedule of sampling stations in investigated area in 2007-2009.

Sampling was done on the board of R/V “Prof. Valkanov” from soft bottom sediments, using Van Veen grab (mouth opening 0.1 m^{-2}). The materials were sieved through 0.5 mm mesh and preserved in 4% formaldehyde. In laboratory the major zoobenthic groups - Polychaeta, Mollusca and Crustacea were identified till species level and the rest of taxa were incorporated in “Varia” group. Later quantitative parameters (abundance and biomass) were measured and recalculated per square meter. The Shannon-Wiener community diversity index H’ (Shanon C. E., W. Wener, 1963) was calculated on the abundance data.

RESULTS AND DISCUSSION

Total of 19 taxa, belonging to groups Polychaeta, Mollusca, Crustacea and Varia were established for the period 2007-2009. Distribution of species number by months is presented at fig. 2. Species maximum is observed in October 2007 and June 2009 and a lack of species in November 2009.

Dominant species is *Nereis succinea* (Polychaeta) with 66% frequency of occurrence. With 33% frequency are presented *Spio filicornis, Melinna palmata, Mercierella enigmatica* and *Polydora ciliata* from Polychaeta and *Monocorophium incidiosum* and *Ballanus improvisus* from Crustacea. All these species belong to marine fauna and can sustain to low quantity of oxygen.

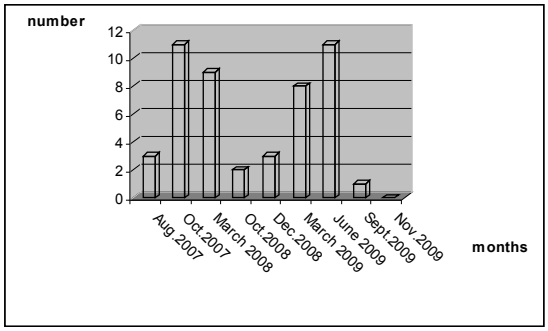

Fig. 2 Species number by months for the period 2007-2009

The distribution of the average yearly abundance by groups is presented on fig. 3 Dominant group; building the zoobenthic abundance is Polychaeta. From 2007 to 2009 its role increases significantly. The crustaceans keep subdominant role, but with decreasing percentage with years. Mollusca and ”Varia” are poorly presented during the investigated period.

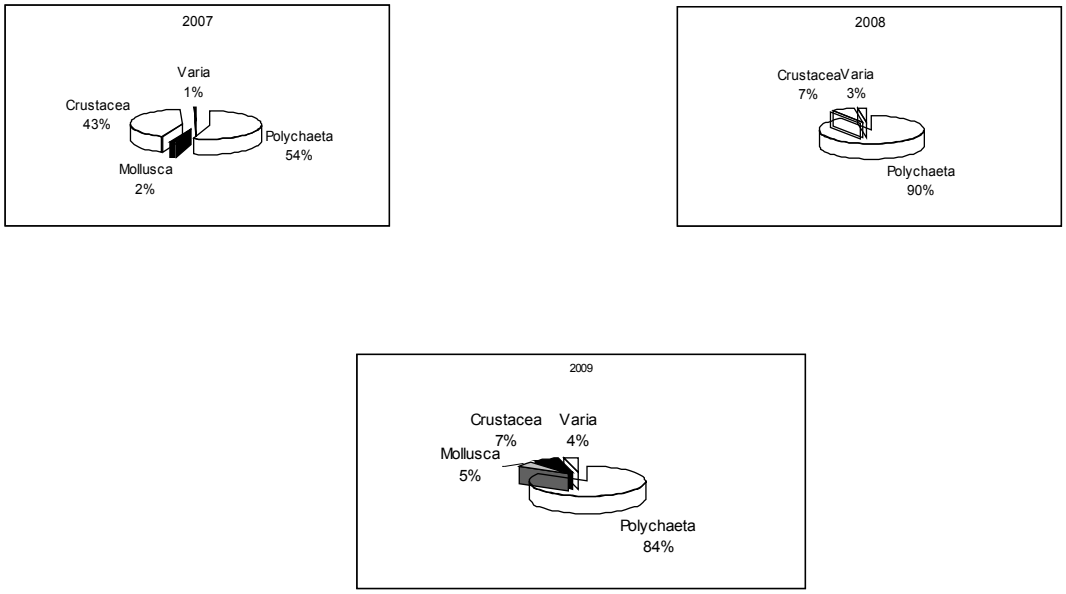

Fig. 3 Percentage share of average yearly abundance by taxonomic groups for the investigated period 2007-2009

The abundance of macrozoobenthos is very variable in monthly aspect (fig. 4). Highest quantity is observed in October 2007 – 4258 ind.m^{-2}, defined by the high values of *M. enigmatica* (Polychaeta) and *M. incidiosum* (Crustacea). A second peak is established in June 2009, where *S. filicornis* and *P. cilliata* dominated in the samples. During the rest of period abundance values are very low.

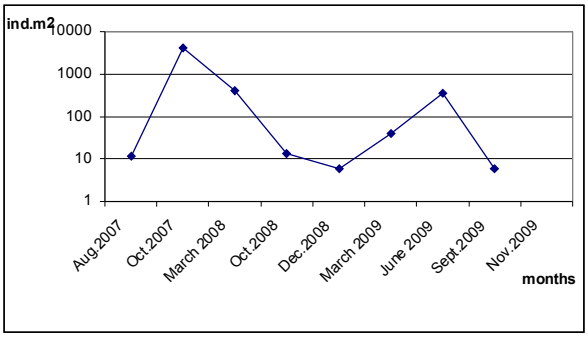

Fig. 4 Logarithmic scale of monthly abundance during investigated period

Diversity index (H’) calculated for the abundance demonstrates highest value for March 2009, when it approaches 1,822 and in June 2009 – 1,53 (fig. 5) For the rest of the studied periods it is around 1 and only in October 2008 goes down to 0,5623. The value of H’ in November reached 0 and is due to the fact that all samples were empty.

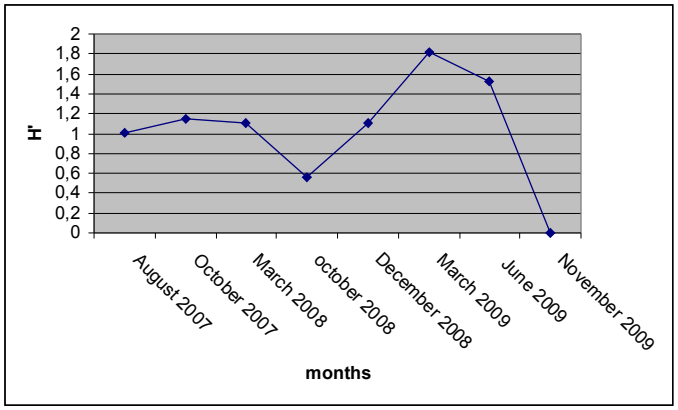

Fig. 5 Shannon-Weaner diversity index per months for the investigated period.

Biomass values are relatively low, due to predominance of small sized opportunistic species during the investigated period.(fig. 6) The maximum is reached in October 2007, when the biomass value was 56,827 g.m^{-2} and *Mytilus galloprovincialis* (Mollusca) and *Ballanus improvisus* (Crustacea) were recorded. After that follows a decrease of biomass and minimum in December 2008. From March to June 2009 the biomass values slightly increase and since September they significantly decrease until 0 in November 2009.

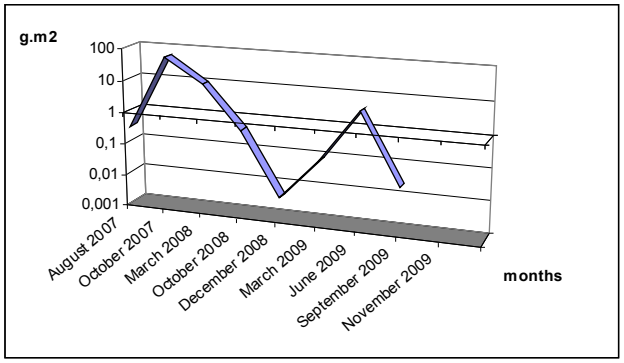

Fig. 6 Monthly distribution of biomass values from Beloslav-Varna lake system during the period 2007-2009.

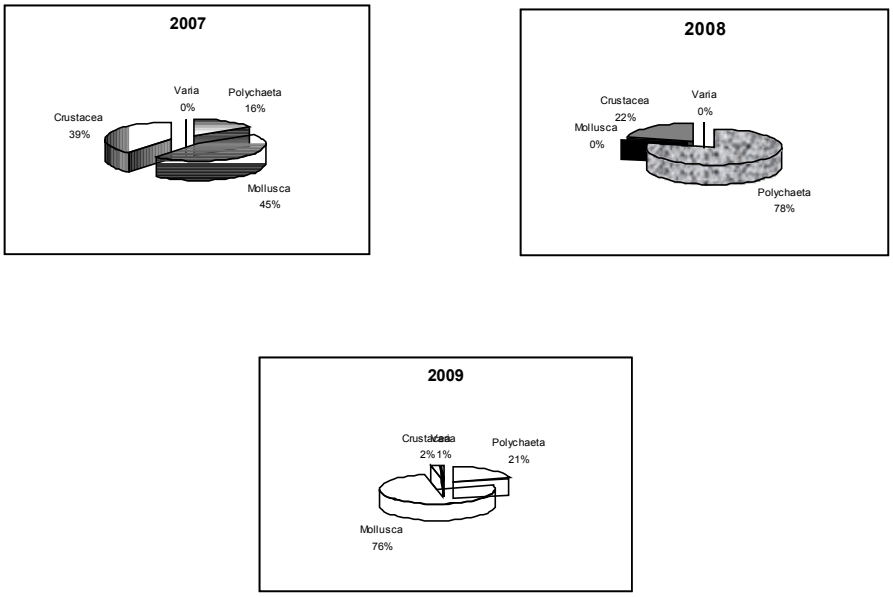

Fig. 7 Percentage share of average yearly biomas by taxonomic groups for the investigated period 2007-2009

The distribution of the average yearly biomass is relatively equally shared between Mollusca and Crustacea for 2007. In 2008 Mollusca desapeared and Polychaeta are almost responsible for the yearly biomass. During 2009 Mollusca dominates again the biomass, followed by Polychaeta.

CONCLUSIONS:

During the period 2007-2009 the macrozoobenthos from Beloslav-Varna Lake system showed relatively stable ecological status with comparison to the period of increased eutrophication. The values of diversity index (H') are rarely under 1 and this happened usually in autumn period, following the summer blooms and hypoxia events.

The species composition is relatively good and presented by Polychaeta and Crustacea, which determine the values of abundance. The quantity of molluscs is still reduced to 3 species and it affects the low quantities of biomass. Values of abundance and biomass decrease progressively from October 2007 till December 2008 and slightly recover in June 2009. The worst situation is recorded in November 2009 when no one species was found in the samples. The reason for this drastic changes might be the dragging activities in Beloslav lake and sand extraction in the frames of Varna Lake.

REFERENCES:

Konsulova Ts., 1992. Macrozoobenthic communities present state in Varna and Beloslav Lake adjacent to Black Sea. Rapp. Comm. Int. Mer Medit., 33:43.

Mee, L. 1992. The Black Sea in crisis: A need for concerted international action. AMBIO – J. of the Human environment, RSAS, 278-286.

Moncheva S., V. Dontcheva, G. Shtereva, L. Kamburska, D. Ruseva, S. Gorinstein,2001. "Application of eutrophication indices for assessment of the Bulgarian Black Sea coastal ecosystem

ecological quality”. III Black Sea Int. Conf. Environmental Protection technologies for coastal areas, Varna, Bulgaria, Book of Proceedings, 71-82.

Pearson T. H., R. Rosenberg, 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. Ann. Rev.,16: 229-311.

Shanon C. E., W. Wener, 1963. The mathematical theory of communication, Urbana, University of Illinois Press, 117.

Shtereva G., A. Krastev, O. Hristova, 2000. “Chemical Investigation of Varna and Balchik Port Area”, Proceedings of 2nd Intern. Conf., Port Development & Coastal Environment, Vol. 1, 171-180.

Trayanova A., 2003a. Ecological status of macrozoobenthic communities in beloslav and Varna Lakes during the autumn of 1999., Proc. of Institute of Oceanology, BAS, 4, 140-147.

Trayanova A., 2003b. Macrozoobenthic community status in the Varna Beloslav lake system as indicator for environmental quality assessment *Proceedings of the First International Conference on Environmental Research and Assessment* Bucharest, Romania, March 23-27, 2003, 58-68.

Dauer D. M., R. M. Ewing, J. A. Ranasinghe, 1989. Macrobenthic communities of the lower Chesapeake Bay.Chesapeake Bay Program. Rep. Virg. Water Control board, March 1985-June 1988. Norfolk, Virginia.

Rees H., C. Heip, M. Vincx, M. M. Parker, 1991. Benthic communities: Use in monitoring point source discharges. ICES Techniques in Marine Environment Sciences, № 16, 70.

Warwick R., M., T. H. Pearson, Ruswahyuni, 1987. Detection of pollution effects on marine macrobenthos: further evaluation of the species abundance/biomass method. Marine Biology, 95: 193-200.

Zaitzev, Yu. 1992. Recent changes in the trophic structure of the Black Sea . Fisheries Oceanography, 1 (2), 180-189.

За контакти:
Гл.асистент Соня Узунова, e-mail: sonja_ouz@yahoo.com
Институт по рибни ресурси – Варна,
бул. “Приморски” 4, Варна 9000, ПК 72, тел. 052 632066