ZOOPLANKTON COMMUNITY CHANGES ALONG THE EUTROPHICATION GRADIENT VARNA LAKES - VARNA BAY (WESTERN BLACK SEA)

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Abstract
The main objective of the present study is to select amongst the zooplankton community characteristics (diversity, quantitative and taxonomic structure, Rotifers/Copepods/Cladocera ratio) relevant descriptors to eutrophication. Plankton fauna in investigated area manifested dissimilar features which greatly correlated with the eutrophic state of the ecosystems Varna Lakes - Varna Bay. The results of Simper and principal component analyses (PCA) gave arguments to suggest the main zooplankton community characteristics as reliable indicators in biomonitorng schemes.
Keywords : Zooplankton, Black Sea, Eutrophication, Coastal Waters.

Varna Bay is the second largest bay along the Western Black Sea coast, connected via two canals to Varna Lake, further prolonged to Beloslav Lake by navigation canal. The studied coastal area (Beloslav Lake- Varna Lake-Varna Bay) is under various types of human pressure, such as urban pollution, chemical industry, agriculture, maritime transport, harbour and electric power plant activities. From the lakes to the Bay, a gradient of decreasing nutrient load and related effects were prominent [1]. Since 1970s, the ecosystems of the area have undergone noteworthy alterations of plankton communities as a result of eutrophication, oxygen deficiencies, and outburst of invasive species [1, 2, 3]. According to water quality index (WQI), the lakes have been categorized as hyper-eutrophic, with "bad"water quality in respect to primary productivity and biomass, abundance of the blooming species and frequency of blooms, whereas Varna Bay was scaled as highly eutrophicated, "poor"water quality [2]. Seasonal data for temperature (T°C), salinity (psu), oxygen, nutrients (N-NO_2, NO_3, NH_4, P-PO_4, Si-SiO_4), chlorophyll-a concentration, phyto- and zooplankton taxonomic composition, plankton abundance and biomass for the period 1998-2005 were focused on. Species richness (S), Shannon index (H) calculated on abundance and biomass data; TRIX (trophic state index), PCA and simper analyses were applied for differentiation of the environmental characteristics along the eutrophic gradient. Obtained results revealed a decreasing trend of zooplankton quantity from the Lakes towards Varna Bay. Zooplankton numerical abundance was 3-15 fold lower in the Bay compared to the Lakes. The dominant taxonomic group for both lakes was the rotifers. Their density and diversity correlated significantly with trophic state indicators Chl a and nutrients [4]. Maximum values of rotifers were recorded in front of Provadiiska River mouth (Beloslav Lake) and close to the ferry terminal. The abundance ratio of major groups Rotifers/Copepods/Cladocera was 41/4/32 in Beloslav, 17/35/6 in Varna Lake (copepods prevailed), and 13/24/10 in Varna Bay (Cladocera significance). The magnitude of rotifers decreased towards the Bay, where benthic larvae and copepods prevailed. The zooplankton biomass structure was dominated by benthic larvae and copepods. The lowest zooplankton quantity and species diversity were registered at sampling stations close to the Varna West Port, thermoelectric power station and sewage plant. The domination of rotifers in the Lakes suggested a higher reproduction rate as a consequence of the disturbed environment compared to the Bay. Further the great share of small sized species and fine filtrators could be indicative for a high phytoplankton concentration. The results of the applied statistical methods figured out dissimilarities between the sites, due to species presence/absence and species abundance. PCA discriminate the three sites (Cluster A-Beloslav, cluster B-Varna Lake, cluster C-Varna Bay), and reveal ecological significance of zooplankton abundance and biomass (mainly Copepods), species occurrence, phytoplankton, Chl a, total inorganic nitrogen, TRIX index, salinity and biodiversity indices. The results gave grounds to suggest as descriptive the above discussed zooplankton characteristics, which could be exploited in the biomonitoring schemes as reliable indicators of indirect eutrophication impacts and water quality assessment.

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