ON THE APPLICATION OF PHYTOPLANKTON BODY- SIZE STRUCTURE AS ECOLOGICAL QUALITY DESCRIPTOR OF TRANSITIONAL WATERS (VARNA LAGOON-BLACK SEA)

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Abstract
The present paper is an attempt to test applicability of individual body size biomass distribution spectra of phytoplankton communities as alternative quality descriptor for assessment of Varna lagoon transitional waters ecological status, analyzed against taxon-based phytoplankton quality attributes.
Keywords : Bio-indicators, Eutrophication, Lagoons, Phytoplankton.

While the WFD sets the basics of ecosystem ecological quality assessment and monitoring the identification of consistent ecological quality descriptors and metrics remains still a scientific challenge. Recently the relation among individual, population, community, ecosystem and body size was synthesized in a metabolic theory of ecology [1]. The concept employ body size to explain home range size, nutrient cycling, numerical abundance distribution, biomass production and speciation and, as a community feature, it is expected to vary with disturbance gradients, according to energetic and ecological constraints [2].
The Varna Lake - Varna Bay system is influenced by domestic and chemical industrial waste water emissions and intensive shipping, preconditioning a clearly pronounced nutrient gradient and related impacts on the biota [3].
The analysis was based on data collected during seasonal field surveys (Dec'04, May and Aug'05) at 5 station along the system: Varna bay (VB), Varna Canal (C) and Varna Lake (VL). The taxonomic composition and body size were determined under OLIMPUS-BS41 inverted microscope and a VIASystem at 200x magnification. The construction of Normalized Biomass Size Spectra (NBSS) of phytoplankton counts was according to [4]. Parallel sub-samples of chl. a fractionation (0.45μm, 20μm and 2μm) were measured.
The following phytoplankton attributes have been analyzed: taxonomic composition, abundance, biomass, dominant species, taxon-based indices (species richness, diversity, evenness) and NBSS descriptors - width and slope. In addition to T°, S, O_2, and nutrient measurements the Throphic State Index (TRIX) was calculated as an integrated measure of euthrophication
A steady gradient of eutrophication along the VL-VB axis persisted during all seasons - TRIX in VB maintained around 5 (moderately euthrophic), in the Canals - between 5 -7 (euthrophic/hyper-etrophic) and in VL above 7 (hyper-euthrophic). Chl. *a* was in average about 5 times higher in VL as compared to VB (25.2 - 6.56 μg/l in spring and 16.23 - 3.38 μg/l in summer). The nano- size fraction dominated in spring the entire system, while in the summer in the C-VL sites, overriding that in the Bay >20 fold (0.44-11.15 mg/m^3).
The phytoplankton communities manifested high variability in the taxonomic spread, dominant species, abundance and biomass, species richness and diversity that in general followed the environmental gradient of nutrients. Bacillariophyceae and Dinophyceae were the dominant taxa in the abundance and biomass during winter-spring while in summer Haptophyceae took over in the abundance especially in the Canal (82.77%). Enhanced diatoms proliferation from VB to VL repsented the bulk of the biomass irrespective of the season (in % of the total in winter: 33-98-98%, spring: 33-22-81% and summer 34-69-62%) the total biomass in VL exceeding 3-5 times the biomass measured in the Bay (winter- 352-1002- 2141 mg/m^3 and spring -1450-3930- 4068). The heterogeneity was featured also by the dominant species diversity along the gradient - *Heterocapsa triquetara* in VB and *Rhizosolenia fragilissima* in VL (winter), *Cyclotella caspia* (VB), *Heterocapsa triquetra* (C) in spring and *Nitzschia delicatissima* (VB), *Phaeocystis pouchetii* (C) and *Gloeocapsa* sp. (VL) in summer, related mainly to the seasonal variability of nutrients, their ratios and grazing pressure in the system. The spatial and temporal body size distribution of phytoplankton communities react to the disturbance pressure (nutrient enrichment) in a way consistent to the response of the taxon-based phytoplankton quality elements, the width decreasing along the euthrophication gradient, typical for ecosystems under stress. In contrast to the relatively high seasonal variability of most of the phytoplankton descriptors analyzed in the study, the width manifested a unimodal pattern irrespective of the season - Fig.1.

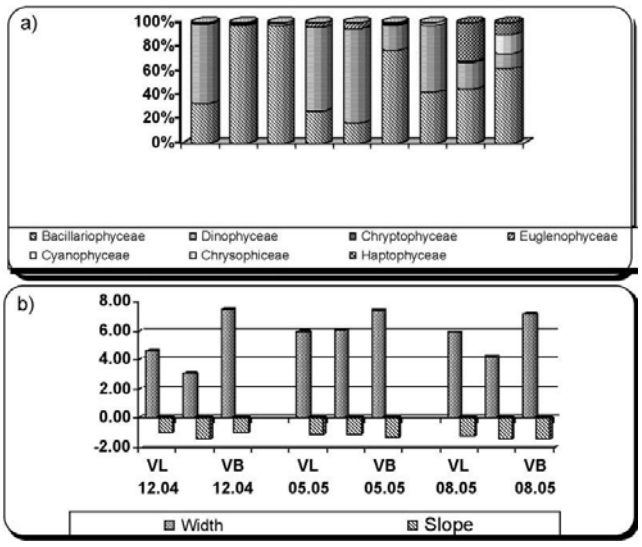

Fig. 1. Seasonal variability of phytoplankton quality descriptors: A) taxonomic structure by biomass [mg/m^3]; B) body-size spectra width and slope.

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