

PHYTOPLANKTON IN THE ORGANIC PARTICULATE MATTER FLUX IN VARNA BAY (BLACK SEA)

S. MONCHEVA¹, V. DONCHEVA¹, G. STEREVA¹, A. KONSOULOV¹,
E. KOZHUHAROV²

¹ Institute of Oceanology, BAS, Varna, Bulgaria
² Institute of Geology, BAS, Sofia, Bulgaria

Varna Bay is one of the most affected by the anthropogenic pressure regions along the Bulgarian Black sea coast. Dramatic changes both in the chemistry and in the biology have been reported. An apparent shift in the dominant phytoplankton species composition together with an increase in the frequency and duration of the blooms have been well documented, the anoxia conditions during summer period becoming a recurrent phenomenon (MONCHEVA *et al.*, 1993). As the autochthonous organic matter produced as a consequence of eutrophication has been considered the key factor in the ecological disaster of the area, the investigation of the nature and fate of the organic flux constitutes a major interest. The subject of the present paper is to highlight the role of phytoplankton component in the organic matter and the dominant mechanism of its downflux transition in respect to the variability of some chemical and biological characteristics. The results are based on sampling from May to November 1993. The following determinants have been measured: temperature, O₂, pH, NH₄, Pmin., Porg, Ptot., Corg. and Ptot. in the suspended matter, zooplankton and phytoplankton species composition and abundance, Chl. A in the water. The flux of some of these parameters have been measured in sediment traps deployed, including fecal pellets, separated in geometrical and size classes. The phytoplankton standing crop is characterized by both high abundance and biomass during the entire period ranging from 1.3 to 12x10⁶ cells/l and from 11.2 to 35.4 mg/l Chl A. The highest value is reached at the end of July (443) and the lowest at the end of May (0.1). It is the only case of *Chrysophyta* and *Dinophyta* species overdominating the BC species (Fig.1, 2). A sequence of blooms have been registered with the following principal species involved: *Chaetoceros socialis* Laud., *Cerataulina bergonii* Perag., *Peridinium triquetrum* (Ehr.) Lebour., *Prorocentrum minimum* Ost., *Emiliana huxleyi* (Lohm.) Kempt (May-June); *C. bergonii*, *Ch. socialis*, *Nitzschia closterium* Cl., *Detonula confervaceae* (Cl.) Gran. (July); *Skeletonema costatum* (Grev.) Cl., *C. bergonii* (September) and *Leptocylindrus minimus* Gran., *Thalassiosira subsalina* Pr. Lavr., *Th. parva* Pr. Lavr. (November). The summer phytoplankton assemblage registered is not typical for this season when usually dinoflagellates predominate. Most likely this could be related to the specific hydrological conditions. The dominance of western winds prevents the persistence of water stratification and supports nutrients input facilitating the maintenance of high diatom standing crop (SMETACEK, 1991) and high phytoplankton biomass (fig.1). The latter suggestion is supported by the graphs plotted on Fig.2. The comparison of zooplankton fecal pellets flux (Fp) with the NH₄ concentrations suggests a considerable contribution of Fp to NH₄ possibly related to their high disintegration rate (SMETACEK, 1980). Chl A, Corg. and Chl A : ZB curves provide indication of two patterns of interrelations. In the first one (31.05-22.06, the termination of spring bloom) the Chl. A-Corg lines are inverse probably due to the increased zooplankton crop (low Chl. A : ZB ratio) at almost equal Chl. A concentrations and Chl. A:Corg ratio (34.6%-21%). The ratio BC : NBC is low. In the second one Chl. A curve is almost parallel to Corg variability. The share of Chl. A in Corg. varies from 55% to 77.8% with the exception of August (26%; the termination of second bloom). The ratio of BC:NBC is high (Fig. 2B). The organic matter flux determinants considered (Fig. 2C) manifest both a direct settling of phytoplankton cells and zooplankton fecal pellets as possible mechanisms of sedimenting out the excess of phytoplankton biomass. The suspected switching factor is the BC : NBC ratio and the species composition. This is supported by the comparison of the dominant species record in the water and the sediment trap. The BC : NBC ratio in the sediment traps differs considerably from that from the watershed (0.09-34.2). The Fp seem to account for the phytoplankton transfer to sediments at a high BC:NBC water ratio (exceeding 100 in our case study). The variability of Chl. A in the sediment flux follows that in the water column with a time lag, the higher the phytoplankton biomass the greater the proportion that sediments out (Fig. 2D). The same stands for the Corg flux. The data presented suggest the following conclusions preliminary. Phytoplankton in Varna Bay is maintained high despite the magnitude of variation typical for eutrophic areas. The same stands for Chl. A proportion and Corg in the water domain (ranging from 27 to 77%). The possible factor controlling the ratio Corg : Chl. A could be zooplankton grazing. Phytoplankton may be considered as a major component in downflux. The species composition and BC : NBC ratio in the water column seem to be decisive in the sedimentation mode, Fp dominating the flux at high BC:NBC ratio.

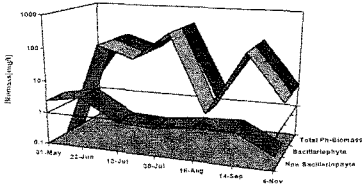


Fig.1. Phytoplankton biomass dynamics in log scale.

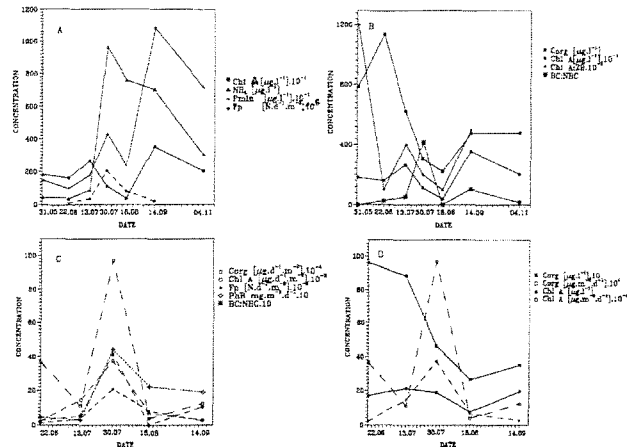


Fig. 2 : Dynamics of the main determinants in the water column (solid line) and in the sediment traps (dashed line) ZB- zooplankton biomass; Ph B-phytoplankton biomass; BC:NBC (Bacillariophyta:Non Bacillariophyta) biomass

P