MICROPHYTOPLANKTON IN A SHALLOW MARINE LAKE (EASTERN ADRIATIC, NE MEDITERRANEAN)

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Abstract
The objective was to determine the structure and dynamics of microphytoplankton in the small shallow marine Lake Vlaška situated in the Middle Adriatic Sea. The microphytoplankton communities consisted mainly of diatoms throughout the year, while dinoflagellates caused outbursts of growth in autumn. The simultaneous dominance of more than one species is the main feature of the microphytoplankton assemblages in the lake. The reason for this can be found in the very frequent and rapid changes of the environmental conditions.
Keywords : Phytoplankton, Adriatic Sea.

The Neretva River estuary is a small, low tidal (25 cm average daily amplitude) estuary, situated on the eastern coast of the Middle Adriatic Sea. The marine Lake Vlaška is one of the smallest lakes (0.5 km^2, 10 m max. depth) in the lower Neretva estuary. The lake has a highly stratified estuarine character with a very pronounced separation between the brackish and marine layers. Hypoxia (<40%) was present in the 6-10 m layer from July to December 1999.

An investigation of the phytoplankton in Lake Vlaška was carried out as a segment of an interdisciplinary research project from April 1999-April 2000. The objective was to determine the structure and dynamics of microphytoplankton (cells longer than 20 μm) in order to study its importance in the water column. Samples for the analysis of phytoplankton abundance were fixed in 2% neutralized formaldehyde. Sub-samples (25-50 mL) were allowed to settle for 24-48 hours in the counting chambers. Microphytoplankton cells were counted using an inverted microscope Olympus IMT-2 equipped with phase contrast [1]. Microphytoplankton data were presented with reference to major groups: Bacillariophyta (Baci), Dinophyta (Dino), Chrysophyta and Prymnesiophyta (Chry). Results are expressed as cell density per liter, with each cell of filamentous or chain-forming taxa counted as a single cell.

Results
A total of 145 microphytoplankton taxa, 74 diatoms, 58 dinoflagellates, 8 coccolithophorids, 3 silicoflagellates, and 1 euglenophycean, chlorophycean and cyanophycean each were identified. The microphytoplankton communities consisted mainly of diatoms (an annual average of 74%), while dinoflagellates caused outbursts of growth in September 1999. The cyanophyte had a larger abundance (24-38% of microphytoplankton) from January to March 2000.

Microphytoplankton abundances oscillated over four orders of magnitude (Fig. 1). Three peaks of microphytoplankton were observed throughout the year. The first peak was in April 1999 (1.2 x 10^6 cells L^{-1}), the second in August-September 1999 (8.0 and 4.0 x 10^6 cells L^{-1} respectively), and the third in April 2000 (7.2 x 10^5 cells L-^{1}). The first peak reflected the intensive development of the diatoms *Thalassiosira* sp., *Cerataulina pelagica*, *Chaetoceros compressus*, *Ch. curvisetus*, *Hemiaulus hauckii* and *Leptocylindrus danicus* that accounted for up to 78% of the microphytoplankton population (Fig. 2). The second peak was mostly (>87% of microphytoplankton abundance) made up of *Nitzschia longissima* (August 1999, 7.9 x 10^6 cells L-1) and *Scrippsiella trochoidea* (September 1999, 4.0 x 10^6 cells L^{-1}). The third peak belonged to *Cyclotella* sp. and *Ceratium fusus* (94% of microphytoplankton). A minimum microphytoplankton abundance (4.4 x 10^3 cells L^{-1}) was recorded in November 1999.

The surface layer showed fresh and brackish water (e.g. *Dinobryon sertularia*, *Oscillatoria* sp., *Asterionella formosa*, *Fragilaria crotonensis* and others), but they were present at background levels. The taxa from the deep Adriatic (*Kofoidinium velleloides*, *Spatulodinium pseudonoctiluca*, *Podolampas palmipes* and others) are frequently found together below 5 m depths. There were 30 rare taxa (<1% of the total number of samples): *Rhabdosphaera tignifer, Oscillatoria* sp., *Pediastrum boryanum*, *P. clathratum*, *Cosmarium reniforme*, *Halosphaera viridis*, *Asterionella bleakeleyii*, *Bacillaria paxillifer*, *Synedra crystallina*, *S. superba*, *Chaetoceros rostratus*, *Ch. lorenzianus*, *Neocalyptrella robusta*, *Pleurosigma elongatum*, *Navicula cancellata*, *Entomoneis paludosa*, *Grammatophora marina*, *Ceratium horridum*, *C. setaceum*, *C. teres*, *C. arietinum*, *Gyrodinium opium*, *G. mitra*, *Oxytoxum parvum*, *O. laticeps*, *O. scolopax*, *O. sphaeroideum*, *Phalacroma rotundatum*, *Protoperidinium pyriforme* and *P. steinii*.

Conclusions
The microphytoplankton community in the estuary is of marine origin, dominated by small diatoms (Thalassiosira, *Cyclotella*) in spring. In summer, some dinoflagellates increased in numbers, but larger diatoms (*Nitzschia*, *Pseudo-nitzschia*) were the most abundant cells. Dinoflagellates played a minor role throughout the year, but *Scrippsiella trochoidea* was abundant in autumn. These succession pattern were similar to those described by Margalef [2]. The simultaneous dominance of more than one species is the main feature of the microphytoplankton assemblages in Lake Vlaška. The reason for this is most likely the frequent and rapid changes of the environmental conditions in the estuary.

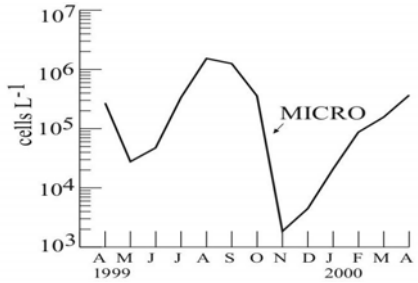

Fig. 1. Microphytoplankton abundance in the Lake Vlaška.

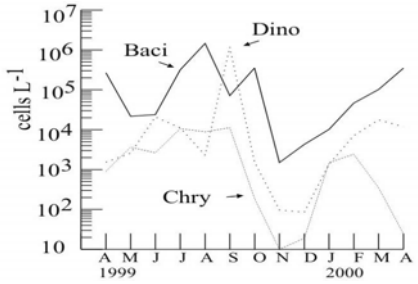

Fig. 2. Abundance of the microphytoplankton groups in the lake (diatoms-Baci, dinoflagellates-Dino, silicoflagellates and coccolithophorids-Chry).

References

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