Influence of Nutrient Availability on Phytoplankton Community Structure of the Eastern Part of the Baltic Sea

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The Gulf of Riga is a shallow brackish-water area. Its water exchange with the Baltic Proper is restricted and the salinity barrier between surface and bottom layer is weak. Due to a regular appearance of homothermium with resulting intense vertical mixing of water layers in the cold half of the year, the surface water is annually enriched with nutrients from the bottom layers. Average annual freshwater inflow constitutes 7,3 % of the total volume of the Gulf, suggesting that the Gulf of Riga is strongly affected by river waters. Significant anthropogenic load to the Gulf of Riga, particularly in the southern region, caused increased eutrophication in the 1980ies. That was characterized by a decrease of water transparency, elevated nitrogen and phosphorus concentration, high biological oxygen demand, high level of primary production, as well as quantitative and qualitative changes in the structure of the pelagic and benthic communities at various trophic levels. The aim of the present studies was to determine the effects of nutrient enrichment on the growth rates and community structure of summer phytoplankton of the Gulf of Riga.

Surface water collected in the southwest coast of the Gulf (slightly influenced by river discharge) in mid-July 1996 was filtered through 150 μm mesh (to remove micrograzers), distributed into 10 l polycarbonate carboys and spiked with different combinations of nutrients. Nutrient uptake, changes in the algal biomass and in the species composition were determined during 10 days of exposition.

In the original phytoplankton assemblage, 29 species were found, belonging to five algal classes. At the beginning of the experiment, diatoms dominated in the total phytoplankton biomass. While not presented in final assemblage, the diatom *Sceletonema costatum* was the fastest grower during the first three days of exposition, with 1.3 to 1.7 divisions per day.

At the end of the exposition period, 17 of the original 29 species had disappeared. The Shannon species diversity index decreased relative to the initial values by 25 - 58 %, due to a loss of 83 % of the initial diatom species and 83 % of the dinoflagellates. In contrast, growth rates of the chlorophytes (*Oocystis borgei*) and cyanobacteria (*Microcystis wesenbergii* and *Snowella lacustris*) were the highest at the end of experiment. Only one species of cyanobacteria (Anabaena flos-aquae) disappeared during the experiment, while the diversity of chlorophytes and cryptomonads halved. Some species (diatoms - *Fragilaria crotonensis*, *Thalassiosira pseudonana*, cyanobacteria - *Microcystis wesenbergii*, *Merismopedia punctata*; chlorophytes - *Scenedesmus acutus*) were not found in the original assemblages, but were presented at the end of the experiment. Diatoms *Fragilaria crotonensis* and *Thalassiosira pseudonana* could grew only in the presence of iron and metals.

The experiments showed that most diatoms species preferred relatively high concentrations of inorganic nitrogen and from all inorganic nitrogen compounds ammonium was used the first. The dominance of cyanobacteria *Microcystis wesenbergii* and *Snowella lacustris*, as well as chlorophytes *Oocystis borgei* at the end of the experiment, when all reserves of inorganic nitrogen were almost exhausted, but significant amounts of phosphorus ($P\text{-}PO_4$) and silicon ($Si\text{-}SiO_3$) still remained available, could be explained by the ability to sustain growth from uptake of dissolved organic nitrogen. In the urea-supplemented culture, the urea concentration significantly decreased, but the pool was not exhausted till the end of the cultivation period. Even if the uptake of nitrogenous organic substances is not as efficient as the uptake of inorganic nitrogen sources, it still could be believed that dissolved organic matter sustains growth in some phytoplankton species.