O42.3

Effects of altered phytoplankton compositions on the significance of nutrient and chlorophyll ratios

Maximilian Berthold[1,2], Rhena Schumann[2]

[1]Mount Allison University, Canada. [2]University of Rostock, Germany

Abstract

There is a clear relationship between nutrient inputs and subsequent chlorophyll increase, leading to a primary producer shift towards phytoplankton during eutrophication. Despite reduced nutrient inputs, chlorophyll concentrations of lakes, lagoons and even ocean basins are still increasing. These hysteretic effects pose a challenge to our understanding of how nutrient and chlorophyll concentrations and the underlying mechanisms are related. Causes can be for example changing phytoplankton species compositions. We observed such developments at the southern Baltic Sea coast, an area with reduced nutrient point sources, but accumulated nutrient legacies in the catchment area. We hypothesized that these compositional shifts may have been caused by resilient phytoplankton communities that are physiologically acclimatized to low nutrient levels mediating growth by exploiting diffuse nutrient inflows across ecosystem boundaries. We used short-term growth, fertilization, and enzymatic assays to analyze the mismatch of close-to-determination-limit dissolved nutrients vs. high standing stock of phytoplankton biomass. Furthermore, long-term patterns on nutrient inputs through point and diffuse sources were evaluated. We found that systems with especially high N:P ratios (up to 50:1) were dominated by picophytoplankton, which in turn was not solely P- but co-limited for N. Fertilizing samples from the mid of the water body stimulated growth only close to point sources. Contrary unfertilized samples could grow at the land-water contact zone without point sources nearby. Furthermore, the phytoplankton community accessed organic nutrient pools through enzymes depending on external nutrient availability. We concluded that traditional nutrient and chlorophyll ratios failed to explain the ongoing phytoplankton dominance. However, monitoring of organic nutrient pools, or high-throughput enzymatic assays may be a viable option for state agencies to distinguish apparent from real nutrient limitations. Targeted restorations measures could be formulated based on combined physiological and long-term monitoring assessment of nutrient limitations.

Keywords

nutrients, phytoplankton, eutrophication, monitoring