Verh. Internat. Verein. Limnol.	27	2948	Stuttgart, December 2000

Use of triangular TN:TP:SRSi-diagrams to evaluate nutrient ratio dynamics structuring phytoplankton assemblages

Katrin Teubner, Thomas Teubner and Martin T. Dokulil

Abstract

Triangular diagrams are most appropriate to show the relative availability of nitrogen (TN), phosphorus (TP) and silica (SRSi) for diatoms, as well as non-siliceous algae in phytoplankton communities. These diagrams show the nutrient ratios TN:TP, SRSi:TN and SRSi:TP in proportion to each other at the same time (details in TEUBNER 1996).

The 11 investigated lakes from the region of Berlin–Brandenburg were grouped in four lake categories according to the averages of the absolute concentrations of macronutrients, of chlorophyll *a*, and of morphometric parameters (euphotic, mixed and maximum depth). These categories are: "hypertrophic riverine lakes", "waters of moderate mineral content", "dimictic mesotrophic lakes" and "dystrophic lakes".

Comparison of the seasonal dynamics of TN, TP and SRSi in proportion to each other through triangular diagrams shows that lakes of different trophic status, phytoplankton and morphology, also have different seasonal dynamics of TN:TP, SRSi:TN and SRSi:TP ratios.

The "hypertrophic riverine lakes" was the only lake category with high seasonal dynamics of all three macroelements and shifted from preferential P-limitation during winter/spring (TN:TP>16:1) to preferential N-limitation during summer/autumn (TN:TP <16:1). In this case, phytoplankton consisted of at least 50% of siliceous Bacillariophyceae and Chrysophyceae, or at least 50% Cyanobacteria (TEUBNER et al. 1999).

In contrast to strong seasonal dynamics of all the three elements in the shallow "hypertrophic riverine lakes", the seasonal variations in the other investigated lakes were restricted to only two elements. In the eutrophied "dystrophic lakes" with high variations of TN:TP at "constant" SRSi, phytoplankton were either dominated by cyanobacteria or by other algae (excluding Bacillario- and Chrysophyceae) throughout the seasons, whereas diatoms were negligible.

Deep "dimictic mesotrophic lakes" and shallow eu- and hypertrophic "waters of moderate mineral content" with weak seasonal changes in TN:TP in relation to strong variation of SRSi show no preference for cyanobacterial dominance, but higher seasonal variations between diatoms and the remaining algal classes. Therefore, low seasonal dynamics of TN:TP in relation to SRSi appears to be unfavourable for cyanobacterial dominance, although TN:TP ratios lower than 16:1 prevail in the case of a hypertrophic flushed lake. These weak seasonal variations for TN:TP were caused by variable TN at "constant" TP in "dimictic mesotrophic lakes", while TP concentrations varied at "constant" TN in "waters of moderate mineral content".

To conclude, significant changes in biovolume of cyanobacteria, the siliceous algae (diatoms and Chrysophytes) and the remaining algae were associated with different dynamics of the nutrient ratios in the investigated lakes.

The full paper will be published elsewhere.

References

TEUBNER, K., (1996): *Struktur und Dynamik des Phytoplanktons in Beziehung zur Hydrochemie und Hydrophysik der Gewässer: Eine mulivariate statistische Analyse an ausgewählten Gewässern der Region Berlin-Brandenburg.* – PhD thesis, Humboldt-University of Berlin, 232 pp.

TEUBNER, K., FEYERABEND, R., HENNING, M., NICKLISCH, A., WOITKE, P. & KOHL, J.-G., 1999: Alternative blooming of *Aphanizomenon flos-aquae* or *Planktothrix agardhii* induced by the timing of the critical nitrogen:phosphorus ratio in hypertrophic riverine lakes. – *Arch. Hydrobiol. Spec. Issues Advanc. Limnol.* 54: 325–344.

Authors' addresses:

K. TEUBNER*, M. T. DOKULIL, Institute of Limnology, A-5310 Mondsee, Austria.

T. TEUBNER, Schulstr. 15 A, D-13187 Berlin, Germany.

*Author to whom correspondence should be addressed.

0368-0770/00/0027-02948 $ 0.25