



Baltic Sea nitrogen fixation estimated from the summer increase in upper mixed layer total nitrogen

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ABSTRACT: We estimated nitrogen fixation from the increase in total nitrogen (N_2 gas excluded) in the upper 20 m during the summer biomass increase of heterocystous filamentous cyanobacteria at the off-shore Landsort Deep station (BY31, 5 yr) and at 10 more stations in all major basins of the Baltic Sea proper. Estimated fixation rates were 2.3-5.9 $\text{mmol N m}^{-2} \text{d}^{-1}$, within the range of reported direct measurements. Estimated total fixation in the Baltic Sea proper, 180-430 Gg N yr^{-1} taking nitrogen settling loss and atmospheric deposition into account, was sufficient to sustain 30-90% of the June-August pelagic net community production. Filamentous cyanobacteria (mostly *Aphanizomenon* sp.) had low C: N and C: P ratios in spring 1998, indicating internal storage of both N and P. From early June, when their biomass growth started, ratios rose gradually to the biomass peak in August and early September, when the C: N ratio (6.5 mol/mol) was close to the Redfield ratio, but the C: P ratio reached 420, almost four times Redfield. The C: N ratio of the peak biomass was 1.5 times that in spring, and the C: P ratio was 13 times higher. The high C: P ratio indicates a smaller P demand by filamentous diazotrophs than expected from Redfield ratios. Only a few percent of the P mineralized daily is needed for filamentous cyanobacterial growth in summer. Filamentous cyanobacteria incorporated 16-41 mmol N m^{-2} into biomass (C: N 5.6.2) at BY31 in summer 1998. This was less than the estimated nitrogen fixation, suggesting fixed N leaks from growing diazotrophs.

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