

Positive and negative effects of allochthonous dissolved organic matter and inorganic nutrients on phytoplankton growth

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Abstract: Dissolved organic matter (DOM) can have both positive and negative effects on phytoplankton growth. The magnitude of these effects may vary depending on the source of DOM and the composition of the phytoplankton community. Here, I address the relative importance of the positive and negative effects of DOM extracts on phytoplankton growth. In short-term experiments with phytoplankton from West Long Lake, a small, moderately coloured lake in northern Michigan, U.S.A., the net effect of doubling ambient DOM on phytoplankton growth was positive. Increasing DOM concentrations from $\sim 10 \text{ mg C}\cdot\text{L}^{-1}$ to $\sim 20 \text{ mg C}\cdot\text{L}^{-1}$ had a negative effect on total phytoplankton growth by reducing irradiance and thus reducing the depth to which growth was positive. However, inorganic nutrients in the DOM extracts increased growth at each irradiance level. The positive effect on phytoplankton growth owing to the nutrients associated with DOM was greater than the negative effect caused by shading. Although the positive effects of allochthonous DOM inputs outweighed the negative effects for the nutrient-limited phytoplankton in these experiments, the net effect depends on the concentration and availability of nutrients associated with allochthonous DOM as well as the physiological status of the phytoplankton community.