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Effect of inorganic N enrichment on basal pelagic production in boreal unproductive lakes along a gradient of DOC concentration – results after 1 year of fertilization

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Input of inorganic nitrogen (N) in boreal unproductive lakes is steadily increasing due to anthropogenic deposition and usage of artificial fertilizers. N enrichment is predicted to have a major impact on the ecosystem productivity and food web structure in unproductive clear-water and humic lakes. For a long time, pelagic primary production (PP) has been mainly regarded as being phosphorus (P) limited. However, recent studies have shown that this is not true for unproductive lakes in northern Sweden, where phytoplankton is mainly N limited. Addition of inorganic N should therefore increase phytoplankton growth in these lake ecosystems. Bacterial production (BP) in the pelagic habitat, on the other hand, is usually limited by P. Nevertheless, elevated N could have a stimulating effect on BP through enhanced leakage of dissolved organic carbon (DOC) from phytoplankton following enhanced N availability and higher PP. Further, unproductive lakes vary naturally in their DOC content which affects overall nutrient- (N and P), energy- and carbon availability (light, C) for the basal producers (phytoplankton, bacteria). It is still not clear how higher inorganic N availability affects primary- and bacterial production in the pelagic in lakes with varying DOC content. We subsequently assessed this question by conducting whole-lake fertilization experiments with inorganic N additions in 6 lakes with varying DOC concentrations (2 low DOC; 2 medium DOC; 2 high DOC). For each DOC level one lake functioned as a reference and one was fertilized with N. Year 2011 was a reference year (all lakes) and 2012 was the first year of fertilization (i.e. in 3 lakes). Measurements included basal productivity such as primary production and bacteria production, lake water chemistry and physical parameters (i.e. light, temperature). The results of this study will help to develop a conceptual understanding of how increased inorganic N availability (through land use such as forestry and/or enhanced N deposition) affects basal productivity in boreal lakes which can have consequences for overall whole lake-ecosystem productivity and functioning.