River export of bioavailable nutrients and labile organic carbon effects on estuarine nutrient stoichiometry and bacterioplankton nutrient limitation

Soares, Ana; Marchlewska, Joanna; Islam, Sohidul; Berggren, Martin

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ABSTRACT

Nutrient control of planktonic processes is a fundamental aspect of aquatic ecology that is not well understood in northern ecosystems. Boreal forests and wetlands export large amounts of dissolved organic carbon (DOC), total nitrogen (TN) and phosphorus (TP) via river runoff, but a highly variable portion of the nutrient pools is bioavailable. We used a bioassay method to simultaneously measure the bioavailability of TN, TP and DOC in upland headwater sources, and in river mouths that represent the points of entry to the Baltic Sea. The stoichiometry of bioavailable elements was vastly different from the stoichiometry of bulk carbon and nutrient fractions. We show that TN, although being dominated by organic N, had a much higher degree of bioavailability than DOC and TP. Our preliminary results demonstrate that the stoichiometry of bioavailable elements can be used to accurately predict nutrient limitation of estuarine bacterioplankton, in situations where predictions based on bulk nutrients would fail. Our approach opens up new possibilities to assess the ecological status of fresh and coastal waters, and to evaluate the effects of nutrient loads on plankton communities.