



Dissolved organic nitrogen flux and bioavailability in a UK peatland catchment

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In the United Kingdom and in most parts of Europe there is a dearth of knowledge on the dynamics of dissolved organic nitrogen [DON] in streams, lakes and rivers. Studies of total nitrogen yields have focused on dissolved inorganic nitrogen [DIN = nitrate plus nitrite plus ammonium] to the near exclusion of DON. However, in temperate uplands where peat or organic soils dominate; DON may constitute a substantial amount of the total dissolved nitrogen [TDN] flux. The amount of DON which is bioavailable for plant and microbial uptake is crucial in evaluating the significance of DON loadings on the functioning of upland rivers and streams. This study estimates annual and seasonal TDN [DIN plus DON] flux for a heavily eroded peatland water supply reservoir catchment in the South Pennines, UK. The South Pennines is a region of historically high nitrogen deposition and as such, reservoirs with their longer residence time and greater surface area for nutrient exchange and turnover are most suitable for estimating long-term nutrient dynamics and fluxes in this environment. Annual and seasonal fluxes were determined from a fortnightly water monitoring regime and a continuously recorded discharge spanning December 2012 – November 2013. Seasonal DON bioavailability was determined by the fractionation of water samples from the reservoir inflow and outflow into low molecular weight [LMW] and high molecular weight [HMW] DON operationally defined as the molecular weight fraction less than or greater than 10kDa respectively. Findings from this study indicate that DON constitutes approximately 30% of the TDN flux to the reservoir catchment with an average concentration of $50\mu\text{mol/l}$ and a median of $41\mu\text{mol/l}$. DON flux was highest in spring but lowest in summer making up less than 18% of the TDN flux. Of the approximately 35% LMW DON entering the reservoir in summer only 11% is found in the reservoir outflow. This suggests that the LMW DON (<10kDa) which has been observed to be bioavailable in other studies is being utilised in the reservoir. More research on DON dynamics and bioavailability is required to ascertain its eutrophic significance and role in supporting upland freshwater ecosystems.