Investigating the bioavailability of organic nutrients to freshwater biota

Supervisors
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Project description:




The impact of elevated concentrations of inorganic nutrients on the ecological structure and function of freshwaters is well known. However, in many rivers organic nitrogen and phosphorus concentrations can exceed those of inorganic chemical species. As dissolved organic matter (DOM) concentrations are increasing in most temperate systems, if some or all of this DOM is bioavailable it could represent a major oversight in programmes seeking to control the freshwater eutrophication. There is good evidence that some low molecular weight organic compounds, such as urea, are directly available for uptake by algae. However, the bioavailability of more complex, higher molecular weight compounds is poorly known.

The bioavailability of DOM may be transformed in rivers through exposure to light which can photodegrade it, or through bacterial and fungal consortia which biodegrade complex molecules, making the DOM molecules smaller and potentially more readily available to primary producers. Bioavailability may also be controlled by the nature of the biota, their requirement for nutrients, and the particular conditions in and availability of inorganic nutrient fractions in each water body. This studentship focuses on these processes, and will investigate their role as controls on the bioavailability of DON and DOP to primary producers. It will be linked to a NERC Large Grant programme *Characterising the Nature, Origins, and Ecological Significance of DOM in Freshwater Ecosystems (DOMAINE)* providing an unparalleled opportunity for the student to work with a large, multidisciplinary research team of over 20 researchers working in partnership with 10 Government, NGO and business partners with interests in and responsibility for freshwaters.
The student will collect water samples with widely varying DOM composition from sites instrumented under the DOMAINE programme. DOM content will be characterised chemically using high resolution mass spectrometry techniques, and relative bioavailability will be determined as the increase in chlorophyll *a* in algal cultures exposed to different DOM compounds under controlled laboratory conditions. A range of experiments will be used to test bioavailability relative to: (i) algal composition (natural algal populations *vs* cultured representatives of the major algal groups: diatoms, green algae, cyanobacteria); (ii) photodegradation; (iii) microbial degradation and (iv) nutrient limitation. In a second suite of experiments, bioavailability of a range of specific compounds detected at the DOMAINE sampling sites will be studied singly and in combination.

The student will also have the opportunity to work on DOM availability to plants and mosses at CEH Lancaster in the second year of study.