**Defining nutrient sources and fluxes driving lowland drinking water reservoir ecosystem response**

**Lead Supervisor Name** Professor Penny Johnes

**Lead Supervisor Contact Details**

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**Lead Supervisor Location/Student Home Institution**

Institution: Bristol

School: School of Geographical Sciences, Science

**Full Project Description**

Nutrient enrichment of surface freshwaters is the single largest stressor on freshwater ecosystems and the services they provide, throughout the developed world. However, efforts to develop mitigation measures to tackle extinction and impairment for eutrophicated waters have been hampered, to date, by an incomplete understanding of the range of nutrient forms generating these stresses in catchments. Specifically, measures focusing on controlling the flux of single (inorganic) nutrient forms to these waters fail to consider the capacity of the biota to access, utilise, and respond to organic and particulate nutrient fractions, with a range of emerging organic contaminants generating further damage to ecosystem health. In order to develop effective policy and management to tackle these problems, a holistic approach is required. Novel techniques recently developed in a suite of NERC funded research programmes led by the supervisory team proposed here now allow a more sophisticated approach to characterising the nature, origins and ecological significance of all nutrient fractions delivered to freshwater ecosystems from their catchments. This studentship will provide the student with the opportunity to receive training in these cutting-edge techniques from world-leading experts in the development of hierarchical monitoring and analysis approaches for waters, the deployment of novel telemetered sensor technologies for freshwater monitoring, novel high resolution omics methods for compound specific determination of organic matter chemistry in contributing sources and the water body, and in bioassay-based approaches to determine the range of stressors generating impacts in the phytoplankton, epilithic and macrophyte communities of surface freshwaters. The student will work on a local water supply reservoir, Chew Valley Lake (SPA, SSSI) that supports an internationally important wildfowl population and regionally important trout fishery managed by the CASE Partner (www.bristolwaterfisheries.co.uk/lakes/chew-valley-lake/), but exhibits a highly degraded macrophyte and phytoplankton ecology. The student will use these novel techniques to pinpoint the key contributing sources in the catchment and key contaminants impairing lake ecosystem health. Working closely with the CASE Partner, Bristol Water (who lead the local Mendip Lakes Partnership with Natural England, Environment Agency and Catchment Sensitive Farming) and also with the Bristol Avon Catchment Partnership (www.wessexwater.co.uk/bristolavon/), the outcomes from the studentship will be used to develop a holistic understanding of the pressures driving extinction and impairment in the lake, and feed into the development of a targeted catchment management strategy to improve the ecosystem health, natural capital and ecosystem service resilience in Chew Valley Lake and its catchment, and provide wider benefits for people and nature at a catchment scale.

**Real Life challenges this project will address**

Loss of biodiversity in a water body with high conservation status designation (SPA, SSSI), impacts of increasing algal production on the quality of the resource for water supply, its suitability to sustain an intensive trout hatchery on the lake, and its ultimate suitability as a drinking water supply

**What you should know about this project**

The project provides a unique opportunity for the student to work with a team of world leading environmental scientists and a major water company to investigate a problem that is pervading all of the UKs lowland drinking reservoirs.

**What expertise you will develop**

The student will gain extensive experience in the use of state-of-the-art water monitoring based around sensor technologies, sampling methods for both organic and inorganic species, laboratory analysis methods including state-of-the-art mass spectrometry methods for target and comprehensive analysis of dissolved organic matter and particulates. Once collected the data will be fed into the development of appropriate, targeted mitigation measures to tackling impairment of ecosystem health in lowland water supply reservoirs

**Why this project is novel**

At present policy and management for eutrophicated, multiple-use lakes and reservoirs is ineffective as it focuses on only a limited number of the stressors which impact on ecosystem health and services. The project will use recently developed, cutting edge approaches to expand our understanding of what drives the ecosystem responses to nutrient enrichment, and develop sound, comprehensive evidence to underpin policy development.

**Rest of Supervisory Team:**

**Stakeholder Organisation** Bristol Water

**Stakeholder Supervisor** Matthew Pitts

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