# *In situ* determination of macro-nutrients using 'Lab-on-Chip' sensors: developments, deployments and future direction.

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*In situ* sensors are attractive alternatives to discrete sampling of natural waters, offering the potential for sustained long term monitoring in remote locations, and eliminating the need for sample handling. In addition sensors can be clustered into multi-parameter observatories, and networked to provide both spatial and time series coverage. Microfluidic technology miniaturises bench-top assay systems into portable devices, known as a 'lab on a chip' (LOC) sensors. The principle advantages of this technology are low power consumption, simplicity, speed, and stability without compromising on quality (accuracy, precision, selectivity, sensitivity). For several years the Ocean Technology and Engineering Group at the U.K.'s National Oceanography Centre has been developing state-of-the-art microfluidic chemical sensors, designed to autonomously perform *in situ* measurements down to full ocean depths. By taking advantage of the low reagent and power consumption achievable with microfluidics, these sensors can be – and have been – deployed for months at a time in a wide range of settings. In this presentation I will provide an overview of the current state of the technology, including the current suite of trace elements we can detect down to the nM range.

We have recorded for the first time nutrient concentrations and pH in Seychelles waters, which is now part of an on-going deployment. I will be showing some initial data collected over 4 days to highlight this work. I will also present high resolution P data collected over a 2 month deployment in a chalk river. The high resolution data has revealed interesting insights into P cycling in rivers and estuaries under varying flow regimes. This has highlighted future research directions by providing access to unprecedented high resolution data not possible through manual sampling strategies.