Christchurch Harbour Macronutrients Project

www.christchurch-macronutrients.org.uk

Approximately 40 per cent of the world's population live within 100 km of the coast and estuaries making them some of the most vulnerable sites of impact from man's activities. Excess concentrations of phosphate and nitrate in river water originating from fields, crops and sewers are some of the major pollutants affecting Britain's rivers and estuaries. It is estimated that human activities have enhanced global cycles of N and P by on average 100% and 400%, respectively.

Despite these anthropogenic impacts and intense demographic, economic and ecological pressures, estuaries provide highly valuable ecosystem benefits for humans.

Although considerable effort has been devoted to understanding macronutrient cycling in estuaries, a major area of uncertainly remains in our knowledge of how sudden storms affect the riverine input of macronutrients to estuaries and their impact on the biological activity in these transitional waters. Improving our understanding of these unpredictable events is crucial because climate change means that the intensity and frequency of storms and flooding (Fig. 1) are likely to increase.

Figure 1: Christchurch Harbour this winter showing prolonged flooding

Figure 2: Aerial photo of Christchurch Harbour courtesy of Grahame Austin

Figure 3: Satellite view of Christchurch Harbour Macronutrients Project sampling sites (Google Maps)

The Christchurch Harbour Macronutrients Project is one of four consortium projects funded by NERC through the Macronutrient Cycles Programme (http://macronutrient-cycles.ouce.ox.ac.uk/). The aims are to quantify the magnitude and spatial/temporal variation of N and P fluxes and nature of their transformations through the Christchurch Harbour estuary (Fig. 2) under a changing climate and perturbed carbon cycle. The consortium is made up of a team of scientists, from the Universities of Southampton, Portsmouth and East Anglia and the National Oceanography Centre, Southampton. They will investigate the effect of storms on the input of nutrients from the rivers Stour (Throop) and Hampshire Avon (Knapp Mill) into the Christchurch Harbour estuary in Dorset and out to the coast (The Run) (Fig. 3) .

The project is for 3.5 years in total with the first 12 months to be spent intensively monitoring the river inputs and exchange of nutrients at the estuary mouth, then the team will look at sediment re-suspension studies and the role of phytoplankton in macronutrient cycling within the estuary.

The intensive monitoring programme will use a number of state of the art continuous monitoring techniques and modelling approaches. A similar arrangement to that used by the Demonstration Test Catchment sites is to be installed using YSI sondes and automated ISCO samplers to take regular water samples which can be later analysed in the laboratory. Lab on a chip technology (Fig. 4) is also to be used to obtain continuous nitrate/nitrite data. The plan is to produce an accurate assessment of the impact of nutrients entering the estuary during storm induced increased flows in the two rivers.

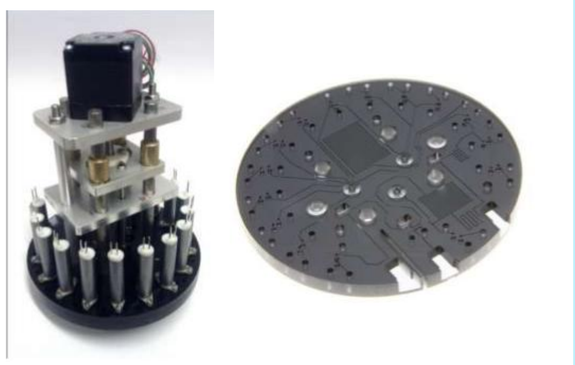

Figure 4: Lab on a chip nitrate/nitrite sensor using microfluidics

Figure 5: In-situ annular flume from Partrac Ltd

Sediment resuspension studies will then take place within the estuary using an *in-situ* annular flume (Fig. 5) which will simulate storm conditions at the sediment bed. These experiments will determine the effect of sediment resuspension on nutrient recycling within the estuary and will be performed on differing sediment types.

Stakeholders include DEFRA, the Environment Agency, Natural England, SembCorp Bournemouth Water and Wessex Water. Local end-users include the Christchurch Harbour Steering Group and we plan to work closely with the Hampshire Avon DTC group and the Hampshire Avon Catchment group to pool our knowledge of the area, data and ideas. **Contact: Fay.Couceiro@port.ac.uk**