

## Nutrients

The nutrient measurement programme within LOIS aimed to:

- provide data sets linking observations in the rivers, estuaries and the North Sea for the most important nutrients: phosphorus (soluble reactive and, in the rivers, total dissolved), nitrogen (nitrate, nitrite and ammonium plus ammonia) and silicon (silicate),
- provide seasonal and long-term information on the spatial and temporal variation of concentrations of these essential nutrients within the LOIS study area,
- generate reliable estimates of nutrient fluxes from the main rivers of the study area and investigate the influence of land use on nutrient levels,
- facilitate estimation of the fluxes and fate of nutrients in rivers, estuaries and coastal seas *via* classical analysis techniques and numerical simulations.

The LOIS nutrient monitoring programme has provided detailed information on the temporal variations of loads and concentrations of phosphorus, nitrogen and silicon in the LOIS rivers at locations immediately upstream of the tidal limits. In addition, a number of sites on the rivers Swale and Tweed were selected to provide information on the influence of catchment land use on nutrient concentrations and river water quality. During the same period, complementary measurements of dissolved nutrient concentrations were made in the tidal reaches of the Yorkshire Ouse and Humber estuary (March 1994 to December 1996). Nutrient data were also obtained within the North Sea coastal strip, between Berwick-on-Tweed and The Wash during 1993-1995 and within the Tweed estuary during 1996 -1997. These data will provide quantitative information on the seasonal transport of nutrients from land to coastal waters and the North Sea *via* rivers and their estuaries. Nutrient fluxes influence both chemical and biological conditions in the water, particularly dissolved oxygen and the growth of phytoplankton, benthic organisms and macrophytes. In the last fifty years, the river loads of phosphorous and nitrogen to the North Sea have increased by about five and seven-fold respectively, with concomitant effects that indicate of nutrient enrichment or eutrophication. The Humber rivers are a major source of nutrients into the North Sea. Riverine loads of total nitrogen to the Humber are ranked fourth on a European scale, with the estimated load being less than the Rhine, Elbe and Weser, but greater than the Scheldt, Ems, Thames and other major rivers on the north-east coast of Britain.

The Overview CD-ROM includes a selection of nutrient data provided by the programme from the rivers, the Humber and Ouse estuaries and the North Sea coastal strip. Other CD-ROMs will include more comprehensive outputs from the nutrient measurements, including data from the Tweed estuary.

The nutrient data illustrated are:

- measurements of nutrient concentrations in the LOIS river systems during the period 1994 - 1996 (**river water quality**),
- measurements of nutrient concentrations undertaken in the coastal strip from *Challenger* (1993) (**estuarine and coastal water quality**),
- measurements undertaken in the Humber and Ouse estuaries between March 1994 and December 1996 (**estuarine and coastal water quality**),
- measurements of nutrient concentrations taken along the S line in the Shelf Edge study area (**shelf edge water quality data from bottles**).

Also included are **river flow data** used in the calculation of loads.