Phytoplankton dynamics in feeder rivers of the Humber Estuary

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As part of the LOIS RACS(R) programme, phytoplankton growth and production dynamics in the feeder rivers to the Humber Estuary are being investigated. The project has 4 main objectives, namely:

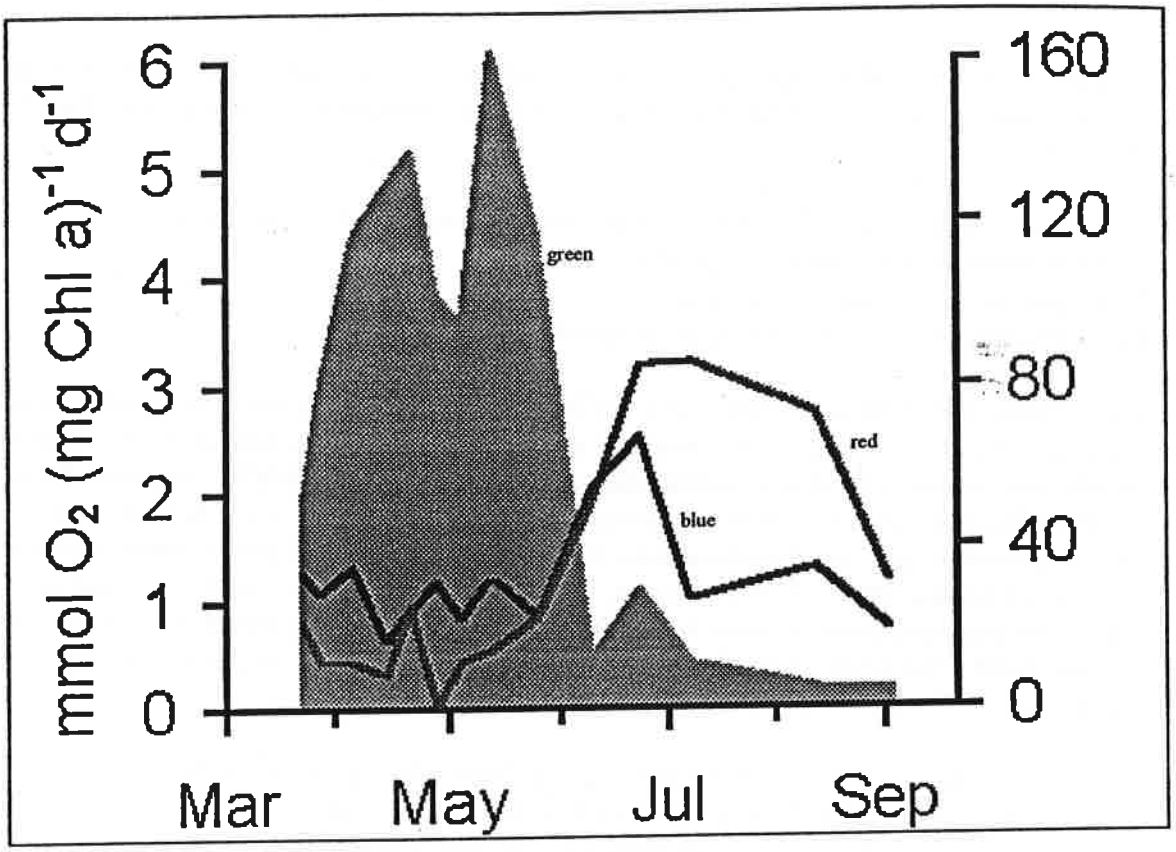
1) To quantify seasonal changes in phytoplankton biomass and composition.
2) To estimate *in situ* growth and production rates.
3) To quantify the major loss processes.
4) To develop models to predicting phytoplankton carbon flux.

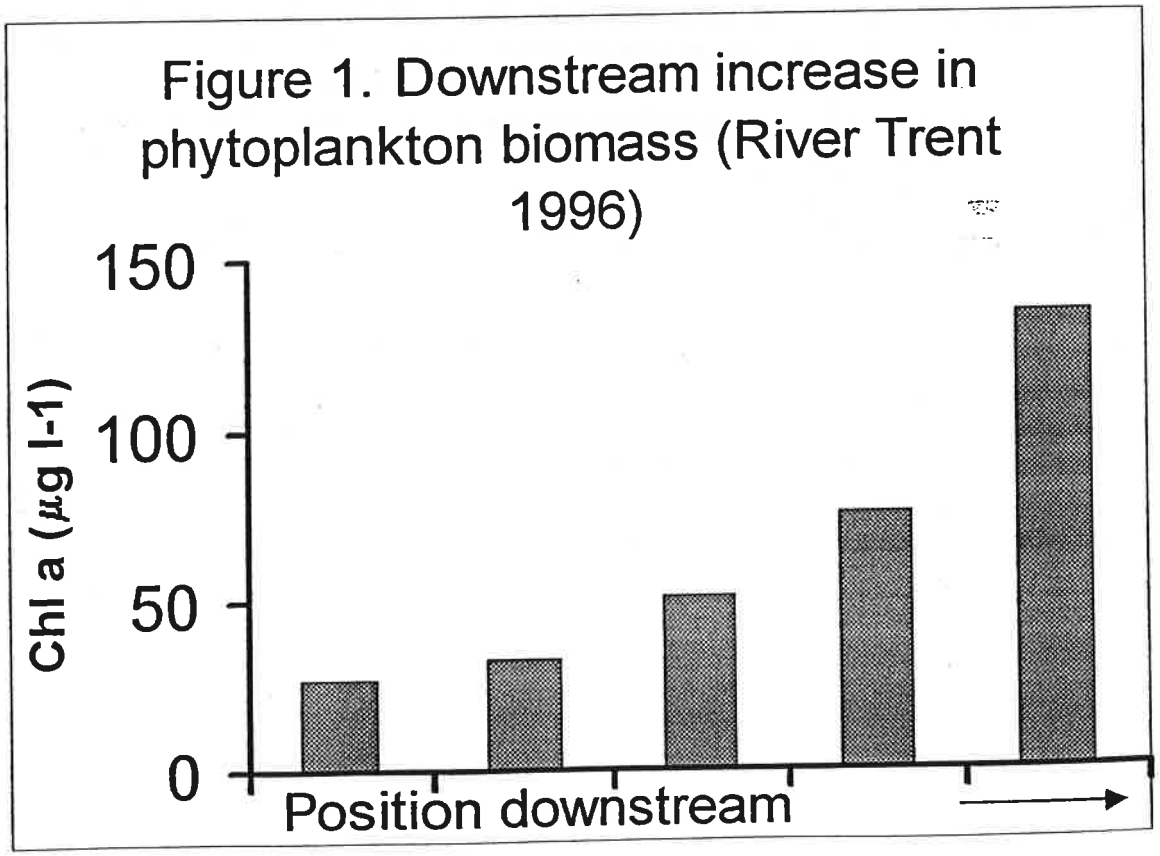
Both rivers, the Yorkshire Ouse and theTrent showed pronounced spring phytoplankton biomass peaks (c. 160 mg l^{-1} chlorophyll *a*) followed by a summer decline. The spring populations comprised mainly centric diatoms (main genus: *Cyclotella, Stephanodiscus* and *Cyclostephanos*) while green phytoplankton algae such as *Scenedesmus* spp., *Chlamydomonas* spp., and *Ankistrodesmus* spp. dominated the summer months. However, in the Trent sporadic centric diatom blooms occurred in summer, particularly at the upstream sites. The phytoplankton biomass of the Yorkshire Ouse was supplied mainly by the Rivers Ure and Nidd. The River Trent showed a progressive downstream increase in biomass due to growth within the river (Fig. 1).

Estimates of algal carbon flux were made using chlorophyll *a* and flow data provided by the LOIS team at York and a chlorophyll *a*:carbon ratio of 1:50 (g g^{-1}). During the period June 1995 - June 1996 the Rivers Ure and Nidd were the major sources of phytoplankton carbon to the Yorkshire Ouse. Calculated fluxes for the Yorkshire Ouse suggest that algal carbon was lost between the confluence of the feeder rivers and the tidal limit. The phytoplankton carbon flux in the Yorkshire Ouse was greatest in winter during the major flood events. In contrast, in the R. Trent peak phytoplankton carbon transport occurred in the spring despite low flow because large phytoplankton populations were able to develop. The annual flux of algal carbon to the Humber Estuary supplied by the R. Trent 1.7×10^9 g C $Yr.^{-1}$ This was 4 times greater than the algal carbon flux from the Yorkshire Ouse (0.4×10^9 g C $Yr.^{-1}$) illustrating the importance of the R. Trent in the export of phytoplankton carbon to the Estuary.

As of April 1996 *in situ* production rates were estimated for the tidal limits of the Rivers Yorkshire Ouse and Trent. Results were slightly higher than values recorded for other European rivers. Both the rates of production and respiration were controlled to some extent by temperature. Net productivity was only achieved during the spring biomass maximum while in summer, with increasing temperature, the system became heterotrophic (Fig. 2). This has lead to the hypothesis that under high temperatures the phytoplankton populations 'respire themselves away' in these relatively deep, turbid rivers.

Figure 2. Seasonality of biomass (green), primary production (blue) and respiration (red) - River Trent 1996





LOIS land-ocean interaction study

Land-Ocean Interaction Study

Second Annual Meeting
Hull

18 - 20 March 1997

Natural Environment Research Council

LOIS Publication No 323