Spatial and temporal changes in phytoplankton abundance in the upper and middle reaches of the River Severn

By C. S. Reynolds and M. S. Glaister

With 16 figures and 1 table in the text

Abstract

The results of a synoptic sampling programme, designed to determine broad features of the abundance and species composition of the suspended algae in a British river (Severn) and covering 13 stations down a 160-km length of its upper and middle reaches through a period of over one year, revealed several counter-intuitive aspects. Neither benthic algae washed into the flow nor inocula clearly introduced from standing waters in the fluvial catchment represented any major component of the suspended-algae fraction downstream, which was dominated by species (of Stephanodiscus, Navicula, Chlorella, Scenedesmus) believed to have been native to the river. Moreover, these algae showed temporal phases of wax and wane which are arguably regulated by local factors (depth, velocity) working on local populations rather than by homogeneous properties of the entire river on a single population moving downstream. Even in the case of growing populations increasing in concentration downstream, the change is frequently too great to be explained in terms of growth during bulk transport of the population at the mean fluvial velocity. On the other hand, intermediate hydraulic storage (in "dead-zones" of non-flowing water, now recognised to be widespread in occurrence), is argued to be capable of detaining sufficient algal-rich water for sufficient length of time for mutual fluid-exchange with the main flow to explain the downstream enhancement. The effect will become still more significant if the rate of growth of the algae is more rapid in the dead-water than in the flow.

Introduction

The ecology of river plankton is generally supposed to be less well-studied than that of lakes, reservoirs or of the seas. There is, in fact, a long history of documented investigations world-wide, including some classic research papers (Butcher 1924, Liepolt 1961, Greenberg 1964) and some excellent overviews (see, particularly, Gessner 1955, Hynes 1970, Whitton 1975). Nevertheless, while the structure of river plankton communities and the dominating influence of unidirectional flow in regulating their distribution and productivity are broadly understood, intuitive doubts persist about the origin and survival of planktonic populations, despite their constant tendency to be washed downstream (Reynolds 1988). Wawrik's (1962) view that the phytoplankton was native to be Danube,