The Water Framework Directive (WFD) requires Member States to review the environmental impact of human activity on the status of their water bodies (Article 5). As part of this review, information must be collected on the type and magnitude of significant pressures to which surface waters are exposed. Also, on the basis of the characteristics, or susceptibility, of water bodies to these pressures, an assessment must be carried out of the risk that water bodies will fail to meet the WFD’s objective of achieving ‘good status’.

This project’s aim was to develop a method to carry out the initial risk assessment for lakes, specifically in relation to nutrient pressures. Approaches of increasing sophistication were developed to assess the size of diffuse and point-source nutrient pressures. A nutrient classification for different lake types was produced to assess the impact of these pressures. Approaches to ecological classification for phytoplankton composition and abundance in lakes and slow-moving rivers were also developed, taking phytoplankton as the biological element most sensitive to nutrient pressures.

To develop the nutrient (total phosphorus (TP)) classification, reference conditions were determined first. Five approaches to identify site-specific reference conditions were examined and reference conditions specific to each lake ecotype developed for risk assessment. The analysis highlighted distinct differences between different lake types – the lowest reference TP concentrations were determined for deep, low alkalinity lakes whereas the highest were for very shallow high alkalinity lakes.

TP concentrations were derived for boundary values of the five WFD status classes (high, good, moderate, poor, bad) for each lake ecotype, with the good–moderate boundary set to represent a doubling of reference concentrations. Any sites observed or predicted to have TP concentrations higher than this boundary would be considered as not achieving good status (i.e., at risk of failing the WFD quality objectives).

Relationships between observed in-lake concentrations of TP and phytoplankton chlorophyll_a were explored for each lake ecotype, to develop an appropriate classification for phytoplankton abundance. In general, there was no significant difference in the response between different lake ecotypes, either in relation to depth or alkalinity type. A TP–chlorophyll_a relationship specific to all Great Britain (GB) lakes was calculated, potentially to derive chlorophyll_a reference conditions. Alternative approaches to developing chlorophyll targets for lake types, independent of TP, were also developed, but require further development and validation before they can be applied to risk assessment.

A novel approach to an ecological classification of the phytoplankton community structure was developed using phytoplankton functional groups. Morphological or physiological characteristics of phytoplankton taxa were used to populate the phytoplankton functional groups. This project developed probabilities for the occurrence of these functional groups in different lake and river types with increasing trophic status at different times of the year or, for rivers, in different flow regimes. A WFD-style assessment of ecological status is possible by comparing the similarity of observed phytoplankton assemblages with that of a pre-determined reference assemblage. This approach applied to Windermere suggests that the phytoplankton classification effectively represents the changing ecological impact associated with changing nutrient loading to the lake. The classification structure and its application to a number of lake ecotypes, however, must be validated more widely before it can be adopted nationally for WFD purposes.

The assessment of P pressures from point sources considered three types: sewage treatment works (STWs), septic tanks and cage fish farms. Inputs from the first were thought to be relatively well understood, but a review of the methods and data available showed this not to be so. The numbers of people served by STWs are poorly known (only design capacity is readily available), and also...
the P export coefficients for humans after sewage treatment are not well defined. The TP load from septic tanks is also difficult to evaluate separately from that which emanates from STWs because the number, location and level of maintenance of private septic tanks is unknown. Given these uncertainties, an average TP export coefficient value for humans is recommended for the initial risk assessment, applicable to either secondary sewage treatment or treatment through a septic tank system. The TP load from fish farms can be assessed for locations where the type of fish cultured and the annual tonnage produced are known. At present, these(7,8),(992,992)...