

# Evidence

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## The ecological classification of UK rivers using aquatic macrophytes

Project summary SC010080/S1

The EU Water Framework Directive (WFD) requires us to assess the ecological status of water bodies so that we can take action to protect and improve them. The work described here developed and tested a tool to classify rivers in the UK using aquatic macrophyte survey data. Macrophytes are water plants that are visible to the naked eye and this classification tool will be used alongside other techniques by Environment Agency staff to determine the ecological quality of our rivers.

The full report provides details of the scientific work underpinning the tool (it is not a user manual). It will be of interest to academics working in similar fields and practitioners implementing the classification requirements of the WFD in the UK and other EU member states.

Development of the tool followed a number of steps:

- collating existing data
- devising river survey methods
- defining river types and identifying macrophyte metrics (measures),
- screening of reference sites,
- modelling the biology expected under reference conditions
- establishing an ecological basis for class boundaries
- assessing the uncertainty associated with each water body classification.

Macrophyte survey data were collated from a range of sources but most data were provided by the UK conservation agencies and the Environment Agency. Over 6,500 surveys were collated, covering much of the UK river network. Survey data for each water body were matched to basic environmental and pressure data, covering nutrient chemistry, catchment land cover, physical habitat modification and river flow.

The UK river network was stratified into 16 types on the basis of two environmental variables (alkalinity and slope) that have a strong influence on river macrophyte community composition and productivity.

A subdivision of high-alkalinity rivers was required to separate those on hard, naturally infertile geologies in the north and west from those on easily weathered geologies in the south and east of Britain.

Metrics reflecting the composition (River Macrophyte Nutrient Index, RMNI), richness (numbers of hydrophyte taxa and hydrophyte functional groups) and abundance (cover of green filamentous algae) of vegetation were developed. Relationships between these metrics and various man-made pressures were assessed to test their usefulness. Individual metrics were sensitive to different pressures but they were best used collectively to indicate the general status of a river.

Ecological status is assessed by the deviation of survey sites from minimally impacted reference conditions. Reference sites were established by screening site environmental and macrophyte data and modelling their relationships to identify sites with minimal pressures and impacts.

The observed macrophyte metrics in test sites were expressed relative to values expected in reference sites in the form of an Ecological Quality Ratio (EQR). The class boundaries were aligned with WFD quality status definitions based on the sensitivity of a species to eutrophication (raised levels of nutrients). Statistical approaches were used to set class boundaries. A rule based-approach was developed to combine results from the different macrophyte metrics.

A range of case studies are provided in the report to illustrate the large-scale geographical distribution of water bodies by type, to assess longitudinal changes in EQR in major UK rivers, and to assess the ecological status of rivers specially designated for their aquatic vegetation.

This summary relates to information from Project SC010080/R1, reported in detail in the following output:

**Report:** SC010080/R1

**Title:** The ecological classification of UK rivers using aquatic macrophytes

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