Article

Assessing the status of marl lakes under the European Union Water Framework Directive – insights from contemporary and palaeolimnological studies of three English lakes

Emma Wiik[1, 2], Helen Bennion[2], Carl D. Sayer[2] and **Stewart J. Clarke[3]**

With 5 figures and 2 tables

Abstract: Methods for ecological status assessment of high-alkalinity lakes under the Water Framework Directive (WFD) differ between continental Europe and the UK. In the UK, marl lakes, i.e. carbonate-precipitating lakes, are placed in a separate category in which metrics account for the naturally low phosphorus content and sensitive macrophyte communities found therein. If this separation is appropriate, the UK method, which applies a correction factor for stricter assessment of marl lakes, should assess ecological status more effectively. Using contemporary macrophyte and chlorophyll-*a* data, this supposition was assessed for three English lakes by calculating ecological status with and without the correction factor. The veracity of the results was assessed using palaeolimnological and historical surveys. Further, the potential of macrophyte maximum colonisation depth (C_{max}) as an additional metric was investigated. For two lakes, the status suggested by historical-palaeolimnological data was poorer (Moderate) than that suggested by WFD classification, both with and without the correction factor (Good and/or High). This has important implications as restoration is required only for water bodies classed below Good. For the third lake, for which high chlorophyll-*a* resulted in Poor status in agreement with historical-palaeolimnological data, the discrepancy between the macrophyte metrics with and without the correction factor was considerable (Poor, Moderate, respectively). The results suggest that a separate marl lake category is warranted and may be advisable for other Member States in continental Europe. Importantly, status was higher than recommended for the two lakes close to the Good/Moderate boundary even with the correction factor. This leads us to recommend more studies be undertaken on eutrophication responses of marl lakes. In lakes where macrophyte species composition varies with water depth, eutrophication is apparent through reductions in C_{max} especially of Characeae and Potamogetonaceae. C_{max} is simple to measure and may much improve the reliability of marl lake assessment.

Key words: Ecological status, biodiversity, WFD, macrophytes, algae, nutrient enrichment, Characeae, Potamogetonaceae.

Introduction

Marl lakes, high-alkalinity lakes that precipitate carbonates, exist across Europe (Krienitz et al. 1996, Krolikowska 1997, Hargeby et al. 2007, Istvánovics et al. 2008, Ludovisi & Gaino 2010). They are considered an important habitat type from a nature conservation perspective and are recognised and protected under the European Union (EU) Habitats Directive as habitat type H3140 – "Hard oligomesotrophic waters with

Author's address:

[1] Geography Department, Loughborough University, Loughborough LE11 3TU, UK

* Corresponding author; e.wiik@ucl.ac.uk

[2] Environmental Change Research Centre, Department of Geography, University College London, Gower Street, WC1E 6BT, UK

[3] Natural England, Suite D, Unex House, Bourges Boulevard, Peterborough, PE1 1NG, UK