

Preface: ‘Quantitative ecological responses for the Water Framework Directive related to eutrophication and acidification of European lakes’

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This special issue of *Aquatic Ecology* presents most of the results on lakes from the EU FP6 project REBECCA, “Relationships between ecological and chemical status of surface waters”, that were obtained during the project period 2004 to 2007. The REBECCA project has been funded by the EU Commission DG Research (Contract no. SSPI-CT-2003-502158), and was also supported by national research funds and partner institutions. The objective of REBECCA has been to provide scientific support for the implementation of the EU Water Framework Directive (WFD) (EC 2000). Knowledge on relationships between the biological and physico-chemical properties of surface waters is a prerequisite for a successful implementation of the WFD, because dose-response relationships are needed to enable the management of catchments and to ensure that water bodies will achieve the ecological objective. This objective is defined as good ecological status for a given type of water body, and it is therefore essential to identify the boundary between good and moderate ecological status. More information about the

REBECCA project is available at the project website: www.environment.fi/syke/rebecca.

The production of papers for this Special issue of *Aquatic Ecology* started in May 2006 with a fruitful and pleasant workshop that took place in a beautiful, ancient monastery at the shore of Lago di Como in Varenna, Northern Italy, kindly organised by Gianni Tartari at IRSA, CNR, Italy. The spirit and enthusiasm created at this workshop, as well as the beautiful surroundings and inspiring discussions, have been the basis for the commitment of all authors to complete the articles included here. It is a great pleasure to see that our common efforts have now finally reached its goal.

Most of the results presented in this Special issue of *Aquatic Ecology* were also discussed at the REBECCA final conference in Oslo, Norway, in May, 2007 that was organised by the Norwegian Institute for Water Research (NIVA) (Norway), Finnish Environment Institute (Finland) and the Centre for Ecology and Hydrology (UK). Since REBECCA has been a policy support project, dissemination of preliminary results to water managers has also been done during the project period at annual meetings, as deliverables available at the project website, as well as at the regular workshops of the ECOSTAT working group that is responsible for the WFD-required intercalibration of classification systems for assessment of ecological status in surface waters. The articles in this issue are, however, the only scientific publications of these results, providing

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more analytical details and scientific discussions than have been possible through other dissemination channels used during the project. Through this joint publication of most of the results, our aspiration is that the results will be communicated as a coherent package of information to the wider scientific world. We also hope these results will contribute to an improved understanding of European lake ecosystems and their behaviour when exposed to widely occurring human pressures.

The results are based on a compilation of data from >5000 European lakes from 20 countries into large common databases for the different biological groups of organisms, including also physico-chemical data, and analyses of these data using a variety of statistical and modelling techniques, especially regressions and multivariate methods.

The main output from these articles is the identification and evaluation of ecological indicators for different biological groups of organisms and the quantification of their responses to two main pressures affecting European lakes: eutrophication and acidification. The REBECCA work on lakes focuses on these pressures, due to availability of ecological monitoring data from a large number of lakes representing many different lake types in Europe. Some of the thresholds often detected in the response curves have already been applied by water managers and experts to set type-specific boundaries between good and moderate ecological status, which is the WFD environmental objective.

The following set of papers from the REBECCA work on lakes is included, as well as one closely linked paper on the intercalibration of assessment systems for aquatic macrophytes:

- One paper on the construction and content of REBECCA databases, providing the overview of the amount and structure of the data available for analyses: Moe et al.
- Three papers on phytoplankton responses to eutrophication:
 - Reference conditions for chlorophyll in the absence of eutrophication pressure, providing the baseline for the classification systems: Carvalho et al.
 - Regressions between chlorophyll and nutrients (phosphorus and nitrogen): Phillips et al.
 - Responses of three major class level indicators of phytoplankton composition along the trophic gradient: chrysophytes, pennate diatoms and cyanobacteria: Ptacnik et al.
- Three papers on aquatic macrophyte responses to eutrophication:
 - Identifying sensitive and tolerant indicator species of macrophytes: Penning et al. a.
 - Testing the performance of existing macrophyte community indices: Penning et al. b.
 - Comparing macrophyte indicator species and indices used for intercalibration of classification systems: Toth et al.
- Two papers on responses of macroinvertebrates:
 - Responses of macroinvertebrates to eutrophication, including identification and evaluation of indicator species and existing indices developed for rivers: O'Toole et al.
 - Responses of macroinvertebrates to acidification, including evaluation of existing indices developed for rivers and development and testing of new lake-specific species-based indicators: Schartau et al.
- One paper on response of fish to acidification, evaluating the impact of humic substances on the threshold for brown trout survival: Hesthagen et al.
- Synthesis paper integrating the main conclusions from all the articles, focusing on the thresholds identified in the dose-response relationships, linking them to theoretical ecology and pointing out their applicability for the implementation of the WFD: Lyche Solheim et al.

In total, this issue contains eleven papers. We appreciate the inputs of the many reviewers who provided constructive comments during the evaluation and contributing to improved quality of the different manuscripts. Each paper was sent to two reviewers and in most cases a second review cycle was needed. We both acted as Guest Editors for the manuscripts. We hope that these results will provide better insight into the dynamic behaviour of aquatic ecosystems across Europe, and that the results will be used to further support the intercalibration of classification systems, and to support a more sustainable

water management in Europe in the near future in compliance with the Water Framework Directive.

The first editor likes to thank her colleague Dr. Jannicke Moe, whose tremendous and continuous efforts in compiling and managing the REBECCA databases for lakes provided the best possible basis for all this work. Finally, last but not the least, Dr. Seppo Rekolainen, the coordinator of the whole REBECCA project, is greatly acknowledged for 4 years of pleasant and fruitful collaboration to improve the knowledgebase for WFD implementation.

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Reference

European Commission (2000) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 of establishing a framework for community action in the field of water policy