



Application of a hydrodynamic and ecological model for Lake Ravn

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English Summary

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SUMMARY

Lake Ravn is a deep (maximum depth 33 meters) lake stratifying in the summer time. In warm periods the lake is often subjected to blooms of very poisonous bluegreen algae. Since 1989 there has been a significant ($P < 0,001$) reduction of the mean P-inlet concentration mainly due to improved waste water purification.

Ecological model

A one-dimensional hydrodynamic and ecological model was set up for Lake Ravn. The model describes the oxygen and nutrient balance in the lake together with some biological variables, such as specific dominating phytoplankton and zoo-plankton.

The applied modelling system, DYRESM-CAEDYM, is one of the most complex deterministic modelling systems developed for lake modelling in the world. Even though the calibration and validation results for Lake Ravn show, that there are still parts of the modelling system, which could be further developed, it appeared that the model set up for the Lake was able to describe the seasonal dynamics of central chemical and biological variables in a satisfactory way.

It is therefore assessed that the model is suitable for predictions of ecological status of the lake under various scenarios of external nutrient load. Data on phytoplankton biomass (carbon weight) were used to model a chlorophyll concentration reflecting the true phytoplankton biomass, since chlorophyll is one of the present EU-intercalibrated indicators of ecological status in lakes.

The most important results from the model scenarios with varying nutrient load is shown in Table 1.

Table 1. Required reduction in nutrient load to Lake Ravn, in order to meet the WFD requirement of single parameters.

Parameter	Required reduction in P-load in order to obtain the average status in the summer period, as required by the WFD
Total P-conc.	10 – 15 %
Chlorophyll	40 – 50 %
Secchi depth	75 – 90 %
Parameter	Required reduction in N-load in order to obtain the average status in the summer period, as required by the WFD
Total N-conc.	75 %

It should be noted that when the final EU-intercalibration is presented, it may not be all parameters (but for example 80%), which shall meet the WFD-requirements in order to obtain the classification of “good ecological status”.

Based on the model scenarios it was concluded, that a 40-50 % reduction in the P-load would result in summer concentrations of both total P and chlorophyll in the lake that meet the WFD requirement. This is expected to have an affect on secchi depth also, but the WFD-requirement for the secchi depth may not be fulfilled every year.

The model scenarios also show that the N-load should be reduced by at least 75 % to meet the WFD requirement regarding N-concentration in the summer period.