

Abstract

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Title

Rapid ensemble modelling of cyanobacteria and geosmin, evaluating changes in management

Description

Cyanobacterial growth may degrade water quality by producing toxins and taste and odour compounds. Therefore, the concentrations of cyanobacterial metabolites in source water should be characterised so that water can be treated to appropriate standards. However, when there are significant changes in the management of cyanobacteria, for example through changes in algaecide use, predicting source water characteristics is challenging as historical observations of cyanobacterial abundance are not necessarily applicable.

To address this challenge, mesocosm experiments and modelling approaches have had varying degrees of success. But these approaches can be time-consuming and large uncertainties remain in predicting source water characteristics, both of which become a barrier to informed decision making under tight deadlines. Consequently, there is a need for rapid assessments that provide both confidence in predictions and recognition of uncertainties.

In this research, a framework was implemented to generate 10-year synthetic time series of *Dolichospermum circinale* and geosmin concentrations in source water. The framework incorporated multiple statistical and conceptual models to provide confidence in predictions; and used probabilistic methods to characterise uncertainties. The models were driven by climatic conditions (solar radiation and temperature) and nutrient levels (phosphorus). Three methods of geosmin prediction were compared, including, a purely statistical non-linear regression, a cell quota-based method, and a conceptual model that applied mass-balance principles and first order production and loss kinetics.

The framework was implemented to assess *D. circinale* numbers at Happy Valley Reservoir should algaecide dosing cease and indicated that *Dolichospermum* cell counts would sporadically exceed 20,000 cells, which is a proposed threshold for managing recreation at the site. Probability of exceedance curves for geosmin were produced which supported the design of treatment plant upgrades and provided confidence that product water aesthetic improvements could be achieved.