# WATER QUALITY MODELING IN KOTMALE RESERVOIR

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Kotmale reservoir is the uppermost reservoir in the Mahaweli water resource development scheme in Sri Lanka. Though hydro-energy generation is its prime purpose, it acts as a storage reservoir in the satisfaction of downstream irrigation water requirements, too. Its total storage capacity is about $172x10^6m^3$ while the height of the dam is about 87m. The Kotmale reservoir faced several water quality related problems in the recent past. During a severe drought in 1991, the reservoir water level dropped and a thick bloom of Microcystic aeruginosa was observed in the upstream region. This shifted towards the dam due to wind action covering the whole surface of the reservoir This paper presents modeling of water quality in the Kotmale reservoir to predict water quality in it, which enables taking precautionary measures in such situations. The collection of water quality data within a reservoir is very expensive and therefore, the ability to predict water quality, by a model would be very valuable.

A coupled hydrodynamic-water quality model, DYRESM-CAEDYM, was calibrated and validated for the Kotmale reservoir. The component, DYRESM is a one-dimensional hydrodynamic model for predicting the vertical distribution of temperature, salinity and density in lakes and reservoirs. The other component, CAEDYM is a complex ecological model containing process descriptions of primary production, secondary production, nutrient and metal cycling, oxygen dynamics and the movement of sediment. DYRESM-CAEDYM couples these two models, resulting in a powerful tool to investigate the interactions between physics, chemistry and biology in aquatic ecosystems. The model requires a series of input data that include the meteorological conditions (air temperature, relative humidity, wind velocity, solar radiation, rainfall, evaporation), inflow quantity, inflow quality and outflow quantity over the period of simulation in addition to initial vertical distribution of all the simulated state variables.

The model DYRESM-CAEDYM was able to predict water quality in the reservoir and released from the reservoir. The model was configured to simulate water level, temperature, salinity, density and 5 water-quality constituents (DO, $NO_3$, $NH_4$, $PO_4$, pH). The model reasonably reproduced the seasonal and spatial patterns of water-temperature, dissolved oxygen, nitrate, ammonia, orthophosphorus and pH.

To predict reservoir water quality, the model needs only the inflow water quality, which can be measured easily and inexpensively. If adverse water quality conditions are predicted, precautionary measures that could be taken can be studied with the help of the model. The calibrated model is a useful tool to manage the Kotmale reservoir to avoid adverse water quality conditions in the reservoir as well as supplied from it.

*National Science Foundation, Sri Lanka for providing financial assistance through its research grant RG 2001/E01, Mahaweli Authority for providing data and Centre for Water research, University of Western Australia for providing the DYRESM model are greatly acknowledged.*