PERIPHYTON AND WATER QUALITY IN THE MANAWATU RIVER, NEW ZEALAND

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ABSTRACT

The factors responsible for the establishment and summer proliferation of attached filamentous algae in the Manawatu River were investigated. The life cycle of the dominant alga *Cladophora* was observed to be closely linked with the seasonal river and climatic changes. The magnitude and frequency of flush events were the major factors responsible for reducing the attached algal biomass. During steady low flow conditions, the results of phosphorus nutrient availability tests demonstrated that phosphorus availability frequently limited the growth rate of the *Cladophora* proliferations. The concentration of dissolved reactive phosphorus during these periods was 3-4 mg P m^{-3}. Dissolved inorganic nitrogen concentrations during steady low flow conditions were low, compared to overseas rivers that experienced similar filamentous algal proliferations, and the results of nitrogen nutrient availability tests never indicated nitrogen limitation of the *Cladophora* growth rate.

The water quality effects of these proliferations were also investigated. The two effects monitored were; diurnal fluctuations of Dissolved Oxygen (DO) and pH. These could become quite severe and consequently affect the river's ability to adequately assimilate effluent discharges from Palmerston North and its associated food industries. Of the two algal-induced fluctuations, DO was the more important. Frequently, maximum daily DO deficits (DOD_ms) of 3.0 g m^{-3} were observed and these severely limited the river's ability to satisfy the oxygen demands of all discharges while maintaining the minimum desirable DO concentration.

A regression equation was developed using the data from both the 1981/82 and 1982/83 seasons to predict the daily DOD_m. The largest contribution to the total predicted DOD_m was from the total river community respiration followed by a seasonal effect, the river flow, the regression constant and the terrestrial insolation. The regression equation accounted for 72% of the observed variation in the daily DOD_m during the two seasons.

Fluctuations in the pH of the Manawatu River were also important, as a component of the effluent discharges is ammonia, the toxicity of which increases exponentially with a linear rise in pH. However, algal-induced pH fluctuations were reduced downstream of the discharges by bacterial respiration associated with the oxygen-demanding effluents. This phenomenon and the timing of both pH and ammonia fluctuations meant that toxic concentrations were not observed, although the temporal variation of ammonia was often erratic. However, future discharge changes may alter this situation, and continued surveillance of downstream pH and ammonia is warranted.

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