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Factors Affecting Growth of Cyanobacteria in Malpas Dam:



Causes and Consequences

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I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

Robert Woods

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Executive Summary

Blooms of cyanobacteria in Malpas Dam, a small reservoir on the New England Tablelands of NSW have been a recurrent aspect of the hydrological cycle in the dam since its construction in 1968. Specific concerns regarding their ability to produce toxins and their direct impact on various other aspects of water quality such as dissolved oxygen levels have made the management of cyanobacteria in the dam a prime objective for Armidale Dumaresq Shire Council (ADSC), the management body responsible for the dam.

The general causes of cyanobacteria blooms in freshwater are widely understood however for each locality the exact combination of these factors can vary. In Malpas Dam previous research has indicated that the dam is eutrophic and regularly suffers from thermal and oxygen stratification, factors which are commonly the controlling influences on the establishment of cyanobacteria blooms. However the specific conditions which facilitate the growth of cyanobacteria in the dam remained a mystery.

The research contained in this report includes the assessment of a range of water quality parameters in the dam and relates those to the establishment of cyanobacteria colonies. Further monitoring of catchment inputs to the dam was also performed and the influence these have on conditions in the dam in respect to cyanobacteria growth were evaluated.

Monitoring of dam water quality parameters was undertaken from January 1998 to July 1999 at a Site 1 near to the offtake point from the dam. Parameters measured included: Ortho-phosphorus, total oxidized nitrogen, turbidity, Chlorophyll-*a*, water temperature, dissolved oxygen concentration, secchi depth and algal counts and identification.

It was found that although there were numerous medium to strong relationships between these variables, the growth of cyanobacteria was limited to periods when the mean water column water temperature was between 14-20°C and the mean water column turbidity

did not exceed 6NTU. The range of water temperatures identified here extends from October to June and represent the window during which blooms may occur. Nutrients were abundant ($>50\mu\text{g/L}$ TON and $>20\mu\text{g/L}$ Ortho-P) during the entire monitoring period.

The influence that turbidity has on cyanobacteria will be dependant on the timing of increased turbidity levels. The major controlling force for this is the occurrence of significant rainfall events in the Malpas Catchment. From the monitoring carried out at 'Willow Glen' station on the Gara River it was determined that rainfall events greater than 8mm/Day resulted in a significant increase in turbidity and nutrient levels in discharge. This condition represents a threshold at which catchment inputs have the potential to influence in-dam water quality.

The response of dam water quality at Site 1 to catchment inputs was reliant on the overall magnitude of rainfall events. Events which contributed greater than 2000ML impacted at Site 1 less than 10 days after first entering the dam. The effects of events less than this tended to be buffered by the shallow elongated region extending from Gara River inlet to the main body of the dam and did not show any obvious presence at Site 1.

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