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" The work described in this thesis was carried out by me under the supervision of Dr. (Mrs) Swarna Piyasiri and a report on this has not been submitted to any university for another degree."

N.M.P. perera

"I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation."

Swarna Piyasiri ..... 05/11/98.

Dr (Mrs) Swarna Piyasiri

Fish plankton interactions and controlling *Microcystis* blooms in the Kotmale reservoir

By

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Fish plankton interactions and controlling *Microcystis* blooms in the Kotmale reservoir

N.M.P. Perera

ABSTRACT

Kotmale reservoir is the uppermost impoundment of Sri Lanka, which was constructed in 1985 under the Accelerated Mahaweli Programme, for the main purpose of hydroelectric power generation.

The quality of the reservoir water has been investigated since 1987 and these results indicated that the reservoir is very sensitive towards eutrophication. The appearance of a thick *Microcystis aeruginosa* bloom in 1991, even at high flow-through rates, indicated the intensity of the eutrophication process.

The scope of the present investigation was to analyze the types of fish plankton interactions in the reservoir and to find out the possibility of using this information in controlling *Microcystis* blooms during extremely heavy blooming conditions.

The field investigations carried out in the Kotmale reservoir, from March 1994 to April 1996, which include the plankton, fish and physiochemical properties of the reservoir water.

To find out the rate of consumption of algal blooms by *Oreochromis* hybrids, feeding rate experiments were conducted in Beira Lake. (It was not possible to conduct this experiment in Kotmale reservoir, as the bloom was not a permanent situation in the impoundment).

99% of the total plankton biomass of the reservoir was made up of phytoplankton. Out of this , Chlorophyceae was the most abundant with *Staurastrum species* forming the prominent phytoplankton of the reservoir. There was a seasonal variation in the major phytoplankton types, which correlated with the water level fluctuation of the impoundment. For most part of the year *Staurastrum* species dominated the reservoir water, while after the drought (April - June), *Microcystis aeruginosa* became the prominent phytoplankton, particularly in the upstream regions.

Filamentous diatom, *Melosira granulata* and the dinoflagellate, *Peridinium cinctum* also formed an important part of the phytoplankton community, but did not show a contrast periodic appearance like the *Microcystis aeruginosa.*

The zooplankton was made up of copeopods, cladocerans and rotifers, but their influence on the phytoplankton community cannot be a major importance (grazing pressure) as the majority of zooplankton were small in size. All the zooplankton species recorded can be considered as typical tropical forms.

The fish community of the reservoir was dominated by *Oreochromis* hybrids (*O.niloticus* and *O.mossambicus*) which was made up of 80% of the commercial fish catch. These hybrids interacted with the plankton community of the reservoir throughout their life cycle. Fingerlings preferred, larger zooplankton like the cladocerans while the adults preferred phytoplankton. When the reservoir water level was high, they fed on sedimented diatoms and detritus, while they positively

selected *Microcystis aeruginosa* and *Peridinium cincturm*, when these plankton became plentiful in the environment.

The fish showed a diurnal feeding pattern, with a maximum food intake between 12 to 18 00 hours. Microscopic analysis of cultured gut contents showed that they could digest most of the algae taken in. The pH of the stomach dropped below 2, indicating that the fish is capable of breaking down the cell walls of *Microcystis* and other algae. Investigations in the Beira Lake indicated that *Oreochromis* hybrids (size class; 15-20 cm), in the intense feeding time can eat 5.178 $\pm$ 4.52 g (wet weight) of food, or it has taken in 2.49 $\pm$ 1.9 g of food for 100 g of its bodies wet weight.

The above results, indicate, that the use of *Oreochromis* hybrids to control *Microcystis* blooms in the Kotmale reservoir is possible, as the fish filter out the algae, converting it directly to fish flesh which can be readily harvested out of the water body. This short phytoplankton-herbivorous fish food chain is one of the most productive ways to get rid of excess nutrients.