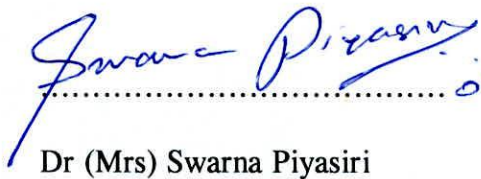


“ The work described in this thesis was carried out by me under the supervision of Dr. (Mrs) Swarna Piyasiri and a report on this has not been submitted to any university for another degree.”

A handwritten signature in black ink, appearing to read 'N.M.P. perera', written over a dotted horizontal line. The signature is fluid and cursive, with a long horizontal stroke extending to the right.

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.”

 05/11/98 .

Dr (Mrs) Swarna Piyasiri

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

By

**Nishanthi Marian Priyanka Perera**

Thesis submitted to the University of Sri Jayewardenapura for the award of  
the degree of Master of Philosophy in Limnology on 05<sup>th</sup> November 1998.

## Table of contents

	Page numbers
<b>CHAPTER 1 - INTRODUCTION</b>	
1.0 History of Sri Lankan reservoir	1-2
1.1 Kotmale reservoir	
1.1.0 The location	3-3
1.1.1 Construction and morphometric features of the reservoir	3-5
1.1.2 The hydrology of the catchment	6-6
1.1.3 The Ecology of the reservoir and its catchment	6-8
1.1.4 The aquatic environment	
1.1.4.1 Physico chemical properties of the reservoir water	9-9
1.1.4.2 Biotic factors	
(I) The plankton	10-10
(II) The fishery of the reservoir	10-11
1.1.5 Eutrophication and <i>Microcystis</i> bloom problem of the reservoir	12-14
1.2 Objectives	14-15
<b>CHAPTER 2 - LITERATURE SURVEY</b>	
2.0 Reservoir ecosystem	16-16
2.1 Eutrophication	16-18
2.2 Phytoplankton blooms	18-19
2.2.1 Dominance of Cyanobacteria	19-20

2.3 The biotic impact of eutrophication	
2.3.1 The negative impact and some of the methods used to control eutrophication.	20-21
2.3.2 The positive impact	22-23
2.4 Fish plankton interactions and bloom control	
2.4.1 Fish zooplankton relationships in controlling the phytoplankton	23-26
2.4.2 Phytoplankton control by herbivorous fish	26-27
2.4.2.1. Fish plankton interactions that can control <i>Microcystis</i> blooms	27-29

### **CHAPTER 3 - METHODOLOGY**

3.1 Field investigations at the Kotmale reservoir.	
3.1.1 Determination of physical and chemical properties of the reservoir water.	30-32
3.1.2 Determination of plankton dynamics of the reservoir water.	33-34
3.1.3 Fish plankton interactions (Gut content analysis of the fishes)	34-35
3.1.4 Digestibility of <i>Microcystis</i> and other plankton	35-36
3.1.5 Peak feeding hours of the <i>Oreochromis</i> hybrids.	36-38
3.2 Determination of the feeding rates of the <i>Oreochromis</i> hybrids at the Beira Lake	36-40

### **CHAPTER 4 - RESULTS**

4.1 Physiochemical characteristics of the reservoir during the study.	
4.1.1 Water level fluctuation.	41-46
4.1.2 The temperature and pH	47-47

4.1.3	The Secchi depth and the euphotic limit.	47-49
4.1.4	Conductivity, dissolved oxygen and nitrates	49-49
4.2	Plankton dynamics in the reservoir	
4.2.1	Community structure and population dynamics of phytoplankton	
4.2.1.1.	Species composition and abundance.	50-55
4.2.1.2	Seasonal variation of the phytoplankton.	55-57
4.2.1.3	Spatial distribution of the phytoplankton	57-60
4.2.1.4	Temporal distribution of the phytoplankton	60-63
4.2.2.	The zooplankton	
4.2.2.1	Species composition.	64-67
4.2.2.2	Seasonal variation	67-69
4.2.2.3	Spatial distribution of zooplankton	69-72
4.2.2.4	Diurnal vertical migration	73-76
4.2.3	Phyto and zooplankton interactions	73-77
4.3	Fish fauna of the Kotmale reservoir	
4.3.1	The species composition	78-81
4.3.2	size and weight class distribution	81-84
4.3.3	Habitat preference	85-86
4.4	Feeding habits (fish plankton interactions) and the food web structure of the Kotmale reservoir.	
4.4.1	Feeding habits of fishes	
4.4.1.1	Macrophyte and detritus feeders	87-89

4.4.1.2. Phytoplankton selection	90-94
4.4.1.3. The zooplankton feeders	94-98
4.4.2 Digestibility of food items	98-99
4.4.3 Food web structure of the Kotmale reservoir.	100-101
4.4.4 Diurnal feeding patterns of <i>Oreochromis</i> hybrids	
4.4.4.1 Feeding intensity	102-108
4.4.4.2 pH and food	109-111
4.5 Feeding rates of <i>Oreochromis</i> hybrids ( experiments conducted at the Beira lake	112-114
<b>CHAPTER 5 - DISCUSSION</b>	
5.0 Introduction	115-115
5.1 Physiochemical properties of the reservoir	116-118
5.2 Plankton	
5.2.1 Species composition	118-120
5.2.2 Seasonal variation	120-123
5.2.3 Spatial and diurnal distribution	123-125
5.3 Species composition of fish	125-127
5.4 Food web structure	127-130
5.5 Feeding habits of <i>Oreochromis</i> hybrids	130-132
5.6 The pH variation and the digestibility of food items by tilapias	132-134
5.7 Intense feeding hours of <i>Oreochromis</i> hybrids	134-135

5.8 The possibility of top down control of <i>Microcystis</i> by using <i>Oreochromis</i> hybrids at the Kotmale reservoir	135-137
6. <b>Conclusions</b>	138-139
7. <b>References</b>	140-158

### Figure captions

No.	Contents	Page
1.	The Accelerated Mahaweli Programme of Sri Lanka.	2
2.	The Kotmale reservoir and its surrounding area.	4
3.	Location of the Kotmale reservoir and sampling stations.	31
4.	Schematic diagram of the methodology used in field investigations	32
5.	Schematic diagram of gut content analysis.	34
6.	Monthly variation in water level, secchi depth, pH and conductivity of the reservoir water.	43
7.	Monthly variation in rainfall and maximum water level at M1	44
8.	a. Temperature variation in the three Major stations of the impoundment.	48
	b. Diurnal temperature variation at Major st 1.	48
9.	Monthly variation of phytoplankton in 0-10 m samples at M1.	56
10.	Surface distribution of the prominent phytoplankton groups in two major stations of the reservoir.	
	a. Major station 1	58
	b. Major station 2	58
11.	Percentage distribution patterns of four major phytoplankton groups in the surface layers.	59
12.	Vertical distribution of the total phytoplankton population in Major station 1 from August 94- August 95.	61



13.	Vertical migration patterns of 04 phytoplankton groups in M1 (December 1995)	62
14.	Percentage zooplankton composition in M1 (0-10m sample)	65
15.	Seasonal variation of the dominant zooplankton types at M1 (0-10 m samples)	68
16.	Spatial distribution of the seasonal changes in the 03 zooplankton groups at 5 stations of the reservoir.	71
17.	Vertical distribution of the 03 dominant zooplankton groups at M1	72
18.	Diurnal migration patterns of the dominant zooplankton groups in the Major St. 1	76
19.	The relationship between the major zooplankton and phytoplankton (at M1, surface samples)	77
20.	Percentage composition of the fisher in the reservoir (a. Gill net and b. Cast net)	79
21.	Catch per unit effort in the gill net fishery of the reservoir in two sampling months.	82
22.	Size and weight class distribution of gill net fishery.	83
23.	Size and weight class distribution of the cast net fishery.	84
24.	The major food items of <i>Puntirus sarana</i> .	89
25.	Monthly percentage distribution of major plankton groups in the <i>Oreochromis</i> hybrids stomach contents.	92
26.	Major food items of <i>Dania malabaricus</i> .	95
27.	The Major food items of <i>Oreochromis</i> hybrid fry.	96
28.	The simplified food web structure of the Kotmale reservoir.	101
29.	The daily variation in stomach fullness (point per fish) and the percentage of empty stomachs of <i>Oreochromis</i> hybrids	104
30.	Percentage distribution of the stomach weights with time.	105

31.	The relationship between the wet weight of the fish and wet stomach weight of Male <i>O. niloticus</i> type hybrids.	106
32.	Percentage distribution of stomach fullness (W) of <i>Oreochromis</i> hybrids in the Kotmale reservoir (15-20cm)	107
33.	Diagrammatic representation of the degree of fullness of the gut of <i>Oreochromis</i> hybrids in the Kotmale reservoir with time.	108
34.	pH variation of stomach contents of <i>O.</i> hybirds with time	110
35.	The relationship of stomach pH and fullness with time.	111
36.	The variation of stomach fullness with time	112

### List of tables

<b>Table</b>	<b>Contents</b>	<b>page/s</b>
1.	Morphometric and hydrological data of the Kotmale reservoir	5
2.	Mean and ranges of physiochemcial parameters of the reservoir. During the study period	42
3.	Correlation between the physiochemical parameters.	45
4.	a. Phytoplankton distribution (Percentage of species).	51
	b. Phytoplankton distribution (Percentage of numbers)	51
5.	The categorization of the phytoplankton according to their abundance.	52
6.	Species composition of phytoplankton	53
7.	Statistifical significane between different parameters.	63
8.	Categorization of zooplankton species according to their abundance in the reservoir water.	66
9.	Monthly variation in rotifers of the Kotmale reservoir.	70
10.	Catch per unit effort of Gill net fishery in the reservoir.	82

11.	Distribution of common fish species in different habitats of the reservoir.	86
12	Summarization of dietary habits of the fish in the reservoir.	88
13.	Sesonal variation in Electivity Index for different food items in <i>Oreochromis</i> hybirds (According to Ivelve's Index).	91
14.	The dirunal variation in feeding of <i>Oreochromis</i> hybirds.	102
15.	pH variation of the different parts of the alimentary canal of the <i>Oreochromis</i> hybirds with rference to presence and absence of food.	109
16.	The feeding intensity of <i>Oreochromis</i> hybirds with time in Beirha Lake.	114

#### List of plates

<b>Plate No.</b>	<b>Contents</b>	<b>page/s</b>
1.	The Kotmale reservoir	8
2.	The different parts of the alimentary canal of the <i>Oreochromis</i> hybirds	39
3.	Cage culture experiments in Beirha Lake	40
4.	Reservoir during drought season, in March 1996.	46
5.	<i>Staurastrum</i> species	54
6.	The bloom forming phytoplankton.	54
7.	The copepods.	74
8.	The rotifers.	74

9.	The cladocerans.	75
10.	<i>Oreochromis</i> hybrids	80
11.	<i>Cyprinus carpio</i> .	80
12.	<i>Dania malabaricus</i> and <i>Rasbora daniconis</i>	85
13.	The major food items of adult <i>Oreochromis</i> hybrids	
	a. detritus and diatoms	93
	b. Phytoplankton	93
14.	The major zooplankton eaten by the adult <i>D. malabaricus</i>	95
15.	The zooplankton in the gut contents of adult	
	<i>Oreochromis</i> hybrids	94
16.	Digested phtoplankton in the gut of <i>Oreochromis</i> hybrids	99

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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 copepods, 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.