THE LIMNOLOGY OF IHALAGAMA WEWA, A MINOR PERENNIAL RESERVOIR IN THE WET ZONE OF SRI LANKA, WITH SPECIAL REFERENCE TO PRODUCTION OF *Oreochromis mossambicus and Etroplus suratensis*

H. H. Costa[1], T. B. Wanninayaka[2] and M. J. S. Wijeyaratne[3]

2. Department of Fisheries & Aquaculture, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka.

3. University of Kelaniya, Kelaniya, Sri Lanka.

Introduction

Several hydrobiological studies on tropical ponds and minor man made reservoirs have been carried out in India, some specially in connection with fish production (Ganapathy, 1940; Krishnamurthy and Visveswara, 1965; George, 1966; Sreenivasan, 1968). To date only one detailed hydrobiological study has been carried out in Sri Lanka covering an annual cycle (Costa & de Silva, 1969; 1978a; 1978b; 1978c; 1978d; 1978e; Costa & Abeysiri, 1978; Costa & Goonatillaka, 1978; Costa & Liyanage, 1978). Studies on the hydrobiology of man made fresh water reservoirs in Sri Lanka have been meagre and no detailed accounts exist covering an annual cycle of the hydrobiological features of either the minor fresh water reservoirs or the major fresh water reservoirs. Knowledge about the hydrobiological characteristics of man made reservoirs and specially minor reservoirs has now become important with the intensified inland fisheries development program in Sri Lanka where it has been suggested that minor reservoirs, both in the wet zone and dry zone of Sri lanka be used as 'ponds' for the culture of fish with community participation.

The present detailed study, covering a period of more than two years of the limnological features and fish fauna of a small shallow perennial 'pond', with intensive submerged and floating aquatic vegetation characteristic of the water bodies of the wet zone of Sri Lanka, was undertaken to get an understanding of the seasonal variation of chemical characteristics, plankton, higher plants, productivity and community structure of the fishes living in this reservoir. Studies on the biology of species of fish present in the water body will become useful in the adoption of management procedures aimed at increasing the potential production of fish to be cultured in the reservoir.

Materials and Methods

Five sampling sites were selected and water samples for analysis were collected once or sometimes twice a month. Samples collected for dissolved oxygen determinations were fixed for oxygen immediately after collection. Dissolved oxygen was estimated by the modified Winkler procedure. The pH was determined by a portable pH meter. Standard methods were followed in the estimation of other chemical parameters. Transparency was determined by a secchi disc. Primary productivity was estimated by the dark and light bottle technique. Results given are average for two years.

Fish fauna was collected using cast nets. The fish were immediately preserved in 5% formalin and were brought to the laboratory for identification and further analysis. Fecundity was determined by subsampling. The relative importance of major groups of food items was calculated using the method described by Helawell and Abel (1971). Similarity indices of food items of *Oreochromis mossambicus* and *Etroplus suratensis* with those of all other species present in the water body were calculated using the method described by Odum (1971).

Results

Morphometry and the physical features

Ihalagama Wewa is a man made minor fresh water reservoir situated in the Western province of Sri Lanka at Ragama 16 km north of Colombo. It is used by the villagers both for irrigating paddy lands and also for bathing purposes. It is about 2 ha in extent and has a mean depth of about 0.7 m. The maximum length is 168 m and the maximum width is 70 m. There is a small inlet at the east end of the 'pond' while on the west side is a bund made of earth which rises to a height of 4 m. This bund is 118 m long and is built to retain the water draining from the catchment areas. There are two outlets with sluice gates, one at each end of the bund. The sluice gates control the level of water in the reservoir. The lower areas of the bund in contact with the water is cemented.

The depth of the water column changed with the volume of water contained in the tank depending on the season.

Alongside the bund, the bottom was sandy whilst elsewhere the bottom was mostly muddy. From all sides, it sloped gradually to the centre where it was the deepest.

Temperature of the water

Generally the water temperature showed little variation seasonally and diurnally. The temperature of the surface water ranged from 27°C to 32°C and at the bottom it varied from 26°C to 30°C. Diurnal sampling showed that the temperature of the water rises until about 2.00 pm before beginning to fall again. The values for temperature showed that the 'pond' because of its very small surface volume in relation to surface area responds relatively quickly to changes in air temperature.

Organic matter in the benthic sediments:

Organic matter in the benthic sediments was determined for all the months of the year. Most of the reservoir or portions of the reservoir were covered by *Salvinia molesta* all around the year and there is a rich growth of aquatic plants. The percentage of organic material in the bottom soil varies from 13% to 33% with a mean of 22.4%.

Transparency and conductivity:

Even though there was continous decomposition of *Salvinia* plants which produced detritus, the water remained clear during most of the time of the year. However, the transparency values for the water decrease when surrounding areas receive heavy downpours. Then the washed in mud and other material cause it to become brownish and more turbid.

The transparency and conductivity values are given in Table I. The secchi readings generally varied between 60 cm and 90 cm on clear days. The conductivity values ranged from 75 μScm^{-1} to 275 μScm^{-1}.

Dissolved oxygen:

The dissolved oxygen concentrations in water were measured for every month at two hour intervals begining 10.00 a.m. of the sampling dates. Most of the monthly samples showed low dissolved oxygen concentrations during the early hours of the day but with the approach of the mid day the oxygen values increased to around 6 mg/1. The % saturation of oxygen varied between 40 and 70% in the surface water and at the bottom between 20 and 40%.

Table I: The mean values of transparency and conductivity for stations 1-5 in Ihalagama Wewa.

Station	*Trasparency (cm)*	*Conductivity* μScm^{-1}
1	61	140
2	65	130
3	85	130
4	75	170
5	73	250

pH:

The pH varied from 5.9 to 8.3. The pH values recorded for surface and bottom waters were not much different. The series of samples taken show a certain amount of horizontal heterogeneity of the pH values for certain months of the year. The highest recorded pH values were in September.

Free carbon dioxide:

A notable feature of this 'pond' was the detection of free carbon dioxide in all the months of the year. Concentrations as high as 1.54 ppm were detected in April while the lowest concentrations detected were in January. Diurnal analysis of free CO_2 concentrations has shown that there is a general reduction of free CO_2 in the water with the approach of the mid day.

Total alkalinity:

Data on the alkalinity of surface waters showed that there was little variation between the months and between the times of the day. The values recorded were the lowest during the rainy months (May/June) and highest during the dry months ranging around 100 ppm. There was no clear cut horizontal heterogeneity as regards to alkalinity values.

Higher plants:

The charateristic feature of the 'pond' was *Salvinia molesta* cover. The invasion of water bodies in the wet zone by *Salvinia* is now more a common feature than a rare one. The extension and recession of the cover varies from month to month. In some months very little area clear of the plants was seen. Also these floating plants could be shifted by wind action so that extensive areas could become clear or be covered in a short time. The *Salvinia* cover affects chemical as well as biological processes in the water as for example their decomposition which occurs in the drier months could produce large quantities of detritus. Both the fresh and decaying plant material thus become an important food component to the herbivorous fish fauna. Besides *Salvinia* there are several rooted macrophytes both floating leaves such as *Nelumbium* sp and *Nymphaea* sp and submerged leaves such as *Hydrilla sp* and *Ceratophyllum sp.* The edge of the 'pond' was occupied by patches of reeds and rushes, large *Pandanus* trees and a few patches of *Eichchornia crassipes*. Some of these provide the allochthonous food material for the fish community.

Phytoplankton:

Obeservations on the phytoplankton showed that there is a seasonal variation in the density of the different groups of phytoplankton. The Cyanophyceae showed a peak around May just before the onset of monsoonal rains. The Bacillariophyceae showed considerable variation in the numbers but a peak was discernible in June. Chlorophyceae was the most dominant group with a number of genera belonging to several sub groups (Table II). The least number of green algae was found in May while in other months there was a uniformly high production compared to other groups.

The commonest blue greens encoutered were *Anabaena* and *Lyngbia*. The commonest diatom was *Navicula* while the commonly encountered filamentous green algae were *Chladophora* and *Ulothrix*.

When the total phytoplankton abundance for the whole 'pond' was considered two peaks were evident in March and August.

Zooplankton:

The zooplankton was mainly represented by Copepods, Cladocerans and Rotifers. The Copepoda dominated the zooplankton with low populations in the months of April, May and June. The Cladocera was the next dominant group and showed two peaks during May and November. The rotifera were present in small numbers in the collections of most months.

The peaks of total phytoplankton roughly coincided with the peaks of total zooplankton. With the depletion of phytoplankton populations there were corresponding decreases in zooplankton populations.

The dominant zooplankton species are given in Table III.

Marginal fauna:

The invertebrate and vertebrate fauna recorded from the marginal areas are given in Table IV

Table II: Distribution and abundance of phytoplankton at stations 1-5 (Number per 100 ml)

Station 1

	Jan.	*Feb.*	*Mar.*	*Apr.*	*May*	*Jun.*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
BLUE GREEN ALGAE												
Anabaena	34	112			182			52		18	51	
Aphanocapsa			4	6	4		1171	4	6			
Chroococcus					24							
Coelasphaerium	5	7	2									
Lyngbia			20	56	76	118	50	248	90			3
Oscillatoria	14	26										18
Phormidium				18		4						
Spirulina	5											
Synecoccus		12										
Tetrapedia	2											
DIATOMS												
Cyclotella						4						
Diatoma									12			
Dictyosphaerium	4	2										
Eunotia			8			36						
Melosira	70	7	2								95	26
Navicula	47	77	10	134	182	828	115	344	90	10	30	26
Pinnularia		14					2		2	6	16	52
Stephanodiscus	2											
Tabellaria						4	34	20	12			

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
GREEN ALGAE												
Ankistrodesmus	2			6								
Cosmerium	2	2						4				3
Botryococcus												34
Bulbochaeta	2											
Chladophora	27	89	160	260	396	680	396	836	118		11	54
Closterium	4		2									
Eudorina	29			16		25	74					3
Gonatozygon							70	32				
Gonium							7				13	
Kirchinella	488	408					223	880	80			598
Microspora												3
Micrasterias											3	
Mougeotia				114		58						
Neritium					2							
Oedogonium							72	232	6		3	
Pediastrum	826	413	50	326	34		197	268	102	100	413	429
Protococcus	23	24		18				4				
Scenedesmus	4	5										
Spirogyra			22		24	101	60	112	14	2	3	34
Ulothrix	1002	388	138	340	26	554	701	1248	756	84	243	694

Station 2

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
BLUE GREEN ALGAE												
Anabaena	22				14	19			4			
Aphanocapsa			5	2	22		4	8	8			
Coelasphaerium	6			30								
Gloecapsa						31						
Lyngbia	8	2	6	58	56	199	79	12	108			2
Oscillatoria	3	2		6		2	11					2
Phormidium				14							5	18
Tetrapedia	3											
DIATOMS												
Diatoma							11					
Dictyosphaerium		8										
Eunotia										10	26	
Gomphonema											3	
Melosira	53	12	2	4		2					10	
Navicula	9	6	54	750	115	658	414	336	86	6	13	24
Nitzchia						5						
Pinnularia	8					7		4	2	4	10	4
Tabellaria				6		19	79	36	20			

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
GREEN ALGAE												
Cosmerium		2							2			
Botryococcus	11											20
Bulbochaeta									44			
Chladophora	17	10	21	178	235	343	317	348	222		3	10
Closterium							4					
Cylindrocystis						2						
Eudorina	3						11					
Gonatozygon						96	54		144			
Gonium							4					
Kirchinella		520					921	1088	36			702
Micrasterias								4				
Mougeotia				286		314						
Neritium					3							
Oedogonium					76		360	68				
Pandorina		16	3				26					
Pediastrum	843	816	38			96	583	876	292	50	65	346
Protococcus		4	3	6		10		4			5	
Scenedesmus						5			2			
Spirogyra				92	34	62	58	32	26	5	13	10
Ulothrix	3001	5222	414	274	137	391	832	8252	776	92	250	830
Volvox	22											
Station 3												
BLUE GREEN ALGAE												
Anabaena	75	7	28			99			16			39
Aphanocapsa			36	4	3	13	2	4	10			
Chroococcus									12			
Coelasphaerium					3	2	18	8	4			
Lyngbia		7	4	30	45	20	20	36	24			
Merismopedia	3											1400
Nostoc						35						
Oscillatoria				2		11						22
Phormidium						51					3	39
Polycistis	3											2
Spirulina	3							4			3	
Tetrapedia	3											
DIATOMS												
Cocconeis												3
Diatoma						9						
Dictyosphaerium	84	334										

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Eunotia					3	7				8	26	
Melosira	90				9	18				4	8	
Navicula	15	7	282	4	198	222	24	376	186	4	13	25
Nitzchia						35						
Pinnularia	9		2			2	2			4	10	
Tabellaria				4	12	20		24	2			

GREEN ALGAE

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Ankistrodesmus	9			2	12		4					
Cosmerium					3				2			3
Botryococous	3											
Characium			4				2					
Chladophora	12	34	24	78	330	315	79	196	56			42
Eudorina									4			
Gonatozygon						73	24	184	34			
Gonium									2			
Kirchinella	24	1788				2	3254	384	1038			322
Microspora								144				
Mougotia			62	20		99						
Oedogonium							199	60	150			
Pediastrum	378	1946	124	266		35	191	48	426		101	1081
Penium									2			3
Protococcus	54	168					84		4		8	
Spirogyra					54	62		44	30	4	13	19
Ulothrix	4011	5414	356	358	120	279	2167	1428	4886	88	242	1686
Volvox	9											11

Station 4

BLUE GREEN ALGAE

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Anabaena	2				12	40			20			
Aphanocapsa			2	2		10	6	4	4			
Chroococcus					2930	30	18					
Gloecapsa						5						
Lyngbia	2		12	50	2		57	16	32			
Merismopedia	2					5						
Oscillatoria				7			6		71			
Phormidium						10						
Polycistis	2											
Rivularia									2			
Spirulina			2				6					

DIATOMS

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Cyclotella											7	
Dictyosphaerium	22											
Eunotia			6	22	2						5	
Gomphonema	2											

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Melosira	27		8		2	5				4		
Navicula	6	19	10	149	36	780	384	64	164	8	21	
Nitzchia						105						
Pinnularia	2	5	2	5	2			20		4	5	
Surirella	2											
Tabellaria	3					90	12	16	10			
GREEN ALGAE												
Ankistrodesmus	2				2							
Chladophora	3	22	20	293	53	545	300	16	72			
Closterium						5						
Eudorina				5				4				
Gonatozygon						25	60	48	20			
Gonium											7	
Kirchinella	603	211					486	820	360			
Mougotia			42	67		175					25	
Oedogonium							150	128	100		7	
Pandorina	51											
Pediatrum	443	204	4	91	46	435	420	292	162	96	426	
Protococcus	32						6				35	
Scenedesmus			2	2								
Spirogyra				19	19	20	15	16	22	8		
Ulothrix	2381	1030	318	50		465	1377	2928	4484	144	687	
Zygnema								24				

Station 5

BLUE GREEN ALGAE

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Anabaena	34			32				8	18		85	20
Aphanocapsa	2		3	20	5	18	3	8	6			
Chroococcus					26							
Coelasphaerium	8	3		20		3						
Lyngbia	2	27	8	132	5	6	13	28	16			
Oscillatoria				20		9					15	
Phormidium		3										20
Polycistis											125	
Spirulina				4			3					56
Tetrapedia	2											
DIATOMS												
Diatoma			5									
Dictyosphaerium	22	24										
Eunotia					2						3	
Gomphonema	2											11
Melosira	36	3	13			3					5	8

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
Navicula	6	54	50	72	185	372	93	188	140	8	375	30
Pinnularia	2	3	3	8						4	3	3
Tabellaria			2		7	54	19	8	10			
GREEN ALGAE												
Ankistrodesmus	2				5		48					
Cosmerium												8
Bulbochaeta		3									25	
Chaetophora											10	
Chladophora	16	69	141	504	98	366	217	140	172		48	25
Closterium	4											
Crucigenia												22
Cylindrocystis							10					
Eudorina								4	4			
Gonatozygon						54	22	16	46			
Kirchinella	984	204				456	851	736	146			1590
Microspora											60	
Mougotia			35	72		141						
Oedogonium							10	252	30			
Pandorina	34	9										
Pediastrum	984	471	141	216		189	400	432	104	48	125	1098
Penium	4											
Protococcus	6				2	12	13		18			
Spirogyra		45		56	19	105		40	10	12		
Ulothrix	2202	972	197	956	166	357	486	4244	2830	172	1233	3052
Volvox												20

Table III : Distribution and abundance of zooplankton at station 1-5 (per 100 ml)

Station 1

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
CLADOCERA												
Chydorus	2	5	4	4	2							
Camptocerus					2							
Daphnia		2		2	10	4	2	8	6	2	3	5
Unid. Cladocerans						50	28	60				
COPEPODA												
Canthocampus	18	96	18	6	12	18	22	24	34			18
Cyclops		2								2	5	
Diaptomus	2		1	4	4	4	7	12	4	4	11	
NAUPLIUS LARVAE	2											
CRUSTACEAN EGGS			4	4		7	7	8				

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.
ROTIFERS												
Brachionus				4								
Chonochilus						4						
Euchlanis					2			12				
Notholca							2					
Station 2												
CLADOCERA												
Chydorus				2	8		7					
Daphnia				4		19	4	8	4	4	5	
Diaphanosoma											3	
Macrothrix						2						
Unid. Cladocerans						12	7	24			5	
COPEPODA												
Canthocampus	25	64	3	18	3	14	22	224	48		5	20
Cyclops										4	3	
Diaptomus			2	6	5	12	14		2	2		
CRUSTACEAN EGGS				2	20	12		4				
ROTIFERS												
Euchlanis					3	2	4		2			
Ploesoma							4					
Testudinella									4			
Unid. Rotifers	20											
Station 3												
CLADOCERA												
Cydorus	3	2		2	9				2			
Bosmina		5										
Ceriodaphnia						2						
Daphnia				4	12	4	4		4	4		
Eurycerus						2						
Unid. Chladocerans						13		8	8			
COPEPODA												
Canthocampus	24	55	4	18	6	52	469	32	46		8	6
Cyclops		7			3					4	3	
Diaptomus		2	2	2	6	2	4	8	22	4		
NAUPLIUS LARVAE						7						
CRUSTACEAN EGGS		17	4					8				

	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sep.	Oct.	Nov.	De
ROTIFERS												
Euchlanis					3				6			
Notholca						4						
Station 4												
CLADOCERA												
Chydorus				12								
Daphnia				7		5			4	2	2	
Unid. Cladocerans						5	6	4	8			
COPEPODA												
Canthocampus	8	2	16	5	2	5	12	148	30			
Cyclops								4		4	2	
Diaptomus				12		10	6		4	4		
NAUPLIUS LARVAE						5						
CRUSTACEAN EGGS		2		12			9					
ROTIFERS												
Keratella												3
Lecan								4				
Testudinella	2											
Unid. Rotifers	2											
Station 5												
CLADOCERA												
Chydorus	2			28	7							
Daphnia										4	3	
Unid. Cladocerans						12	6	16				
COPEPODA												
Canthocampus	16		6				25	32				14
Cyclops										4		
Diaptomus				4	2	9	6	20		6	3	3
NAUPLIUS LARVAE					2	12						
CRUSTACEAN EGGS			8	8		3	19	16				
ROTIFERS												
Euchlanis	2						3					
Microcodon						3						
Unid. Rotifers	10											

Table IV: The non-planktonic invertebrates and vertebrates

	Very common	*Common*
Oligochaeta :		
Nais communis	*	
Allonais inaequalis		*
Hirudinea :		
Hirudo birmanica	*	
Mollusca :		
Indoplanorbis exsustus		*
Pila globosa	*	
Thiara scabra		*
Melanoides tuberculatus		*
Bithynia ceylonica		*
Crustacea :		
Caridina simoni	*	
Macrobrachium idae	*	
Porathelphusa senex		*
Allitropus typus		*
Odonata :		
Anisopteran nymphs	*	
Zygopteran nymphs	*	
Hemiptera :		
Naucoris scutellaris		*
Sphaerodema rusticum		*
Hydrometra greeni		*
Micronecta sp		*
Anisops sp		*
Coleoptera :		
Cybister confusus		*
Diptera :		
Anopheles sp		*
Chironomus spp.	*	
Amphibia :		
Rana tigrina		*
Rana temporaria	*	
Reptilia :		
Natrix piscator		*
Aves :		
Phalacrocorax niger	*	

Primary productivity:

The values for gross primary productivity were surprisingly low throughout the year irrespective of whether it is the dry season or the wet season with comparatively little seasonal variation. Community respiration however, was comparatively high in proportion to the productivity values. These values indicate that perhaps in some days of the months there may be no production at all in the reservoir waters. The lowest value for gross productivity was recorded in April.

Benthos:

Benthic fauna consisted mainly of Oligochaetes, Molluscs, beetle larvae and Chironomid larvae. Benthic biomass expressed as g/m^2 for some months is given in Table V:

Table V: Benthic biomass in some months.

Animals	*Januray*	*March*	*June*	*September*	*December*
Oligochaetes	0.870	1.2105	3.616	0.4285	0.4102
Molluscs			5.963		
Beetle larvae and other insect larvae	0.1337		0.1705	.	0.1105
Chironomid larvae	0.0782	0.0967	0.1792	0.5022	0.2720
Total	1.0919	1.3077	9.9322	0.9307	0.7927

Community structure of fish:

The species of fish recorded for Ihalagama Wewa are given in Table VI.

Table VI: The fish opeis recorded from Ihalagama Wewa.

Cobiitidae:

Lepidocephalichthys thermalis

Cyprinidae:

Rasbora daniconius
Amblypharyngodon melettinus
Danio aequipinnatus
Puntius filamentosus
Puntius dorsalis
Puntius vittatus
Puntius amphibius
Esomus danrica

Cyprinidontidae:

Aplocheilus dayi

Ophicephalidae:
Ophicephalus striatus

Cichlidae;

Etroplus suratensis
Etroplus maculatus
Oreochromis mossambicus

Bagridae:
Macrones vittatus

Heteropneustidae:
Heteropneustus fossilis

Morphometry and length weight relationship of fishes:

Standard length in relation to total length, height in relation to standard length and length weight relationships were determined for most of the fishes. The statistical relationships of total length to standard length, height in relation to standard length and length weight relationship all of which are significant at 5% level are given in Table VII:

Table VII: Statistical relationships between standard length (SL) and total length (TL), and Height (H) and standard length, and length weight relationships of the fish cought in Ihalagama Wewa.

Lepidocephalichthys thermalis:	$SL = 0.7224\ TL + 0.2579$
	$Wt = 0.0013\ TL^{4.1126}$
	$H = 0.2649\ SL - 0.2296$
Rasbora daniconius:	$SL = 0.8392\ TL + 0.2887$
	$Wt = 0.0062\ TL^{3.1465}$
	$H = 0.2556\ SL - 0.2400$
Amblypharyngodon melettinus:	$SL = 0.7761\ TL + 0.0347$
	$Wt = 0.0093\ TL^{2.7960}$
	$H = 0.2137\ SL - 0.0437$
Danio aequipinnatus:	$SL = 0.8503\ TL - 0.1039$
	$Wt = 0.0075\ TL^{3.0990}$
	$H = 0.4136\ SL - 0.4638$
Puntius filamentosus:	$SL = 0.7223\ TL + 0.4001$
	$Wt = 0.0171\ TL^{2.65}$
	$H = 0.3095\ SL + 0.2247$

Puntius dorsalis:

$SL = 0.8456\ TL - 0.6022$

$Wt = 0.0151\ TL^{2.7901}$

$H = 0.3293\ SL - 0.0141$

Puntius vittatus:

$SL = 0.8526\ TL - 0.2747$

$Wt = 0.0147\ TL^{2.9000}$

$H = 0.2304\ SL + 0.3650$

Puntius amphibius:

$SL = 0.7552\ TL - 0.0628$

$Wt = 0.0152\ TL^{2.7781}$

$H = 0.3303\ SL + 0.0189$

Esomus danrica:

$SL = 0.8559\ TL + 0.3269$

$Wt = 0.0204\ TL^{2.5433}$

$H = 0.2128\ SL + 0.0622$

Aplocheilus dayi:

$SL = 0.7501\ TL + 0.0250$

$Wt = 0.0045\ TL^{3.5800}$

$H = 0.1909\ SL + 0.0242$

Etroplus suratensis:

$SL = 0.8204\ TL - 0.1532$

$Wt = 0.0233\ TL^{2.9500}$

$H = 0.5903\ SL + 0.0036$

Etroplus maculatus:

$SL = 0.7414\ TL + 0.1774$

$Wt = 0.247\ TL^{2.8181}$

$H = 0.5331\ SL + 0.0452$

Oreochromis mossambicus:

$SL = 0.8188\ TL + 0.5327$

$Wt = 0.0099\ TL^{3.1457}$

$H = 0.3811\ SL\ 0.8847$

Macrones vittatus:

$SL = 0.7769\ TL + 0.3235$

$Wt = 0.0652\ TL^{2.08}$

$H = 0.1588\ SL + 0.5827$

Fecundity of Fish:

The egg counts are given in Table VIII. The fecundity prior to spawning differed from fish to fish and with size of fish.

Table VIII: – The fecundity of some fish in Ihalagama Wewa.

Species	Number of eggs	Size range of the fish examined (cm)
Etroplus suratensis	3000 - 4000	8.0 - 18.0
Oreochromis mossambicus	600 - 1140	12.0 - 18.0
Rasbora daniconius	2800 - 3000	8.0 - 10.0
Amblypharyngodon melletinus	700 - 900	6.0 - 8.0
Danio aequipinnatus	1800 - 2000	6.0 - 9.0
Puntius filamentosus	2500 - 3200	7.0 - 10.0
Puntius dorsalis	215 - 950	7.0 - 15.0
Puntius amphibius	800 - 950	6.0 - 8.0
Esomus danrica	7500 - 8100	6.0 - 9.0
Etroplus maculatus	150 - 450	4.0 - 6.0
Macrones vittatus	500 - 600	6.0 - 9.0

Spawning patterns of fish:

The GSI of *R. daniconius* increased steadily from February raching the peak in April and thereafter fell gradually. It was least in June.

In *P. filamentosus* the GSI increased steadily from February, reached peak in April, thereafter fell until June and increased again showing another peak. It was least in December.

The GSI of *Puntius dorsalis* also showed several peaks, one in February, the others in August and October and became least in November.

In *Danio aequipinnatus* the GSI increased to a single peak in June. The GSI was least in December.

A wide range of GSI was observed for *Esomus danrica* indicating that ovaries at different stages of maturity can be encountered in many months of the year.

In the case of *Etroplus maculatus*, the GSI values showed a minor peak in June and a major peak in November. The spawning period appeared to be the dry months.

The GSI of *Amblypharngodon melettinus* showed two peaks one in May and one in December. There appeared to be two pronounced spawning periods.

In the case of *Puntius amphibius* the GSI increased until May. The spawning period appeared to extend from June to December. In the case of *Macrones vittatus* a wide range of GSI was observed with seasonal fluctuations.

Food and feeding ecology of fish :

The fish community in Ihalagama Wewa consists of herbivores, omnivores and carnivores. The food spectra for different sizes of fish are given in Table IX.

Table IX: The food items ingested by the different fish species

	Puntius filamentosus	*P. amphibius*	*P. vittatus*	*P. dorsalis*	*Esomus danrica*	*Rasbora daniconius*	*Daneo aequipinnatus*	*Amblypharyngodon melettinus*	*Etroplus suratensis*	*E. maculatus*	*Lepidocephalichthys thermalis*	*Macrones vittatus*	*Heteropneustus fossilis*	*Oreochromis mossambicus*
Green algae:–														
Ankistrodesmus		+	+	+	+	+	+	+	+	+		+	+	+
Bulbochaeta	+													
Chladophora	+			+	+	+	+	+	+		+			
Closterium					+			+			+			
Cosmerium	+	+	+	+	+	+	+	+	+	+	+	+		
Dondium	+		+		+			+	+		+			
Eudorina	+				+									
Gonium									+					+
Kirchinella														+
Neritium				+										+
Oedogonium	+	+	+	+	+	+	+	+	+	+	+			
Pandorina	+													
Pediastrum	+			+	+			+	+	+				+
Protococcus				+					+					+
Selenastrum				+										+
Scenedesmus	+			+			+		+					+
Tetraspora														+
Spirogyra	+	+				+	+							
Ulothrix	+	+	+	+	+	+	+	+	+	+	+	+		
Botriococcus														+
Blue green algae														
Anabaena									+					
Aphanocapsa	+				+									
Coelasphaerium				+	+									+
Gloeotheca		+	+	+			+		+		+	+	+	
Lyngbia	+			+	+	+			+		+	+		
Merismopedia	+			+	+				+	+				
Oscillatoria									+					
Phormidia	+								+					
Sirogonium	+		+	+	+	+		+			+		+	
Spirulina		+		+					+					
Diatoms														
Diatoma				+				+						
Eunotia		+			+				+	+				
Gomphonema				+										
Melosira	+	+	+	+	+			+	+	+				
Navicula	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pinnularia	+	+		+	+				+		+			
Tabellaria	+	+	+	+	+	+	+	+	+	+	+	+		

Table IX: The food items ingested by the different fish species (Contd.)

	Puntius filamentosus	*P. amphibius*	*P. vittatus*	*P. dorsalis*	*Esomus danrica*	*Rasbora daniconius*	*Daneo aequipinnatus*	*Amblypharyngodon melletinus*	*Etroplus suratensis*	*E. maculatus*	*Lepidocephalichthys thermalis*	*Macrones vittatus*	*Heteropneustus fossilis*	*Oreochromis mossambicus*
Salvinia	+	+	+		+				+	+	+	+	+	+
Crustacea														
Canthocamptus				+		+					+	+		
Other Cyclopoids						+				+				
Cladocerans		+	+	+						+		+		+
Other crustaceans				+		+	+			+		+		
Insecta														
Coleopterans						+								
Chironomid larvae														
Other insects	+		+	+		+	+		+	+	+	+	+	+
Nematodes				+							+	+	+	
Rotifers														
Brachionus														+
Euchlanis				+							+			
Fish												+		

Lepidocephalichthys thermalis :– It is a benthic inhabitant and is omnivorous in its food habit. In its younger stages its food includes phytoplankton, zooplankton and rotifers. At a larger size it ingests large quantities of benthic diatoms in addition to green algae and blue green algae, fresh water oligochaetes, chiromomid larvae and trichopteran larvae.

Rasbora daniconius :– The diet mainly of algae when the fish are young changes to a more or less omnivorous diet as they grow.

Amblypharyngodon melettinus :– Feeds only on a herbivorous diet mostly consisting of green algae, blue green algae, diatoms and higher aquatic plants mainly *Salvinia*.

Danio aequipinnatus :– Its major food component consists of adult aquatic insects and insect larvae. They make up nearly 75% of its food.

Puntius filamentosus :– Most of the food consumed by the younger stages consists of diatoms and blue green algae. This habit changes to eating parts of macrophytic plants and consuming large quantities of detritus. A few remains of rotifers and insects were also seen in the gut contents. They may be indirectly ingested with plant material.

Puntius dorsalis :– This fish is an omnivore. Here too, a change in the pattern of food ingestion was seen with growth in size.

Puntius vittatus :– Nearly 75% of the food of adult fish consists of green algae. However, these fish feed also on zooplankton and mesocrustaceans specially *Caridina simoni*.

Puntius amphibius :– Most of the food ingested consists of phytoplankton when young but change to a partial animal diet later. *Chironomus* larvae, zooplankton, mesocrustaceans and *Salvinia* leaves were frequently seen as food components in the stomaeh.

Esomus danrica :– The food of all sizes of this fish generally consists of diatoms, green algae and blue green algae although diatoms form the major part. Parts of *Salvinia* leaves frequently make up the rest of the food.

Aplocheilus dayi :– It is an insectvorous fish and its diet mainly consists of small adult insects and insect larvae.

Ophicephalus striatus :– It is a carnivorous fish. The food consists of juveniles of *Puntius* spp., *Danio aequipinnatus, Amblypharyngodon melettinus, Esomus danrica thermoicos and Caridina simoni.*

Etroplus suratensis :– This is a benthic feeder and therefore it is not surprising that most of its food consists of benthic diatoms. A very small portion consisted of animal matter mainly *Chironomus* larvae. The macrophytes ingested were mostly *Salvinia* parts and submerged hydrophytes.

Etroplus maculatus :– This fish appears to be more omnivorous in its food habits than *E. suratensis.* Its diet while consisting of plant material also consisted of zooplankton (Cladocerans, Copepods) and insect larvae, mainly *Chirononus* larvae.

Oreochromis mossambicus :– It is a herbivorous fish in the adult stages. The nutrition was mostly obtained from the green algae The major filling of the gut, however, was from decaying plant material, remnants of higher plants and green algae.

Macrones vittatus :– It is a carnivorous fish; the diet consisted of small fish, *Caridina simoni* and insects. Surprisingly, parts of *Salvinia* leaves were detected in many stomachs.

Heteropneustes fossilis :– It is a benthic fish. Most of its food items consisted of *Caridina* sp., *Macrobrachium* juveniles, adult aquatic insects and insect larvae, mostly chironomid larvae. Parts of *Salvinia* plants were detected in several fish.

Discussion

Until now there is no detailed study carried out on the hydrobiology of a perennial minor reservoir (' pond') in Sri Lanka. There were many reasons in making this very extensive study of the Ihalagama Wewa which extended over a period of two years. Among them were to get an idea of;

1. The biological impact of the presence of an extensive cover of *Salvinia molesta,* which has become a characteristic feature of most of the water bodies in the wet zone as well as in the dry zone.
2. The physico-chemical conditions existing in a water body with extensive growth of *Salvinia.*
3. The plankton community and productive processes of the reservoir.
4. The invertebrate and vertebrate community and their relationships in the food web of the reservoir.

The prime purpose of this study, however, was to get an understanding of the trophic status of the introduced fish *Oreochromis mossambicus* and indigenous fish *Etroplus suratensis* vis a vis in relation to the natural community of fishes already existing in the reservoir.

Ihalagama Wewa represents a typical man made fresh water minor reservoir in the wet zone of Sri Lanka like all other man made reservoirs it has an earthen dam to store the inflowing water and with sluice gates to regulate the outflow of stored water for agricultural purposes. Water flows in from the catchment area bringing in nutrients; the excess of which is allowed to flow out during the rainy season. Being a very shallow perennial reservoir, there is water stored throughout the year with a variable residence time, which generally increases during the dry period of the year with the closure of the sluice gates.

Like all other perennial tanks in the wet zone of Sri Lanka, a typical dense growth of hydrophytes is evident in Ihalagama Wewa. However, ecologically the most important feature is the growth of exotic plant *Salvinia molesta.*

The extension and the recession of the *Salvinia molesta* cover over the water surface varies from month to month with varying degrees of decrease or increase of the water column. With the onset of rains, the growth of *Salvinia* begins. The explosive growth causes a dense cover, which may in some months extend to cover the whole area of the reservoir. The direct effect is that it cuts off the sun's rays falling directly into the water. This has important effects as seen in the analysis of the physico-chemical components and in the analysis of the productivity processes of the water body. Generally this cover makes the dissolved oxygen content of the water to remain low as well as to decrease the productivity of the phytoplankton. With the onset of the dry season and with the decline of rain, *Salvinia* begins to die and decompose with the subsequent recession of the cover and exposure of greater areas of the water body accompanied by changes in the physico-chemical components. The decomposition of *Salvinia* leads to the formation of detritus, which falls to the bottom of the reservoir giving proportionately higher organic content to the benthic sediments as well as accumulation of soil on the margin of the reservoir causing it to become shallower. The growth of *Salvinia* also impedes the growth of other hydrophytes and leads to their death and decay. These processes have important effects on the animal community living in the reservoir. Both the extension of *Salvinia* cover as well as its decomposition leads to a decrease in the dissolved oxygen content of the water. On the other hand, a dense layer of decomposing vegetable mater at the bottom leads to the formation of a rich benthic community consisting mostly of fresh water oligochaetes, molluscs and crustaceans which feed on detritus. This detritus also comes from the autochthonous material produced by the decomposition of both submerged and floating hydrophytes such as *Nelumbium* sp., *Nymphaea* sp., *Hydrilla* sp., etc.

As the study on the food and feeding ecology of fish has shown, many species of herbivorous and omnivorous fish subsist on parts of *Salvinia* leaves. *Salvinia* is also sometimes heavily ingested by *Oreochromis mossambicus* and *Etroplus suratensis*. Because of the spongy nature of *Salvinia* leaves, their nutritive value is not certain; but at least they serve as an important gut filling for the fishes feeding on them. As these studies have indicated, the *Salvinia* cover produces effects which may not be conducive to extensive culture of fish. Hence spread of *Salvinia* has to be prevented or *Salvinia* should be eliminated by biological, mechanical or chemical means before fish are stocked in the reservoir.

Morphometrically, this reservoir like all other minor reservoirs are shallow and therefore can be considered more as a 'pond'. No thermal stratification was noted here because of its shallow nature. The annual variation of surface temperature was around 5°C while at the bottom the variation was around 4°C. However, the diurnal fluctuation in the areas devoid of *Salvinia* cover was conspicuous and pronounced and was around 4°C.

Rainfall plays an important role in the biological processes of the reservoir. During rain and floods, the volume of the water increases in the reservoir with the flushing rate of the water through the sluice gates becoming rapid. The result is that the residence time of water decreases. Since the water body is small (around 2 ha) less time is allowed for the nutrients to get dissolved in the water and subsequent development of planktom. During the dry period, the residence time of water is more and some groups of algae show outbreak of blooms. This is also aided by the nutrients added by the decomposition of *Salvinia.* A certain amount of organic material from the surrounding domestic tenements and cattle excreta is washed into the reservoir during the rains and the nutrients in these are probably utilized by the hydrophytes and *Salvinia* to form dense outgrowths with the outbreak of the rains. Like in other water bodies (Costa and de Silva, 1978b), rainfall appears to have very little effect on the temperature of the water body.

Secchi disc transparency varied from place to place in the reservoir. At the region of the outflow where the reservoir is comparatively deeper, transparency values were high while in other areas transparency varied. Stations closer to the edge or with a scattered cover of *Salvinia* showed lesser values for transparency. Generally the water in the reservoir is less turbid than the water in Colombo lake (Costa and de Silva, 1978b) and was more alike to those described by Sreenivasan (1968) for ponds in India.

The continuous decomposition of macrophytic plant material has made the waters to be slightly acidic. The pH of the water in Ihalagama Wewa was around 6.5 with little seasonal fluctuations. However, slight diurnal variation in pH values was seen. The pH values are slightly lower in the morning hours and increases during the course of the day. Some utilization of CO_2 in the water may account for this slight variation. The pH of this water body is generally slightly more acidic in comparison to most other perennial water bodies in the wet zone (Costa and de Silva, 1978b).

The alkalinity values varied from month to month and from station to station even though the water body was a small one. The alkalinity values also varied from hour to hour. These were highest during the rainy months and lowest during the dry months. Highest decomposition of organic matter (*Salvinia* and other hydrophytes) occurs during the dry months which increases the alkalinity by bringing into solution the carbonates.

The water in the Ihalagama Wewa was about 40% saturated with dissolved oxygen in the early hours of the day at the surface and about 20% at the bottom. Just after the mid day the oxygen saturation levels were around 70% at the surface and 40% at the bottom. The general average values for dissolved oxygen in the reservoir was around 6 mg O_2/l. There were, however, slight seasonal variations. These oxygen values are a reflection of the photosynthetic production minus the loss by diffusion, respiration and decomposition. The low oxygen values may be a reflection of the decomposition processes occurring in the reservoir. An oxygen deficit was observed for several months between the surface and the bottom layers.

In the Ihalagama wewa the density of phytoplankton was low compared to Colom lake (Costa and de Silva, 1978b), which is highly eutrophic. Generally there was a unifo distribution of green algae throughout the year with a peak in May. The Cyanophyce appeared to show a peak just before the onset of the monsoonal rains. The Bacillariophyce showed a peak in June. When the total abundance for all groups of phytoplankton w considered two peaks were noted; one in February and the other in August, both duri the dry period occuring in the western sector of Sri Lanka. The Chlorophyceae were t dominant algae. Unlike in Colombo lake (Costa and de Silva, 1978b), the commone blue green algae encountered were *Anabaena* and *Lyngbia*. *Microcystis* were few. Althou Zafar (1967) has noted that low pH and low dissolved oxygen concentrations favour t formation of *Microcystis* and other blue greens, we found that *Microcystis* was rather ra in the Ihalagama Wewa unlike in Colombo lake (Costa and de Silva, 1978c).

Like in Colombo lake (Costa and de Silva, 1978b), the zooplankton community i composed of rotifers, copepods and cladocerans; the major group being copepoda. Unlik in Colombo lake (Costa and de Silva, 1978b), the peaks in zooplankton coincide approximately with the peaks of total phytoplankton so that a relationship between th numbers of zooplankton and phytoplankton organisms was discernible. With the declin of algal populations, there was a correspending decrease in the numbers of the zooplankto The increase in the herbivorous zooplankton is the direct result of abundant phytoplankto on which they graze. When the phytoplankton populations decline, a decrease in th zooplankton populations is also to be expected. In this reservoir where the green alga predominates, the grazing effect is more marked than, for example, in Colombo lak where there is a predominance of blue green algae all of which may not be utilized as source of food by the zooplankton.

Gross primary productivity was moderately low throughout the year. Low metaboli rates were noted for this reservior and this is also supported by the data for primar productivity. The diurnal changes in carbonate values are slight and this is also true fo changes in dissolved oxygen. These narrow fluctuations in dissolved oxygen and alkalinit may be also indicative of low productivity and low metabolic levels. The low electric conductivity and low net plankton values also indicate a low level of productivty in th reservoir.

The primary organic production varied from 0.14 $gC/m^2/day$ to 1.89 $gC/m^2/da$ The annual production of carbon in Ihalagama Wewa amounts roughly to 8054.3 k According to Sreenivasan (1966), carbon values divided by 0.44 give the dry weight plankton biomass produced and accordingly the total biomass of phytoplankton produc is about 18305.3 kg per annum.

The spawning patterns and fecundity studies of the fish occurring in Ihalagan Wewa have indicated that the spawning periods differ with different species and th some species in the community produces small numbers of ova while other fishes produ very large numbers. If conditions are favourable, higher fecundity in fish will lead to t production of proportionately larger number of fingerlings. Species such as *R. danicornius, E. danrica* and *P. filamentosus*, when considered in relation to *O. mossambicus* and *E. suratensis,* produce large number of eggs, which will eventually produce large number of fingerlings, which if not subjected to predation will compete for food with the fingerlings of stocked fish. The intrinsic rate of natural increase, therefore, is greater in *R. daniconius, E. danrica* and *P. filamentosus* and this would enable these fish to build up large populations more rapidly.

As mentioned earlier, the principal purpose of this study was to determine the utilization of this reservoir for fish production. It has been proposed by one of us (Costa, 1979) that the minor reservoirs in the dry zone should be utilized for fish production on a community basis and the fish that would be considered for this purpose should be Chinese carps, where harvesting of these fish will be easy because of the seasonal nature of the reservoirs in the dry zone. In the wet zone perennial water bodies, other fish should be considered and in this respect *O. mossambicus, E. suratensis* and *Chanos chanos* are ideal candidates for culture. In the Ihalagama Wewa already small numbers of the exotic fish *O. mossambicus* and the indigenous fish *E. suratensis* exist as members of the fish community. This gave us an opportunity to study the position of these two species of fish in relation to the other members of the fish community specially with regard to competition for food sources and predation. The availability of food will be an important factor, which will determine to a large extent the ultimate production of fish. The presence of predatory and competitor fish species can also greatly reduce the production of a favoured fish species.

The fish species in the Ihalagama Wewa fall into three categories classified according to their food habits namely carnivorous fish, omnivorous fish and herbivorous fish. The three carnivorous species of fish occuring in the Ihalagama Wewa are *O. striatus, H. fossilis* and *M. vittatus*. Fishes belonging to Family Cyprinidae provide a large part of food for *O. striatus* but it is possible that cichlid fishes, at least in their younger stages, may become prey to this fish. *H. fossilis* and *M. vittatus* are both benthic fishes and could destroy the eggs and young of *E. suratensis*. Although large numbers of *M. vittatus* were collected during sampling by cast nets, very few *O. striatus* were collected and because of its small numbers at least in this reservoir this predator may not influence the two cichlid fishes. Neither the water bird *Phalacrocorax niger* appears to be of a threat as this bird also preys mostly on the fishes belonging to Family Cyprinidae specially *Rasbora* and *Puntius spp.*

The rest of the species of fish living in Ihalagama Wewa are either omnivorous or herbivorous subsisting on diets of algae, zooplankton, insects, crustaceans and macrophytic vegetable matter. Since *O. mossambicus* and *E. suratensis* are omnivorous fish, similarity indices of the diets of all the fish belonging to these two categories were calculated and are given in Table X. In this reservoir, there is a high similarity of the food of *E. suratensis* with those of the three *Puntius* species other than *P. vittatus*. These similarity indices were above 0.6500. When compared with the food of *D. aequipinnatus* and *R. danicornius,* the similarity indices were moderate being 0.55 and 0.50 respectively. Similarity Indices of the diets of all other fish co-occuring with *E. suratensis* were less than 0.66.

Similarity indices of the diet of O. *mossambicus* with those of *E. maculatus* and *P. dorsalis* were moderate having values of 0.50 and 0.44 respectively. The similarity indices for other fishses namely *H. fossilis, M. vittatus, E. danrica, P. filamentosus* and *D. aequipinnatus* were 0.38, 0.37, 0.37, 0.32 and 0.28 respectively.

Growth and abundance of a population of fish is mainly dependant on the availability of food. High similarity indices indicate that there is a high similarity regarding the food they ingest. The Table X also means that the available food is shared by many species of fish. This would create a situation where there is competition for food specially if the food resources are less abundant.

Table X: Similarity indices of the diets *of E. suratensis* and *O. mossambicus* with the diets of other fish in Ihalagama Wewa.

	E. suratensis	*O. mossambicus*
Lepidocephalichthys thermalis	0.5581	0.1875
Rasbora daniconius	0.5000	0.2069
Amblypharyngodon melettinus	0.4865	0.2308
Daneo aequipinnatus	0.5500	0.2759
Puntius filamentosus	0.7083	0.3243
P. dorsalis	0.6923	0.4390
P. vittatus	0.5000	0.3200
P. amphibius	0.6500	0.2759
Esomus danrica thermoicos	0.6667	0.3529
Etroplus maculatus	0.5641	0.5000
Macrones vittatus	0.4211	0.3703
Heteropneustus fossilis	0.3125	0.3810

In this reservoir *P. filamentosus, P. amphibius, P. dorsalis,* and *E. danrica* will compete for food with *E. suratensis* while species of fish such as *E. maculatus* and *P. dorsalis* will compete for food with *O. mossambicus.* This competition will affect population expansion resulting in decrease of the fish yield. Although quantitative sampling was not carried out, in one experimental trial catch where the net was cast more than 20 times the numbers of fish caught were as follows; *A. melettinus* 100, *R. daniconius* 60, *P. filamentosus* 30, *D. aequipinnatus* 10 and *E. suratensis* 10. It is to be concluded that comparatively only a few *O. mossambicus* and *E. suratensis* are found in this reservoir. Although ideal conditions for breeding exist for *E. suratensis* such as sandy substrate, one of the reasons for low abundance of this fish in the reservoir may be the competition for food available with the other species of fish which co-occur in very large numbers in this reservoir. Lesser availablity of food does not mean that complete elimination of the species will occur but will result in a decrease in abundance. Like the fish community at Maha Oya (Costa and Fernando, 1967) several species of fish in the reservoir subsist on similar diets and therefore occupy similar food niches.

Predator removal has already been practised in water bodies in other countries and even in large tropical lakes such as Victoria lake in East Africa (Martin, 1979). If successful culture of favoured fish species in minor reservoirs is to be practised in Sri Lanka it will be necessary to remove predators as they will ultimately affect the fishery yield of the favoured fish species. In a perennial tank such as Ihalagama Wewa it may not be possible to remove all the predator fish species.

Ihalagama reservoir is not utilized for fish production. Since there are a large number of such perennial reservoirs in the wet zone, these reservoirs should be adopted for fish production on a planned programme. Species suggested for stocking are *O. mossambicus, O. niloticus, Tilapia melanopleura, Etroplus suratensis* and *Chanos chanos*. If properly managed, this could result in a substantial increase in fish production in these reservoirs. However, if such a stocking program is to be carried out successfully, the predation as well as competitor fish should be kept to a minimum and the possible spread of *Salvinia* should be checked for reasons outlined earlier as well as to facilitate harvesting of fish. These conditions are not impossible to achieve in a small reservoir such as Ihalagama Wewa.

It will be interesting if a similar study could be carried out on a seasonal tank in the dry zone of Sri Lanka to determine the productivity, recruitment patterns of fish, fish species and the resulting effects of stocking of favoured fish in the reservoirs.

Summary

1. The limnology and the biology of fishes in Ihalagama Wewa, a fresh water man made minor reservoir in the wet zone of Sri Lanka, were studied from Nov. 1977 to Oct. 1979.

2. The seasonal variations of temperature, transparency, conductivity, dissolved oxygen content, free carbon dioxide content, alkalinity and pH of the water were measured. There were very little seasonal fluctuations in the temperature, free CO_2 content and dissolved oxygen content of the water. Conductivity was very low and ranged from 75 μS cm^{-1} to 275 μS cm^{-1} while the secchi disc transparency varied between 60 cm and 90 cm.

3. The highest abundance of phtoplankton was observed in the dry months. The dominant phytoplankton were green algae while the most abundant zooplankton were copepods.

4. Extensive growth of *Salvinia molesta* causing a dense cover over the water surface was evident throughout the year. This extensive growth of *Salvinia* may be responsible for the low primary productivity of the lake as well as the low dissolved oxygen concentration of the water.

5. The morphometrics, food and feeding and fecundity of the species of fish present in the lake were studied. Of the 16 species of fish present in the lake, *Puntius filamentosus, P. amphibius, P. dorsalis* and *Esomus danrica* may compete for food with *Etroplus suratensis* while *Etroplus maculatus, P. dorsalis* and *E. danrica* may compete for food with *O. mossambicus*. Generally the degree of competition is higher with *E. suratensis* than with *O. mossambicus.*

References

Costa, H. H. and Abeysiri, R. R.
1978 - Hydrobiology of Colombo Lake VII – The food and feeding ecology of the fish *Tilapia mossambica.* *Spolia zeylanica, 32,* 93 – 104.

Costa, H. H. and de Silva, S. S.
1969 - Hydrobiology of Colombo Lake I- Diurnal variation in temperature, hydrochemical factors and zooplankton *Bull. Fish. Res. St. Ceylon,* 20, 141-142.
1978 *a* - Hydrobiology of Colombo Lake II – Seasonal variation in physico chemical factors. *Spolia zeylanica, 32,* 19 – 34.
1978 *b* - Hydrobiology of Colombo Lake III – Seasonal fluctuation in plankton. *Spolia zeylanica, 32,* 35 – 43.
1978 *c* - Hydrobiology of Colombo Lake IV – Seasonal fluctuation of aquatic fauna living on water plants. *Spolia zeylanica, 32,* 55 – 70.
1978 *d* - Hydrobiology of Colombo Lake V – Seasonal study of marginal fauna. *Spolia zeylanica, 32,* 71 – 81.
1978 *e* - Hydrobiology of Colombo Lake VI – Seasonal variation in primary productivity. *Spolia zeylanica, 32,* 82 – 92.

Costa, H. H. and Fernando, E. C. M.
1967 - The food and feeding relationships of the common meso and macrofauna in the Maha Oya, a small mountainous stream at Peradeniya, Ceylon. *Ceylon J. Sc. (Bio Sc.) 7,* 74 – 90.

Costa, H. H. and Goonatilleke, W. D. A.
1978 - The hydrobiology of Colombo Lake VIII – The Bacterial Ecology. *Spolia zeylanica, 32,* 111 – 128.

Costa, H. H. and Liyanage, H.
1978 - The hydrobiology of Colombo Lake IX – The production of *Tilapia mossambica.* *Spolia zeylanica, 32,* 129 – 139.

Ganapati S. V.,
1940 – The ecology of a temple tank containing permanent bloom of *Microcystis aeruginosa.* *J. Bombay Nat. His. Soc., 42,* 65 – 70.

George, M. G.,
1966 – Comparative plankton ecology of five fish tanks in Delhi, India. *Hydrobiologia, 27,* 81 – 108.

Helawell, A. M. and R. Abel,
1971 – A rapid volumetric method for analysis of the food of fishes. *J. Fish. Biol., 3,* 29 – 37.

KRISHNAMURTHY, K. P. AND VISVESWARA, G.,

1965 – Hydrobiological studies in Chandhi sagar (Jumma Tank). Diurnal variations in plankton. *Hydrobiologia, 25*, 99 – 118.

MARTIN, G. G.,

1979 – Predator removal. Effects on fisheries yields in Lake Victoria (East Africa). *Science, 203*, 646 – 649.

ODUM, H. P.,

1971 – *Fundamentals of Ecology* W. B. Saunders Co., U.S.A. pp. 574.

SREENIVASAN, A.,

1966 – Limnology of tropical impoundments I – Hydrobiological features and fish production in Stanley Resrvoir, Malta Dam. *Int. Revue ges Hydrobiol, 2*, 295 – 306.

SREENIVASAN, A.,

1968 – The limnology and fish production is two ponds in Chingle (Madras). *Hydrobiologia, 32*, 131 – 144.

ZAFAR, A. R.,

1964 – On the ecology of algae in certain fish ponds of Hydrabad, India I - Physico chemical complexes. *Hydrobiologia, 23*, 179 – 195.