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Trophic Interrelationships Among the Exotic and Indigenous Fish Co-occurring in Some Reservoirs in Sri Lanka

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Abstract

The introduced fish species such as *Oreochromis mossambicus* and *Trichogaster pectoralis* are now well established in many inland waterbodies of Sri Lanka and contribute significantly to the fish production of a large number of reservoirs. Successful establishment of these species has been explained as a result of filling a vacant niche in these reservoirs. It has been suggested that these exotic species have adversely affected the indigenous fish fauna resulting in a decrease in their abundance. The present study on the food and feeding habits of two introduced fish species namely *O. mossambicus* and *T. pectoralis* and five indigenous species, namely *Etroplus maculatus, Rasbora daniconius, Puntius filamentosus, Anabas testudineus and Mystus vittatus* co-occurring in five inland reservoirs of Sri Lanka indicates that moderate to high overlap in the food niches extists among the exotic and indigenous species. If food is limited, interspecific competition for food may occur among the exotic and indigenous species. Results of the present study also show that *O. mossambicus* and *T. pectoralis* do not feed on young fish and therefore do not exert a predatory pressure on indigenous ichthyofauna. Alteration and degradation of habitats, use of pesticides and exploitation for ornamental purposes may be more responsible for the decline of indigenous fish populations rather than the introduction of exotics such as *O. mossambicus* and *T. pectoralis.*

Introduction

More than twenty fish species have been introduced into the freshwaters of Sri Lanka for many purposes including the control of malaria, recreation and development of inland fisheries. Four species of larvivorous fish of the Family *Poecilidae* that have been introduced during the period 1930 to 1960 now exist as small localized populations in some inland waterbodies (Pethiyagoda 1994). The rainbow trout *Oncorhynchus mykiss* which has been originally introduced in the 1880s for recreation purposes now exists only in few streams above 1700 m from the mean sea level (Pethiyagoda 1991). Several species of anabantoids, carps and tilapias have been introduced to the freshwater reservoirs for the development of inland fisheries. Some of them are now well established and contribute significantly to the inland fish production (De Silva and De Silva 1991, Amarasinghe 1994, Amarasinghe and De Silva 1992, Nathanael and Silva 1996). Of the anabantoids, snakeskin gourami *T. pectoralis* contributes significantly to the fish production of many minor and medium sized reservoirs. Of the carps, only the common carp *C. carpio* has established self-sustaining populations (Pethiyagoda 1994). Of the tilapias, the Java tilapia *O. mossambicus* is now well established in many inland reservoirs and contributes for 56 to 99% of their fish catch depending on the location (De Silva 1988, Amarasinghe et al. 1989, Amarasinghe 1994).

It is the view of most conservationists that almost all exotic species exert some pressure on the native co-occurring fauna by way of predation or competition. It has been suggested that the introduction of *O. mykiss* may have been responsible for species extinctions in Sri Lanka (Pethiyagoda 1991). Further, some suggest that the extensive invasion of inland waterbodies by tilapias would also result in species extinctions in the longer term (Pethiyagoda 1994). A similar claim has been put forward by Bluhdorn and Arthington (1992) who studied *O. mossambicus* populations in Australia. However, some argue that indigenous fish in Sri Lanka were not negatively affected by the introduction of tilapias (Fernando 1991) and in fact have benefited because the presence of tilapias has reduced the predatory pressure on them (De Silva and Fernando 1980).

Due to these conflicting views on the influence of exotics such as tilapias on the indigenous fish, the present study was carried out to evaluate the degree of trophic interrelationships among exotic and indigenous fish species co-ocurring in some freshwater reservoirs in the western region of Sri Lanka. The main objective of this study was to determine whether the exotic species such as *O. mossambicus* and *T. pectoralis* adversely affect the co-occurring indigenous fish populations by predation or competition.

Materials and Methods

The present study was carried out from August 1992 to September 1993 in five minor reservoirs in the western region of Sri Lanka namely Madampe, Mahawewa, Mattegoda, Lunuwila and Boralasgamuwa reservoirs (Fig.1). Seven species of fish, namely *O. mossambicus, T. pectoralis, E. maculatus, R. daniconius, P. filamentosus, A. testudineus* and *M. vittatus* were collected once a month between 0900 h and 1100 h using a cast net of stretched mesh of 1.5 cm. More than 50 individuals of each species were used in the present study.

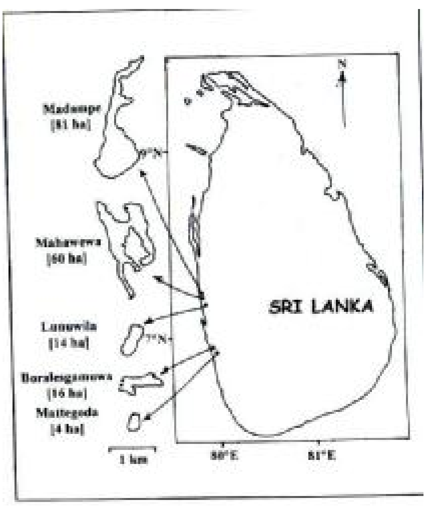

Fig. 1. Location of the five study sites.

Fish were preserved in 10% formalin immediately after catching and transported to the laboratory of the University of Kelaniya. In the laboratory, fish were identified and the total length of each individual was measured. Each fish was eviscerated, the stomatch contents were scooped out and the food items were identified as much as possible under an optical microscope. The stomach contents were quantitatively analyzed using the relative volume of each food item. The similarities between the diets of two species were determined using the following equation of Schoener (1970).

$$S = 100 - \tfrac{1}{2} \sum | p_{xi} - p_{yi} |$$

where

S = Similarity between the diets of species X and species Y

p_{xi} = Relative abundance (%) of the i^{th} food item in species X

p_{yi} = Relative abundance (%) of the i^{th} food item in species Y

Values for S range from 0% to 100%. In the present study, values less than 33% were considered to indicate a low similarity while those above 67% were considered to indicate a high similarity as described by Moyle and Senanayake (1984).

Results

Of the fish species used in this study, *O. mossambicus* and *T. pectoralis* are exotic species while *E. maculatus, R. daniconius, P. filamentosus, A. testudineus* and *M. vittatus* are indigenous. The size range of the fish used in the present study is given in table 1.

The food items identified in the stomach contents of these fish species in the five reservoirs studied are given in table 2. Altogether 31 genera of diatoms, 21 genera of cyanobacteria and 46 genera of green algae were identified in the stomach contents together with fragments of aquatic macrophytes, detritus and animal matter. Fragments of aquatic macrophytes were not recorded in the stomach contents of *A. testudineus* and *M. vittatus.*

Figures 2 to 6 show the relative abundance of major taxonomic groups of food items present in the diets of fish in each reservoir. The major food item of *O. mossambicus, T. pectoralis, E. maculatus, R. daniconius* and *P.*

Table 1. Size range of the fish species used in the present study.

	Mahawewa Reservoir	Mattegoda Reservoir	Lunuwila Reservoir	Madampe Reservoir	Boralesgamuwa Reservoir
A. testudineus	3.4 - 6.0	4.4 - 9.0	4.4 - 6.2	5.3 - 8.8	4.1 - 8.8
E. maculatus	1.9 - 7.7	_	3.1 - 6.5	1.9 - 8.0	_
M. vittatus	_	4.8 - 10.6	5.8 - 6.8	5.0 - 7.7	5.0 - 7.0
O. mossambicus	2.6 - 13.7	2.4 - 15.0	4.1 - 7.6	1.7 - 17.9	3.5 -12.2
P. filamentosus	3.9 - 11.1	_	4.4 - 8.8	3.5 - 9.4	_
R. daniconius	4.2 - 11.3	3.7 - 10.00	4.2 - 9.6	3.9 - 9.0	4.5 -12.0
T. pectoralis	3.8 - 15.0	5.5 - 9.5	9.7 - 12.2	_	4.6 -16.0

total length = in cm

Table 2. Food items recorded in the stomach contents of the fish species studied.

	Mahawewa						Borales gamuwa					Lunuwila							Madampe						Mattegoda				
	R	O	P	T	E	A	R	O	T	A	M	R	O	P	T	E	M	A	R	O	P	E	M	A	R	O	T	M	A
Cyanobacteria																													
Anabaena	*	*	*	*	*	*	-	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	*
Aphanocapsa	-	-	-	-	-	-	*	-	*	-	-	*	*	-	-	-	-	-	*	-	*	-	-	*	-	*	*	*	-
Chroococcus	*	*	-	*	*	*	*	*	*	-	-	*	-	*	-	-	-	-	*	*	-	*	-	*	*	*	*	-	-
Coelosphaerium	-	*	-	-	*	*	*	*	-	*	-	-	*	*	-	-	-	-	*	-	*	-	-	*	*	-	*	-	-
Dactyococcopsis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-
Glococapsa	*	*	*	*	*	*	-	-	*	-	-	*	*	*	*	-	-	-	*	*	*	*	*	-	*	*	*	-	-
Gloeotrichia	-	*	-	*	*	-	-	-	*	-	-	*	*	*	*	-	-	-	*	*	*	-	*	-	-	-	*	-	-
Gomphosphaeria	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hapalosiphon	-	-	-	-	-	-	-	-	*	-	-	*	-	-	-	-	-	-	*	*	-	*	-	-	-	-	-	-	
Lyngbia	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	-
Merismopedia	-	*	*	*	-	*	-	*	*	*	-	*	*	*	*	*	-	*	*	*	-	*	-	-	*	*	*	*	-
Microcystis	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*
Nostoc	*	*	*	*	*	-	-	*	*	*	-	*	*	*	*	*	-	-	*	*	*	*	-	*	*	*	*	-	-
Oscillatoria	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*
Phormidium	*	*	*	*	*	-	-	-	*	-	-	*	-	*	-	-	-	-	*	-	-	*	-	-	*	*	*	-	*
Plectonema	*	*	*	*	*	-	*	*	*	*	-	*	*	*	*	*	-	*	*	*	*	*	-	-	*	*	*	-	-
Raphidiopsis	-	-	*	-	-	-	-	*	*	-	*	-	-	-	-	-	-	-	-	-	*	-	-	-	-	*	*	-	*
Rivularia	*	-	*	*	-	-	*	*	*	-	*	*	-	*	-	*	-	*	-	-	-	-	-	-	-	*	*	-	-
Spirulina	*	*	*	*	*	-	*	*	*	-	-	*	*	*	-	*	*	-	*	*	-	*	-	*	*	*	*	-	-
Stigonema	-	*	-	-	*	-	-	-	-	-	-	*	-	-	-	-	-	-	*	-	-	-	*	-	-	-	*	-	-
Trichodesmium	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	*	-	-	*	*	*	*	-	-	-	-	*	-	-
Green algae																													
Ankistrodesmus	*	*	*	-	*	*	-	*	*	-	-	*	*	*	*	*	*	*	*	*	-	*	*	-	*	*	*	*	-
Arthodesmus	-	-	-	-	*	-	-	*	*	-	-	-	-	-	-	-	-	-	*	*	-	*	-	-	*	*	*	-	-
Botryococcus	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulbochaete	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	-	*	-	*	*	-	*	*	*	-	*
Chaetomorpha	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
Chaetophora	-	*	*	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
Chara	-	*	-	-	*	-	-	-	-	-	-	*	*	*	*	*	*	-	*	-	-	*	-	-	-	-	-	-	-
Chlorella	*	-	-	-	-	-	-	-	-	-	-	*	*	-	*	-	-	-	-	*	-	-	-	-	-	-	-	-	-
Chlorococcum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
Closterium	-	*	*	*	*	-	*	-	*	-	-	*	-	-	-	-	-	-	*	*	*	*	-	-	-	-	-	-	-
Coelastrum	-	*	*	-	-	-	*	-	*	*	-	*	*	*	*	*	*	*	*	-	*	*	-	-	-	*	-	-	-
Coelochaete	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-
Cosmarium	*	*	*	*	*	-	-	-	-	*	-	*	-	-	-	*	*	-	*	*	*	*	*	*	*	*	*	*	-
Cruciginia	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Desmidium	*	-	-	*	-	-	*	*	*	-	-	*	-	-	*	-	-	-	-	*	*	-	-	-	-	*	*	*	-
Dictyosphaerium	-	*	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Docidium	-	-	*	*	-	-	-	*	*	-	-	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Euastrum	*	*	*	*	*	*	*	*	*	-	-	*	*	-	-	-	-	-	*	-	-	-	-	-	*	*	-	-	-
Gonatozygon	*	*	*	*	*	-	*	*	*	-	-	*	-	*	-	-	-	-	*	*	*	*	-	-	-	*	*	-	-
Gymnodinium	-	*	*	*	*	-	-	*	*	-	-	*	-	-	*	-	-	*	*	*	*	*	-	-	-	*	-	-	-
Kirchneriella	*	*	-	-	*	*	*	*	*	-	-	-	*	*	-	-	-	-	-	*	*	*	-	-	*	*	*	-	*
Microspora	-	-	*	*	*	-	-	-	-	-	*	*	-	*	-	-	-	*	*	*	*	*	-	-	-	*	*	-	-
Mougeotia	-	-	-	-	*	-	*	-	*	-	*	-	-	-	-	-	-	-	*	-	*	-	*	*	-	-	-	-	-
Nephroccytium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-
Netrium	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	-	*	*	*	*	*	-	-	*	*	*	*	*
Oedogonium	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	-	*	*	*	*	*	*	*	*	*	*
Oocystis	-	-	*	*	-	-	*	-	*	-	-	-	-	-	-	-	-	-	*	*	*	*	*	-	-	-	-	-	-
Ophiocytium	-	*	*	-	-	-	*	*	*	*	-	-	-	-	-	-	-	-	*	-	-	*	-	*	-	*	*	*	*
Pediastrum	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	-	-	-	-	*	*	*	-	-	*	*	*	-	-
Penium	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-
Peridinium	-	*	*	*	*	*	*	*	*	-	-	*	*	*	-	-	-	*	*	*	*	*	-	*	*	*	*	-	-
Phacus	-	*	*	*	*	*	*	-	*	*	-	*	-	-	-	-	-	-	-	*	-	*	-	-	-	-	*	*	-
Pleurotaenium	-	*	*	*	*	*	-	-	*	-	-	*	-	-	-	-	-	-	-	*	-	*	-	-	-	-	-	-	-

continued...

Table 2. continued...

Protococcus	*	-	*	*	-	-	-	*	*	-	-	*	*	*	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-
Pseudochaete	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	*	-	-	-	-	-	-	-	-
Scenedesmus	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*	-	*	-	-	-	-	-
Schizoxchlamys	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenastrum	-	-	-	-	-	-	-	*	*	-	*	-	*	-	*	-	-	-	*	-	-	-	-	-	*	-	*	-	-
Spirogyra	-	*	*	*	*	-	-	*	*	*	-	*	*	*	*	-	-	-	*	*	*	*	*	-	*	*	-	-	*
Staurastrum	*	*	*	*	*	-	-	-	*	*	*	*	-	*	-	*	*	-	-	*	*	*	*	-	-	-	-	-	-
Stigeoclonium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-	-	-
Tetraedron	-	*	*	*	*	-	*	*	*	-	-	*	-	-	*	-	-	-	*	*	*	*	-	-	*	-	*	-	-
Tribonema	*	*	*	*	*	-	*	*	*	*	-	*	*	*	-	-	-	*	*	*	*	*	*	-	*	*	*	*	-
Ulothrix	*	*	*	*	*	-	-	*	*	-	-	*	-	*	*	-	-	-	*	*	-	*	-	-	-	-	-	-	-
Volvox	-	-	-	-	-	-	-	-	*	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-
Zygnema	-	*	*	*	*	-	*	*	*	-	-	*	*	-	-	-	-	-	*	*	*	*	-	-	*	*	-	-	-
Diatoms																													
Achnanthes	*	-	-	*	-	-	*	*	*	-	-	*	*	-	-	-	-	-	-	*	*	-	-	-	-	*	*	-	-
Amphipleura	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphora	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asterionella	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	-	-	-	-	-	-	-
Biddulphia	-	-	*	-	-	*	-	-	*	-	-	-	-	-	-	*	-	-	*	-	*	*	-	-	*	*	*	-	-
Cocconeis	*	*	*	*	*	-	-	-	*	*	-	*	-	*	*	*	-	-	*	*	*	*	-	-	-	*	-	-	-
Crucigenia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-
Cyclotella	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	*	*	*	*	*	-	*	*	-	*	*	*	*	-
Cymbella	*	*	-	*	*	-	*	-	*	-	-	*	-	*	*	-	-	-	-	*	-	-	-	-	-	*	-	-	-
Diatoma	*	*	*	*	*	-	-	*	*	*	-	*	-	*	-	*	-	*	-	-	-	-	-	-	*	*	-	-	-
Diploneis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	*	-	-	-	-	-	-	-
Epithemia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
Eunotia	-	-	-	-	-	-	-	*	*	-	*	*	-	-	*	-	-	*	-	-	-	-	-	-	-	*	-	*	*
Fragillaria	*	*	*	*	*	-	*	-	*	-	-	*	*	*	*	*	*	-	*	*	*	*	-	-	*	*	*	-	-
Fremyella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-
Frustulia	*	*	*	*	*	*	*	-	*	-	-	*	-	*	*	*	-	-	*	-	*	*	*	-	*	*	-	-	*
Gomphonema	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Gyrosigma	-	*	*	-	*	*	-	*	*	-	-	-	-	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	*	*	-	-	-	-	-	-	-	-
Mastigloia	-	*	-	*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-
Melosira	*	*	-	*	*	-	-	*	*	-	-	*	*	*	*	-	-	-	*	*	*	*	-	*	*	*	*	*	-
Meridion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	-
Navicula	*	*	*	*	*	*	*	-	*	*	-	*	*	*	*	*	*	-	*	*	*	*	-	-	*	*	*	-	-
Neridium	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	*	-	-	*	*	*	*	-	-	*	*	*	*	*
Nitzchia	*	*	*	*	*	*	*	*	*	-	*	*	*	*	-	*	*	*	*	*	*	*	*	-	-	-	-	-	-
Pinnularia	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	-	*
Stauroneis	*	*	*	-	*	-	*	*	*	-	-	*	-	-	-	-	-	-	*	-	*	-	-	*	*	*	-	-	-
Surirella	*	*	-	*	-	*	*	*	*	-	-	*	*	*	-	*	-	-	-	-	-	-	-	-	*	*	*	-	-
Synedra	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	*	-	-	*	*	*	*	-	*	*	*	*	-	-
Tabellaria	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	-	-	*	*	*
Terpsinoe	-	*	-	*	-	-	-	-	-	-	-	*	-	-	-	-	-	-	*	-	-	*	-	-	-	-	-	-	-
Aquatic Macrophytes	*	*	*	*	*	-	*	*	*	-	-	*	*	*	*	*	-	-	*	*	*	*	*	-	*	*	*	-	-
Animal matter																													
Cladocera	*	*	*	*	-	*	*	-	*	-	*	-	-	*	-	*	-	*	*	*	*	-	*	*	*	*	-	*	-
Copepods	*	*	*	-	*	*	*	*	-	-	-	*	*	*	-	*	-	-	*	*	*	-	*	*	*	*	-	*	*
Crustacean larvae	*	*	*	-	*	-	*	*	*	-	-	*	*	-	*	-	*	-	*	*	-	*	-	-	*	*	*	-	-
Fish	-	-	-	-	*	-	-	-	-	*	-	-	-	-	-	*	-	*	-	-	-	-	*	*	*	-	*	-	-
Insect larvae	*	*	*	-	*	-	*	*	*	-	-	*	*	*	*	-	-	-	*	*	*	-	-	-	*	*	*	-	*
Rotifers	*	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*	-	*	*	*	*	-	*
Unid. arthropod parts	*	*	*	*	-	*	*	*	*	*	*	*	*	-	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

O = *O. mossambicus*
T = *T. pectoralis*
E = *E. maculatus*
R = *R. daniconius;*

P = *P. filamentosus*
A = *A. testudineus*
M = *M. vittatus*

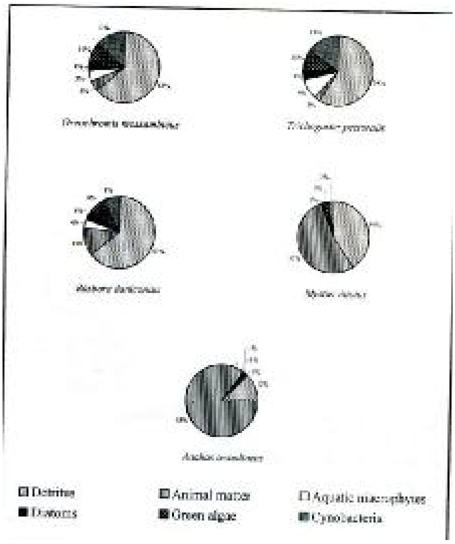

Fig. 2. Relative importance of major taxa of food items in the stomach contents of the fish collected from Mattegoda reservoir.

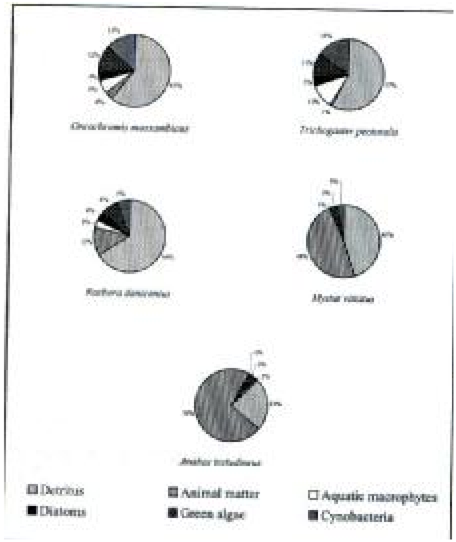

Fig. 3. Relative importance of major taxa of food items in the stomach contents of the fish collected from Boralesgamuwa reservoir.

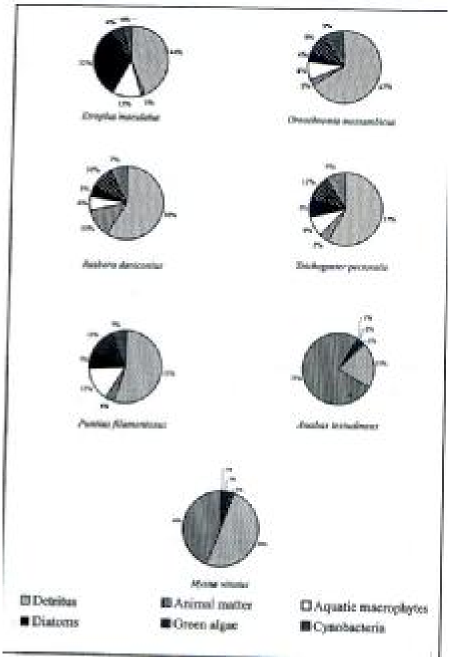

Fig. 4. Relative importance of major taxa of food items in the stomach contents of the fish collected from Lunuwila reservoir.

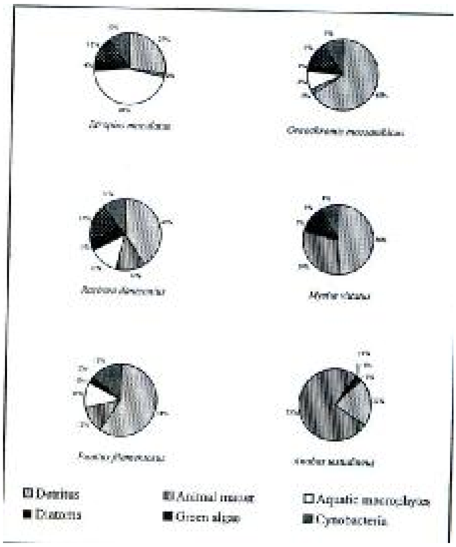

Fig. 5. Relative importance of major taxa of food items in the stomach contents of the fish collected from Madampe reservoir.

filamentosus in all five reservoirs studied was found to be detritus. In *A. testudineus*, the main food item was animal matter contributing more than 70% of the diet. In *M. vittatus*, detritus was the main food item in Lunuwila and Madampe reservoirs while in Mattegoda and Boralasgamuwa reservoirs, it was animal matter. In *O. mossambicus*, the animal matter content in the diet ranged from 2.6% recorded in Madampe reservoir to 4.7% recorded in Mattegoda reservoir while in *T. pectoralis* it ranged from 0.8% recorded in Boralasgamuwa reservoir to 4.7% recorded in Lunuwila reservoir.

Values for similar indices indicate that high dietary overlap exists between the exotic species and three indigenous species namely *E. maculatus, R. daniconius* and. *P. filamentosus* in all the five reservoirs studied (Table 3). In most instances the dietary overlap between these three indigenous species and *O. mossambicus* was above 85%. The dietary overlap between the exotic species and *A. testudineus* was low in all reservoirs. Moderate overlap in the diet between the exotic species and *M. vittatus* was observed in all reservoirs except in Madampe where high dietary overlap was evident.

Discussion

All seven species of fish studied were found to be omnivorous. However, the amount of animal matter present in the diet of the two exotic species namely, *O. mossambicus* and *T. pectoralis* was less than 5.0 % of the total volume of the stomach contents. They mainly feed on detritus and algae. Earlier studies carried out in Sri Lanka indicate that the main food item of *O. mossambicus* of around 25 mm in length was zooplankton when detritus was excluded from the analysis (Costa and Abeysiri 1978). Maitipe and De Silva (1985) showed that reservoir populations of

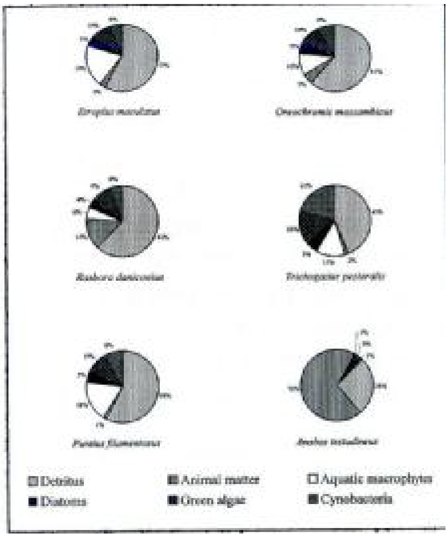

Fig. 6. Relative importance of major taxa of food items in the stomach contents of the fish collected from Mahawewa reservoir.

Table 3. Percentage dietary overlap among the two exotic and five indigenous fish species studied.

Mahawewa			Mattegoda			Boralasgamuwa			Lunuwila			Madampe	
	O.m	*T.p*		*O.m.*	*T.p*		*O.m.*	*T.p.*		*O.m*	*T. p*	*O.m*	
E.m.	91	79	*R.*d.	91	84	*R.d.*	*86*	*80.*	*E.m.*	90	88	*E.m*	61
R.d.	90	69	*A.t.*	19	18	*A.d.*	31	28	*P.f.*	86	94	*A.t.*	28
P.f.	92	82	*M.v.*	51	49	*M.v.*	55	53	*A.t.*	27	29	*M.v.*	71
A.t.	35	3							*M.v.*	59	61	*P.f.*	81

O.m.-Oreochromis mossambicus; *T.p. - Trichogaster pectoralis*; *E.m. - Etroplus maculatus; R.d. -Rasbora daniconius*; *P.f. -Puntius filamentosus*; *A.t. - Anabas testudineus M.v.-Mystus vittatus*

O. mossambicus were able to change their food habits from phytoplanktivory to zooplanktivory and detritivory depending on the availability. It has also been reported that *O. mossambicus* is an opportunistic predator of small fish (Jayaram 1981) which even feeds on its young when food is scarce (Neil 1966).

In the stomach contents of *O. mossambicus* in all five reservoirs studied body parts of fish were not present. The animal matter comprised only of annelids, crustaceans, aquatic insects and rotifers. It is evident that in these reservoirs *O. mossambicus* is not piscivorous and therefore it is very unlikely that it feeds on the young of indigenous fish. Thus the hypothesis that the populations of some indigenous and endemic fish species have declined due to predation by tilapia (Pethiyagoda 1998) has to be further examined before coming into a definite conclusion.

High dietary overlap between the two exotics and three indigenous species, ie. *E. maculatus, R. daniconius* and *P. filamentosus* was recorded mainly because their main food items were detritus, green algae and cyanobacteria. *A. testudinius,* although omnivorous, fed mainly on animal matter resulting in a low dietary overlap with the two exotics. In *M. vittatus,* which is also an omnivore, the major food items were detritus and animal matter. Therefore, the dietary overlap between *M. vittatus* and the two exotics was found to be either high or moderate. The results of the present study indicate that there is a significantly high overlap in the food niches between the exotics and indigenous ichthyofauna in these reservoirs. Similar results have also been reported in some other reservoirs in Sri Lanka (Wijeyaratne and Costa 1992).

High dietary overlap between the exotics and indigenous fish indicates that there may be interspecific competition if food is limiting. In such instances, species such as *O. mossambicus* may have an advantage over most of the indigenous fish species due to many factors. These include its ability to breed throughout the year (De Silva 1988), high rate of survival of the young due to mouth brooding and ability to tolerate wide range of ecological conditions. However, since the main food items of *O. mossambicus* i.e, detritus and algae, are highly abundant in Sri Lankan reservoirs, it is very unlikely that the food of this species will become scarce. Piet (1996) also showed that in a Sri Lankan reservoir, partitioning of food resources is an important mechanism for potential competitors to co-exist when food resources are scarce, and that generalists may be benifitted by unlimited food resources.

It has been reported that *O. mossambicus* is not found in rapid streams where substrate does not consist of sand, mud or silt but with the increase in siltation this species may invade such habitats where large number of endemic fish species, some of which are considered to be endangered, threatened or rare are found (Pethiyagoda 1994). It is a common ecological phenomenon that when the habitats are altered new species emerge replacing at least some of the existing species resulting in species succession. Therefore, if the habitat conditions in forest streams change, the endemic ichthyofauna of Sri Lanka will undoubtedly be adversely affected and new species such as *O. mossambicus* will take their place in such habitats. This will further be accelerated by the fishing pressure exerted by man on these endemic populations due to exploitation for the aquarium industry. It has been argued that in comparision with threats such as the introduction of exotic tilapias, use of pesticides, and alteration and degradation of habitats, the threat due to exploitation for ornamental purposes is very small (Pethiyagoda 1994). However, since most of these endangered, threatened and rare endemic fish live in streams where habitat conditions are not condusive for *O. mossambicus,* the threats mentioned above other than the introduction of exotic tilapias appear to be more responsible for the decline of the populations of endemic fish in these habitats. It is important that action be taken not only to minimize the alteration and degredation of habitats and the contamination of waterbodies with pesticides but also to breed these endemic fish species in captivity for ornamental purposes rather than collecting them from the wild. Wild individuals may only be collected occasionally to genetically improve the brood stocks.

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