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Food and feeding habits of the exotic fish *Oreochromis mossambicus* (Peters, 1852) from a tropical reservoir of Chalakudy River, Kerala

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ABSTRACT

The diet composition of the exotic fish, *Oreochromis mossambicus* (Peters, 1852) was studied in Poringalkuthu Reservoir, Kerala from June 2011 to May 2012. *O. mossambicus* (2.52 t) forms a regular fishery which indicate that the fish has been established successfully in the reservoir. Gut content analysis revealed detritus to be the dominant food item followed by chlorophyceae, cyanophyceae, bacillariophyceae, zooplankton, plant matter, sand particles, fish parts, insects and miscellaneous items. The present study shows that the species is an omnivore, with a euryphagous feeding habit.

Keywords: Chalakudy river, Exotic fish, Gut contents, *Oreochromis mossambicus*

The study of food and feeding habits of fishes helps to explore their behaviour, habitat use and trophic interactions in aquatic ecosystems (Walters *et al.*, 1997). While dealing with the process of fish invasions, the evaluation of feeding nature and trophic status of fishes are of core concern. *Oreochromis mossambicus* (Peters, 1852) commonly known as Mozambique tilapia is a medium-sized, benthopelagic, mouth brooding cichlid native to the rivers of central and southern Africa (Philippart and Ruwet, 1982; Trewavas, 1982). *O. mossambicus* is a highly successful invader in fresh and brackishwater ecosystems and is listed among the worst hundred alien species (Lowe *et al.*, 2000). The species is characterised by many ecological adaptive features like broad feeding spectrum, trophic flexibility, acclimatisation to changing and unfavourable aquatic ecological conditions, high fecundity and parental care (Singh and Lakra, 2011) which make the fish invade and establish in any ecosystem where it gets introduced. *O. mossambicus* was first introduced into Indian waters from Sri Lanka in 1952 and then it was stocked in many south Indian reservoirs for fishery enhancement (Sugunan, 1995). Studies on the dietary characteristics of *O. mossambicus* have been reported from Indian waters (Aravindan, 1980; Hatikakoty and Biswas, 2003; Ganie *et al.*, 2013; Indira *et al.*, 2013; Singh and Shukla, 2014). In the present study, an effort is made to examine the feeding habits, seasonal variation in diet composition and feeding intensity of *O. mossambicus* in Poringalkuthu Reservoir of Chalakudy River in Kerala.

River Chalakudy is the fifth longest river of Kerala that originates and flows through the southern parts of

Western Ghats, a global biodiversity hotspot (Myers *et al.*, 2000) which sustains a rich ichthyofaunal diversity of nearly 98 species (Biju *et al.*, 2000). The fish samples were collected from June 2011 to May 2012 from the fish landings of Poringalkuthu Reservoir in Chalakudy River on a monthly basis using gillnets. A total of 263 specimens of *O. mossambicus* (151 males and 112 females) in the length range 140-259 mm were examined during the study. After recording the length, weight and sex, the fishes were dissected and the guts were preserved in 5% formalin. The gut contents were identified under a stereomicroscope (x10) and the food items were weighed and counted. The percentage occurrence of various gut contents was analysed following frequency of occurrence method (Hynes, 1950). By visual examination, the percentage volumes of gut contents were estimated using points method (Pillay, 1952). Index of preponderance was used to estimate the dominant food items in the gut (Natarajan and Jhingran, 1962). The feeding intensity during different months was ascertained by classifying the stomachs into full, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{4}$ full and empty following points method.

The qualitative estimation of the gut contents (Fig. 1) revealed that *O. mossambicus* in Poringalkuthu Reservoir is an omnivorous feeder, consuming predominantly detritus (35%), chlorophyceae (33%), bacillariophyceae (10%) and cyanophyceae (9%). Zooplankton (3%), plant matter (3%), sand particles (2%), fish parts (1%), insects (1%) and miscellaneous items (3%) were also encountered as food items in smaller quantities. Detritus in the guts of the fish consisted of a mixture of decayed organic matter, litter and mud. The source of detritus could be heavy rain which introduce different plant

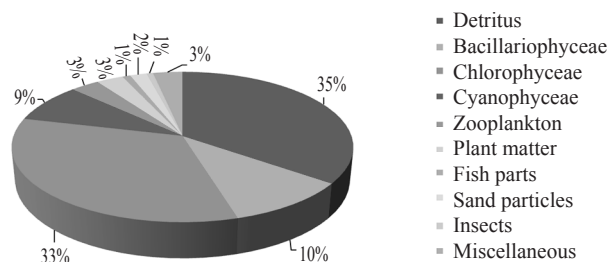


Fig. 1. Food composition of *O. mossambicus* pooled for different months

material undergoing decomposition. Chlorophyceae in the diet were represented by genera *Spirogyra*, *Ulothrix*, *Chaetophora*, *Pediastrum* and *Chlorella*. The major cyanophyceae recorded in the guts of *O. mossambicus* comprised the genera *Spirulina*, *Oscillatoria*, *Microcystis*. *Dinophysis*, *Navicula*, *Fragilaria* and *Nitzschia*. The fish parts included flesh, scales and larvae and the insects were identified by exoskeleton parts and appendages. Monthly variation in the gut contents indicated that both males and females have similar feeding habits ingesting the same food items but with slight variation in quantity. Detritus

were present in the guts consistently throughout the year which showed highest percentage of occurrence in December (38.81%) and January (37.21%) for males and females respectively (Table 1 and 2). A marked increase in the occurrence of bacillariophyceae was seen in pre-monsoon with a peak in March for male fishes and April for females. Chlorophyceae, showed a peak index value for both the sexes in the reservoir in February while its distribution in the fish guts were low in the monsoon months. Cyanophyceae dominated the gut contents in April (pre-monsoon) in males, while females showed its increased occurrence in December. Zooplankton and macrophytes were most abundant in the monsoon season with a slight high proportion of both in females during July and June respectively. Fish parts were observed to have an increasing trend from June to September (monsoon) in males but in females no regular trend was noted even though it was found high in pre-monsoon months. In females during monsoon and pre-monsoon seasons, the occurrence of sand particles followed a more or less similar pattern and it was found to be high from October to January. Insects represented the least

Table 1. Index of preponderance values of food items in male *O. mossambicus* in Chalakudy River

Months	% composition of food items									
	Detritus	Bacillariophyceae	Chlorophyceae	Cyanophyceae	Zooplankton	Plantmatter	Fish parts	Sand particles	Insects	Miscellaneous
June 2011	37.14	5.71	31.43	5.71	8.57	4.29	0.48	1.90	0.48	4.29
July	37.34	6.22	31.12	5.81	8.30	4.98	0.83	1.24	0.41	3.73
August	35.29	5.04	32.77	8.40	6.30	5.04	0.84	0.84	0.42	5.04
September	36.08	5.66	33.96	7.08	4.72	4.72	1.42	1.42	0.24	4.72
October	35.71	6.49	32.86	7.79	4.68	4.68	1.04	2.08	0.78	3.90
November	37.50	6.25	33.33	7.81	5.21	4.17	0.52	1.56	0.52	3.13
December	38.81	4.26	36.03	8.21	5.22	3.20	0.64	1.28	0.21	2.13
January 2012	38.19	5.73	36.28	8.35	3.82	3.82	0.48	0.95	0.24	2.15
February	36.73	9.18	36.73	7.14	1.84	2.45	0.82	1.84	0.82	2.45
March	36.62	11.10	33.29	8.32	3.33	2.91	0.28	1.11	0.28	2.77
April	33.86	10.58	31.75	9.26	3.17	3.97	0.53	1.59	1.06	4.23
May	33.42	10.40	31.19	8.66	4.95	2.97	0.99	2.97	0.50	3.96

Table 2. Index of preponderance values of food items in female *O. mossambicus* in Chalakudy River

Months	% composition of food items									
	Detritus	Bacillariophyceae	Chlorophyceae	Cyanophyceae	Zooplankton	Plant matter	Fish parts	Sand particles	Insects	Miscellaneous
June 2011	36.91	6.04	30.20	4.03	8.05	6.04	1.34	2.68	0.67	4.03
July	36.98	6.04	31.70	5.66	9.06	4.53	0.38	1.51	0.75	3.40
August	36.25	5.18	33.66	9.06	5.83	3.88	0.65	1.29	0.32	3.88
September	36.43	5.10	34.61	7.29	5.46	4.37	0.36	1.64	1.09	3.64
October	35.96	6.16	33.56	8.22	4.11	5.14	0.34	2.05	0.34	4.11
November	36.73	5.71	33.06	7.14	5.10	4.08	1.22	2.45	1.22	3.27
December	36.31	5.30	33.28	9.08	5.30	3.63	0.91	1.82	0.61	3.78
January 2012	37.21	6.20	36.18	9.04	4.13	2.33	0.52	1.55	0.52	2.33
February	35.18	10.05	36.18	8.04	3.02	3.02	1.01	1.01	0.50	2.01
March	35.79	10.53	33.68	8.42	2.63	2.11	1.58	1.58	0.53	3.16
April	34.30	10.83	32.49	9.03	2.71	2.71	1.08	2.17	1.08	3.61
May	34.62	10.58	31.73	8.41	3.61	3.61	0.72	2.40	0.72	3.61

dominant food item which had the highest record in females during monsoon and pre-monsoon and in males the index value of insects was high in pre-monsoon period.

Feeding intensity fluctuated throughout the year showing two peaks in male and female individuals. The degree of fullness of stomach in *O. mossambicus* during the study period is depicted in Fig. 2 (a,b). Percentage of empty stomachs was higher during June - September and November - February in males and during June - September and January - February in females. The feeding rate was reduced significantly among females during spawning months.

The results also showed that the fish is a euryphagous feeder with broad and diversified feeding spectrum consuming a variety of food items. Depending upon the

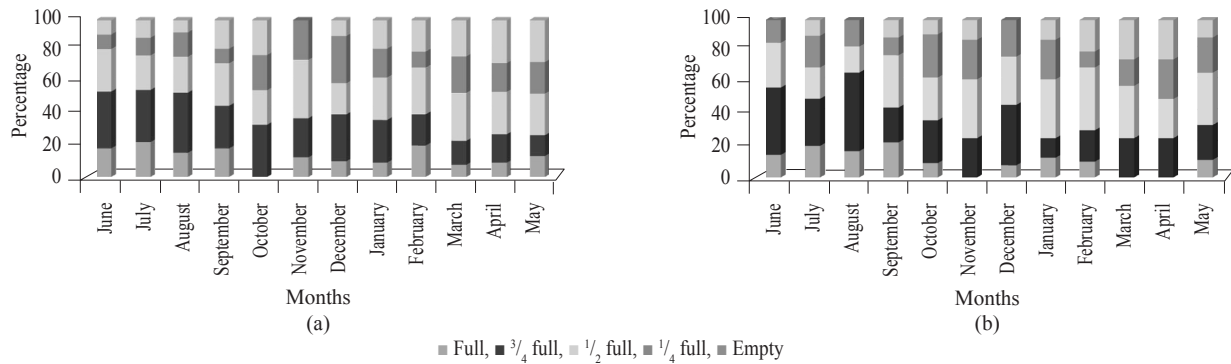


Fig. 2. Degree of fullness of stomach in *O. mossambicus*. (a): Males, (b): Females

availability and food preference, the fish can rapidly switch over among different dietary options (Bowen and Allanson, 1982; McKaye and Marsh, 1983; McKaye *et al.*, 1995). *O. mossambicus* may possibly be a primarily herbivorous or a detritivorous fish (Bruton and Bolt, 1975; Whitfield and Blaber, 1978; De Silva *et al.*, 1984). The high occurrence of detritus reveals a detritivorous feeding nature of the fish (Doupe and Knott, 2010). A similar result of dominance of detritus in the diet of *O. mossambicus* was reported in Yamuna River in India (Ganie *et al.*, 2013). The record of sand grains in the gut of the fish is an indication of its probable bottom feeding habits. Occurrence of molluscan shells in the diet also furnishes a possible benthic feeding nature of the fish. Aravindan (1980) and Panikker (2000) reported the omnivorous feeding habit of *O. mossambicus* which is in favour of the present study.

Several studies were undertaken on the decline of fish species in the natural waters of India due to the expansion of *O. mossambicus* (Sreenivasan and Sundarajan, 1967; Jhingran, 1984; Natarajan and Menon, 1989; Sreenivasan, 1996; Lakra *et al.*, 2008; Singh and

Lakra, 2011). The orange chromidae, *Etroplus maculatus* may greatly be affected by tilapia because both the fishes share more or less similar resources (Raghavan *et al.*, 2008). *O. mossambicus* may cause perilous threat to the existence of the vulnerable species *Tor khudree* in Periyar Lake, Kerala (Kurup *et al.*, 2006). The proliferation of tilapia may be a reason for the fast decline of *T. khudree* observed by the local fishers in Poringalkuthu Reservoir, which may gradually displace the golden masheer from the reservoir. *O. mossambicus* is an important species in the daily landings from the reservoir. The high catch (2.52 t per year) of *O. mossambicus* in Poringalkuthu Reservoir (Roshni *et al.*, 2015) indicates successful establishment of the species in the reservoir and the species may replace the endemic and threatened fish fauna in the far future. Therefore, there is urgent need to initiate continuous monitoring of the population status

and range expansion of *O. mossambicus* in the study site and related parts of the river. The investigation on the history of invasion, habitat specificity and eco-biology of the fish is suggested to evaluate its potential impacts on native fishes and for developing effective management strategy.

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