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Food and feeding habits of *Oreochromis mossambicus* (Peter-1852) from Vadavar river, Lower Anicut Tamilnadu, India.

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Abstract

A total of 270 specimens of *Oreochromis mossambicus* were collected from Vadavar river Lower Anicut, South India during December 2009 to August 2010. Qualitiative and quantitative study of gut contents showed that *Oreochromis mossambicus* strongly selected green algae, blue green algae and diatom as dominant food items throughout the study period. It was also noted that both the juveniles and adults fed predominantly on green algae, blue green algae and diatoms.

Keywords: algae, diatoms, food and feeding habits, *Oreochromis mossambicus*, percentage composition, Vadavar river.

INTRODUCTION

Cichlid fishes have a worldwide distribution but are known to have originated from Africa and Madagascar where they are important to the economy and ecology of the ecosystems, which they inhabit. The reason for their wide distribution is probably connected with their prolific reproductive habits (Fryer and Iles, 1972; Babiker and Ibrahim, 1979). *Oreochromis mossambicus* was first introduced to India in 1952. Its culture in Indian water was later discouraged because it was reported to be a serious threat to native carps. Nevertheless *Tilapia* has been privately reared in certain pockets of North – East India (Hatikakoty, 2002). *Tilapia* was brought by the Central Marine Fisheries Research Institute, Mandapam on August 7, 1952 from Bangkok and the second by the Madras Fisheries Department in the same year from Ceylon. A small stock of tilapia from Mandapam was taken to the pond culture Division of CIFRI at Cuttack in December, 1953, to make a detailed study of the biology and culture of the species and the probable effects of its culture on Indian major carps (Jhingran 1991). *Tilapia* can be broadly classified into three subgenera which are mainly the *Tilapia*, *Sarotherodon* and *Oreochromis* species, the latter being mostly mouth brooders. *Tilapia* is one of the most important species for the 21st Century aquaculture and is cultured in more than 100 countries (Fitzbimmons 2000 and Lopez and Arcila 2009). Nile tilapia *Oreochromis niloticus* is cultured worldwide mostly in semi – intensive culture systems.

Fish must exploit food in aquatic environment and the adaptation for that might be some morphological traits related to feeding. Understanding the relationship between body structures and fish diet could be important for predicting the diet of, how they feed and the mechanics of feeding. Studies on stomach composition could provide useful information in positioning of the fishes in a food web in their environment and in formulating management strategy options in multi species fishery. Pius and Benedicta (2002) reported the use of stomach content results to reduce intra and inter specific composition for ecological niche. The data on stomach composition of fish is vital in providing straight forward models of stomach content dynamics.

Fishes may be classified, according to the amount of variation in the types of food consumed by them as follows (1) euryphagic, feeding on a variety of foods; (2) stenophagic, feeding on a few different types of food; and (3) monophagic, feeding on only a single type of food (Nikolsky, 1963). Studies on the diets of *Tilapia* from various habitats in different countries have indicated that both *O. mossambicus* and *O.niloticus* are omnivorous. However, some controversy remains with regard to feeding habits and resources exploited. In some cases, *O.mossambicus* were found to be detritivorous (Vass and Hofstede 1952; Bowen 1981; Hofer and Newrkla, 1983; Otto Infante 1985; Bitterlich 1985) while, in other cases, they were found to prefer phytoplankton and aquatic macrophytes (Doha and Haque 1996, Dempster *et al.*1993). In this context, the present investigation was planned to bring out the exact information of food and feeding habits among *O.mossambicus* from Vadavar river.

MATERIALS AND METHODS

A total of 270 specimens of *Oreochromis mossambicus* in different size groups were collected weekly from a branch of Kollidam river namely Vadavar River, Tamilnadu, South India during the period between December 2009 to August 2010. The specimens were kept chilled in ice box immediately after capture by using a cast net and they were brought to the laboratory for gut contents analysis. Total length (in mm) and total weight (in gm) of all specimens were recorded. And then the sex was noted immediately. The stomach of

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Table. 1. Monthly percentage composition of food items of *Oreochromis mossambicus* in the present study area during the present study period.

Month and Year	Specimens examined	Empty stomach	Diatoms	Blue green algae	Green algae	Zooplankton	Plant matter	Insects	Worms	Fishes	Unidentified
Dec'09	30	10	12.38	29.30	45.72	1.17	2.65	0.58	0.29	1.47	6.48
Jan'10	30	8	18.04	31.12	45.85	1.84	0.92	0.73	0.18	1.28	0.00
Feb'10	30	5	17.66	33.55	40.83	0.00	6.18	0.00	0.00	0.00	1.76
Mar'10	30	10	12.08	35.98	44.47	1.02	2.10	0.51	0.77	0.00	3.08
Apr'10	30	9	15.5	27.5	49.25	5.0	0.0	2.25	0.00	0.00	0.00
May'10	30	11	21.72	16.98	53.33	2.58	0.43	0.86	0.64	0.00	3.44
Jun'10	30	3	15.37	16.03	64.46	0.82	0.00	0.00	0.66	0.00	2.64
Jul'10	30	7	25.06	8.87	62.40	0.52	0.00	0.78	0.00	0.00	2.34
Aug'10	30	4	15.87	8.16	68.25	0.00	1.58	0.45	1.13	0.45	4.08
% Occurrence of average 9months			17.07	23.05	52.72	0.94	2.09	0.68	0.40	0.35	2.64

each specimen was taken out and gut weight was noted with the help of electronic balance. The stomach was also dipped into alcohol to avoid deterioration. Then, every gut was split open and the various food contents in it was observed and identified. Finally the gut contents were preserved in 5% formalin.

All the food contents were transferred into petridish containing known quantity of water. They were thoroughly mixed and were examined under the binocular microscope. The contents of the stomach were identified to the species level where ever possible and analysed by the frequency of occurrence method and numerical method as described by Bagenal (1978). The number of stomach samples in which a given food item is found is expressed as a percentage of all non-empty stomachs examined. It gives an estimate of the proportion of that food item. The advantage of the frequency of occurrence method is its helpfulness in establishing relative abundances. It also requires less time. It is however inadequate when a significant

Fig. 1. Average percentage composition of food items of *Oreochromis mossambicus* at the present study area during the present study period.

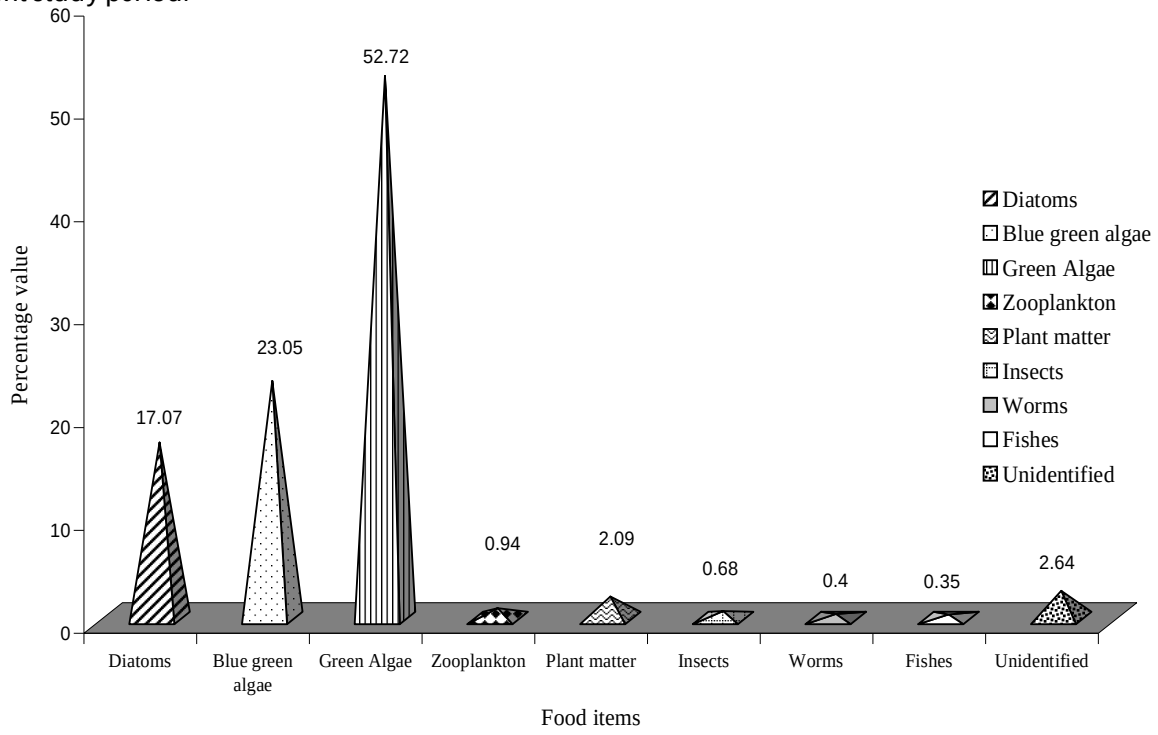
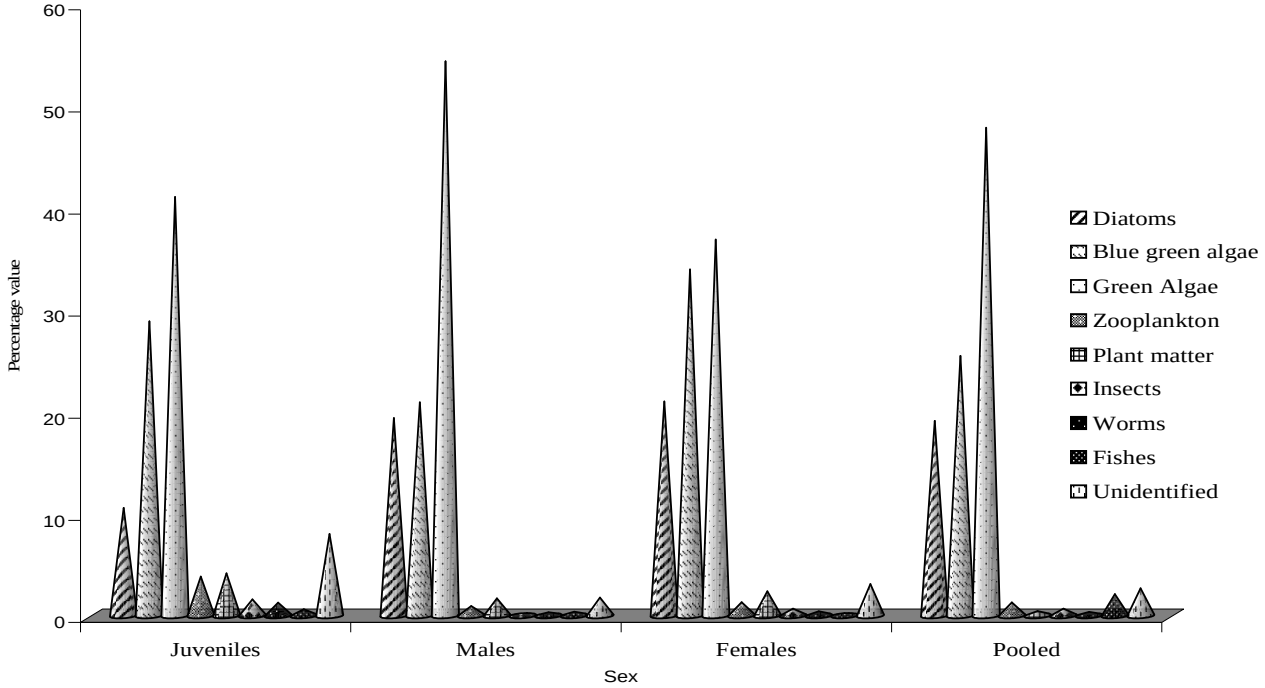


Fig.2. Percentage composition of various food items among different sexes of *Oreochromis mossambicus* in the present study area during the present study period.



component of the diet does not occur in discrete units of uniform size. It provides little information on the food values of different items.

RESULTS

The results on the stomach contents of *Oreochromis mossambicus* are presented in Tables 1and 2. The stomach contents were of 9 categories (Table - 1). These were green algae (47.80%), blue green algae (25.45%), diatoms (19.08%), unidentified materials (2.70%), fish parts (2.11%), zooplankton (1.31%), remains of insects (0.69%), plant matter (0.45%) and worms (0.37%).

The gut content analysis of fishes from each fish showed that the fish feed on a variety of food. The food types recorded are fish parts, zooplankton (*Daphnia sp.*, *Cyclops sp.*), worms, insects (Chironomus larvae, mosquito larvae, tubifex larvae), plant matter, unidentified materials, green algae (*Spirogyra sp., Closterium sp., Ulothrix sp., Scenedesmus sp., Zygnema sp., Oedogonium sp.,* colonial algae, *Ankistrodesmus sp., Agenellum sp., Volvox sp., Pediastrum sp., Dichotomosiphon sp., Actinastrum sp.*), blue green algae (*Anabaena sp., Oscillatioria sp., Gomphosphaeria sp., Agmeneilum sp.*) and diatoms (*Synedra sp., Cyclotella sp., Navicula sp., Cymbela sp., Nitzschia sp., Fragillaria sp.,*) as shown in Table-1.

Monthly percentage composition of food items

The monthly percentage composition of food items are given in Table- 1. The highest percentage of green algae was recorded in the month of August 2010 (68.25%) and the lowest in February 2010 (40.83%). The highest percentage of blue green algae was observed in the month of March 2010 (35.98%) and the lowest in Aug 2010 (8.16%). The highest percentages of diatoms were recorded in July 2010 (25.06%) and then the lowest in March 2010 (12.08%). The highest percentage of unidentified materials were recorded in Dec 2009 (6.48%) and the lowest in Feb 2010 (1.76%). The highest percentage of plant matter was recorded in Feb 2010 (6.18%) and the lowest in May 2010 (0.43%). The highest percentage of zooplankton was recorded in Apr 2010 (5.0%) and lowest in July 2010 (0.52%). The highest percentages of remains of insects were observed in Apr 2010 (2.25%) and lowest in Aug 2010 (0.45%). The highest percentage of worms were recorded in Aug 2010 (1.13%) and lowest in Jan 2010 (0.18%). The average percentage occurrence of various food items among nine months are as follows (Fig. 1)

Green algae	(52.72%)
Blue green algae	(23.05%)
Diatoms	(17.07%)
Unidentified materials	(2.64%)
Plant matter	(2.09%)
Zooplankton	(0.94%)
Remains of insects	(0. 68%)
Worms	(0.40%)
Fish parts	(0.35%)

Percentage composition of food items in relation to sex

The percentage composition of gut contents in juvenile, male and female are given in Table-1. The percentage

Table. 2 Age and Sex-wise percentage composition of food items of *Oreochromis mossambicus* in the present study area during the present study period.

Sex	Specimens examined	Diatoms	Blue green algae	Green algae	Zooplankton	Plant matter	Insects	Worms	Fishes	Unidentified
Juveniles	13	10.57	28.84	41.02	3.84	4.16	1.60	1.28	0.64	8.01
Males	144	19.37	20.90	54.30	0.96	1.70	0.21	0.34	0.39	1.79
Females	113	20.99	33.92	36.84	1.32	2.39	0.70	0.44	0.26	3.10
Pooled samples	270	19.08	25.45	47.80	1.31	0.45	0.69	0.37	2.11	2.70

composition of stomach contents for the juveniles comprised of green algae (41.02%), blue green algae (28.84%), diatoms (10.57%), unidentified materials (8.01%), plant matter (4.16%), zooplankton (3.84%), insect (1.60%), worms (1.28%), and fish parts (0.64%). While the food of the males was made up of green algae (54.30%), blue green algae (20.90%), diatoms (19.37%), unidentified materials (1.79%), plant matter (1.70%), zooplankton (0.96%), fishes parts (0.39%), worms (0.34%) and insect (0.21%). The percentage composition of food items in the stomach of the females comprised predominantly green algae (36.84%), blue green algae (33.92%), diatoms (20.99%), unidentified materials (3.10%), plant matter (2.39%), zooplankton (1.32%), remains of insect (0.70%), worms (0.44%) and fish parts (0.26%). The juveniles and the adults fed predominantly on green algae, blue green algae and diatoms (47.80%), (25.45%) and (19.08%) respectively. The adults food consisted of fish parts, worms, remains of insect in small quantities (Table-2).

DISCUSSION

The presence of wide variety of food items in the diet of *O.mossambicus,* indicates an omnivorous feeding habit. Detailed dietary composition also showed that all are omnivorous, but more dependent on pelagic food items. *O.mossambicus* are generalist / opportunistic omnivores that consume detrital material, vegetation ranging from diatoms to macroalgae to rooted plants, invertebrates and small fish (Trewevas 1983). Diets differ depending on location – specific resource availability. De Silva *et al.* (1984) report *O.mossambicus* populations in different lakes are different in diets and trophic strategies ranged from detritivory to herbivory, to near–exclusive carnivory with individuals preying on small fish and invertebrates. The diet of *O.mossambicus* in Vadavar river comprised of every available food items, even though in small quantities. The fact that every food item assessed appeared in its diets of both juveniles and adult stages show the omnivorous nature of the species. The juveniles fed more on zooplankton, insects, worms and fishes than the adults. This agreed with the findings of De Silva *et al.* (1984).

A change of diet with increasing body size of fish has been widely reported (Galis *et al.* 1993). This may be an adaptation to reduce intraspecific composition among different size groups. In the present study, it is also revealed that larger fish eat proportionately more voluminous food types such as green algae, blue green algae and diatoms. This observation that the smaller ones have a relatively lower food amount in their gut than the larger fish relates to the feeding index. This is attributable to age- specific difference in feeding behaviour, and the inability of young fish to feed relatively large food particles.

Tilapia ingest a wide variety of natural food organisms, including plankton, some aquatic macrophytes, planktonic and benthic invertebrates, larval fish, detritus and decomposing organic matter. With heavy supplemental feeding, natural food organisms typically account for 30 to 50 percent of tilapia growth. *Tilapia* are often considered filter feeders because they can efficiently harvest plankton from the water. However, *Tilapia* do not physically filter the water through gill rakers as efficiently as true filter feeders such as gizzard shad and silver carp. The gills of *Tilapia* secrete a mucous that traps plankton. The plankton–rich mucous or bolus is then swallowed. Digestion and assimilation of plant material occurs along the length of the intestine (usually atleast six times the total length of the fish).

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