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FOOD AND FEEDING HABIT OF *PUNTIUS FILAMENTOSUS* (VALENCIENNES, 1844) IN THE MEENACHIL RIVER, KERALA

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ABSTRACT
Fishes consume different kinds of food and they differ greatly in the nature of food they consume. Food and feeding habits of fishes is largely influenced by their habitat. The present investigation is on the food and feeding habits of the spotted barb *Puntius filamentosus* in the Meenachil River, Kerala. The study revealed that the fish is a planktophagus omnivore feeding mainly on chlorophyceans. Plant matter was found to be the major food item in all size categories of fishes analysed. No considerable seasonal variations in the types of food consumed by the fish and in the feeding intensity during the post and pre monsoon months. The young ones were more active feeders than the larger size groups. The consistent occurrence of sand and mud throughout the study period indicates that the species is a bottom grazer as well. Variation in the diet according to the size of fish indicates small changes in the preference of food items in different size categories which may favour to avoid direct competition for food between the smaller and larger size groups.

KEYWORDS: *Puntius filamentosus*, Meenachil River, feeding intensity, RLG, stomach contents.

INTRODUCTION
Fishes are notably opportunistic feeders and a knowledge on where and what they feed will provide an insight in to their ecology rather than simply knowing the actual components of their food. They are highly adapted in their food and feeding habits, utilizing most of the readily available food. The magnitude of fish population in a region is a function of its food potentialities. The functional morphology of feeding deserves detailed exploration because of its intimate linkage to all aspects of fish evolution and biology. The basic knowledge on the food preference and feeding habits of fish species from a natural habitat help in understanding the autecology, production and ecological role of the population. The dietary habits of fish based on stomach content analysis are widely used as an important means of investigating the trophic relationship in aquatic communities. The dietary analysis of fishes in specific habitats indicates the trophic segregation pattern among the members of fish community in that habitat.

Puntius is the genus of the fish with greatest species richness in India. *Puntius filamentosus* commonly called as "Spotted Barbs" is a widely distributed tropical fresh water fish with ornamental value due to its attractive colour and appearance (Talwar and Jhingran, 1991). The species is endemic to but wide spread within the Western Ghats mountain region of southern India (Mercy *et al.* 2002; Kurup *et al.*, 2004) and forms a good fishery in Kerala, occurs in large shoals in freshwater rivers and lakes. Substantial work has been done by various workers on the food and feeding habits of commercially important fishes from Indian rivers (Geetha *et al*., 1990; Mercy *et al*., 2002; Gupta, 2015), but little information on that of *Puntius filamentosus* from Kerala waters (Premkumar *et al*., 1986). The present work is aimed to investigate the diet of *Puntius filamentosus* inhabiting the Meenachil river of Kerala and analysed the seasonal and size dependent variation in the feeding intensity and type of food consumed by the fish.

MATERIALS AND METHODS
Monthly collections of *Puntius filamentosus* were made during October 2016 to April 2017 from the Meenachil River by cast net. A total of 330 specimens (males, females and indeterminate) in the length range of 79 mm to 162 mm were analysed for the study. The total length (to the nearest 1 mm) and total weight (to the nearest 0.1 g) of each specimen were recorded. The fishes were then dissected out, sex and maturity stages were recorded, and the stomachs were removed and preserved in 4% formaldehyde solution. Both qualitative and quantitative analyses of diet were carried out. Each stomach was emptied into petridish and examined under microscope. Attempts were made to identify the food items up to the possible taxonomic level depending on the state of

digestion. The food contents were assigned semi digested matter status, when the process of digestion made identification impossible. To analyse the amount of each food item in the gut the method of Platell and Potter (2001) was modified by evenly spreading the contents from each stomach in the counting cell chamber and examining under microscope. Analysis was done using frequency of occurrence and numerical methods as described by Hyslop (1980). In the frequency of occurrence method, the occurrence of each food item was expressed as the percentage of total number of stomachs containing the food. The number of each food item was expressed as the percentage of total number of food items found in the stomach in the numerical method.

To assess changes in the diet with fish size, the fishes were categorized into 5 size groups, ranging from 70 - 90 mm, 90 – 110 mm, 110-130 mm, 130 – 150 mm and 150 -170 mm. Seasonal studies on the food and feeding habits was carried out by compiling the monthly data into post(Oct-Jan) and pre monsoon(Feb-April) seasons.

Feeding intensity was determined based on the degree of distension of stomach and the amount of food items in the stomach. The stomachs were classified as gorged, full, ¾ full, ½ full, ¼ full, trace and empty and the fishes were classified as actively fed(gorged, full, ¾ full), moderately fed (1/2 full) and poorly fed (¼ full, trace, empty). Seasonal and length group based determination of feeding intensity was carried out.

RESULTS AND DISCUSSION

Relative Length of Gut

Each fish species has its own structural adaptations of the alimentary canal towards its specific food habit which varies greatly with regard to the ratio of animal and plant food materials ingested (Das Gupta, 2004). The proportion of gut length to body length vary due to varied nature of diet at different stages of their development (Das and Srivastava, 1979; Premkumar *et al*., 1986; Geetha *et al*., 1990; Rao and Sivani, 1996). Various researchers have used the ratio between gut length and body length (RLG) as an indication of the diet. It is a fact that the vegetable matter requires more time for digestion and hence herbivorous fishes have higher RLG values than omnivorous and carnivorous fishes. RLG values estimated for the herbivorous fishes *Labeo rohita* and *L gonius* were 12 and 9.5 respectively (Das and Moitra, 1956, 1958, 1963) whereas in omnivorous fishes *Puntius conchonius* and *Barbus hexasticus* the RLG values were 3.3 and 2.3 respectively (Das and Nath, 1965) and in carnivorous fishes the values are very low (Das and Moitra, 1956) as in *Bagarius bagarius* (0.8) and *Notopterus chitala* (0.4). In the present study the RLG value (mean) calculated was 2.18 and the length of the gut as well as the RLG values increases gradually as the fish grows in size (Table I) which reveals the transformation of smaller carnivorous to larger omnivorous nature of the fish *Puntius filamentosus* in the Meenachil river.

Diet composition

Information on gut contents of fishes is important in understanding community ecology, structure and stability of food webs, trophic dynamics, resource partitioning, functional role of fishes in different aquatic ecosystems and ecological energetics (Wootton, 1999; Bacheler *et al*., 2004). Seasonal numerical percentage (N %) and frequency of occurrence (F %) of various food items of *Puntius filamentosus* in the Meenachil river is shown in Table II. The trophic spectrum of *Puntius filamentosus* was composed of 12 dietary items which were classified in to 6 major categories as Bcacillariophyceans, chlorophyceans, cyanophyceans, dinophyceans, animal components and inorganic components. Considerable amount of digested and semi digested plant matter was present in almost all stomachs. Plant matter contributed the major component (74.51%) followed by inorganic components such as sand and mud (21.33%) and animal matter (3.16%). The fish are able to digest plant material due to the breaking up of the plant cell by the grinding action of the sand grains (Blaber, 1976) and it has been suggested that the function of considerable fraction of inorganic particles in the stomach contents is to act as a grinding paste in the degradation of the plant cell walls in the stomach (Thomson, 1966).

Phytoplankton formed the predominant planktonic component of food throughout the period of study and *Chlorella* contributed 43.2% of the diet category during the post monsoon season and 29.64% during the pre monsoon season. Cyanophycean *Nostoc* was next in abundance to *Chlorella* and it contributed 12.66% of the total plant component of the diet. Other genera of phytoplankton present and their overall contribution in the plant component of the diet were *Oscillatoria*(11.95%), *Bacillaria*(8.64%), *Ulothrix*(8.23%), *Nitschia*(8.12%), *Cyclotella*(7.78%), *Navicula*(6.61%) and *Peridinium*(3.59%). Most fish species, to a certain degree are opportunistic feeders and feed on a wide spectrum of organisms, but switch between food items depending upon seasonal availability and abundance of the item. Seasonal variations in the composition of phytoplankton in the diet of *Puntius filamentosus* of the Meenachil River is presented in Fig.1.

Variation in the diet of *Puntius filamentosus* in the Meenachil River according to the size of fish indicates small changes in the preference of food items in different size categories which may favour to avoid direct competition for food between the smaller and larger size group of fishes. The diet of smallest length classes(70-90mm) are composed predominantly of *Bacillariophyceans* while fish of the next higher classes had less percentage of *Bacillariophyceans* and more percentage of *Chlorophyceans.* Feeding on certain food

item at different intensities may be an adaptation to minimize the interspecific competition for food (Wijeyaratnae and Costa, 1990; Blay, 1995). The smallest length classes consumed higher percentage of animal components. It was also noticed that with an increase in size and consumption of chlorophycean food, there was a rise in the occurrence of sand and mud particles in the stomach.

Feeding intensity

Actively fed (40.5%) and poorly fed fishes (39.0%) were more or less equal in the samples. Moderately fed fishes were low in the samples compared to the other two categories (20%). Feeding intensity was more or less same in the post and pre monsoon periods. % of actively fed fishes varied between 33 and 42 during the post monsoon season and between 30 and 44 during the pre monsoon period. Moderately fed fishes were less in the samples, 7-20% during the post monsoon period and 20-26% during the pre monsoon period. On an average 49% of the fishes analysed during the post monsoon period and 40% analysed during the pre monsoon period were poorly fed. The low feeding intensity during the post and pre monsoon months may be an indication of intense spawning during this period. Most of the fishes collected were in advanced stages of sexual maturity.

The percentage of feeding intensity in relation to various length groups is presented in Fig.2. Generally, fishes with actively fed stomachs were recorded more in smaller length groups (70-90 mm) and the lowest in larger length groups (150-170 mm). Poorly fed fishes were more in larger length groups and were less in smaller fishes.

The present study shows that phytoplankton constituted the main diet of *Puntius filamentosus* in the Meenachil River. No significant seasonal variation in the food type consumed was recorded, however, considerable qualitative difference in the plankton genera identified in the stomach contents. Fishes feeding on filamentous algae and other phytoplankton along with sand and mud are usually placed under the group of bottom feeders. The present study also leads to the idea that *Puntius filamentosus* in the Meenachil River frequently or even some times tends to resort to bottom feeding.

Table I: Size dependent variations in the length of gut and RLG of *Puntius filamentosus* in the Meenachil River.

Length groups	No. of fishes examined	Length of gut(cm)			Relative length of Gut(RLG)		
		Min	Max	Mean	Min	Max	Mean
Total	330	9.2	43	26.5	1.15	3.23	2.18
70-90 mm	30	9.2	24.2	14.2	1.15	2.75	1.67
90-110 mm	72	13.5	33	21.1	1.44	2.88	2.07
110-130 mm	150	17.2	36.2	27.3	1.48	3.23	2.28
130-150 mm	58	23.5	42.4	31.7	1.57	2.96	2.31
150-170 mm	20	24.5	43	33.2	1.63	3.06	2.42

Table II: Seasonal numerical percentage (N %) and frequency of occurrence (F %) of various food items of *Puntius filamentosus* in the Meenachil river.

Food item	Post Monsoon		Pre Monsoon		Total	
	N %	F %	N %	F %	N %	F %
Bcacillariophyceans	8.55	75.33	25.76	96.35	15.70	85.21
Chlorophyceans	40.77	100	30.71	98.20	37.81	99.16
Cyanophyceans	25.50	91.08	2.95	36.20	14.20	63.47
Dinophyceans	0	0	15.80	76.81	7.80	35.01
Animal components	3.53	29.36	3.78	28.66	3.16	28.99
Inorganic components	21.65	98.65	21.00	100	21.33	99.30

Table III: Percentage of various food items (N % and F %) in various length groups of *Puntius filamentosus* in the Meenachil River.

Length groups	Bcacillariophyceans		Chlorophyceans		Cyanophyceans		Dinophyceans		Animal components		Inorganic components	
	N%	F%	N%	F%	N%	F%	N%	F%	N%	F%	N%	F%
70-90 mm	35.35	100	19.65	100	4.74	42.12	13.25	90.32	10.65	96.32	16.36	97.84
90-110 mm	19.11	96	35.56	100	6.30	50.21	12.25	93.21	10.43	76.81	16.35	100
110-130 mm	7.74	90.32	44.2	100	13.66	63.25	7.12	87.84	2.25	50.21	25.03	100
130-150 mm	7.39	93.06	43.12	100	14.36	72.1	5.20	97.00	1.28	42.21	28.65	100
150-170 mm	6.98	92.22	42.31	100	19.32	90.08	3.61	72.1	0	0	27.78	100

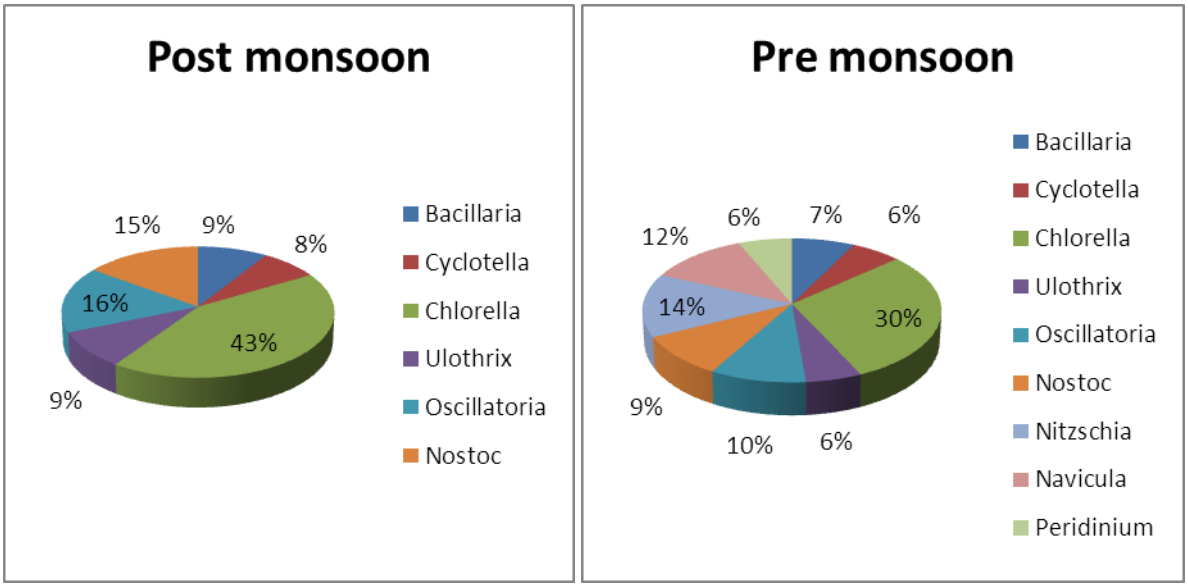

Fig. 1: Seasonal variations in the composition of phytoplankton in the diet of *Puntius filamentosus* of the Meenachil River.

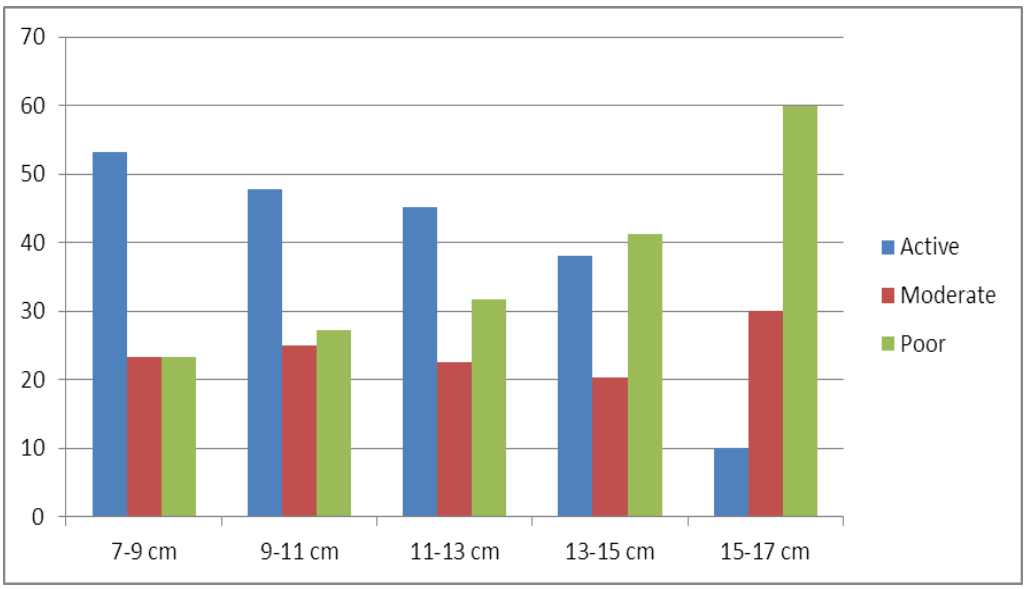

Fig. 2: Feeding intensity (%) of *Puntius filamentosus* in the Meenachil River in relation to size (Length).

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