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Research Article

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SEASONAL VARIATION IN GUT CONTENTS OF INDIAN MAJOR CARP, *CIRRHINUS MRIGALA* FROM MEERANPUR LAKE, INDIA

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Abstract: The present study was carried out to analyze the gut contents of Indian major carp, *Cirrhinus mrigala* from Meeranpur Lake of district Sultanpur, India from June 2018 to May 2019. The information on the feeding habits of fish helps to understand the inter-specific relationship of aquatic fauna and the productivity of the water body. The result so obtained was used to compute the percentage volume of food items in the gut (% V_i), frequency of occurrence of gut having particular food items (% O_i), index of preponderance (I) and grading of various food items in gut contents of Mrigal, *Cirrhinus mrigala*. In the present study, the gut was consisted by decay matter, phytoplankton, zooplankton, plant materials and insects. The result showed that the decay matter and plankton dominated in gut contents and considered as main food components during pre-breeding, breeding and post-breeding seasons. The bottom feeder and omnivorous feeding habit of *Cirrhinus mrigala* was confirmed by the index of preponderance and grading of various food items.

Keywords: *Cirrhinus mrigala,* Feeding habit, Gut analysis, Meeranpur Lake, Seasonal variation.

INTRODUCTION

Fishes are exclusively aquatic and cold blooded animals with streamlined body having either cartilaginous or bony endoskeleton or lateral line sense organs (Verma and Prakash, 2020a). The fish *Cirrhinus mrigala* is the third most important Indian major carp next to Bhakur (*Catla catla*) and Rohu (*Labeo rohita*). It is commercially cultured in the Indian sub-continent and is commonly known as "Mrigal" or "Nain" due to presence of golden eyes. The analysis of gut contents provides an important insight about feeding patterns and quantitative assessment of feeding habit. Assessment of food and feeding habit is important to evaluate the ecological role and position of the fish in the food web of ecosystems (Allan and Castillo, 2007; Pradhan and Patra, 2015). The information on diet and food habits are valuable in the decision making process related to natural resources (Kido, 1996). The information on food and feeding habit provides further support to fisheries management

and fish production. Food ingestion in fish is highly variable and depends on the availability of food items, species combination and their interactions (Rahman *et al*., 2009). A good relationship between the fish and food component is necessary for the production and exploitation of the fishes and they constitute an indispensable part of an aquatic ecosystem and agriculture (Verma, 2018 and 2019).

In fishes, assessment of food and feeding habit using gut content analysis has long been used for preliminary assessment (Hyslop, 1980; Cortes, 1997) while these were recorded qualitatively, quantitatively and percentage abundance (Pelicice and Agostinho, 2005; Baker *et al*., 2014). The food feeding habit and gut content analysis can be used to evaluate the habitat preferences, prey selection, effects of ontogeny and developing conservation strategies. Chakrabory *et al.* (2019) described the status of Indian major carps spawns**.** The fishes prefer to eat planktons (Kumar *et al*., 2007 Prakash *et al*., 2020**;** Verma and Prakash, 2020b; Sugumaran *et al.,* 2020).

The qualitative and quantitative dietary analysis of fish in their natural habitats enrich the understanding of the growth, abundance, productivity of water body (Nansimole *et al*., 2014) and used to describe food habits and feeding patterns of fishes (Ekpo *et al*., 2014). A number of researchers including Kumar *et al*. (2007), Padmakumar *et al*. (2009) and Soni and Ujjania (2017) did a lot to find out the quantification of food, feeding habit and feeding intensity relationship of fishes, number of indices and importance of preponderance index. Considering these facts, author attempted to analyze the gut content and feeding habit of Mrigal (*Cirrhinus mrigala*) from Meeranpur lake of Sultanpur (U.P.), India in different seasons from June 2018 to May 2019.

MATERIALS AND METHODS

The Mrigal fishes were collected twice in a month from Meeranpur lake of district Sultanpur, Uttar Pradesh, India with the help of fisherman. The study was conducted from June 2018 to May 2019 to analyze the seasonal variation in food choices and feeding habits. Just after collection 10% formalin solution was injected in to the gut of all collected fishes in order to stop digestion of food items and brought to the Research laboratory of Post Graduate Department of Zoology, Ganpat Sahai P. G. College Sultanpur, Uttar Pradesh, India. The gut was then cut open and the contents were analyzed under binocular microscope for the food composition, preference and relative importance of various food items. Quantification of food, feeding habit and feeding intensity relationship of fishes, importance of preponderance index etc. were done by the number of indices as elaborated by Hynes (1950), Baker *et al*. (2014). The relative importance of all food contents was quantified by the index of preponderance and was calculated with the help of percent-age composition (volume and occurrence) of food contents to follow the equation of Natrajan and Jhingran (1961).

Percentage by Volume (% Vi)=(Volume of individual food item (Vi))/(Total volume of gut contents (Vt))×100

Frequency of Occurrence (% Oi)=(Number of stomachs containing prey (Ni))/(Total number of stomachs examined (Nt))×100

The index of preponderance (I) = Percentage by Volume (V_i) × Frequency of occurrence (O_i)/ Summation ($V_i \times O_i$) × 100

RESULTS AND DISCUSSION

The gut content analysis of Mrigal, *Cirrhinus mrigala* was done in breeding season (June-September), post breeding season (October-January) and pre breeding season (February-May). The observed and identified gut contents in different season were grouped into different categories like phytoplankton, zooplankton, plant material, insects and decay matter and enumerated in table 1-3.

1. Gut contents analysis during breeding season (Table 1):

The present study revealed that during breeding season, decay matter formed the main food item of gut contents forming 31.34% by volume and

35.82% by occurrence; phytoplankton formed the second important food item of gut contents forming 22.42% by volume and 19.78% by occurrence; zooplankton formed the next important food item of gut contents forming 18.88% by volume and 17.92% by occurrence; plant material forming 16.12% and 11.24% by volume and 15.76% by occurrence and insects forming 11.24% by volume and 10.72% by occurrence.

Table 1 : Gut content analysis of Indian major carp, (*Cirrhinus mrigala*) during breeding season.

Food items	% of Volume(Vi)	Frequency of Occurrence (Oi)	$V_i \times O_i$	Index of Preponderance (I)	Grading
Phytoplankton	22.72	23.86	542.10	25.65	II
Zooplankton	20.64	21.38	441.28	20.88	III
Plant material	18.43	17.24	317.73	15.03	IV
Insects	12.58	11.42	143.66	06.80	V
Decay matter	25.63	26.10	668.94	31.65	I
Summation	**100**	**100**	**2113.71**		

The index of preponderance and grading of various food items of gut contents was represented as a mathematical dominance. Decay matter (49.26%; Grade I) > Phytoplankton (19.46%; Grade II) > Zooplankton (14.85%; Grade III) > Plant material (11.15%; Grade IV) > Insects (5.28%; Grade V) during breeding season (Fig. 1 A).

2. Gut contents analysis during post-breeding season (Table 2):

The present study revealed that during post breeding season, decay matter formed the main food item of gut contents forming 25.63% by volume and 26.10% by occurrence. Phytoplankton formed the second important food item forming 22.72% by volume and 23.86% by occurrence. Zooplankton formed the next important food items of gut contents forming 20.64% by volume and 21.38% by occurrence. Plant materials were 18.43% by volume and 17.24% by occurrence. Insects were 12.58% by volume and 11.42% by occurrence.

Table 2 : Gut content analysis of Indian major carp, (*Cirrhinus mrigala*) during post-breeding season.

Food items	% of Volume(Vi)	Frequency of Occurrence (Oi)	$V_i \times O_i$	Index of Preponderance (I)	Grading
Phytoplankton	22.72	23.86	542.10	25.65	II
Zooplankton	20.64	21.38	441.28	20.88	III
Plant material	18.43	17.24	317.73	15.03	IV
Insects	12.58	11.42	143.66	06.80	V
Decay matter	25.63	26.10	668.94	31.65	I
Summation	**100**	**100**	**2113.71**		

The index of preponderance and grading of various food items of gut content was represented as a mathematical dominance. Decay matter (31.65%; Grade I) > Phytoplankton (25.65%; Grade II) > Zooplankton (20.88%; Grade III) > Plant material (15.03%; Grade IV) > Insects (6.80%; Grade V) during post-breeding season (Fig. 1 B).

3. Gut contents analysis during pre-breeding season (Table 3) :

The present also revealed that during pre-breeding season, decay matter formed the main food item of gut contents forming 41.62% by volume and 42.70% by occurrence. Phytoplankton formed the second important food item forming 20.72% by volume and 19.88% by occurrence. During pre-breeding season Mrigal prefers plant materials in comparison to zooplankton, forming 19.20% by volume and 18.34% by occurrence. Zooplankton formed 9.82% by volume and 9.56% by occurrence while insects formed 8.64% by volume and 9.52% by occurrence.

The index of preponderance and grading of various food items of gut contents was represented as a mathematical dominance. Decay matter (65.40%; Grade I) > Phytoplankton (15.16%; Grade II) > Plant material (12.96%; Grade III) > Zooplankton (3.45%; Grade IV) > Insects (3.03%; Grade V) during pre- breeding season (Fig. 1 C).

Table 3: Gut content analysis of Indian major carp, (*Cirrhinus mrigala)* during pre-breeding season.

Food items	% of Volume(Vi)	Frequency of Occurrence (Oi)	$V_i \times O_i$	Index of Preponderance (I)	Grading
Phytoplankton	20.72	19.88	411.91	15.16	II
Zooplankton	9.82	9.56	93.88	3.45	IV
Plant material	19.20	18.34	352.12	12.96	III
Insects	8.64	9.52	82.25	3.03	V
Decay matter	41.62	42.70	1777.17	65.40	I
Summation	**100**	**100**	**2717.34**		

Result showed that the seasonal qualitative changes in food composition was not observed while quantitatively food contents was dominated by decay matter, phytoplankton, zooplankton, plant materials and insects which may be due to food preference, feeding zone of fish and availability of different food contents in the water body. Amir *et al.* (2013) studied the feeding habit of *Cirrhinus mrigala* and reported that it was bottom feeder and gut contents were dominated by debris, where as Khabade (2015) found gut contents of *Cirrhinus mrigala* dominated by zooplankton. Manon and Hossain (2013) studied the food and feeding habit of *Cyprinus carpio* from Nawgao Bangladesh and reported the studied fish as plant feeder.

Index of preponderance provides summarized information of the volume and frequency of occurrence of various food items. Similarly, it also provides the definite and measurable grading basis of various food items. In the present study, the index of preponderance for decay matter (49.26% ; 31.65% and 65.40%) ; phytoplankton (19.46% ; 25.65% and 15.16%) ; zooplankton (14.85% ; 20.88% and 3.45%) ; plant material (11.15% ; 15.03% and 12.96%) and insects (5.28% ; 6.80% and 3.03%) were noticed during breeding, post breeding and pre breeding seasons respectively (Table 4).

Table 4 : Index of preponderance of gut contents of Mrigal (*Cirrhinus mrigala*) during breeding, post-breeding and pre-breeding season.

Food items	Index of preponderance		
	Breeding	Post-breeding	Pre-breeding
Phytoplankton	19.46	25.65	15.16
Zooplankton	14.85	20.88	3.45
Plant material	11.15	15.03	12.96
Insects	5.28	6.80	3.03
Decayed matter	49.26	31.65	65.40

The seasonal variation in gut contents showed the feeding habit of the fish. It was confirmed by the index of preponderance which reveals the omnivorous and bottom feeding habit of Mrigal (*Cirrhinus mrigala*). Pradhan and Patra (2015) noticed the index of preponderance of *Cirrhinus mrigala* from Pond of Tankapani village, Odisha and classified the fish as omnivorous. Kumar *et al*. (2015) also used the index of preponderance to classify *Catla catla* as planktonivorous from Udai Sagar, Rajsthan. Kumar *et al*. (2007) and Das and Moitra (1963) on their analysis of feeding habits of fishes vividly explained the omnivorous nature of fresh water fishes in different water bodies.

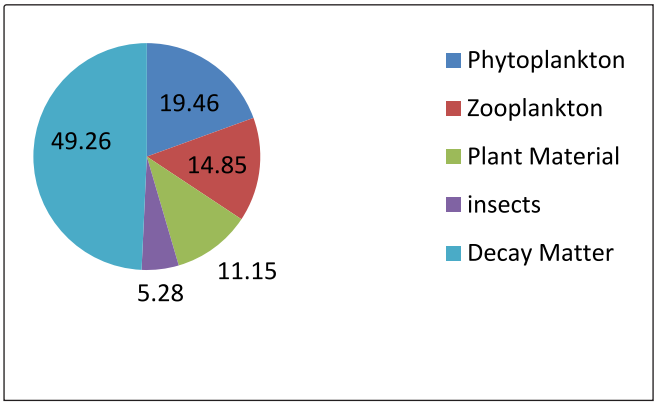

Fig. 1 A: Breeding Season

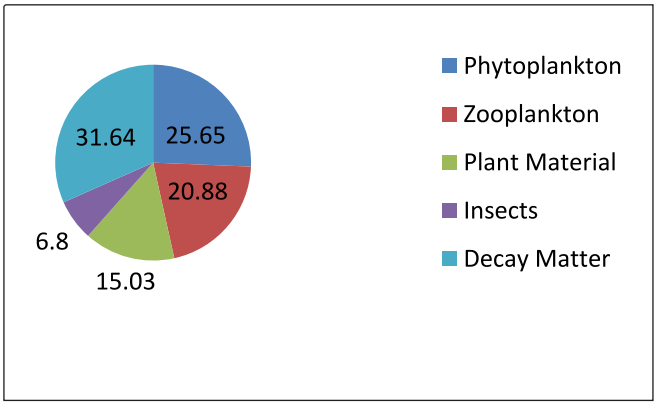

Fig. 1 B: Post-Breeding season

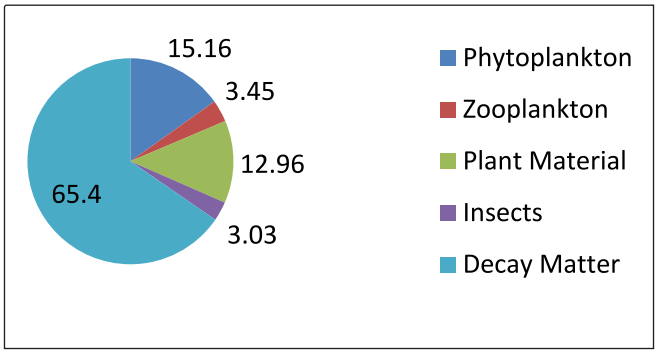

Fig. 1 C: Pre-Breeding season

Fig. 1 (A-C): Representation of seasonal gut contents of Mrigal, *Cirrhinus mrigala* from Meeranpur Lake.

CONCLUSION

Gut content analysis showed that the availability and preference of food items by the fish helps to find out the feeding habit of fish and accordingly fisheries management in the water-body. In the present study, decay matter was the dominant food component followed by phytoplankton, zooplankton, plant materials and insects in the fish gut. On the basis of these observations, it can be concluded that the experimental fish Mrigal, *Cirrhinus mrigala* is bottom feeder and omnivorous in nature.

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