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Nutritional habit of *Channa striatus* (Bloch) from the paddy field of Madhepura District, Bihar

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Abstract:*Channa striatus* (Bloch) has been gaining importance as a common nutrition rich fish. Mean RLG value was found to be highest in the size group of 5.0-10.0cm (0.55) and lowest in the size group of 21.1-25.0 cm. (0.46). The results reveal that the species fall in the carnivorous category. Gut content analysis reveal that zooplankton was the highest percentage (12.50) occurrence in July, insects was found to be highest (23.53%) in June. The highest percentage of crustaceans was observed in February (22), annelids was highest in April (7.40), molluscs occurred in April (3.70) and occurrence of fish in the gut was in September (55.56). The highest percentage of plant matter noticed in January (15.09) andmucks and unidentified components was observed in December (23.26). Analysis of gut contentrevealed that in fry stages most dominant food item was zooplankton (68.52%), followed by insect (25.2%), annelids (5.01%),crustacean (1.02%) and plant matter (0.25%). In juvenile the most preferred food item being insects (31.16%), followed by trash fishes (30.82%), crustaceans (19.82%), annelids (12.18%), plant matter (4%) and molluscs (2.02%). In adult, a strong positive selection was observed for fish (46.37%), insects (12.45%), mucks and unidentified material (12.04%), plant matter (10.12%), crustaceans (9.16%), annelids (6.84%) and molluscs (3.02%). Gastro somatic index (GSI) was ranged from 1.15 ±0.36 (August) to 5.14 ±1.76 (April) for males and that of female from 2.24 ±1.10 (December) to 9.52±3.91 (September).

Key words: *Channa striatus*, RLG, GSI, Gut content analysis

INTRODUCTION

The striped snakehead, *Channa striatus* (Bloch), distributed throughout the South-East Asian countries and has been identified as a potential species for rearing in paddy fields, derelict and swampy water as it is a hardy and air-breathing fish. The fish breeds during south-west and northeast monsoons in flooded rivers and ponds and frequently found in flooded rice-fields[1]. Of freshwater food fishes, they are amongst the easiest to transport due to their air breathing abilities and hardness. Mortalities on transit are generally low. In local markets, they are kept in large bins or tubs in large numbers in little water without aeration. Several works have been reported on the feeding of *Channa* species from outside India. Studied onfood and feeding ratios of the Amur snakehead, *Channa argus* in water bodies in the lower reaches of the Amu Darya[2] while studied on the linear regression model to predict cannibalistic in juvenile *Channa striatus*[3]. Further, recorded feeding intensity and dynamics of *Channa argus* under different illumination[4]. Again studied on the food and feeding habits of *C. punctatus* in beel environment of Bangladesh[5].Several workers investigated food and feeding behaviour of *Channa* species in India. Among the mare: studied the feeding habits of the fingerlings of *Channa striatus*[6], worked on utilization ofnatural food by

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juvenile *C. gachua*[7] and studied the food preference of the juvenile of *Channa gachua*[8]. Meanwhile, investigation of food spectrum and intensity, food preferences and seasonal variation of *C. punctatus* were reported[9,10,11]. Again, Rao *et al.,* (1998) investigated was madeon the food and feeding habits of *Channa* spp. from east Godavari District[12]. Further, adaptation of alimentary tract to feeding habit in four species of *Channa* was also reported[13]. Although, over the last 10 years, its population has undergone a steady decline due to over exploitation, loss of habitat, pollution as well as destructive fishing. According to IUCN status[14], it has been listed among the 66 LR-nt fish species in India. The fish is well known for its taste, high nutritive value and medicinal qualities and is recommended as a diet during convalescence[15]. The paper deals with the food and feeding habit of *Channa striatus* from certain paddy field and wetland of Madhepura district, Bihar.

MATERIALS AND METHODS

The specimens of *C. striatus* were collected from paddy fields of Madhepura district of Bihar during August, 2018 to July, 2019. Food and feeding habits of *Channa striatus* were studied by examining a total of 645 digestive tracts. The guts were removed from the specimen after measuring and weighing each specimen to the nearest cm and gm respectively and were preserved in 5% formalin for subsequent analysis. The preserved guts were later uncoiled, cleaned off the attached fat and the length and weight were recorded.

Relative length of the gut (RLG): The ratio between the gut length and total length (RLG) was estimated by adopting the following formula[16]: Where, GL stands for total length of the gut and TL are the total length of the fish.

Feeding intensity (GSI): The feeding intensity or gastro-somatic index (GSI) was calculated using the following formula[17].

$$GSI = \frac{\text{Weight of the gut}}{\text{Total weight of the fish}} \times 100$$

Gut content analysis: Gut content analysis was done for examining seasonal variation in diet components. Further, the data were analysed for different size group to record basic changes in feeding habit if any and in various stages of growth. Both volumetric and occurrence methods were used for gut content analysis.

(i) Volumetric method: The content of each sample was taken as a unit and various items are expressed as % volume by eye inspection[18]. The content of each gut was vigorously shaken with distilled water and then a drop of the content was examined under microscope. The area occupied by each food item was estimated arbitrarily. At least ten such drops were examined and the average of each of the drops was recorded.

(ii) Occurrence method: In this method, the number of guts containing a particular item of food was expressed as a percentage of the total number of gut examined[19]. This method, apart from describing the qualitative analysis of the diet also gives the frequency of a particular food item occurred in the gut and thus helps to understand the preference of any particular food item.

RESULTS AND DISCUSSION

(**a) Relative length of the gut (RLG):** Mean RLG value was found to be highest (Table-1) in the size group 5.0-10.0cm (0.55) and lowest in the size group 21.1-25.0 cm. (0.46). This indicates a gradual decline in RLG values as the fish grows. The relative length of the gut in *C. striatus* was found to decrease with the increasing length of the fish indicating the change of feeding habit from omni-carnivorous diet in the fry stage to a highly carnivorous in the adult stage. Similar case was also noticed by[20] in *Ompok pabda*; and[21] in *Notopterus notopterus* from different habitats and considered these fish species as carnivorous. A change in the feeding habit of fingerlings of *Channa striatus was reported*[6]. Furthermore, a change in feeding habit of *Channa* in different life stages is reflected in the RLG value at different length groups[13]. Shortened alimentary canal in adult fishes of *C. barca was also observed by*[22]. Thus the low RLG value in adult and high percentage of animal diet in food composition of *C. striatus* confirms that it has a high carnivorous type of feeding habit.

Table-1: RLG value in various length groups of *C.striatus*

Size group (cm)	RLG Value
5 - 10	0.55 (±0.02)
10.1 - 15	0.53 (±0.06)
15.1 - 20	0.50 (±0.02)
21.1 - 25	0.46 (±0.01)

(b) Gut content analysis: The percentage composition of food items in the gut of *C. striatus* as observed in different months has been summarized in the Table-2. The gut content of *C. striatus* have been group into 8 broad categories i.e. zooplankton, insects, crustaceans, annelids, molluscs, fishes, plant matter, mucks and unidentified components. It was seen that there were considerable variations in the percentage of different food items during different months of the year. *Zooplankton* was the highest percentage (12.50) occurrence in July and that of lowest (3.92) in June. Insects percentage varies from 13.95 (December) to 23.53 (June). The highest percentage of Crustaceans was observed in February (22) and lowest (10.05) in May. Percentage occurrence of Annelids was highest in April (7.40) and lowest in June (1.96). The highest percentage of molluscs occurred in April (3.70) and lowest in May (1.61). The highest percentage of occurrence of fish in the gut was in September (55.56) and lowest in December (20.93). The highest percentage of plant matter noticed in January (15.09) and that of lowest percentage in April (1.85). The highest percentage of mucks and unidentified components was observed in December (23.26) and lowest in February (2.0). Seasonal variation showed a slight variation in feeding habit which might be due to fluctuation in the availability of different food items in different season. Percentage occurrence of annelids and molluscs was highest during pre-monsoon season while zooplankton and insects were also found to be the highest percentage during monsoon season. Again, the highest percentage of fish, crustaceans, plant matter and mucks and unidentified components were observed during post monsoon and winter season. The main food items of *C. striatus* were insect eggs, gastropods and aquatic vegetation during summer and maximum food intake was recorded during post-monsoon and pre-monsoon and minimum in winter was reported[9]. Feeding was found to be intensive during February-May and August-October and low during June-July and November-January. From the present study it can be inferred that *C. striatus* changes its food habit with the change in seasons. These findings agree with those of[23] who reported that *Tilapia nilotica* changed its food habit with the change in season.

(c) Food composition in various life stages: Variation of food composition in various life stages is recorded in Table- 3 and the same is summarized below:-

Fry: Analysis of gut content revealed that in fry stages most dominant food item was zooplankton (68.52%), followed by insect (25.2%), annelids (5.01%), crustacean (1.02%) and plant matter (0.25%).

Juvenile: The most preferred food item being insects (31.16%), followed by trash fishes (30.82%) and crustaceans (19.82%). Among other items annelids (12.18%) are notable. Plant matter constituted only 4% of the gut content molluscs constituted 2.02%.

Adult: Fish was found to be the most dominant (46.37%) item in the gut. The next food items in order of preference were - insects (12.45%), mucks and unidentified material (12.04%), plant matter (10.12%), crustacean (9.16%), annelids (6.84%) and molluscs (3.02%).

Table 2: Seasonal variation of food items in *C. striatus*

Month	No. of fish examined	Zooplankton		Insects	Crustaceans	Annelids	Molluscs	Fishes	Plant Matter	Mucks and others
		Protozoa	Rotifers							
Jan	53	-	5.66	16.78	18.86	-	-	28.30	15.09	15.09
Feb	50	-	8	16	22	-	-	32	20	2.0
Mar	45	4.44	6.67	20	17.78	-	-	35.56	11.11	4.44
Apr	54	-	-	20.37	18.52	7.40	3.70	48	1.85	-
May	62	6.45	-	19.35	10.05	4.84	1.61	48.02	9.68	-
Jun	51	-	3.92	23.53	17.65	1.96	-	43.14	5.58	3.92
Jul	56	3.57	8.93	17.86	14.19	-	-	46.43	5.36	3.57
Aug	58	-	-	20.69	17.24	-	3.45	51.73	3.45	3.45
Sep	63	-	-	19.05	20.63	-	-	55.56	4.76	-
Oct	60	5	6.67	20	13.33	-	-	50	-	5
Nov	50	-	-	18	14	-	-	24	20	24
Dec	43	-	9.30	13.95	18.60	-	-	20.93	13.95	23.26

The surface feeders feed on surface plants and animals, the mid or column feeders feed on subsurface food organisms and the bottom feeders feed on mud and decaying substances and also bottom flora and fauna was observed by[24]. The dominant food item of *C. punctatus* as fish fingerlings and insects as well as carnivorous feeding nature was analyzed by[9,10]. The juvenile of *C. striatus* like *C. punctatus* was mainly fed on the animal food viz. crustaceans, insects, molluscs and fishes[5].

Table-3: Variation in food items (%) in different life stages of *C. striatus*

Food Items	Fry (0-5 cm)	Juvenile (5-10 cm)	Adult (<10 cm)
Zooplankton	68.52	-	-
Insects	25.2	31.16	12.45
Crustaceans	1.02	19.82	9.16
Annelids	5.01	12.18	6.84
Molluscs	-	2.02	3.02
Fishes	-	30.82	46.37
Plant matters	0.25	4	10.12
Mucks & unidentified components	-	-	12.04

Table-4: Average Gastrosomatic index (GSI) in various months

Months	Male	Female
August	1.15 (±0.36)	7.95 (±4.31)
September	4.29 (±1.88)	9.52 (±3.91)
October	4.17 (±1.72)	6.22 (±1.89)
November	2.05 (±0.83)	2.26 (±1.21)
December	2.04 (±0.88)	2.24 (±1.10)
January	2.72 (±0.66)	2.52 (±0.49)
February	3.15 (±0.65)	3.37 (±0.81)
March	3.14 (±1.03)	3.57 (±1.04)
April	5.14 (±1.76)	3.84 (±1.53)
May	3.14 (±1.03)	3.57 (±1.04)
June	2.07 (±0.84)	3.84 (±1.53)
July	2.87 (±1.22)	3.57 (±1.18)

(d) Gastrosomatic index (GSI): The observation on feeding intensity was based on gastrosomatic index (GSI) taken on monthly basis and the results have been summarized in Table- 4. It ranged from 1.15 ±0.36 (August) to 5.14 ±1.76 (April) for males and that of female from 2.24 ±1.10 (December) to 9.52 ±3.91 (September). Sharp rise and fall in the feeding intensity was noticed in various months. The GSI showed a steady increase from February-May onwards and then an abrupt fall was noticed in June-July. However, it increased once again during post monsoon months. The variation of GSI in females was more pronounced and they had high feeding intensity in August- September. During winter (November-January) the GSI was found lower in both sexes. Feeding intensity in winter was low because the species hibernate underneath aquatic weeds and in mud. Another reason for low feeding intensity in winter because of their low metabolic rate as the fish is poikilo thermics animal. Further, the reduced feeding intensity in pre-monsoon month may be due to the development of gonads. The poor feeding during breeding season may be attributed to the development of gonad which occupies the major space of the abdominal cavity[17,25,26]. Cannibalistic nature was also recorded specially when food availability was very low. Feeding intensity, however, improved after spawning was over in post monsoon months.

CONCLUSION

In the present study, mean RLG value was found to be maximum in the higher length group and minimum in the lower size group. The results indicate the species fall in the carnivorous category. There is also variation in the percentage composition of different items of food in the gut in different months. It can be inferred that *C. striatus* changes its nutritional habit with the change in seasons. The gut content analysis of *C. striatus* revealed a distinct variation in food intake of the species at different life stages. It revealed that in fry stages most dominant food item was zooplankton followed by insect, annelids, crustacean and plant matter. Similarly, in *Juvenile* insect was the most preferred food item, followed by trash fishes, crustaceans, annelids, plant matter and molluscs. Again in adult, fish was found to be the most dominant item in the gut and the next food items in order of preference were - insects, mucks and unidentified material, plant matter, crustacean, annelids and molluscs. Monthly variation of GSI in *C. striatus* revealed that the maximum feeding intensity in females was from August through October and lowest value was recorded in winter (November-January).

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