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UNDERSTANDING THE FOOD AND FEEDING BIOLOGY OF CATFISH *Sperata seenghala* SYKES, 1839 FROM GOMATI RIVER OF TRIPURA, INDIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between both authors. Author SB designed the study, wrote the protocol and managed the analysis of the study. Author DD managed the literature searches, executed the study and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Aspects of food and feeding biology of the *Sperata seenghala* of Gomati River of Tripura, a part of Eastern Himalayan hotspot region of India was studied over 12 months. The 176 fish (28.7 cm to 67.4 cm TL) specimens were examined for food composition analysis. Out of these, 21 (12.88%) had full stomach, 33 (18.53%) had empty stomach and 122 (68.58%) had partially-filled stomachs. The percent composition of various food items in stomach content was 7.5% of aquatic plant materials, 15.5% crustaceans, 29% aquatic insects, 6.7% molluscans, debris and detritus 5.3% and 36% fishes. Biomass of fish was highest in comparison to other food items. The alimento-somatic and hepato-somatic indices have every indication that *S. seenghala* is carnivorous and thus have intense liver activity. This study could render useful information on the food and feeding habits of the studied fish species and provide background biological knowledge for preparing its diet for future aquaculture practices.

Keywords: Carnivorous; catfish; feeding biology; alimento-somatic index; hepato-somatic index; gut content; Gomati River; Tripura.

1. INTRODUCTION

The knowledge of feeding biology of a particular fish species is important from ecological, aquaculture and conservation point of view [1,2,3]. "Information on the feeding biology of fishes in a given ecosystem have notable significance in fish conservation and is a key factor to determine their growth rate, condition

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and population structure" [4]. It is well known fact that food and feeding habits of the fish vary during different stages of their life history as well as due to changes in the composition of food organisms occurring at different seasons of the year in a particular ecosystem [5,6,7]. Analysis of fish diet in the wild is necessary for understanding their biology, ecology and physiological aspects [8]. "Due to increasing of anthropogenic impacts on river ecosystem in recent time there are effects on zooplankton population and changes in the trophic levels of various food materials leading to changes in food and feeding habit of top carnivores in aquatic food chain" [9]. "The study of food and feeding habits of freshwater fish species is an issue of continuous research because it helps to identify the dynamic nature of trophic relationships present in aquatic ecosystems, identifying feeding composition, structure and stability of food webs in the ecosystem" [10].

"The analysis of diet of fishes is important to better understand the behavior of the organisms and permits a comprehensive understanding of ecosystem functioning that is required for its *in-situ* conservation" [11,12]. "Study on food and feeding habits of fish have numerous importances in fish biological studies" [13]. The relationship between alimentary canal and feeding habits was studied for many fishes by different authors [14,15]. Apart from some scattered data, there is no comprehensive information concerning on feeding biology of wild populations of *Sperata seenghala* is available from North East India in general and Tripura province in particular [16]. "In addition, the quality and quantity of food is one of the critical determinants, influencing the timing of reproduction, fecundity, age at first maturity and the survival of lower life history stages" [17,18]. On this background, the present study was aimed to provide information on feeding activity, food preference, relative length of gut, gut fullness, alimento-somatic index, hepato-somatic index of *S. seenghala* in Gomati River of Tripura with emphasis on specimen size, seasonal variation etc.

2. MATERIALS AND METHODS

The specimens of different age groups *Sperata seenghala* were collected by random sampling method from two localities in the Gomati River of Tripura on monthly basis during August, 2020 to July, 2021. The field collections were done with the help of local fishermen by using cast nets. The total length and total weight of the fishes were recorded after removing the moisture by soaking them with tissue paper using digital caliper and digital weight machine.

The fishes were dissected by giving a vertical incision on the ventral side. The gut length, gut weight, liver weight were taken and immediately the gut were preserved in 4% formalin in marked glass vials. The preserved stomach of each fish was dissected out after 72 hrs. The contents of the stomach were removed very carefully in a Petri dish and then were collected in glass vial making up the volume to 10 ml to determine the different food items eaten by the fish both qualitatively and quantitatively. The stomach contents were analyzed by involving gravimetric method following Hynes [19] and Pillay [20]. Food items were identified up to major taxonomic group as discussed elsewhere [21,22,23]. Relative gut length, Alimento-somatic index and hepato-somatic index were determined during investigation using following formulae as discussed by Parihar and Saksena [24].

Relative gut length = Total length of the alimentary canal/ Total length of the fish

Alimento-somatic index = Total weight of the gut / Total weight of the fish ×100

Hepato-somatic index = Total weight of the liver / Total weight of the fish ×100

The relationship between total length and alimentary canal length was determined by well known statistical formula followed by Manon and Hossain [25].

$$Y = a + b X$$

Where, Y = Alimentary canal length (ACL), x = Total length (TL), 'a' is the interception on the ordinate and 'b' is the regression co-efficient.

3. RESULTS AND DISCUSSION

The month wise results of 176 stomachs analysis of the fishes have been presented in the Table 1 and Fig. 1. Out of the 176 stomachs examined, 12.88% fully loaded with food, 68.58% partially filled with food and 18.53% were without food. The highest percentage of empty stomach was in the month of March, 2021 and lowest percentage of empty was in the month of July, 2021. The highest percentage of full stomachs was found in the month of May, 2021 and lowest percentage of full stomachs was found in September, 2020.

The alimento-somatic index serves as an indicator of feeding phase of a fish in different months. Mean values of ASI for *S.seenghala* ranged from 1.67(Jun) to 4.16(Feb).Monthly variation in alimento-somatic index of *S.seenghala* is depicted in Figure. It is understood that the alimento-somatic

index was high during post spawning season (September- February) and low ASI during spawning season (April- july). The hepato-somatic index (HSI) is an indicator of activity of liver. The range of variation of hepato-somatic index of *S.seenghala* was 0.53 to 1.89 and the mean value was 0.755±42. The highest and lowest value of HSI was observed in the month of February and June respectively. The results are represented in Table 2 and Fig. 2.

Table 1. Month wise feeding activity of *Sperata seenghala* in Gomati River of Tripura during August 2020 to July 2021

Study period	Number of fishes examined	Percentage of stomach fullness	Percentage of stomach partial fullness	Percentage of stomach emptiness
August, 2020	17	2(11.76%)	12(70.78%)	3(17.64%)
September, 2020	18	1(5.55%)	14(77.77%)	3(16.66%)
October, 2020	16	2(12.55%)	11(68.75%)	3(18.75%)
November, 2020	12	2(16.66%)	8(66.66%)	2(16.66%)
December, 2020	12	1(8.33%)	9(75%)	2(16.66%)
January, 2021	15	2(13.33%)	11(73.33%)	2(13.33%)
February, 2021	18	1(5.55%)	14(77.77%)	3(16.66%)
March, 2021	14	2(14.28%)	7(50.0 %)	5(35.71%)
April, 2021	15	1(6.66%)	11(73.33%)	3(20%)
May, 2021	11	3(27.27%)	6(54.54%)	2(18.18%)
June, 2021	19	2(10.52%)	13(68.42%)	4(21.05%)
July, 2021	9	2(22.22%)	6(66.66%)	1(11.11%)
Mean± Sd	176	12.88±6.63	68.58±8.58	18.53±6.03

Fullness includes full and ¾ full; partial fullness includes ½ full and ¼ full; emptiness means empty stomach or insignificant volume

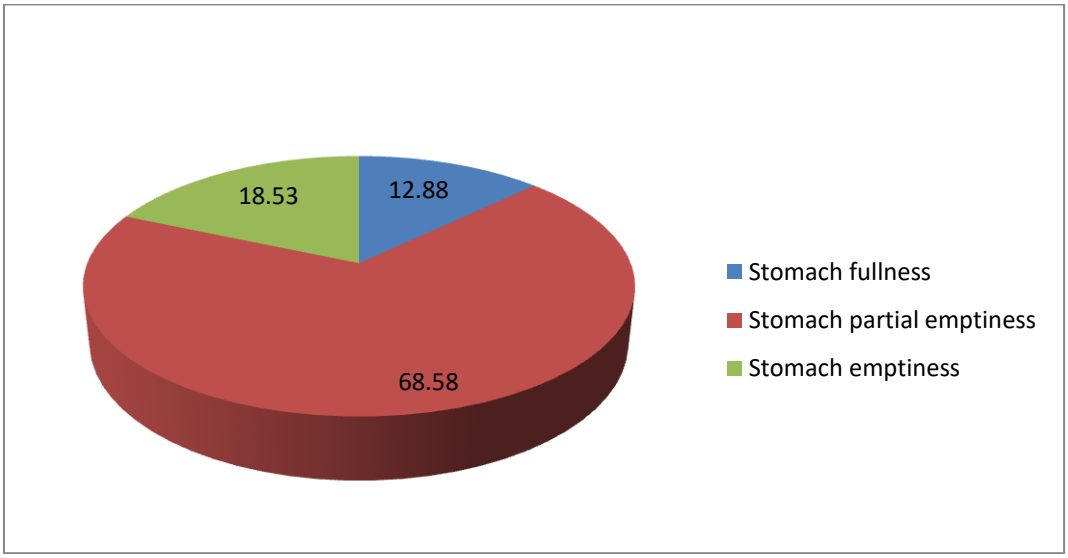

Fig. 1. Feeding intensity of *Sperata seenghala* in respect to stomach fullness during the study period

Table 2. Ratio of length of fish to the length of alimentary canal, alimento-somatic index and hepato-somatic index of *Sperata seenghala* during the study period

Ratio of length of fish to the length of alimentary canal	Alimento-somatic index	Hepato-somatic index
0.7014±0.067	2.142±0.42	0.755±0.80

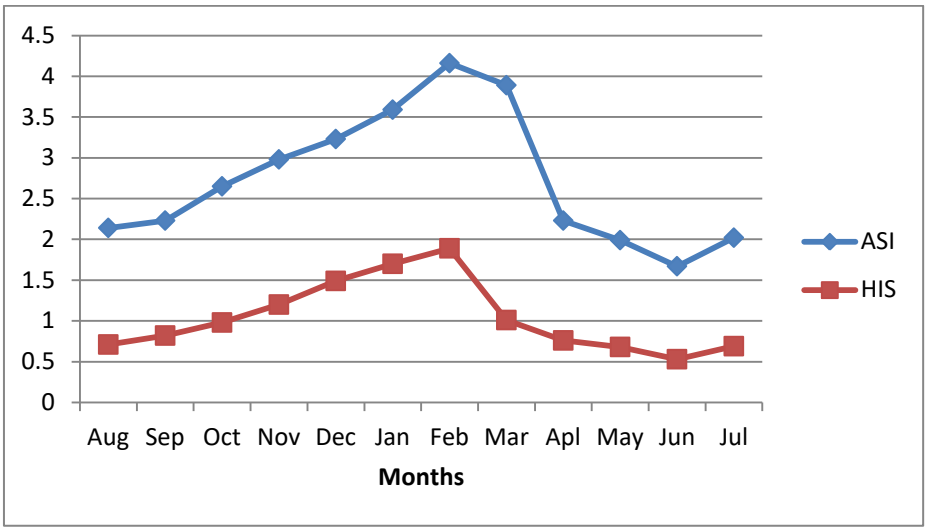

Fig. 2. Monthly variations in Alimento- Somatic Index (ASI) and Histo-Somatic Index (HSI) of *Sperata seenghala* during the study period in Gomati River of Tripura

The ratio between length of fish and the length of intestine is an important parameter for finding habit of the individual fish. The results of relative gut length study presented in the Table 2. The relation between total length and alimentary canal length in the present study clearly indicates that *S. seenghala* with low ratio is a carnivorous species. It has been agreed upon by several authors that when the ratio of total length to length of alimentary canal is more than 1, then the fish is a herbivorous, and when it is less than 1, fish is carnivorous in nature [26-32]. Our findings agree with the statement and the works of Dewan and Saha [33] in *Tilapia nilotica*. *Sperata seenghala* is mostly carnivorous in nature and the food items were basically classified into 6 groups. It fed predominantly on fish while frog eggs, gastropods, copepods, insects remnants were minor importance. In the present study, ratio of length of fish to the length of alimentary canal is 0.7014±0.067 which depicted its carnivorous feeding habit and due to absence of appreciable differences in RGL index in different length group indicated that the growth did not involve any major shift in the basic carnivorous habit of this fish.

Mathematical relationship between total length (TL) and alimentary canal length (ACL) was shown positive linear relationship. It was observed that the alimentary canal length is smaller than the total length. It was recorded that the total length of various size groups was 43.10±7.5 cm in average and the alimentary canal length of various size groups were 30.31±5.96 cm in average. The value of co-efficient of correlation, $r^2 = 0.7691$ which indicates that there is positive correlation between the variables. The results are shown in Table 3 and Fig. 3.

The analysis of stomach contents of *S seenghala* revealed that the food of the fish consists of aquatic plant materials (7.5%), crustaceans (15.5%), insects (29%), fishes (36%), molluscans (6.7%), debris and detritus (5.3%).Insects and fishes were very dominant food item of *S. seenghala* throughout the year irrespective of different age groups of specimen under studied. The summarized findings are presented in Table 4 and Figs. 4 and 5. It is observed that most of the empty stomach cases were found in mature fishes in comparison to other stages, suggesting that well developed gonads hinder feeding activity and thus empty stomach occurred during breeding season. Similar observation was also made by many workers [34,35] .The feeding intensity of immature fishes was found to feed actively, but low in mature and spawning individuals. The food preference changes during different growth stages and also varies from month to month. This food shift occurred due to changes in the composition of food organisms occurring at different seasons of the year.

Table 3. The value of constant intercept "a" regression co-efficient "b" co-efficient of correlation "r" the ratio of ACL and TL of *Sperata seenghala*

Relationship		Value of "a"	Value of "b"	Value of "R^2"
Ordinance(Y)	**Abscissa(X)**			
Alimentary canal length	Total length	1.628	0.697	0.7691

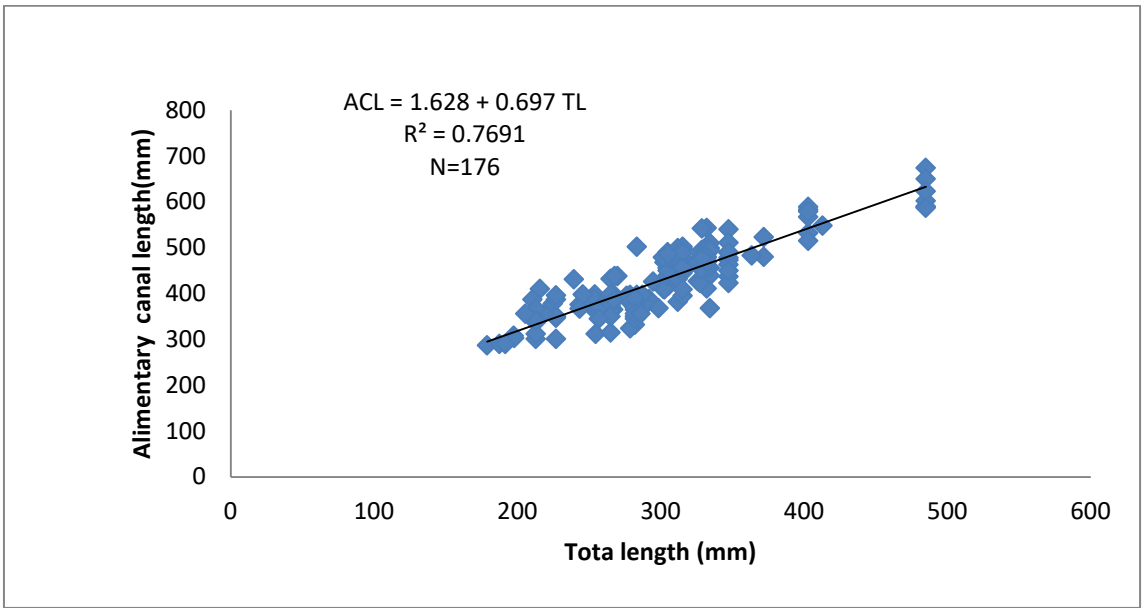

Fig. 3. Relationship between total length (TL) and alimentary canal length (ACL) of *Sperata seenghala* in Gomati River of Tripura

Table 4. Food preference and percentage of major food items found in the stomach of different size of *Sperata seenghala* during the study period

Food items	Food preference among different size of the fish			Average food items (in %)
	Young	Juvenile	Adult	
Aquatic plant materials		+	+	7.5
Crustaceans	+++	++	++	15.5
Insects	++	+++	++	29
Fishes	+	+++	+++	36
Molluscans		+	+++	6.7
Debris and detritus		+	+	5.3

+++= High; ++= Medium; += Low

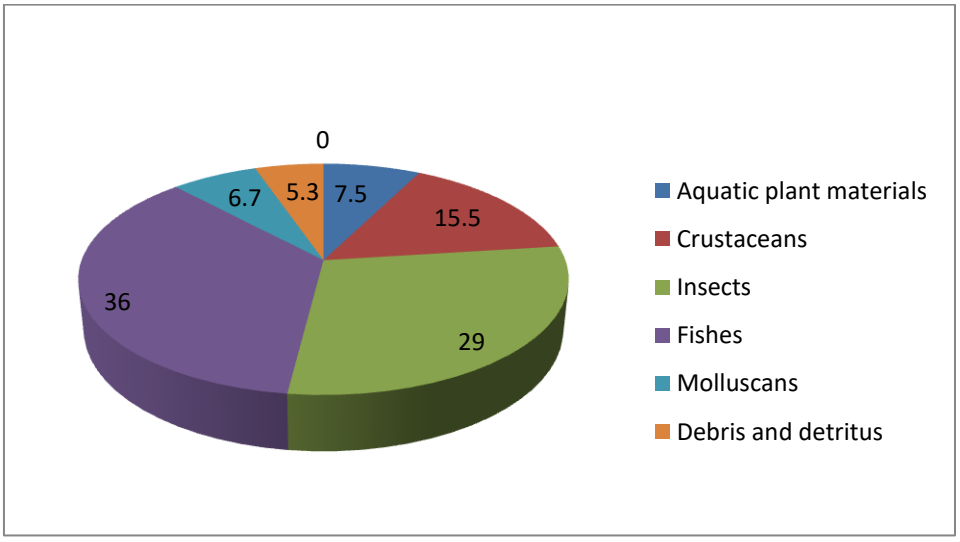

Fig. 4. Percentage occurrence of different food items of *Sperata seenghala* during study period

Fig. 5. *Xenentodon cancila* (Family-Belonidae) locally known as Kaikka fish, most preferred food item in adult stage of *Sperata seenghala* during the study period

4. CONCLUSIONS

Aspects of feeding biology are an important to understand the ecological adaptation of the species to the particular environment and it also provides knowledge on the food preference, seasonal changes in feed availability associated with the ecosystem. The present study provides the first account on feeding ecology of *Sperata seenghala* of Gomati River of Tripura province, a part of Indo-Barma biodiversity hotspot .The *S. seenghala* in Gomati River of Tripura are characterized by carnivorous feeding habits that showed a seasonal and length based variation of food composition, whereas the seasonal changes in diatery pattern might instead reflect the opportunistic feeding behavior of the species.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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