FEEDING INTENSITY AND DIET COMPOSITION OF *CHANNA STRIATA* FROMSELECTED STATIONS OF RIVER KRISHNA, ANDHRA PRADESH

Abstract

Feeding intensity and diet composition of *Channa striata* from Krishna River were studied between June 2019 to July 2020. The stomach contents of 240 fishes were analysed from the three stations to understand the food items of the species. The major constituents of food in gut content of this fish mainly composed of fishes and their larvae, Crustaceans, insect larvae, annelids with semi digested material and unidentified items. Fishes are identified as of teleost, but most of the fish remains could not be identified since they are found in advanced stages of digestion with only skeleton remains. Gastropods identified as polycheate larvae, and Crustaceans are prawn and shrimp, crab larvae. In certain months the presence of sand and mud along with decaying organic matter was also observed.

Keywords: *Channa striata*, Feeding Intensity, Diet Composition.

Introduction: Murrels belonging to Channidae family are predatory air-breathing fishes well distributed in Asian continent and African countries [1]. This family was the most common fish among the local populace with traditionally identified pharmacological benefits in treating wound and in boosting energy of the disease persons particularly *Channa striata*. The genus *Channa* has the highest species diversity with 46 valid species [2]. Nearly 22 valid species of *Channa* have been reported from India, out of which 19 are found in the Eastern Himalayan region [2]. The study of food and feeding habits of fishes from various habitats has shown that the requirements at different stages in their life different time and space [3].It is very important in fishery biology as it relates to various activities of the fish like shoaling behaviors and even entire fishery [4]. Feeding ecology is an important aspect of the life–history strategy of a species to understand its functional role of the fish with in their ecosystem [5]. Food intake is the major factor controlling fish production. Quantitative assessment of food habits in fishes is therefore an important aspect of fisheries management and a study of food and feeding of fishes can shed light on the behavior, habitat use, energy intake of the various fish species and inter/ intra specific interactions that occur in the aquatic ecosystem [6]. The diet of fishes changes with a number of factors which are extrinsic (biotope, region) or intrinsic (species, size, behavior) and thus information on diet of fishes is important to understand the basic functioning of fish

assemblages which are important for developing Ecosystem Based Fisheries Management (EBFM) models [7, 8]. The concept of "critical feeding period" has been found to be useful in understanding the variations in recruitment of wild fish stocks [9] and also an understanding of how the various fish species utilize available food resources allows identification of factors that affect their distribution and abundance [10,11].

Fishes are directly depend upon their surroundings aquatic environment for their food requirement and are highly adopted in their food and feeding habits, utilizing most of the readily available food [12]. Seasonal and diurnal abundance of different food organisms may influence the movements and migration of fishes. Hence it is very essential to gain an insight into the relationship between the fishes and their food organisms for prediction and exploitation of fish resources. Krishna et al., [13] have reported the feeding habits of some fishes on the basis of the presence of percentage of the type of food in the guts of the fishes have observed fishes into herbivores which feeding on plant material, carnivores which feeding on animal material and omnivores which fed on one or more groups of organisms, i.e., plankton, benthos [11]. The magnitude of fish population in a region is a function of its food potentialities [8]. There are also terms like Piscivorous-feeding mainly on fish, Carnivorous-feeding mainly on crustaceans, Planktivorous-feeding on plankton, Detrivorous-feeding on detritus and Cannibalistic-feeding on their own kind. The magnitude of fish population in a region is a function of its food potentialities. The knowledge of the food and feeding habits of fish helps in finding out the distribution of fish population and a through survey of literature indicates that such knowledge is highly essential for successful management of a fishery and such studies are undoubtedly important in any fisher's research program [13].

The seasonal variations of food items and feeding activities of *Channa striata* in Krishna River is scanty. Therefore, the result of this study provides valuable information for the future studies in the Krishna River region. In the present study fishes *Channa striata* was selected for the observation of food feeding habits in the study area of river Krishna, Andhra Pradesh.

Materials and Methods: Fish sampling are called from 3 stations of the River Krishna, Guntur district of Andhra Pradesh and they are Station-ST1: Amaravati - Its located 16°34'50.36"N Latitude and 80°2I'10.65"E Longitude**.** Station-ST2: Venkatapalem - Its located 16°31'01.67"N

Latitude and 80°33'31.71 "E Longitude**.** Station-ST3: Seethanagaram, near Prakasam barrage - Its located 16°30'00.76"N Latitude and 80°36'01.99"E Longitude.

The data of fish length, weights are recorded. The gut content was dissected and preserved 5% formalin. The content each stomach was examined using binocular microscope. A weight of the stomach of the individual fish was recorded, based on the weight of the stomach and body weight of the fish. Gastro somatic index of individual fish was calculated using the following formula.

$$\text{Gastro Somatic Index (GSI)} = \frac{\textbf{Weight of the stomach}}{\textbf{Weight of the fish}} \boldsymbol{X\ 100}$$

Gut contents are analyzed both qualitatively and quantitatively [14]. The volume of food in each gut of fish was measured [15] and various food items are identified. The food content found in the stomach was divided into five groups.

1. Gorged: Stomach was heavy food

2. Full: Stomach was full with food

3. ¾ Full: Stomach was ¾ full with food

4. ½ full: Stomach was ½ full and slightly distended

5. ¼ full: Stomach was ¼ of food

6. Empty: Stomach without food

Point's method: The degree of apparent fullness of the stomach was determined and points were assigned. Gorged (1.25); Full (1.00), ¾ Full (0.75), ½ full (0.50), ¼ full (0.25) and empty was (0.00)

Ten fishes were sacrificed in each month for data collection. The stomach along with their contents were removed and preserved in 5 % formaldehyde and subsequently analyzed both qualitatively and quantitatively. Food items were identified up to the generic level. Quantitative analysis was carried out by using both occurrence and point's volumetric method [14]. Since the items of food were smaller in size, their volume could be estimated only by allotment of points. From the food content, volumes obtained for individual fish by the above method, monthly averages and percentages were calculated. The volume index was evaluated from the total points

of the entire item recorded over the period of study. In order to get a clear picture of frequency of occurrence as well as volume of various items, the ‘‘index of preponderance’’ method [16] was used. The index of preponderance was worked out using the following formula:

$$Ip = \frac{Vi \; X \; Oi}{\Sigma Vi \; X \; Oi} \; X \; 100$$

Where: Ip - Index of preponderance (%); the percentage of one food type. where Vi and Oi represent the percentage of volume and percentage of occurrence indices of each food item respectively.

Feeding intensity during various months was determined from the data on the degree of fullness of the stomach. The condition of feed was determined by the observations of the degree of distension of the stomach as described by [15]. Fishes with stomach gorged, full, ¾ full, ½ full were considered to have been feeding actively, while, stomach ¼ full and empty were considered to denote poor feeding activity. Only actively fed specimens were taken for further analyses of stomach content. The percentage occurrence of stomach under different conditions of feeding was also calculated for the whole period of study.

Results and discussion: During the entire period of study, a total 240 guts of *Channa striata* were examined. The food spectrum of *Channa striata* male fishes were represented in figures (1 to 4) and the female fishes were represented in figures (5 to 8).The seasonal variations of feeding intensity of *C.striata* males were represented in Table (1) and the females were represented in Table (2).The gut content of this fish mainly composed of fishes and their larvae, Crustaceans, insect larvae, annelids with semi digested items and unidentified materials. Fishes are identified as of teleost particularly major carps and minor carps larvae, but most of the fish remains could not be identified since they are found in advanced stages of digestion with only skeleton remains. Gastropods identified as polycheate larvae, and Crustaceans are prawn, shrimp and crab larvae. In certain months the presence of sand and mud along with decaying organic matter was also observed.

Fig. 1: Percentage of composition of food items of *male Channa striata* in the South West Monsoon, 2019-2020.

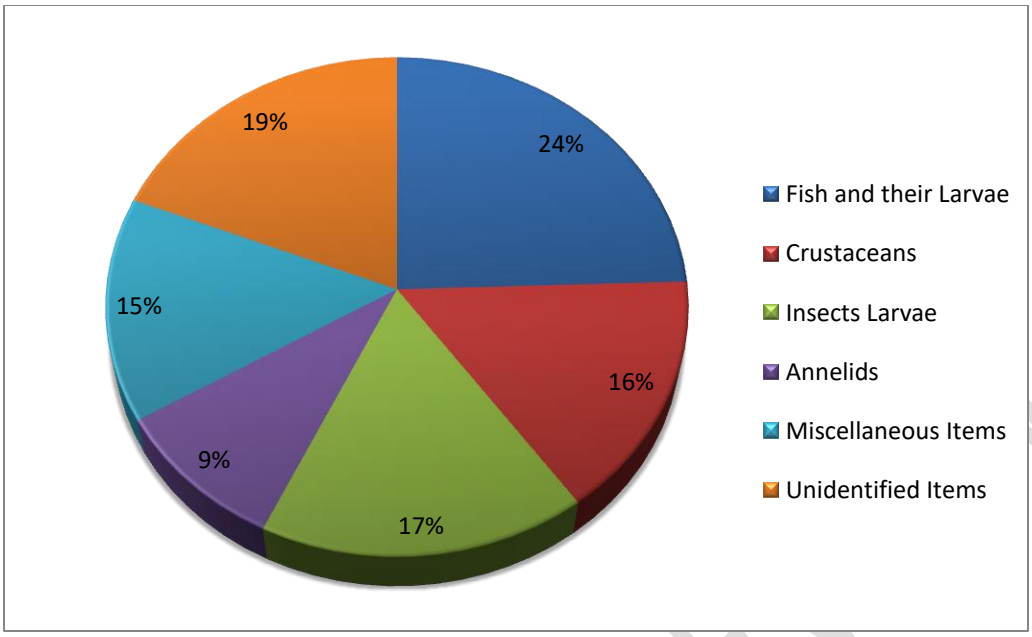

Fig. 2: Percentage of composition of food items of male *Channa striata* in the Post Monsoon, 2019-2020.

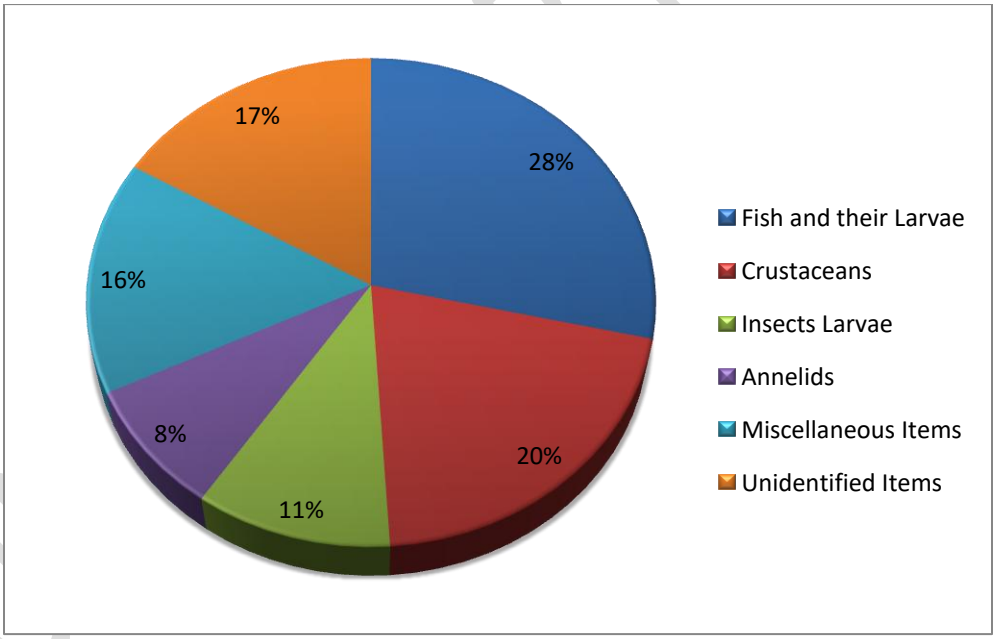

Fig.3: Percentage of composition of food items of male *Channa striata* in the North East Monsoon, 2019-2020

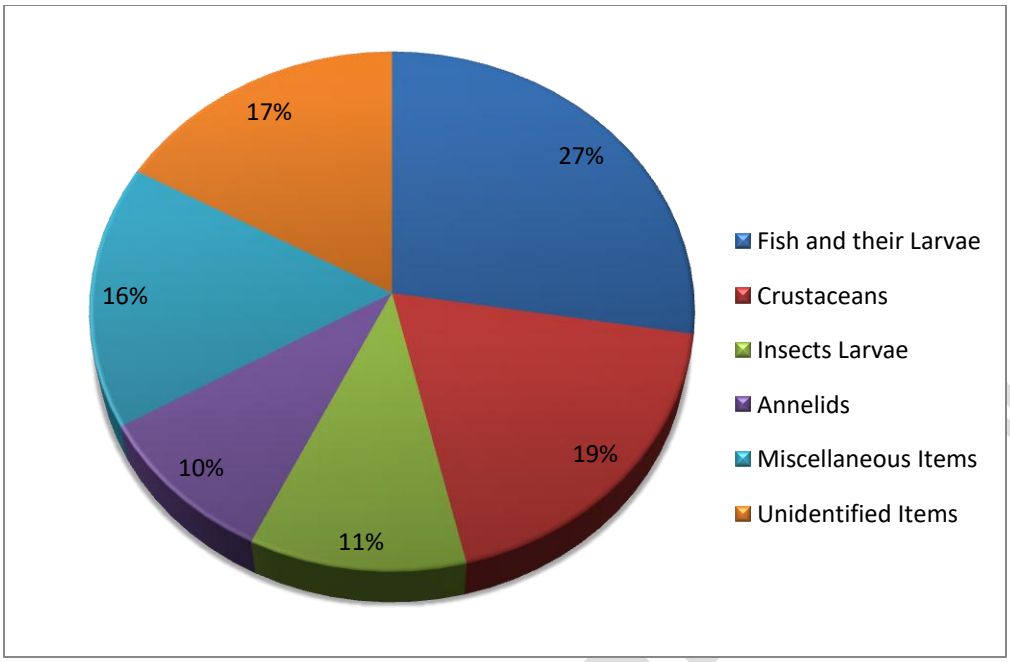

Fig.4: Percentage of composition of food items of male *Channa striata* in the Summer, 2019-2020.

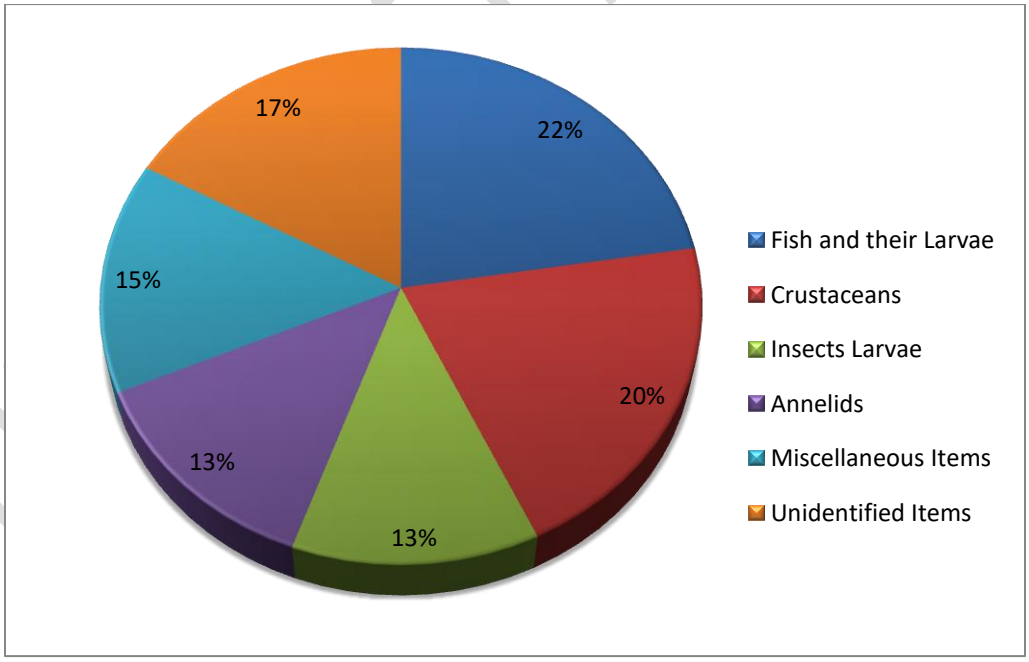

Fig. 5: Percentage of composition of food items of female *Channa striata* in the South West Monsoon, 2019-2020.

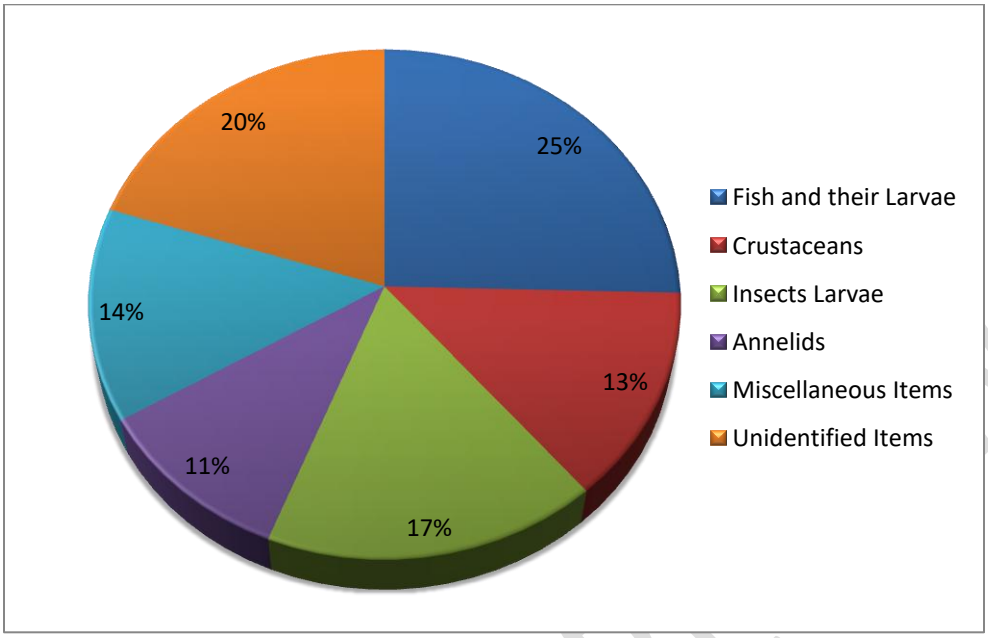

Fig.6: Percentage of composition of food items of female *Channa striata* in the Post Monsoon, 2019-2020.

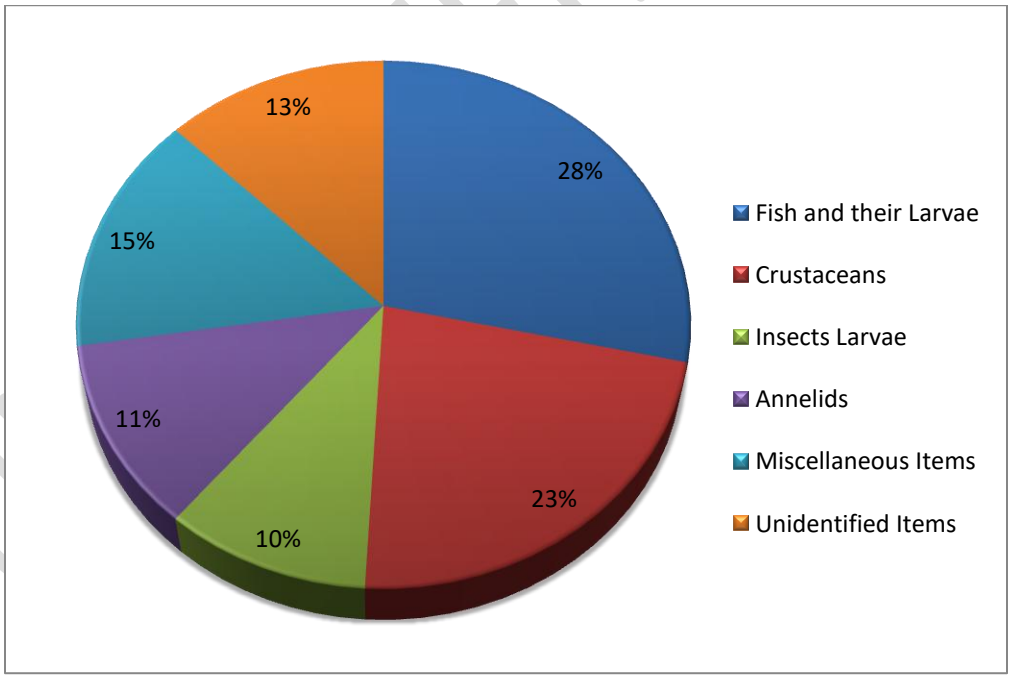

Fig. 7: Percentage of composition of food items of female *Channa striata* in the North East Monsoon, 2019-2020.

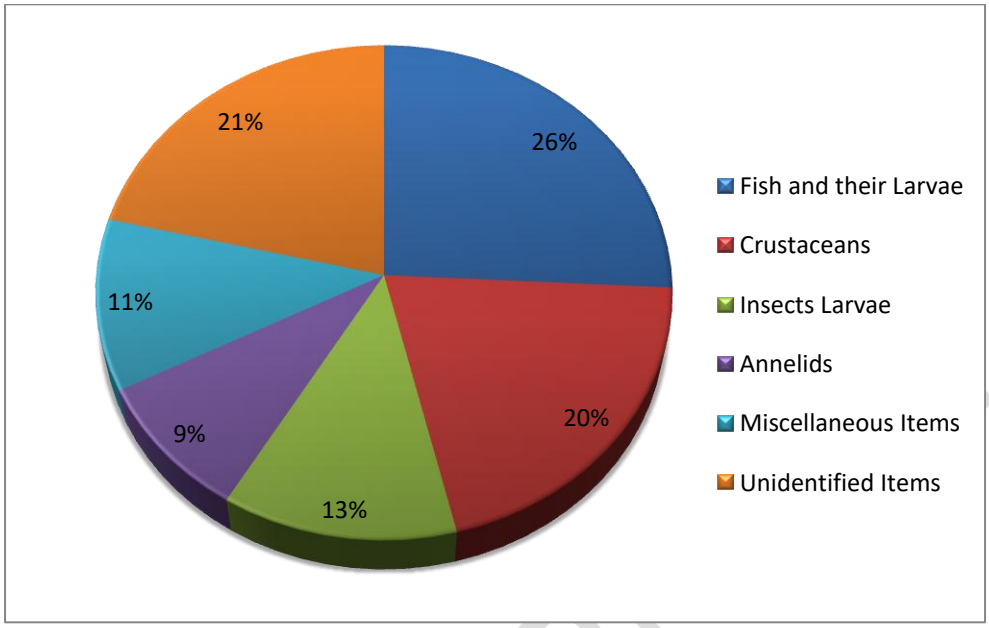

Fig. 8: Percentage of composition of food items of female *Channa striata* in the summer, 2019-2020.

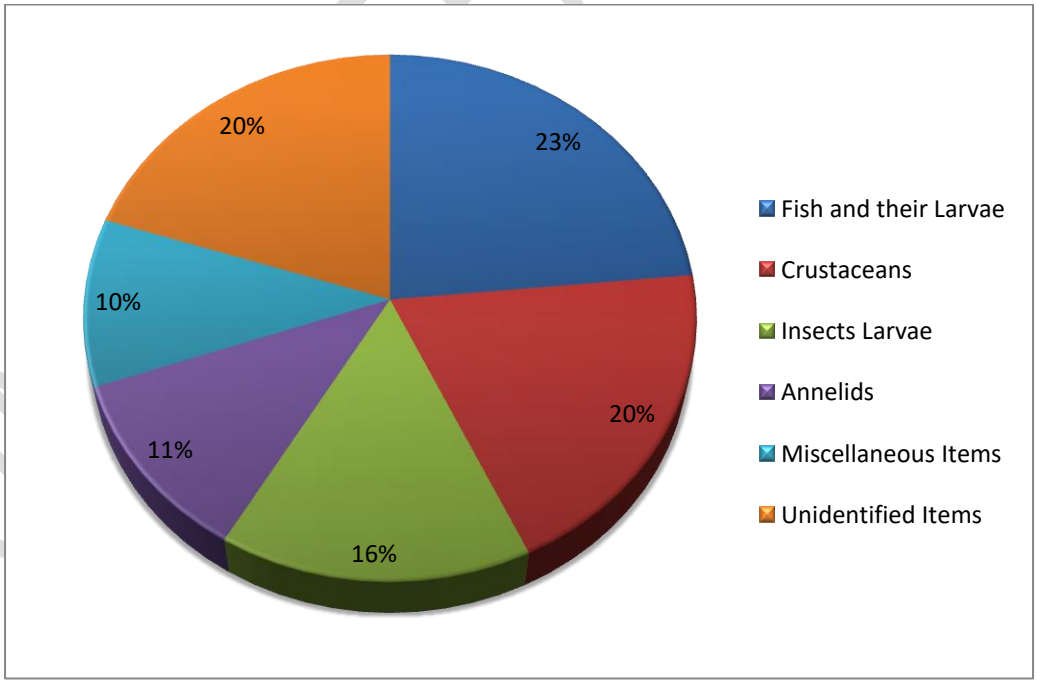

Table: 1- Seasonal variations of Feeding Intensity in *C.striata* males

Seasons	Months	Status					
		Gorged	Full	¾ Full	½ Full	¼ Full	Empty
South West Monsoon	June	0	0	5	10.5	25.5	59
	July	0	0	6	12.5	29.5	52
	August	0	5	9	14.2	30.5	41.3
	September	3	6	12	16.5	26.8	35.7
Post Monsoon	October	4	8	13	15	22.5	37.5
	November	6	10	15.4	18	12.5	38.1
North East Monsoon	December	5	12	16.5	10	15.5	41
	January	7	13	8	16	18.8	37.2
	February	9	14	10.5	19.5	14.9	32.1
Summer	March	8	12	6.5	15.5	19.3	38.7
	April	4	15	19	14.8	10.6	36.6
	May	0	12	16	15.5	16.8	39.7

Table: 2- Seasonal variations of Feeding Intensity in *C.striata* females

Seasons	Months	Status					
		Gorged	Full	¾ Full	½ Full	¼ Full	Empty
South West Monsoon	June	0	0	6	11.5	20.5	62
	July	0	0	8	15.4	20.8	55.8
	August	0	7	12	15.6	22.5	42.9
	September	5	12.5	16.8	22.3	13.4	30
Post Monsoon	October	8	14.4	18.5	10.5	15.8	32.8
	November	5	13	18.4	28.5	25.4	9.7
North East Monsoon	December	4	14.5	10.4	10.6	19.6	40.9
	January	5	11.5	16.4	18.5	11.4	37.2
	February	6	13.5	14.2	15.5	15.6	35.2
Summer	March	6	9.5	17.2	14.3	22.2	30.8
	April	3	12.5	13.5	13.4	19.5	38.1
	May	0	6	12	11.5	24.5	46

Murrels are air breathers are unique in their capacity to utilize atmospheric oxygen for respiration by certain morphological adaptations in addition to the usual branchial respiration.

They can live for many hours or few days out of water and able to migrate across land from one fresh water pond to other. They are capable for thriving for number of days with minute quantity of water, if their body is kept moist. They are carnivorous and great parental care is observed in various species. Murrels contribute important fresh water fishery in various parts of India and in great market demand because of their pleasant tasty flesh and presence of less number of bones/ spines. They are popular fish for aquaculture since they breed in confined water bodies. Considerable scope exists for augmenting the supply of these fishes by under taking large scale culture in our country. Although they are popular in fishery, but proved a curse in other species of fishes for having an aggressive carnivorous nature. Murrels acclaimed all over the country for their flavor, medicinal and recuperative attributes (having high mineral and fat contents) and keeping quality. They are also considered a pest fish since they destroy other natural species of water body where they inhabit. Very little information about their biology, growth, production potentials, seed resources, nursery rearing and grow out has been available.

The investigation revealed that murrels are omnivore species feeding mainly on fishes, crustaceans, insects and annelids followed by gastropods. One various components of the food spectrum indicate that this species mainly fed on benthic and sub-benthic organisms. Murrels fish feed on small benthic crustaceans, worms, molluscs, and small fish [17, 18]. Braga et al., [19] reported that the feeding ecology of a species its thoroughly linked its population dynamics, knowledge of feeding ecology contributes to the understanding of such subjects as resource partitioning habitat preferences, prey selection, predation, evolution, competition and energy transfer within and between ecosystems. Such ecological information strategies and is therefore, a key element in the protection of species and ecosystems. They further, reviews the geographic and /or biogeographic reasons where the majority of the studies concerning the feeding ecology of fish have been conducted, with the goal of identifying reasons and /or environment needs of further attention. Shamsan and Ansari [20] reported that small fishes and crustaceans are the most important food items than any food items in stomach of carnivore's fishes. In the present study preferential food for both Channa species are fishes and their larvae are most dominant food item in the maximum in entire two years study period.

Availability food and feeding conditions play an important role in maturity and growth early sexual maturity in fish can be achieved either genetic selection or better nutrition. It is important to emphasize that the effect of seasonality should always be considered in the studies

on feeding of fish, because the temporal changes of biotic and abiotic factors alters the structure of the food web along the year and as a consequence, the fish often shown seasonal diet shift [21]. Gastro somatic index values as an indication of fullness of stomach and find out the feeding rhythm. During the course of the investigation, maximum numbers of fishes were found with empty stomach. The frequent occurrence of empty stomach or stomach with little content might be dependent on the ratio between the size of the fish and size of the prey as cited on the caloric values of the diet as explained by [22]. The occurrence of empty stomachs of fishes does not show any relationship either to seasonal month or to the size of the fish. The fishes murrels appears to prefer fishes and their larvae sine they constitute major food item in its stomach. The percentage of occurrence of different food items in the diet shows that these fishes select their food from the bottom living organisms and a first preferable food item was small fishes, crustaceans and followed by polycheates worms, including insect larvae. Feeding Intensity is reported that fish metabolism has an influence on feeding behavior and feed intake by fish is such that it meets their energy requirements [23]. Thus if a diet has low energy value, fish will compensate by eating more within the limits of its stomach capacity [24]. Therefore, this may be one reason why during the pre-monsoon season when the low energy value food constituted by detritus was predominant, the occurrence of stomachs with moderate to active feeding activity was the highest.

The ranking of various food items on seasonal variations in diet composition with ranked first by fishes dominated during the entire study period followed by crustaceans, insect larva, annelids, worms and Gastropods. This observations similar with diet composition of carnivorous fishes from coral reef lagoons [25]. Kulbicki et al. [26] reported that many fishes are opportunistic feeders eating what is available within a more or less restricted range of items and changes in number of prey types reflect only this plasticity as well as the variability of prey in the particular biotope where the fish is feeding. Kapoor et al., [27], observed that the length of the alimentary canal is indicative of the food preferences of the fishes with carnivores having the smallest gut length and detritivores the highest [28]. Further, it bserved differences in the relative length of the alimentary tract of juvenile and adult fishes and attributed it to differences in their feeding habits. Wilson [29] had indicated that an increase in microbial activity during the summer season due to elevated temperatures there is an increase in protein levels of detritus during this period. Madhupratap et al., [30] hypothesized the importance of food chain in determining the

success of fisheries *vis-à-vis* oil sardine during periods of adverse environmental conditions resulting in less than optimum plankton production. The present study was confined to studying the food items available in the guts at the time of analysis which revealed that there are seasonal variations in diet and physiological factor like maturation are also influencing feeding patterns. Because of its varied diet that includes animal matter the murrels may be considered as an omnivore. Omnivore is a feeding strategy that fishes to complement protein from fish larvae and crustaceans with energy from the more abundant primary food such as polycheates and fish larvae [4]. Manojkumar.et al., [31] have concluded that *Nemipterus japonicus* from Malabar coast, the fish is a demorsal carnivorous and the diet consisted of fishes, crustaceans, molluscs, polychaetes and miscellaneous food items. In our results also shows that the fishes both *Channa* species are carnivorous and diet containing fish and their larvae, crustaceans, insects and annelids are the major food items. Jambo and Maduako, [32] have reported that the food and feeding habit of *Mugil cephalus* in Niger delta, was fish larvae, crustaceans, insect parts annelids and other plant material along with sand particles. Krishna et al., [33] have reported that the Asian sea bass is a top predator and thus plays an important role in the controlling population of lower tropic level species including crustaceans, fishes, and polychaete worms some extent. Therefore, knowledge of the feeding habits and ecological interactions of *Channa* species and their prey is essential for the management and conservation of the fishery resources in freshwater ecosystem. Not much difference in the energy levels among the two species was observed in the study indicating it as an opportunistic feeder where diet broadly reflects availability and habitat characteristics.

Feeding intensity and diet composition of fishes are of great concern in the management fisheries. Feeding habit of species of fish is intimately associated with the ecological niche that they occupy in the natural environment. Fishes are directly depend upon their surrounding aquatic environment for their food requirements and are highly adopted in their food and feeding habits utilizing most of the readily available food.

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