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Original Article

Comparative Analysis in Gut Content of Three Fresh Water Teleosts (*Clarias Batrachus, Channa punctatus, and Anabas Testudineus*) during Different Season

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Abstract

Aim of the present piece of work was to have a comparative analysis of the food composition and feeding habits among three Indian fresh water teleosts. The gut content of three fishes has been analyzed and are broadly classified into 8 categories i.e. crustacea, rotifer, insects, Chlorophyceae, baccillariophyceae, Myxophyceae, plant matters and decaying organic matters. It was also seen that there were considerable variations in the percentage of different food items in the gut of above fishes during different months of the year. The different food items are variable increases during the different seasons of a year among the three fresh water teleosts.

Keywords: Preponderance Index (I); *Clarias Batrachus; Channa Punctatus; Anabas Testudineus.*

Introduction

Food and feeding habit of fishes has a great significance in aquaculture practice. It helps to select such species of fishes for culture which will utilize all the available potential food of the water bodies without any competition with each other but will live in association with other fishes. This will allow the best utilization of the food sources of water body and will give an optimum yield. Food and feeding habits of fish vary with the time of day and season of the year. Food and feeding habits of fishes have been a field of interest to fisheries researchers since very long Sakhare and Chalak (2014).

Sakhare (2010) studied food and feeding of *Cyprinus carpio* from local markets, reservoirs and ponds around Ambajogai. However, analysis of stomach contents is a method for determining the food and feeding habits of fishes by which we can easily find what the fish take as food. The various forms of feeding found in fishes include filter feeding, carnivores, and herbivores.

Osman and Mohmoud (2009) reported that various methods have been developed for the quantitative estimation of diet composition in fishes. Among these, the estimation of abundance and occurrence of different food items are the most popular. Emmauel and Ajibola (2010) reported crustaceans, pisces and bivalves as the three major food of the frillfin goby *Bathygobius soporator.* This study is intended to provide baseline information on the food and feeding habit of the species, which could serve as guide for aqua culturists and fisheries resource managers.

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Objectives

- This work deals with the studies of the food composition of Indian major carps.
- Variations in food and feeding habits in relation to season.
- Compare the feeding habits among three fresh water fishes.
- Find out the preponderance index (I) of the *C.batrachus*, *C.punctatus* and *A.testudineus* .
- To find out the grading system of food items, which is preferred most by an organism.

Materials and Methods

A total number of 60 specimens of above fishes were collected from fish market nearby university campus, Berhampur, Ganjam, Odisha of different seasons of the year during the months Jan to Dec 2017. Gut of each specimen was dissected out, gut was stretched out and removed from adhering viscera and mesenteries by using brush and blunt forceps to prevent injury of the gut its content emptied into separate Petridis with food items identified as per methods of Dewan et al., (1991).

The entire gut contents of each specimen, preserved in 5% formalin, were taken into consideration in the analysis of the diet. The food items were subjected to higher degree of higher mutilation due to the action of digestive juice. Therefore, the gut content could be identified up to higher taxonomic group. The Index of preponderance (I) for each food items was worked out applying the formula recommended by Natrajan and Jhingran (1961). The different mean values were analysed using the statistical package for social science (SPSS software program, version 10). the result is considered significant if $p<0.05$.

Results

Analysis of the gut content of fishes was an important and direct way of investigating their food habits in different seasons. The identification of food items eaten by a particular species of fish in its habitat was the direct interlink between the tropic components in an ecosystem. In this work, the gut contents of *Clarias batrachus*, *Channa punctatus* and *Anabas testudineus* had been analysed and grading was assigned to different food items.

Gut Content Analysis of *C.batrachus*

The percentage composition of food items in the gut of ***C. batrachus*** as observed in different months has been summarized in the (Table 1). The gut content of *C. batrachus* have been grouped into 8 broad categories i.e. crustacea, rotifer, insects, Chlorophyceae, baccillariophyceae, Myxophyceae, plant matter and decay organic matters . It was seen that there were considerable variations in the percentage of different food items during different months of the year. Crustacea was the highest percentage (43.95%) occurrence in the Spring season (February and March) and that of lowest (31.07%) in the Winter season (December and January) as per Figure 1 and 2. Rotifers percentage varies from higher to lower as 33.33% in Autumn (October and November), 27.17 % in Winter season (December and January), 25.46 % in Summer (April, May and June), 23.15 % Spring (February and March) and 22.79% in Rainy season (July, August and September) respectively as per Figure 3 and 4. The highest percentage of Insect's was observed in Rainy season (July, August and September) in 24.07 and lowest in spring season (February and March) in 12.84%. Percentage occurrence of Chlorophyceae was highest to lowest as Spring (10.65 %), Autumn (10.07%), Summer (10.05%), Winter (7.26%) and Rainy (3.69) respectively. Bacillariophyceae is the other food items, which highest percentage is Winter (10.17) and lowest in Summer in (2.77).

The highest percentage of Myxophyceae occurred in Winter (4.14%) and lowest in Autumn (2.32%). The highest percentage of occurrence of plant matter in the gut content was in Rainy season (July, August and September) is (3.80%) and lowest in Autumn in (0.88). The intake of dead and decaying matter of gut content analysis was highest in Winter (0.34%) and lowest in Autumn season (0.07%) as per Figure 5. Seasonal variation showed a slight variation in feeding main food items of *C. batrachus* were crustacea, rotifers and insects .

Gut Content Analysis of *C.punctatus*

The percentage composition of food items in the gut of ***C. punctatus*** as observed in different months has been summarized in the (Table 2). The gut content of *C. Punctatus* have been group into 8 broad categories i.e. crustacea, rotifer, insects, Chlorophyceae, baccillariophyceae, Myxophyceae, plant matter and decay organic matters. It was seen that there were considerable variations in the percentage of different food items during different months of the year. crustacea was the highest percentage (35.07%) occurrence in the Spring season (February and March) and that of lowest (13.30%) in the Rainy season (July, August and September) as per Figure 6,7 and 8. Rotifers percentage varies from 32.91% in Rainy season (July, August and September) to 13.05% in Winter season (December and January) . The highest percentage of Insect's was observed in Winter season (December and January) and lowest in spring season (February and March) in 10.90%. Percentage occurrence of Chlorophyceae was highest to lowest as summer (15.19%), Rainy (12.12%), Spring (10.72%), Autumn (10.13%) and in Winter (7.11%) respectively as per Figure 9 and 10. The highest percent of baccillariophyceae was seen in Summer

Table 1: Gut content and grading of various food items of *Clarias batrachus*

Food items	% composition of items Volume (V_1)	Occurrence (O_1)	V_1O_1	Preponderance Index (I)	Grading
			Spring		
Crustaccea	30.25	25.25	763.81	43.95	I.
Rotifer	22.22	18.11	402.40	23.15	II.
Insect	13.63	16.38	223.25	12.84	III.
Chlorophyceae	14.21	13.03	185.15	10.65	IV.
Bacillariophyceae	10.05	9.04	90.85	5.23	V.
Myxophyceae	4.32	11.30	48.81	2.82	VI.
Plant matter	4.31	5.12	22.06	1.27	VII.
Decay organic matter	1.12	1.24	1.38	0.09	VIII.
Total			$\sum V_1O_1$= 1737.71		
			Summer		
Crustaccea	27.32	25.60	699.39	39.62	I.
Rotifer	23.12	19.44	449.45	25.46	II.
Insect	19.56	16.05	313.94	17.78	III.
Chlorophyceae	14.61	12.15	177.51	10.05	IV.
Bacillariophyceae	5.14	9.52	48.93	2.77	V.
Myxophyceae	4.17	11.13	46.41	2.63	VI.
Plant matter	5.24	5.18	27.14	1.54	VII.
Decay organic matter	0.81	3.20	2.59	0.15	VIII.
Total			$\sum V_1O_1$= 1765.36		
			Rainy		
Crustaccea	24.61	23.03	566.77	37.18	I.
Rotifer	19.17	18.12	347.36	22.79	II.
Insect	18.33	20.02	366.97	24.07	III.
Chlorophyceae	7.62	7.38	56.23	3.69	IV.
Bacillariophyceae	7.83	10.91	85.42	5.60	V.
Myxophyceae	9.08	4.42	40.13	2.64	VI.
Plant matter	8.13	7.13	57.97	3.80	VII.
Decay organic matter	1.52	2.26	3.43	0.23	VIII.
Total			$\sum V_1O_1$= 1524.28		
			Autumn		
Crustaccea	21.32	22.08	505.85	29.54	II
Rotifer	24.91	22.91	570.69	33.33	I
Insect	18.18	17.60	319.97	18.68	III
Chlorophyceae	11.93	14.46	172.51	10.07	IV
Bacillariophyceae	8.55	10.21	87.29	5.11	V
Myxophyceae	9.72	4.09	39.75	2.32	VI
Plant matter	3.58	4.23	15.14	0.88	VII
Decay organic matter	1.17	0.97	1.13	0.07	VIII
Total			$\sum V_1O_1$= 1712.33		
			Winter		
Crustaccea	25.43	19.91	506.31	31.07	I
Rotifer	22.05	20.08	442.76	27.17	II
Insect	18.23	16.86	307.36	18.86	III
Chlorophyceae	11.02	10.74	118.35	7.26	V
Bacillariophyceae	12.43	13.32	165.57	10.17	IV
Myxophyceae	6.60	10.22	67.45	4.14	VI
Plant matter	3.06	5.28	16.16	0.99	VII
Decay organic matter	1.53	3.50	5.35	0.34	VIII
Total			$\sum V_1O_1$= 1629.31		

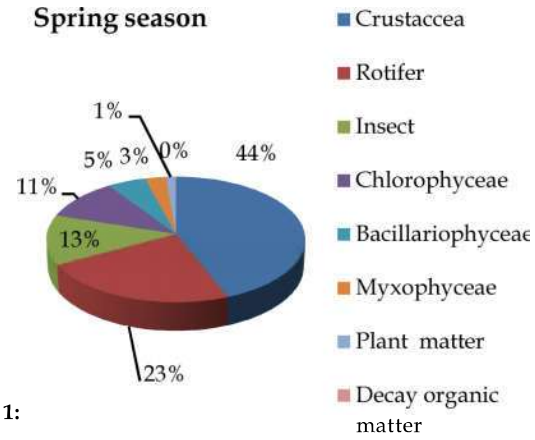


Fig. 1:

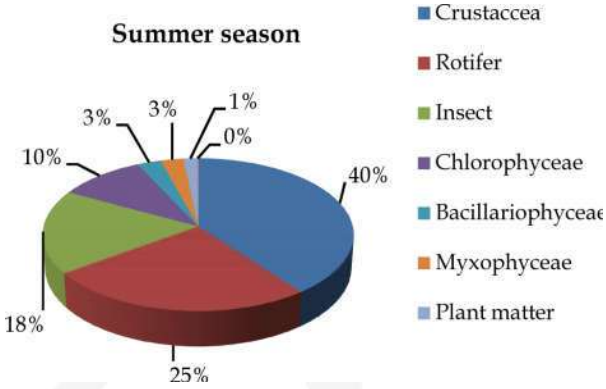


Fig. 2:

Fig. 1 & 2: Gut content and grading of food items of ***Clarias batrachus*** in **spring** & **summer** season.

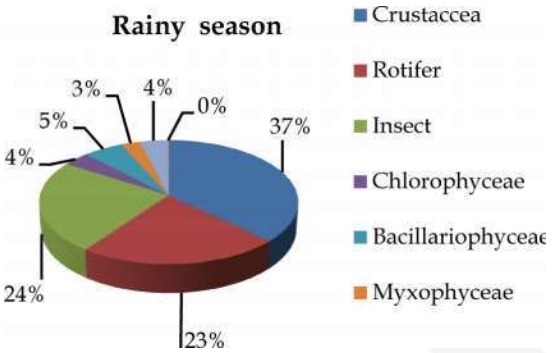


Fig. 3:

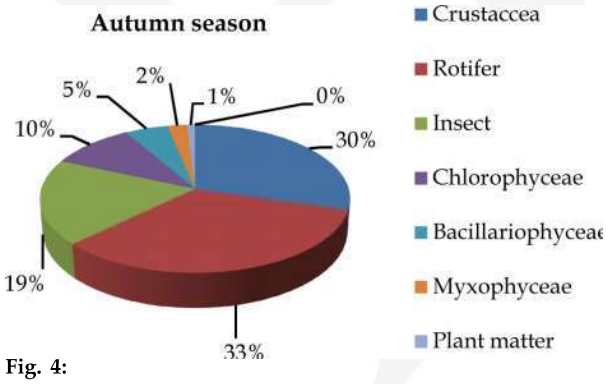


Fig. 4:

Fig. 3 & 4: Gut content and grading of food items of ***Clarias batrachus*** in **Rainy & Autumn** season

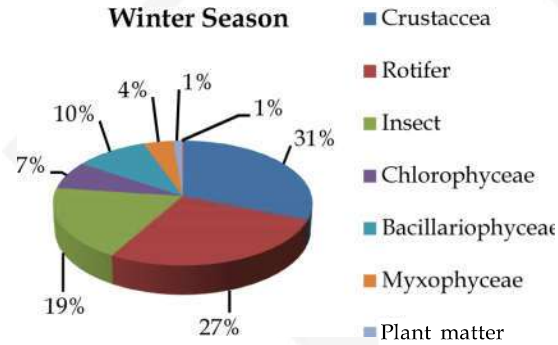


Fig. 5: Gut content and grading of food items of *Clarias batrachus* in Winter season

(11.32) and lowest was seen in Winter (4.88). The highest percentage of Myxophyceae occurred in Winter (5.82%) and lowest in Spring (2.28%). The highest percentage of occurrence of plant matter in the gut content was in Rainy season (July, August and September) is (4.05%) and lowest in Autumn (1.36). The intake of dead and decaying matter of gut content analysis was highest in Winter (4.97%) and lowest in Spring season (0.26%). Seasonal variation showed a slight variation in feeding main food items of *C. punctatus* were crustacea, rotifers and insects.

Gut Content Analysis of *A. Testudineus*

It was clearly seen that ***A.testudineus*** is a carnivorous fish because of they mostly select the crustacea, rotifers, insects and baccillariophyceae. The feeding of crustacea was highest in spring (62.92%) after then rainy (54%), autumn (47.99%), winter (46.26%) and lowest in summer (28.90%) respectively as per Table 3 and Figure 11 and 12. The highest percentage of rotifers are observed in summer season (28.90%) and lowest in spring (8.06%). Insects was the basic food for intake most of time i.e winter (20.30%), spring (18.30%), rainy (15.27%), autumn (8.50%) and least count was seen in summer (7.43%). The highest percentage of Chlorophyceae was accounted in the rainy season (9.18%) and lowest in the winter (0.17) as per Figure 13 and 1 4.

Similarly the baccillariophyceae was highest seen in summer season (20.27%) and least in the rainy season (2.54%). Myxophyceae was the another food items which was seen from highest to lowest are as follow winter (14.27%), autumn(10.26%), summer (9.70%) , rainy(6.66%) and spring(1.48%) respectively. Plant matter was negligible observed

in gut of *Anabas testudineus*. The highest of plant matter was seen in autumn (0.25%) and lowest in winter (0.01) as per Figure in 15 . Dead and decay organic matter was highest seen in summer (4.12%) and lowest in rainy (0.22%).

Table 2: Gut content and grading of various food items of *Channa punctatus*

Food items	% composition of items Volume (V_1)	Occurrence (O_1)	V_1O_1	Preponderance Index (I)	Grading
			Spring		
Crustaccea	20.87	23.36	487.52	35.07	I
Rotifer	22.78	19.65	447.63	32.21	II
Insect	11.03	13.74	151.55	10.90	III
Chlorophyceae	15.54	9.58	148.87	10.72	IV
Bacillariophyceae	14.52	6.34	92.05	6.62	V
Myxophyceae	5.24	6.04	31.65	2.28	VI
Plant matter	3.17	8.51	26.97	1.94	VII
Decay organic matter	2.21	1.65	3.64	0.26	VIII
Total			$\sum V_1O_1$= 1389.88		
			Summer		
Crustaccea	19.81	17.31	342.91	25.62	I
Rotifer	12.39	22.04	273.07	20.40	II
Insect	20.37	11.09	225.90	16.87	III
Chlorophyceae	12.20	16.67	203.37	15.19	IV
Bacillariophyceae	14.27	10.62	151.55	11.32	V
Myxophyceae	6.91	10.87	75.11	5.61	VI
Plant matter	9.68	2.92	28.26	2.11	VIII
Decay organic matter	4.47	8.63	38.57	2.88	VII
Total			$\sum V_1O_1$= 1338.74		
			Rainy		a.
Crustaccea	13.11	14.62	191.67	13.30	III
Rotifer	23.39	20.28	474.35	32.91	I
Insect	18.35	16.78	307.91	21.36	II
Chlorophyceae	8.6	20.32	174.75	12.12	IV
Bacillariophyceae	18.12	9.38	169.96	11.79	V
Myxophyceae	7.23	6.68	48.29	3.35	VII
Plant matter	8.06	7.23	58.27	4.05	VI
Decay organic matter	3.34	4.81	16.06	1.12	VIII
Total			$\sum V_1O_1$= 1441.26		
			Autumn		
Crustaccea	18.41	12.44	229.02	14.83	III
Rotifer	20.18	15.09	304.52	19.72	II
Insect	21.74	28.55	620.68	40.19	I
Chlorophyceae	11.88	13.18	156.58	10.13	IV
Bacillariophyceae	10.36	11.06	114.58	7.42	V
Myxophyceae	9.97	7.19	71.68	4.64	VI
Plant matter	3.8	5.53	21.01	1.36	VII
Decay organic matter	3.75	7.04	26.4	1.71	VIII
Total			$\sum V_1O_1$= 1544.47		
			Winter		
Crustaccea	17.31	13.69	236.97	16.22	II
Rotifer	16.24	11.74	190.66	13.05	III
Insect	18.72	34.81	651.64	44.59	I
Chlorophyceae	14.14	7.35	103.93	7.11	IV
Bacillariophyceae	8.51	8.38	71.31	4.88	VI
Myxophyceae	9.36	9.08	84.99	5.82	V
Plant matter	7.38	6.67	49.22	3.37	VIII
Decay organic matter	8.63	8.41	72.58	4.97	VII
Total			$\sum V_1O_1$=1461.3		

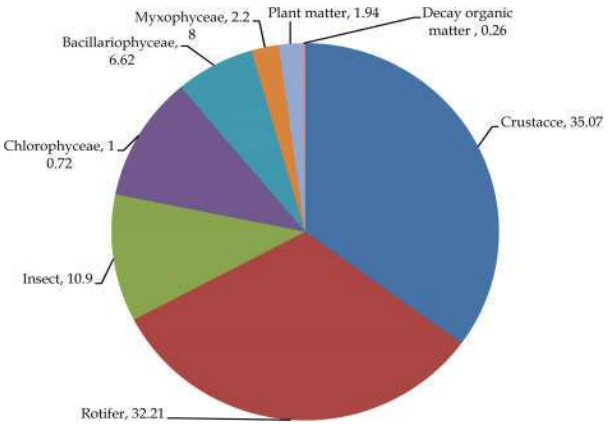


Fig. 6:

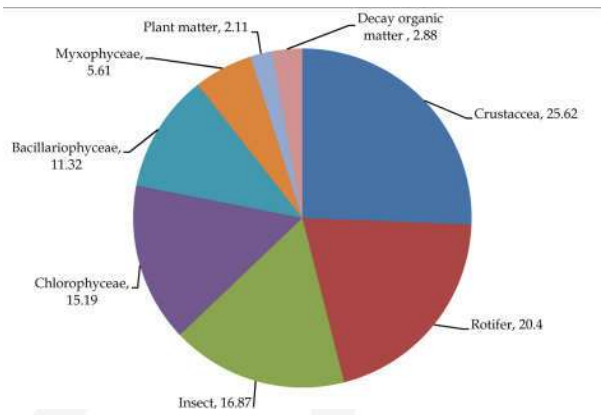
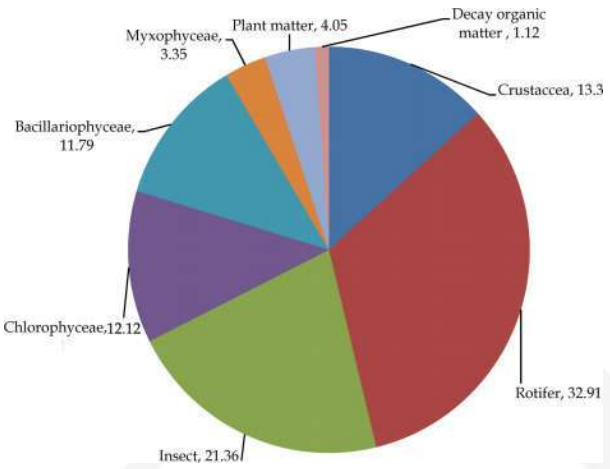


Fig. 7:

Fig. 6 & 7: Gut Content and grading of food items of ***Channa punctatus*** in **spring & Summer** Seasons



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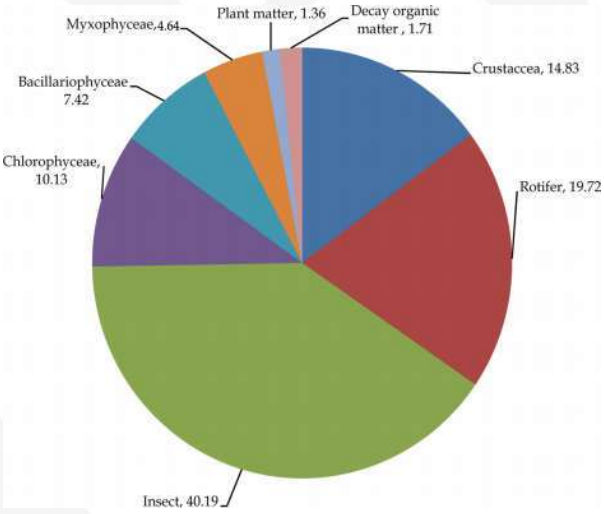


Fig. 9:

Fig. 8 & 9: Gut content and grading of food items of ***Channa punctatus*** in **Rainy &Autumn** Seasons

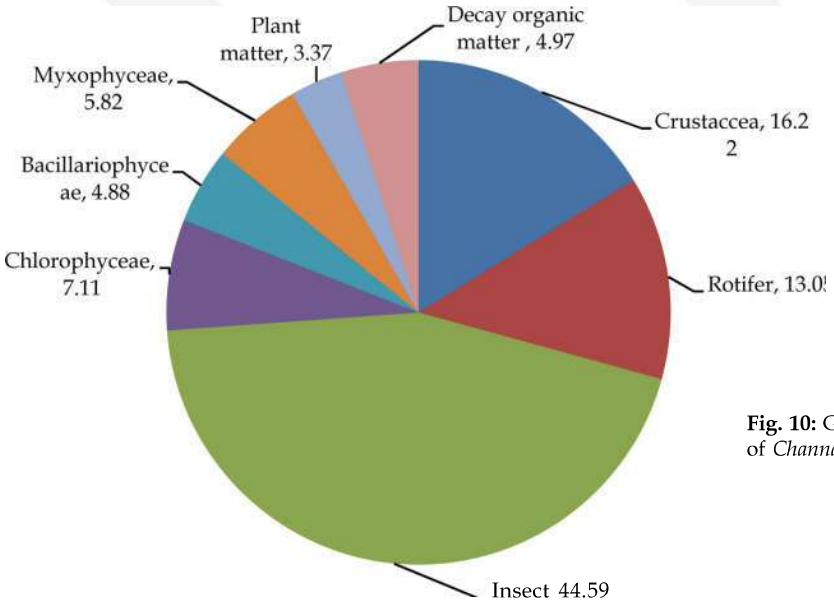
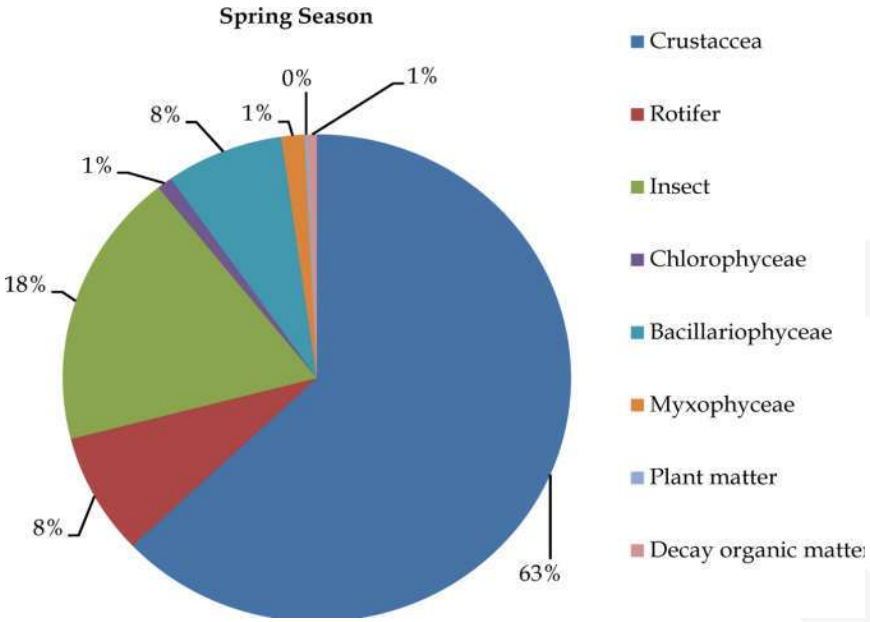


Fig. 10: Gut content and grading of food items of *Channa punctatus* in Winter

Table 3: Gut content and grading of various food items of *Anabas testudineus*

Food items	% composition of items		V_1O_1	Preponderance Index (I)	Grading
	Volume (V_1)	Occurrence (O_1)			
			Spring		
Crustaccea	22.44	53.21	1194.03	62.92	I
Rotifer	17.32	8.83	152.93	8.06	III
Insect	18.17	19.11	347.23	18.30	II
Chlorophyceae	3.38	5.47	18.49	0.97	VIII
Bacillariophyceae	21.54	6.61	142.38	7.50	IV
Myxophyceae	9.27	3.02	27.99	1.48	V
Plant matter	4.08	0.93	3.79	0.20	VI
Decay organic matter	3.81	2.84	10.82	0.57	VII
Total			$\sum V_1O_1$= 1897.66		
			Summer		
Crustaccea	13.65	29.93	408.54	28.90	I
Rotifer	17.54	16.48	289.06	20.45	II
Insect	7.83	13.41	105	7.43	VI
Chlorophyceae	18.21	7.08	128.93	9.12	V
Bacillariophyceae	16.42	17.45	286.53	20.27	III
Myxophyceae	14.77	9.28	137.06	9.70	IV
Plant matter	2.36	0.06	0.14	0.01	VIII
Decay organic matter	9.22	6.32	58.27	4.12	VII
Total			$\sum V_1O_1$=1413.53		
			Rainy		a.
Crustaccea	21.45	43.5	933.07	54	I
Rotifer	18.39	11.33	208.36	12.06	III
Insect	26.04	10.13	263.78	15.27	II
Chlorophyceae	11.28	14.06	158.60	9.18	IV
Bacillariophyceae	10.03	4.37	43.83	2.54	VI
Myxophyceae	9.58	12.01	115.05	6.66	V
Plant matter	0.39	3.29	1.28	0.07	VIII
Decay organic matter	2.87	1.32	3.79	0.22	VII
Total			$\sum V_1O_1$= 1727.76		
			Autumn		
Crustaccea	15.32	44.23	677.60	47.99	I
Rotifer	16.04	11.42	183.18	12.97	III
Insect	12.81	9.37	120.03	8.50	V
Chlorophyceae	9.70	1.5	14.55	1.03	VII
Bacillariophyceae	13.28	18.61	247.14	17.50	II
Myxophyceae	11.19	12.93	144.69	10.26	IV
Plant matter	6.04	0.58	3.50	0.25	VIII
Decay organic matter	5.63	1.36	21.25	1.50	VI
Total			$\sum V_1O_1$= 1411.94		
			Winter		
Crustaccea	18.34	42.8	784.95	46.26	I
Rotifer	16.32	10.54	172.01	10.14	IV
Insect	24.06	14.32	344.54	20.30	II
Chlorophyceae	2.42	1.21	2.93	0.17	VII
Bacillariophyceae	12.29	10.47	128.67	7.58	V
Myxophyceae	13.21	18.33	242.14	14.27	III
Plant matter	4	0.05	0.2	0.01	VIII
Decay organic matter	9.36	2.3	21.53	1.27	VI
Total			$\sum V_1O_1$=1696.97		



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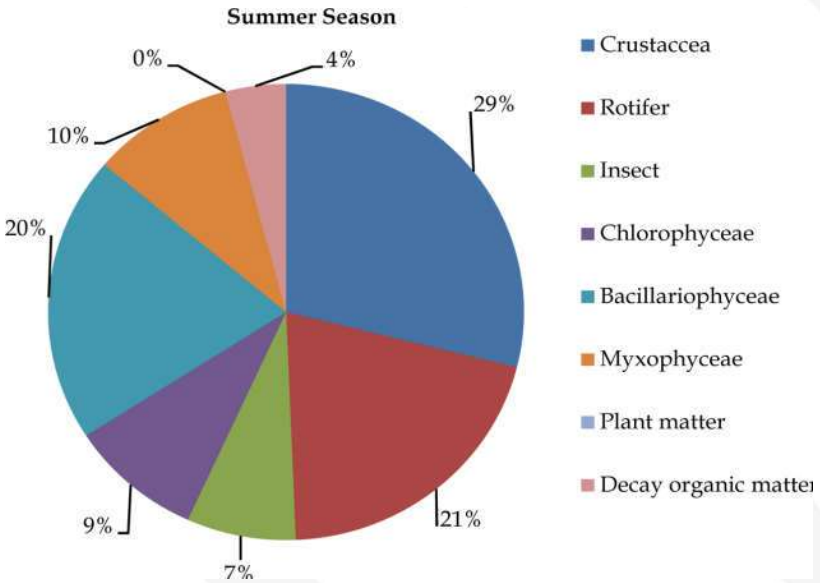

Fig. 11 & 12: Gut content and grading of food items of ***Anabas testudineus*** in **Spring & Summer**

Fig. 12:

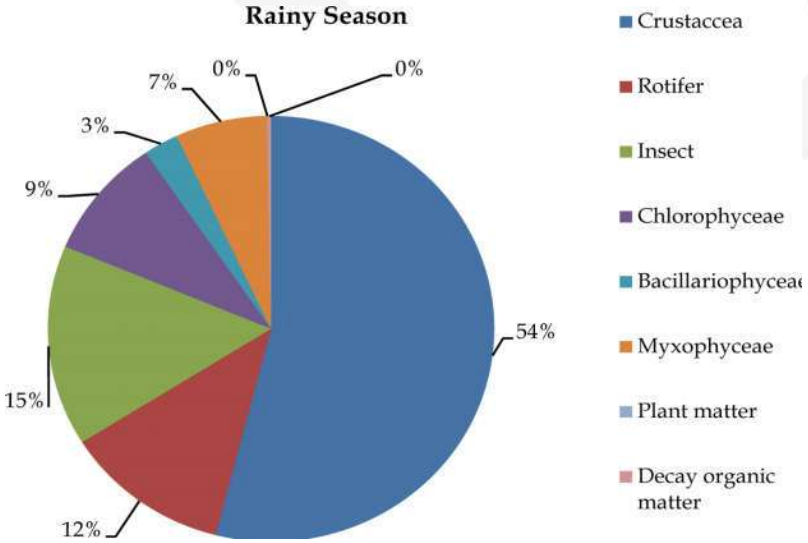

Fig. 13: Gut content and grading of food items of ***Anabas testudineus*** in **Rainy & Autumn**

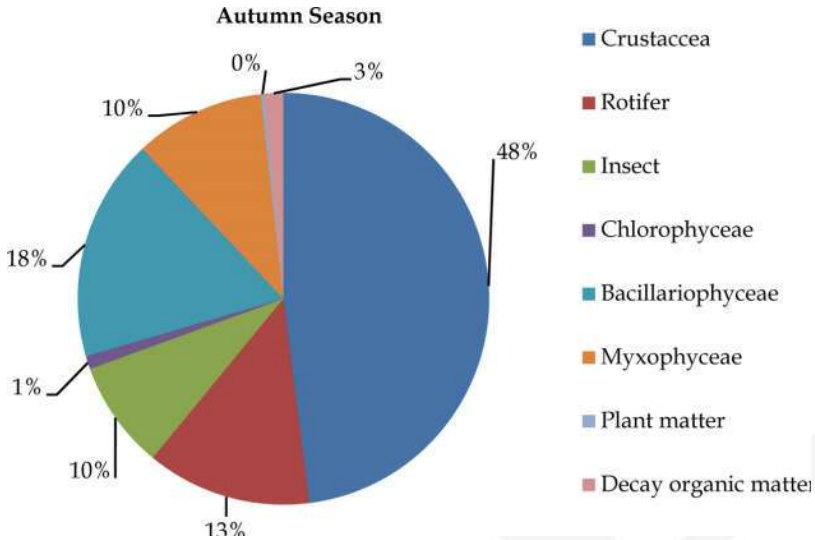

Fig. 14: Gut content and grading of food items of ***Anabas testudineus*** in **Rainy & Autumn**

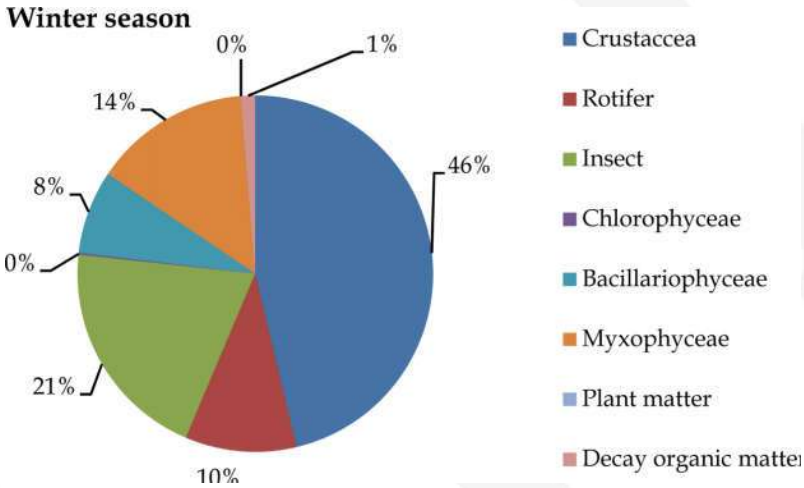

Fig. 15: Gut content and grading of food items of ***Anabas testudineus*** in **Winter**

Discussion

Hora and Pillay (1962) assigned *Clarias batrachus* as a plankton and detritus and reported that this fish consume primarily phytoplankton and zooplankton, *Clarias batrachus* feed mainly on crustacea, algae, rotifers and some insects and hence he categorized the same as plankton feeder. The present observations are in consonance with these food items as reported by earlier workers the *Claris batrachus* is planktophagus and feeds primarily on zooplanktons. David *et. al.*, (2010) observed that the presence of tiny unicuspid teeth in the mouth of the fish suggests that fish species feed on plants, leaves, buds and seeds of water lilies and are thus herbivorous feeders.

Smita *et. al.*,(2012) detailed discussed about feeding habits of *Channa punctatus* is mainly based on the plant matter. The fish is a bottom and water column feeder and less adapted to take zooplankton. Gut content analysis revealed by *Channa punctatus* depend on the vegetable matter. Unidentifiable plant matter formed the major items. Other items was green algae, filamentous algae, detritus and sand particles. The present finding is in agreement with that of earlier work Indranil *et. al.*, (2016) while *Anabas testudineus* feeds on detritus, phytoplankton as well as zooplankton with a narrow range of food varieties. It is a bottom feeder subsisting mainly on decayed vegetation. It is in the line with observation earlier made by Ramesh *et.al.*, (2016). *Channa punctatus* feed on higher percentage of

crustaceans, insects, molluscs, fishes and sand and mud particles and lowest percentage of plant material. Smaller fishes and their larvae were dominant food items thus making as carnivorous.

Similar results were also reported by Roy et.al (2013) in *Anabas testudineus.* Bhowmick (1965) on *Glossogobius guiris* also reported similar results. M. Nazrul Islam *et. al.*(2004)., revealed that the *Channa punctatus* feeds on animal foods (crustaceans, molluscs, insects and fishes).

Bhuiyan *et al.(*2006) reported very poor feeding intensity in mature species of *Channa punctatus* during May to July. Saikia *et al.* (2012) also reported low feeding intensity of *Channa punctatus* in June-July and November-January.The increase in number of empty stomachs during the rainy season could be attributed to the short feeding periods observed at this time due to the reduced low tide duration. This fish is found to be much active on the mud flats at low tide.

Conclusion

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. punctatus* changes its food habit with the change in seasons.

Index of Preponderance of various food compositions in the gut of *C. punctatus* indicated that fish was the most dominant food item in the gut, followed by the insect, crustacean, plant matter mucks and unidentified materials, annelids and molluscs. The different type of food items such as protozoans, crustaceans, insects, algae etc. was very common in the month of October to December in *A. testudineus* while these food items was very common in the month of July to September. The young fishes were found to prefer insect pupae and these fishes fed during day time.

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