

Food and feeding habits of *Channa punctatus* from Kaigaon Toka Dist. Aurangabad (M.S.) in relation to biochemical studies

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Abstract

The research presents food and feeding habits of *Channa punctatus* (Bloch, 1793) in relation to biochemical studies from Kaigaon Toka Dist. Aurangabad (M.S.). Feeding habits, seasonal diet variation of *Channa punctatus* were investigated through stomach content analysis during December 2007 to November 2009. The diet showed significant seasonal patterns and was dominated by crustaceans, followed by insects, molluscs, fishes and least by plant material thus reflecting its carnivorous nature. In biochemical studies various digestive enzymes glycosidases, proteases and lipases were detected in the different regions of gut.

Keywords: Kaigaon Toka, food and feeding habits, biochemical studies, carnivorous.

INTRODUCTION

Food is an important factor in the biology of fishes to the extent of governing their growth, fecundity and migratory movements. Variations in the seasonal and diurnal abundance of the favourite food organisms of different species of fish, in any region, may influence respectively the horizontal and vertical movements of the fish stocks. Hence, a correct knowledge of the relationship between the fishes and food organisms is essential for the prediction and exploitation of the fish stocks. An objective study of these relationships should be properly integrated in the orientation of a commercially exploited fishery, taking into account the diversity of the component species constituting the total fishery of the region. Some biological aspects including food, feeding habits and biochemical relationships of *Channa punctatus* have been studied.

Study of digestive enzymes is an essential step towards understanding the mechanism of digestion and how the organism adapts to changes in the nutritional environment [29]. On the other hand, the assessment of the activity of digestive enzymes in cultured species may be helpful in the selection of feed ingredients [19].

In the present study food and feeding habits, and seasonal variation in chemical composition of protein, lipid and glycogen in body muscles of *Channa punctatus* for the period from June 2007 to May 2009 was studied and the occurrence, distribution and relative activities of digestive enzymes such as glycosidases, proteases and lipases in the different regions of gut of *Channa punctatus* were carried out.

MATERIALS AND METHODS

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Fish samples of *Channa punctatus*, were collected from Kaigaon Toka, Aurangabad District (M.S.) India. Identification of fishes was done upto species level at fish landing center to get its natural colour, pattern of scales, fins, mouth pattern, identification marks like black spot, bloach on operculum, paired and unpaired fins and body parts with help of standard literature by [7, 12, 30, 8, 16, 17, 18, 22]. For analysis of food and feeding habits, food items were identified under microscope by following the keys given by Pennak [26], Ward and Whipple [31].

Several indices were calculated to show the relative importance of each prey item by corrected occurrence percentage (F_c %) of a type of prey [28,11] weight percentage (W%) [15] and the index of preponderance (Ip %) methods which combines the occurrence (F_c %) and weight (W%) percentages and is used to assess the relative importance of each type of prey.

To study biochemical constituents such as proteins, glycogen and total lipids and digestive enzymes qualitatively and quantitatively, the fishes were dissected and entire gut was removed. The stomach, intestine were separated. The different gut regions were homogenized and the homogenates were centrifuged at 1200 rpm for 30 minutes at 4 °C. The supernatants were used as crude enzyme extracts without further purification.

Proteins were estimated by Folin-Phenol reagent method [21].

Glycogen was estimated by using Anthrone reagent. [9]. Total lipids were estimated by Vanillin reagent [3].

Qualitative and quantitative detection of digestive enzymes:-

Glycosidase (carbohydrases):-The qualitative assay of glycosidases (carbohydrases) was carried out by Olatunde [25] and quantitative by Plummer (1978) [28] methods.

Proteases:- Balogun and Fisher [2], Laskowsky [20] and Herriott [13] methods for qualitative and quantitative determination of proteases.

Lipases:- Ogunbiyi and Okon [24] methods were used to determine the qualitative and quantitative activity of lipases.

RESULTS AND DISCUSSION

To study the food analysis of *Channa punctatus*, the weight percentage (Table 2.1 and 2.2, Graph 2.2 and Graph 2.3), frequency

of occurrence (Table 2.3 and 2.4, Graph 2.3 and Graph 2.4) and index of preponderance methods (Table 2.5 and 2.6, Graph 2.5 and Graph 2.6) were carried out for various food items.

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.

Table 2.1. Weight percentage (W %) of prey found in *Channa punctatus* during the months December 2007 to November 2008

Month & Year		Dec 2007	Jan 2008	Feb 2008	Mar 2008	Apr 2008	May 2008	Jun 2008	Jul 2008	Aug 2008	Sept 2008	Oct 2008	Nov 2008
Prey (i)													
Crustacean	Wi	13.82	12.33	13.45	11.32	13.05	14.97	13.18	13.54	12.64	13.29	14.79	12.94
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	19.46	17.24	18.42	17.23	17.6	18.71	17.34	16.88	18.05	16.01	18.72	18.75
Insects	Wi	7.68	8.11	7.90	6.48	6.51	6.94	7.30	8.92	7.39	8.55	7.78	5.4
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	10.814	11.34	10.82	9.86	8.82	8.67	9.60	11.12	10.55	10.30	9.84	7.82
Molluscs	Wi	9.28	8.85	9.17	7.15	7.94	10.67	9.5	10.77	9.53	8.54	8.56	6.50
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	13.07	12.37	12.56	10.88	10.75	13.33	12.5	13.42	13.61	10.29	10.83	9.42
Fishes	Wi	41.30	38.52	44.74	42.54	49.71	46.02	42.13	52.76	40.79	37.11	41.56	34.7
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	58.17	53.87	61.28	64.74	67.35	57.52	55.43	65.78	58.27	44.71	52.60	50.29
Plant Material	Wi	1.66	1.61	1.92	0	0	0	0	0.66	1.20	1.36	2.26	1.65
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	2.33	2.25	2.63	0	0	0	0	0.82	1.71	1.63	2.86	2.39
Sand & Mud Particle	Wi	12.06	11.79	12.52	12.10	10.79	11.32	11.26	12.58	11.35	14.48	14.59	12.91
	WT	71	71.5	73	65.7	73.8	80	76	80.2	70	83	79	69
	W%	16.98	16.49	17.15	18.41	14.62	14.15	14.81	15.68	16.21	17.44	18.46	18.71
	ΣW%	120.82	113.56	122.86	121.12	119.14	112.38	109.68	123.7	118.4	100.38	113.31	107.38

Where 'Wi' is the total weight of a type a prey 'i' and 'WT' is the weight of all prey; $W\% = Wi/WT \times 10$

Table 2.2. Weight percentage (W %) of prey found in *Channa punctatus* during the months December 2008 to November 2009

Month & Year		Dec 2008	Jan 2009	Feb 2009	Mar 2009	April 2009	May 2009	June 2009	July 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009
Prey (i)													
Crustaceans	Wi	13.60	12.50	13.29	11.49	12.78	15.13	13.08	13.67	12.40	13.48	14.57	13.07
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	18.88	17.24	18.45	17.22	17.55	18.67	17.44	16.83	17.97	16.04	18.68	18.67
Insects	Wi	7.45	8.38	7.68	6.60	6.26	7.12	7.05	9.09	7.17	8.73	7.56	5.6
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	10.34	11.55	10.66	9.89	8.59	8.79	9.4	11.19	10.3	10.39	9.69	8
Molluscs	Wi	9.18	9.05	8.93	7.49	7.71	10.85	9.3	10.96	9.31	8.73	8.34	6.69
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	12.75	12.48	12.40	11.22	10.59	13.39	12.4	13.49	13.4	10.39	10.69	9.55
Fishes	Wi	40.30	39.52	43.74	43.54	48.71	47.02	41.13	53.76	39.79	38.11	40.56	35.7
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	55.97	54.51	60.75	65.27	66.91	58.05	54.84	66.20	57.66	45.37	52	51
Plant Material	Wi	1.46	1.81	1.72	0	0	0	0	0.86	1	1.56	2.06	1.85
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	2.027	2.49	2.38	0	0	0	0	1.06	1.45	1.85	2.64	2.64
Sand & Mud Particle	Wi	11.86	11.99	12.32	12.30	10.59	11.52	11.06	12.78	11.35	14.68	14.39	13.11
	WT	72	72.5	72	66.7	72.8	81	75	81.2	69	84	78	70
	W%	16.47	16.53	17.11	18.44	14.54	14.22	14.74	15.73	16.45	17.47	18.44	18.72
	ΣW%	116.43	114.8	121.75	122.04	118.18	113.12	108.82	124.5	117.23	101.51	112.14	108.58

Where 'Wi' is the total weight of a type a prey 'i' and 'WT' is the weight of all prey; $W\% = Wi/WT \times 100$

Table 2.3. Frequency of occurrence (Fc %) of prey found in *Channa punctatus* during the months December 2007 to November 2008

Month & Year		Dec 2007	Jan 2008	Feb 2008	Mar 2008	Apr 2008	May 2008	Jun 2008	Jul 2008	Aug 2008	Sept 2008	Oct 2008	Nov 2008
Crustacean	Ni	24	24	23	23	21	25	22	24	21	19	19	18
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.82	0.8	0.79	0.76	0.77	0.83	0.75	0.8	0.75	0.63	0.67	0.62
	Fc%	20.29	19.75	20.25	21.40	22	23.18	21.49	22.34	21.12	17.94	20.18	18.61
Insects	Ni	17	18	16	16	13	14	13	14	11	14	10	13
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.58	0.6	0.55	0.53	0.48	0.46	0.44	0.46	0.39	0.46	0.35	0.44
	Fc%	14.35	14.81	14.10	14.93	13.71	12.85	12.60	12.85	10.98	13.10	10.54	13.21
Molluscs	Ni	19	20	19	18	17	19	21	19	18	21	17	16
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.65	0.66	0.65	0.6	0.63	0.63	0.72	0.63	0.64	0.7	0.60	0.55
	Fc%	16.09	16.29	16.66	16.90	18	17.59	20.63	17.59	18.02	19.94	18.07	16.51
Fishes	Ni	27	29	28	27	26	28	28	28	27	28	27	27
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.93	0.96	0.96	0.9	0.96	0.93	0.96	0.93	0.96	0.93	0.96	0.93
	Fc%	23.02	23.70	24.61	25.35	27.42	25.97	27.50	25.97	27.04	26.49	28.91	27.92
Plant Material	Ni	8	7	6	0	0	0	0	2	4	5	4	5
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.27	0.23	0.20	0	0	0	0	0.066	0.14	0.16	0.14	0.17
	Fc%	6.88	5.68	5.12	0	0	0	0	1.84	3.94	4.55	4.21	5.10
Sand & Mud Particle	Ni	23	24	22	23	18	22	18	21	19	19	17	18
	NT	29	30	29	30	27	30	29	30	28	30	28	29
	Fi	0.79	0.8	0.75	0.76	0.66	0.73	0.62	0.7	0.67	0.63	0.60	0.62
	Fc%	19.55	19.73	19.23	21.40	18.85	20.39	17.76	19.55	18.87	17.94	18.07	18.61
	ΣFc%	99.98	99.96	99.97	99.98	99.98	99.98	99.98	100.14	99.97	99.96	99.98	99.96

Where 'ni' = No. of stomachs containing a type of prey 'i' and NT = is No. not empty stomachs examined; Fi = ni/NT and Fc = Fi/ΣFi x 100

Table 2.4. Frequency of occurrence (Fc %) of prey found in *Channa punctatus* during the months December 2008 to November 2009

Month & Year		Dec 2008	Jan 2009	Feb 2009	Mar 2009	April 2009	May 2009	June 2009	July 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009
Crustaceans	Ni	25	23	24	22	22	26	21	23	20	19	18	17
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.83	0.79	0.8	0.75	0.78	0.86	0.7	0.7	0.69	0.63	0.62	0.60
	Fc%	20.34	20.72	20.56	13.44	21.54	23.43	20.77	22.19	19.77	17.94	19.49	18.23
Insects	Ni	18	17	17	15	14	15	14	13	12	13	11	12
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.6	0.58	0.56	0.51	0.5	0.5	0.46	0.44	0.41	0.43	0.38	0.42
	Fc%	14.70	13.9	14.39	9.139	13.81	13.62	13.65	12.36	11.74	12.25	11.63	12.766
Molluscs	Ni	20	19	21	17	16	19	20	18	19	22	15	15
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.66	0.65	0.7	0.58	0.57	0.63	0.66	0.62	0.65	0.73	0.51	0.53
	Fc%	16.17	15.66	17.99	10.39	15.74	17.16	19.58	17.41	18.62	20.79	16.03	16.11
Fishes	Ni	28	28	27	26	27	29	28	27	28	29	28	26
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.93	0.96	0.9	0.89	0.96	0.96	0.93	0.93	0.96	0.96	0.96	0.92
	Fc%	22.79	23.13	23.13	15.95	26.52	26.15	27.59	26.12	27.50	27.35	30.18	27.96
Plant Materials	Ni	8	9	7	0	0	0	0	1	3	4	5	6
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.26	0.31	0.23	0	0	0	0	0.03	0.10	0.13	0.17	0.21
	Fc%	6.37	7.47	5.91	3.04	3.86	1.63	1.78	0.84	2.86	3.70	5.345	6.38
Sand & Mud Particle	Ni	24	25	21	20	19	20	17	22	20	30	16	17
	NT	30	29	30	29	28	30	30	29	29	30	29	28
	Fi	0.8	0.86	0.7	0.69	0.67	0.66	0.56	0.75	0.69	1	0.55	0.60
	Fc%	19.60	19.03	17.99	12.18	18.50	17.98	16.61	21.06	19.48	17.94	17.29	18.23
	ΣFc%	4.88	5.01	4.59	4.28	4.29	4.33	3.93	4.22	4.19	4.88	3.74	3.88

Where 'ni' = No. of stomachs containing a type of prey 'i' and NT = is No. not empty stomachs examined ; Fi = ni/NT and Fc = Fi/ΣFi x 100

Table 2.5. Preponderal Index (Ip %) of prey found in *Channa punctatus* during the months December 2007 to November 2008

Month & Year		Dec 2007	Jan 2008	Feb 2008	Mar 2008	Apr 2008	May 2008	Jun 2008	Jul 2008	Aug 2008	Sept 2008	Oct 2008	Nov 2008
Crustaceans	Fc%	20.29	19.75	20.25	21.40	22	23.18	21.49	22.34	21.12	17.94	20.18	18.61
	W%	19.46	17.24	18.42	17.23	17.6	18.71	17.34	16.88	18.05	16.01	18.72	18.75
	Ip%	16.13	14.64	14.42	13.48	13.71	16.92	14.67	13.60	14.49	13.47	14.85	14.71
Insects	Fc%	14.35	14.81	14.10	14.93	13.71	12.85	12.60	12.85	10.98	13.10	10.54	13.21
	W%	10.81	11.34	10.82	9.86	8.82	8.67	9.60	11.12	10.55	10.30	9.84	7.82
	Ip%	6.34	7.22	5.90	5.38	4.28	4.34	4.76	5.15	4.40	6.32	4.07	4.35
Molluscs	Fc%	16.09	16.29	16.66	16.90	18	17.59	20.63	17.59	18.02	19.94	18.07	16.51
	W%	13.07	12.37	12.56	10.88	10.75	13.33	12.5	13.42	13.61	10.29	10.83	9.42
	Ip%	8.59	8.66	8.09	6.72	6.85	9.15	10.15	8.51	9.32	9.62	7.69	6.55
Fishes	Fc%	23.02	23.70	24.61	25.35	27.42	25.97	27.50	25.97	27.04	26.49	28.91	27.92
	W%	58.17	53.87	61.28	64.74	67.35	57.52	55.43	65.78	58.27	44.71	52.60	50.29
	Ip%	54.72	54.91	58.31	60.00	65.39	58.30	60.04	61.61	59.89	55.55	59.78	59.18
Plant Materials	Fc%	6.68	5.68	5.12	0	0	0	0	1.84	3.94	4.55	4.21	5.10
	W%	2.33	2.25	2.63	0	0	0	0	0.82	1.71	1.63	2.86	2.39
	Ip%	0.63	0.55	0.52	0	0	0	0	0.054	0.25	0.34	0.47	0.51
Sand & Mud Particle	Fc%	19.55	19.73	19.23	21.40	18.85	20.39	17.76	19.55	18.87	17.94	18.07	18.61
	W%	16.98	16.49	17.15	18.41	14.62	14.15	14.81	15.68	16.21	17.44	18.46	18.71
	Ip%	13.56	13.99	12.75	14.40	9.75	11.26	10.36	11.05	11.62	14.67	13.11	14.67
	ΣFc%	99.98	99.96	99.97	99.98	99.98	99.98	99.98	100.14	99.97	99.96	99.98	99.96
	ΣW%	120.82	113.56	122.86	121.12	119.14	112.38	109.68	123.7	118.4	100.38	113.31	107.38

Where, Index of Preponderance $Ip\% = Fc\% \times W\% / \sum(Fc\% \times W\%) \times 100$

Table 2.6. Preponderal Index (Ip %) of prey found in *Channa punctatus* during the months December 2008 to November 2009

Month & Year		Dec 2008	Jan 2009	Feb 2009	Mar 2009	Apr 2009	May 2009	Jun 2009	Jul 2009	Aug 2009	Sept 2009	Oct 2009	Nov 2009
Crustaceans	Fc%	20.34	20.72	20.56	13.44	21.54	23.43	20.77	22.19	19.77	17.94	19.49	18.23
	W%	18.88	17.24	18.45	17.22	17.55	18.67	17.44	13.30	17.97	16.04	18.68	18.67
	Ip%	16.31	15.48	15.27	13.58	13.96	17.08	14.54	13.30	13.47	13.12	14.27	14.29
Insects	Fc%	14.70	13.9	14.39	9.139	13.81	13.62	13.65	12.36	11.74	12.25	11.63	12.76
	W%	10.34	11.55	10.66	9.89	8.59	8.79	9.4	11.19	10.3	10.39	9.69	8
	Ip%	6.45	6.95	6.17	5.30	4.38	4.67	5.15	4.92	4.58	5.80	4.41	4.28
Molluscs	Fc%	16.17	15.66	17.99	10.39	15.74	17.16	19.58	17.41	18.62	20.79	16.03	16.11
	W%	12.75	12.48	12.40	11.22	10.59	13.39	12.4	13.49	13.4	10.39	10.69	9.55
	Ip%	8.76	8.47	8.98	6.84	6.15	8.97	9.74	8.36	9.46	9.85	6.71	6.46
Fishes	Fc%	22.79	23.13	23.13	15.95	26.52	26.15	27.59	26.12	27.50	27.35	30.18	27.96
	W%	55.97	54.51	60.75	65.27	66.91	58.05	54.84	66.20	57.66	45.37	52	51
	Ip%	54.20	54.64	56.59	61.09	65.55	59.28	60.74	61.58	60.15	56.60	61.53	59.90
Plant Material	Fc%	6.37	7.47	5.91	0	0	0	0	0.84	2.86	3.70	5.345	6.38
	W%	2.027	2.49	2.38	0	0	0	0	1.06	1.45	1.85	2.64	2.64
	Ip%	0.54	0.80	0.56	0	0	0	0	0.03	0.15	0.31	0.55	0.70
Sand & Mud Particle	Fc%	19.60	19.03	17.99	12.18	18.50	17.98	16.61	21.06	19.48	17.94	17.29	18.23
	W%	16.47	16.53	17.11	18.44	14.54	14.22	14.74	15.73	16.45	17.47	18.44	18.72
	Ip%	13.71	13.63	12.39	13.18	9.93	9.98	9.82	11.79	12.15	14.29	12.50	14.33
	ΣFc%	4.88	5.01	4.59	4.28	4.29	4.33	3.93	4.22	4.19	4.88	3.74	3.88
	ΣW%	116.43	114.8	121.75	122.04	118.18	113.12	108.82	124.5	117.23	101.51	112.14	108.58

Where, Index of Preponderance $Ip\% = Fc\% \times W\% / \sum(Fc\% \times W\%) \times 100$

Table 6.1. Seasonal average protein content in the year 2007 to 2009

Season	<i>Channa punctatus</i>	
	2007-08	2008-09
Summer	18.98 ± 0.50	19.03 ± 0.50
Rainy	19.30 ± 0.29	19.41 ± 0.29
Winter	19.12 ± 0.31	19.16 ± 0.20

Table 6.2 Seasonal average in lipid content in the year 2007-2009

Season	<i>Channa punctatus</i>	
	2007-08	2008-09
Summer	4.28 ± 0.34	4.21 ± 0.45
Rainy	4.49 ± 0.26	4.38 ± 0.28
Winter	4.88 ± 0.19	4.76 ± 0.41

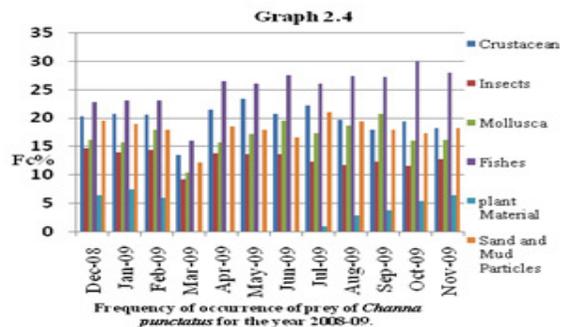
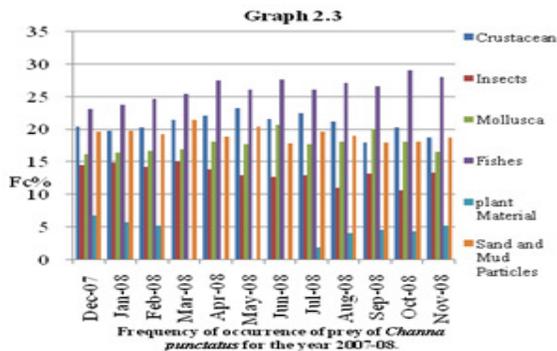
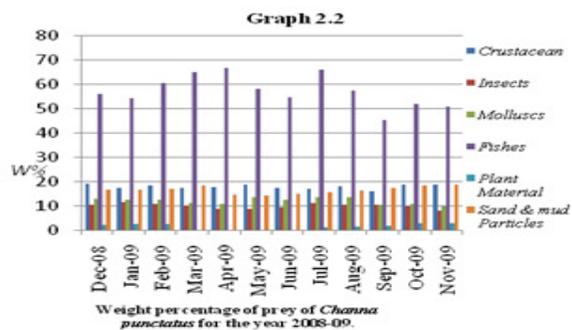
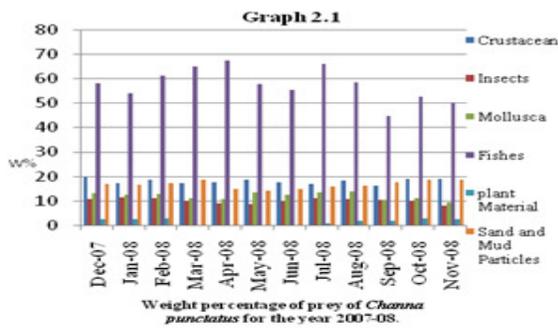
Table. 6.3 Seasonal average glycogen content in the year 2007-2009.

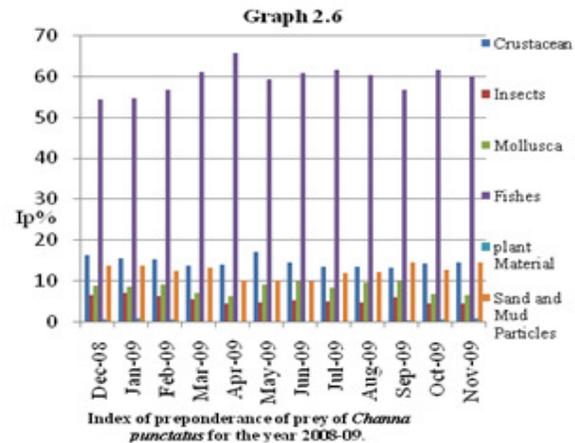
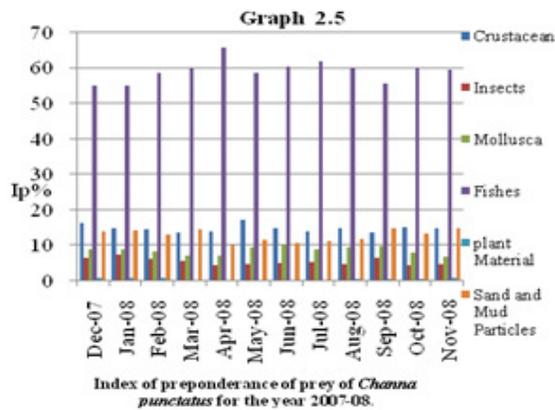
Season	<i>Channa punctatus</i>	
	2007-08	2008-09
Summer	20.05 ± 0.21	20.10 ± 0.32
Rainy	20.16 ± 0.20	20.23 ± 0.35
Winter	20.44 ± 0.37	20.51 ± 0.25

Table. 6.4 Assays of digestive enzymes in the gut of *Channa punctatus*.

	Stomach	Small intestine	Large intestine
¹ GLYCOSIDASES			
α-amylase	0.025 ± 0.010	0.044 ± 0.017	0.203 ± 0.127
Sucrase	0.131 ± 0.031	0.129 ± 0.049	0.213 ± 0.150
Maltase	1.398 ± 0.116	0.917 ± 0.357	2.401 ± 0.497
Lactase	2.706 ± 0.034	1.020 ± 0.056	1.698 ± 0.072
Cellulase	ND	ND	ND
² PROTEASES			
Chymotrypsin	0.042 ± 0.010	0.164 ± 0.062	0.184 ± 0.052
Trypsin	0.036 ± 0.010	0.182 ± 0.040	0.244 ± 0.012
Pepsin	0.328 ± 0.024	0.165 ± 0.018	0.216 ± 0.034
³ LIPASES			
	71.29 ± 4.22	115.75 ± 10.11	62.43 ± 4.88

Values (Mean ± standard deviation), ND = not detected ¹ mg glucose/min/mg protein at 37 °C ² change in optical density at 595 nm/hr/mg of L tyrosine/hr at 37 °C ³ millequivalents offatty acids/mg protein/hr at 37 °C.





Similar results were also reported by Abdus [1] in *Channa punctatus*. Reports by Bhuiyan and Haque [5] on *Glossogobius giuris*, Bhuiyan and Islam on *Xenentodon cancila*, Hossain [14] on *Notopterus notopterus* and Bhuiyan and Islam [6] on *Ompok pabda* from different habitat suggest *Channa punctatus* to feed on animal food as carnivorous. Bhowmick [4] on *Glossogobius giuris* also reported similar results. M. Nazrul Islam [23] revealed that the *Channa punctatus* feeds on animal foods (crustaceans, molluscs, insects and fishes).

The average protein (Table 6.1), lipid (Table 6.2) and glycogen (Table 6.3) content were estimated in summer, rainy and winter seasons during the year 2007-08 and 2008-09. Similar type of variation in the biochemical composition was reported by Bruce, Idler and Bitners, Ganpathi and Rao and Rao reported that the changes in the muscle protein values are related to maturation and spawning rather than feeding activity.

Various digestive enzymes glycosidases (amylase, sucrase, maltase and lactase), proteases (trypsin, chymotrypsin and pepsin) and lipases (Table 6.4) were detected in the different regions of gut. The distribution and activity of the enzymes varied along the entire length of the fish gut. The variety of glycosidases detected indicates the ability to digest a variety of carbohydrate food components. There is higher activity of proteases, in the stomach and small intestine.

Fagbenro [10] reported similar pattern of protein-hydrolyzing enzymes distribution in *Malapterurus electricus*, which has a piscivorous dietary habit. As *Channa punctatus* is known to be piscivorous, feeding mainly on insects and small fishes hence higher activity of proteases are observed.

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