Bangladesh J. Fsh. Res.,8(1), 2004: 27-34

Food habits of *Oxygaster bacaila* (Ham.) from Kaptai Lake, Bangladesh

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Abstract
Gut contents of 120 *Oxygaster bacaila* from Kaptai Lake were studied. Index of preponderance (IP) indicated that *O. bacaila* consumed highest amount of Insects (35.89%) and thus occupied the first position among the food items. Zooplankton (Rotifera and crustacea 31.79%) and the other food items found in the guts were algae (Chlorophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae 24.51%). From the analysis of gut contents, this fish might be considered as omnivore as it consumed both animal and plant foods with higher preference for animal food. The feeding intensity of this fish is fairly high. Total length (TL) versus gut length (GL) relationship and their ratio were found to be $GL = 0.57663\ TL^{1.04801}$ ($r = 0.9963$) and TL: GL = 1: 0.7086 respectively.

Key words : Food habit, *Oxygaster bacaila,* Kaptai Lake

Introduction

There are about 58 fish species in Kaptai Lake (Hafizuddin *et al.* 1989) *Oxygaster bacaila* is one of them. It is a common fresh water indigenous small fish of Bangladesh. It is locally known as chela. This fish is very much popular and less costly. Its found available in the rivers, canals, beels, ponds, lake etc. of Bangladesh (Rahman 1989, Islam and Hossain 1984). Small indigenous fish is not only as a source of animal protein but also as a source of vitamin, iron, calcium, phosphorus etc. (INFS 1977). It also contains 14.60g protein, 4.35g fat, 1.5g carbohydrate, 590mg calcium and 2.0g vitamin per 100 g of fish (Tripathi *et al.* 1997). So, this fish should be considered as a good source of minerals and protein.

Proper knowledge about the food and feeding habits of fish are very important factor for increasing fish production. The food habits of fishes vary with time of the day, size of the fish, season of the year, locality and availability of various foodstuffs. Many workers made studies on the food and feeding habits of different fishes, but so far literature reviewed no published report was found on food and feeding habits of *Oxygaster bacaila* from Kaptai Lake, Bangladesh. So the present work was undertaken to determine the food and feeding habits of *O. bacaila* from Kaptai Lake which might be helpful to the

fish management policy for the increase of production of fish in the Kaptai Lake and other water bodies.

Materials and methods

One hundred twenty specimens of *O. bacaila* were collected for examination from Bangladesh Fisheries Development Corporation (BFDC) fish landing center at Rangamati, Chittagong Hill Tracts from July'99 to June'00. The fish samples were preserved in 5% buffered formalin immediately after collection and carried to the laboratory. Upon collection the length and weight of the fishes were recorded to nearest millimeter and 0.01g respectively. The fishes were dissected by a sharp scissors, then the entire alimentary canal of the fishes were taken out immediately. After dissection of fish total gut length were recorded to nearest millimeter. The food items were identified up to generic level following Ward and Whipple (1952), Davis (1955) and Needham and Needham (1962).

For the analysis of gut contents two methods namely occurrence and points methods were used.

Occurrence method : The number of stomach containing one or more food items was recorded (Hyslop 1980). The number was then expressed as a percentage of all stomach (Hunt and Carbine 1951 and Frost 1954).

Points method : In this method, each of the food item was allotted of points on the basis of quantity and all the points gained by different food items were summed up and scaled down to percentage to express them in percentage composition of the gut contents of all the fish examined (Hynes 1950).

The relative importance of various food items was calculated using index of preponderance (IP) with the following formula:

$$IP = \frac{\%\text{ of total occurrence} \times \%\text{ of total points}}{\sum(\%\text{ of total occurrence} \times \%\text{ of total points})} \times 100$$

$$= \frac{O_1 \times V_1}{\sum O_1 V_1} \times 100 \quad \text{(Natarajan and Jhingran 1961).}$$

Relationship between total length and gut length of the fish was calculated by least square method.

Results

The gut contents were analyzed and categorized into different food groups and so far identified up to generic levels. Following are the food organisms that were recorded under each group.

Insecta	:Red and black ant and small water bugs.
Crustacea	:*Cyclops, Daphnia, Nauplius*
Rotifera	:*Keratella, Brachionus, Trichocerca*

Chlorophyceae	:*Chlorella, Cosmarium, Gonatozygon, Ankistrodesmus, Pediastrum, Staurastrum, Spirogyra*
Bacillariophyceae	:*Actinella, Cyclotella, Naviculla, Fragilaria*
Euglenophyceae	:*Euglena, Phacus, Trachelomonas*
Cyanophyceae	:*Microcystis, Anabaena, Oscillatoria, Aphanocapsa, Gomphospheria, Merismopodia*
Semidigested food	:Phytoplankton, Zooplankton and Plant parts.
Debris and mud particles.	:These are the components of plant matter, sand and clay

Moreover, abundance of each of the food group present in the gut was analyzed by both the occurrence and points method.

Insecta : This group of food item was most abundant and occurred regularly in the gut of *O. bacaila.* Monthly observation indicated that the highest quantity of this food item was present in June (32.87%) and the lowest in April (15.76%). This food item appeared to be 22.56% of the total percentage of occurrence (Table 1). According to Points method the same food item was also found to be the highest in June (32.25%) but the lowest in April (17.65%). This group formed 22.85% of the total percentage of points (Table 2).

Crustacea : The crustacean food item was appeared 13.65% of the total percentage of occurrence. The highest quantity (18.45%) was found in October and the lowest (8.97%) in June (Table 1). On the other hand according to points method this kind of food item was also found to be the highest in October (17.42%) but the content was lowest (8.35%) in July. This group was formed 13.49% of the total percentage of points (Table 2).

Rotifera : This food item was found to appear 16.61% of the total percentage of occurrence. The amount of this item was found to be the highest in June (23.91%) and the lowest in July (5.98%) (Table1). Points method also indicated that this food item was the highest in June (25.79%) but the lowest in July (6.67%) and comprises 16.41% of the total percentage of points (Table 2).

Chlorophyceae : This group of food item was appeared 13.54% of the total percentage of occurrence and its quantity was found to be the highest in July (22.36%) and the lowest in December (8.27%) (Table 1). On the basis of points method the same food item was appeared 14.34% of the total percentage of points and its availability in the gut of the fish was found to be the highest in July (25.79%) and the lowest in September (8.27%) (Table 2).

Bacillariophyceae : This group of food item was appeared 7.16% of the total percentage of occurrence. The highest quantity of this food was found in July (10.25%) and the lowest in February (5.35%) (Table 1). While the Bacillariophyceae comprises 6.88% of the total percentage of points with a maximum of 9.08% in July and a minimum of 5.12% found in October (Table 2). In the month of November no representative of diatoms was found in the gut of this fish.

Euglenophyceae : This food formed 7.09% of the total percentage of occurrence. The amount of this food item was found to be the highest in April (9.12%) and the lowest (4.55%) in August (Table 1). According to Points method this food item was found to be the highest in April (8.39%) and the lowest in August (3.62%). This group was formed 6.88% of the total percentage of points (Table 2). This food item group was found in all season except February, June and October.

Cyanophyceae : This food group formed 8.16% of the total percentage of occurrence. In this method the highest quantity of food item was found in May (12.72%) and the lowest (4.75%) in March. (Table 1). Points method exhibited the highest content of this food item that prevailed in the gut of the fish in May (11.27%) and the lowest in June (5.09%). It was formed 7.39% of the total percentage of points (Table 2). This blue green algae was found all season except in September.

Semi-digested food : This item was comprised different parts of the phyto and zooplankton. It was appeared 5.3% of the total percentage of occurrence. The highest quantity of semi-digested food was found in December (8.79%) and the lowest in May (3.21%) (Table1). Points method also indicated that the highest amount of this kind of food was present in December (8.17%) and the lowest in May (2.87%). This group occupied 5.37% of the total percentage of points (Table2).

Debris with mud : The highest amount of this item was found in December (15.51%) and the lowest in May (2.20%). It was comprised of plant matter, sands and clay particles. It was appeared 8.95% of the total percentage of occurrence (Table 1). But points method estimated this item 9.28% of the total percentage of points. The highest amount was found in September (11.68%) and the lowest in May (4.94%) (Table 2).

Index of preponderance (IP)

Preference for food item by the fish was evaluated by calculating its preponderance index. The index of preponderance for Insecta was 35.89%, Rotifera 18.97%, Chlorophyceae 13.51% and Crustacea 12.82% thus occupied the first, second, third and fourth position in the gut contents of *O. bacaila*. (Table 3).

Relationship between total length (TL) and gut length (GL)

Relationship between total length (TL) and gut length (GL) of the fish was statistically analyzed by least square and was found to be significantly correlated ($r=0.9963$, $t=32.87$) at 0.01 level. Ratio between average total length and gut length was 1: 0.7086.

The relationship between total length and gut length can be expressed by the following equation:

$GL = 0.57663\ TL^{1.04801}$ or $\text{Log GL} = 0.2391 + 1.04801\ \text{Log TL}$ (Table-4).

Table 1. Monthly variation in percentage of occurrence of various groups of food items in the gut of *O. bacaila*

Months	No. of fish	Phytoplankton				Zooplankton			Semidigested food	Debris with mud
		Bacillariophyceae	Chlorophyceae	Cyanophyceae	Euglenophyceae	Crustacea	Rotifera	Insecta		
July.	10	10.25	22.36	11.21	6.19	9.65	5.98	15.85	6.64	11.87
Aug.	10	7.68	12.85	8.79	4.55	13.93	16.25	25.37	5.61	4.97
Sept.	10	6.12	9.25	Not found	8.07	15.65	20.37	22.71	4.86	12.97
Oct.	10	5.98	15.93	6.15	Not found	18.45	17.27	23.87	4.35	8.00
Nov.	10	Not found	13.21	8.75	7.29	14.35	18.12	25.34	4.21	8.73
Dec.	10	6.95	8.27	8.35	7.25	13.57	10.74	20.57	8.79	15.51
Jan.	10	7.32	10.78	9.29	7.95	12.78	12.21	21.86	6.25	11.56
Feb.	10	5.35	12.45	7.61	Not found	15.12	18.65	20.98	7.5	12.34
Mar.	10	8.15	14.32	4.75	6.71	15.89	16.77	24.07	4.09	5.25
Apr.	10	6.75	16.92	6.23	9.12	13.87	20.52	15.76	4.55	6.28
May.	10	8.52	14.98	12.72	6.75	11.59	18.58	21.45	3.21	2.2
Jun.	10	5.75	11.24	5.92	Not found	8.97	23.91	32.87	3.54	7.8
Average		7.16	13.54	8.16	7.09	13.65	16.61	22.56	5.3	8.95

Table 2. The percentage of total points of various groups of food items in the gut of *O. bacaila*

Months	No. of fish	Phytoplankton				Zooplankton			Semidigested food	Debris with mud
		Bacillariophyceae	Chlorophyceae	Cyanophyceae	Euglenophyceae	Crustacea	Rotifera	Insecta		
July.	10	9.08	25.79	9.76	5.89	8.35	6.67	19.48	4.74	10.24
Aug.	10	8.12	16.23	5.86	3.62	12.67	15.53	20.89	7.31	9.77
Sept.	10	5.85	8.27	Not found	6.24	16.75	19.8	25.29	6.12	11.68
Oct.	10	5.12	17.39	5.73	Not found	17.42	15.21	22.35	5.83	10.95
Nov.	10	Not found	12.85	9.32	7.88	13.86	17.37	24.65	6.02	8.05
Dec.	10	7.42	10.99	8.98	6.73	15.48	11.21	19.89	8.17	11.13
Jan.	10	6.77	9.35	7.82	8.25	12.65	13.46	25.96	5.9	9.84
Feb.	10	5.71	11.96	6.12	Not found	14.72	20.15	23.98	5.83	11.53
Mar.	10	7.35	13.16	5.97	7.85	16.12	15.48	21.25	4.92	7.9
Apr.	10	6.44	19.78	5.45	8.39	12.98	18.5	17.65	3.68	7.13
May.	10	8.65	15.89	11.27	7.12	10.95	17.77	20.54	2.87	4.94
Jun.	10	5.23	10.42	5.09	Not found	9.87	25.79	32.25	3.12	8.23
Average		6.88	14.34	7.39	6.88	13.49	16.41	22.85	5.37	9.28

Table 3. Index of preponderance (IP) of various groups of food items of *O. bacaila*

No.	Food groups	% of total points	% of Occurrence	% of occ. × % of points	IP	Grade
1	Insecta	22.85	22.56	515.49	35.89	i
2	Rotifera	16.41	16.61	272.57	18.97	ii
3	Chlorophyceae	14.34	13.54	194.16	13.51	iii
4	Crustacea	13.49	13.65	184.13	12.82	iv
5	Debris with mud	9.28	8.95	83.05	5.78	v
6	Cyanophyceae	7.39	8.16	60.30	4.19	vi
7	Bacillariophyceae	6.88	7.16	49.26	3.42	vii
8	Euglenophyceae	6.88	7.09	48.77	3.39	viii
9	Semidigested food	5.37	5.3	28.46	1.98	ix

Table 4. Relationship between total length (TL) and gut length (GL) and their ratio

Sl. No	Length group (mm)	Mid length (TL)	No. of fishes	Average total gut length (GL) (mm)	Log TL (X)	Log GL (Y)	Expected gut length	Ratio of TL: TGL
1	50-55	52.5	5	35.67	1.72	1.55	36.61	1:0.679
2	55-60	57.5	16	39.82	1.75	1.6	40.27	1:0.692
3	60-65	62.5	25	45.26	1.79	1.66	43.95	1:0.724
4	65-70	67.5	21	48.35	1.82	1.68	47.64	1:0.716
5	70-75	72.5	25	51.96	1.86	1.71	51.35	1:0.716
6	75-80	77.5	10	54.12	1.88	1.73	55.06	1:0.698
7	80-85	82.5	5	59.50	1.91	1.77	58.79	1:0.721
8	85-90	87.5	7	63.42	1.94	1.80	62.53	1:0.724
9	90-95	92.5	4	65.98	1.96	1.81	66.29	1:0.713
10	95-100	97.5	2	68.55	1.98	1.84	70.04	1:0.703
			$\Sigma f = 120$				Average	1:0.7086

Discussion

Index of preponderance (IP) indicated that *O. bacaila* consumed the highest amount of insects (35.89%) thus occupied the first position among the food items while Rotifers (18.97%), Chlorophyceae (13.51%), Crustaceans (12.82%) respectively occupied the second, third and fourth position. The fish fed mainly on aquatic insects (mostly coleopterans and dipteran larvae and small water bugs) and Zooplankton (Rotifera and Crustacea). The other items found in the guts were algae (Chlorophyceae, Euglenophyceae, Cyanophceae and Bacillariophyceae) and some debris with mud.

Alikunhi and Chaudhuri (1954.) have stated that *O. phulo* generally subsists on a predominately Zoo-plankton diet but also feeds on non-planktonic bottom living forms like *Spirogyra,* aquatic insects etc, in the absence or paucity of Zooplankton. Parameswaran *et al.* (1969) have stated that *O. bacaila* subsists predominantly on Zooplankton in all stages of its life. Dewan (1973) reported that the food of *Chela phulo* of a lake of Bangladesh Agricultural University consisted of green algae, higher aquatic plants, Rotifera, Crustacea and organic debris. Natarajan *et al.* (1975) found that the food of *Chela laubuca* (Ham.) appeared to be insect feeder and the insect were mainly coleopterans and dipteran larvae. These results partially agree with the present observation.

Considering Nikolosky's (1963) assumtion and according to our index of preponderance insects (35.89%) and Zooplankton (31.79%) (Rotifera and Crustacea) should be treated as the basic food. Phytoplankton (24.51%) which composed of Chlorophyceae, Euglenophyceae, Cyanophceae and Bacillariophyceae should be considered as secondary food. Debris with mud and Semi digested food (7.76%) should be considered as an incidental food.

The relationship between total length (TL) and total gut length was $GL = 0.57663\ TL^{1.04801}$, ($r = 0.9963$, $t = 32.872$) which was highly significant at 0.01 level. The ratio of TL: GL was 1: 0.7086. As per total length versus gut length, *O. bacaila* should be grouped under the carnivorous type of fish (Das and Moitra 1956, 1963). They stated that the gut length of carnivorous fish is shorter or of equal to the body length. This result fully agreed with the present findings. Because in the present study although the gut length was shorter then the body length. About 68% of the gut contents of the fish occupied by animal foods which indicated the carnivorous nature of the fish.

From the present study it should be claimed that *O. bacaila* mainly depend on insects (Red and black ant and small water bugs), Zooplankton (Rotifers and Crustaceans) and Phytoplankton (Chlorophyceae, Bacillariophyceae, Euglenophyceae and Cyanophyceae) which rightly indicated that the fish is a planktivore omnivorous with preference for animal nature plankton like insects and Zooplankton.

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(Manuscript received 10 April 2004)