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FOOD AND FEEDING HABITS OF THE CLUPEID, *GONIALOSA MANMINA (*HAM.) FROM THE KAPTAI LAKE, BANGLADESH

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ABSTRACT

Food and feeding habits of *Gonialosa manmina* were done by the analysis of 197 guts of the fish using both occurrence and point methods and also by the Index of preponderance. As per Index of preponderance, the preferred food items were graded as cladocerans (65.34%-1st), copepods (20.96%-2nd), miscellaneous (8.89%-3rd), rotifers (2.81% 4th) and bacillariophyceae (0.77% 5th). High feeding intensity was observed during pre and post spawning months. Significant ($P<0.01$) positive relationships were observed between the total length (TL) and total gut length (TGL) ($TGL=2.09799TL^{0.89677}$, r=0.963, t=10.22), total length (TL) and stomach length (StL)($StL=0.18447TL^{0.7599}$, r=0.997, t= 39.92), and total length (TL) and intestine length (IL) ($IL=0.99105TL^{1.0256}$, r=0.9854, t=16.37). Total fish length was slightly shorter than the gut length (1:1.31) and more than 91% animal nature gut contents confirmed that the fish was mainly a surface feeder zooplanktivore in Kaptai lake.

Key words: Gut contents, clupeid, *Gonialosa manmina,* Kaptai Lake.

INTRODUCTION

Food and feeding habits of fish vary with the time of the day, size of the fish and season of the year. An understanding of the growth pattern of a fish would be incomplete without knowledge of the diet on which it subsist and the nutritive values of food items (Jhingran 1972). An understanding of autoecology, production and ecological role of fish populations is derived from studies of the diet based analysis of stomach contents (Windell and Bowen 1978). A sound knowledge on food and feeding habits of fish is very important for successful management of fish farming. No published report was found on the gut contents of *Gonialosa manmina*. However, some works were carried out on the food and feeding habits of different fishes of Kaptai lake (Azadi and Naser 1996, Mamun and Azadi 2004 and Mamun *et al.* 2004). The present investigation was carried out to find out the food and feeding habits of *Gonialosa manmina* from Kaptai

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Lake which might be useful to the fish culturists and fish farm mangers to maintain a needful food composition in the respective water body for a better fish growth to enhance the yield and economy of the country.

MATERIALS AND METHODS

To study the food and feeding habits of *G. manmina*, 197 specimens were collected from Kaptai lake from the fishermen catch by gill nets during the 12 months study period from September 1995 to August 1996. Upon collection the lengths and weight of the fish were recorded to the nearest millimeter and 0.01 g respectively. The fish were dissected by a sharp scissor and the guts were preserved in 5% formalin in labeled vials and stored for further examination. For detecting feeding intensity the guts were classified as full, ¾ full, ½ full and empty. The food items were examined by the help of counting chamber (Sedgwick Rafter) under a compound microscope. Whenever possible, food items were identified upto generic level following Ward and Whipple (1959), Needham and Needham (1978) and Mellanby (1963).

Gut contents were analysed following occurrence and points (volume) methods (Hynes 1950, Pillay 1952, Hyslop 1980). For the relative importance, the ranking of food items was calculated using Index of preponderance (Natarajan and Jhingran 1961). Feeding intensity was determined by recording the fullness of the gut.

Whole gut was divided into two parts *i.e.* stomach and intestine. Relationships between total fish length (X) and total gut length (Y), total fish length (X) and stomach length (Y) and total fish length (X) and intestine length (Y) were calculated by least-squared method (Y=a+bX).

RESULTS AND DISCUSSION

Feeding intensity

Table 1 shows the feeding intensity of the fish recorded as full, ¾ full, ½ full, ¼ full and empty on the basis of the food contents present in the stomachs. The highest numbers of empty guts were found during April to August, especially in July when 50% of the guts were empty (Table 1). This might be attributed to the peak spawning in these months. Low feeding activity may be due to shortage of food items or due to the spawning and highly matured gonads mainly in female fish which occupied almost the whole body cavity (Lagler *et al.* 1962). In the present study the data were differentiated into pre-spawning (January to March),

Spawning (April to October) and post-spawning (November to December) periods. The average percentage of empty guts in pre-spawning (13.59%), spawning (35.34%) and post-spawning (14.38%) phases showed that the feeding intensity was significantly affected by the state of maturation (Rahman 1996). To compensate the loss due to spawning, high feeding intensity was observed during the pre and post spawning months.

Food composition

The gut contents were categorized into eight different groups and identified upto generic levels. Following food organisms were found in the guts contents of *G. manmina.*

Bacillariophyceae: *Navicula, Cyclotela, Melosira, Cymbella, Synedra, Eunotia*

Chloropyceae: *Chlorella, Pediastrum, Lola, Coelastrum, Eudorina, Glocotila*

Cyanophyceae: *Anabaena, Microcystis, Lyngloya*

Euglenophyceae: *Phacus*

Cladocera: *Daphnia, Moina, Bosmina, Alona, Sida*

Copepoda: *Cyclops, Diaptomus, Mesocyclops*

Rotifera: *Keratella, Brachionus*

Protozoa: *Arcella, Difflugia*

Plant parts: Hydrophytes and rooted aquatic plants as well as submerged floating vegetation.

Miscellaneous: Broken parts of zooplanktons and semi-digested unidentifiable food materials.

TABLE 1. PERCENTAGE OF FULLNESS OF THE STOMACHS OF *G. MANMINA.*

Months	No. of fish examined	Fullness				
		Full	¾ full	½ full	¼ full	Empty
Sep.' 95	14	14.28(2)	-	21.42(3)	35.71(5)	28.57(4)
Oct.	16	24.0(4)	18.75(3)	-	31.25(5)	25(4)
Nov.	17	29.41(5)	23.52(4)	11.76(2)	17.64(3)	17.64(3)
Dec.	18	33.33(6)	11.11(2)	27.77(5)	16.66(3)	11.11(2)
Jan.'96	19	36.84(7)	31.57(6)	21.05(4)	-	10.52(2)
Feb.	18	44.44(8)	33.33(6)	5.55(1)	-	16.66(3)
Mar.	17	23.52(4)	17.64(3)	17.64(3)	11.76(2)	19.41(5)
Apr.	15	-	26.66(4)	20(3)	20(3)	33.33(5)
May	16	-	12.5(2)	18.75(3)	31.25(5)	37.5(6)
Jun.	18	-	16.66(3)	22.22(4)	27.77(5)	38.88(7)
Jul.	14	-	14.28(2)	21.42(3)	14.28(2)	50(7)
Aug.	15	6.66(1)	20(3)	33.33(5)	-	40(6)

Table 2 shows the monthly percentage of occurrence of food items in the guts of *G. manmina*. Highest percentage of plant parts (4.9%, July), Bacillariophyceae (5.7%, April), Chlorophyceae (8.8%, January), Cyanophyceea (3.7%, March), Euglenophyceae (3.6%, March), Cladocera (64.4%, May), Copepoda (38.1%, October), Rotifera (10.4%, March), Protozoa (3.6%, October) and miscellaneous (30.9%, July) were found in different months.

TABLE 2. PERCENTAGE OF OCCURRENCE OF FOOD ITEMS IN 197 STOMACHS OF *G. MANMINA*.

Food items	No. of stomachs												Average of 12 months
	14	16	17	18	19	18	17	15	16	18	14	15	
	Months												
	S'95	O	N	D	J'96	F	M	A	M	J	J	A	
Plant parts	2	4.8	2.5	-	-	-	-	2.9	2.4	3.9	4.9	2.0	2.11
Bacillariophyceae	3.2	4.9	3.3	5.2	5.4	5.6	5.2	5.7	4.4	-	3.6	4.1	4.22
Chlorophyceae	4.8	4.9	3.6	4.5	8.8	4.2	5.1	4.4	2.7	3.9	-	3.2	4.18
Cyanophyceae	2.2	2.0	-	-	-	1.6	3.7	2.1	2.6	3.4	2.3	3.4	1.94
Euglenophyceae	1.5	2.5	2.2	2.0	-	-	3.6	2.9	2.4	2.9	2.8	2.2	2.08
Cladocera	41.2	19.3	34.4	51.2	53.2	40.4	44.2	29.5	64.4	30.5	14.4	34.6	38.1
Copepoda	26.8	38.1	32.1	24.5	19.6	29.6	14.8	30.3	-	24.6	28.2	20.3	24.08
Rotifera	4.9	9.4	6.1	-	7.8	7.2	10.4	8.6	9.8	10.1	9.5	7.5	7.61
Protozoa	1.9	3.6	1.7	-	-	2.0	2.5	-	0.9	1.9	3.4	3.5	1.78
Miscellaneous	11.5	10.5	14.1	12.6	5.2	9.4	10.5	13.6	10.4	18.8	30.9	19.2	13.89

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Table 3 shows the monthly percentage of total points (volume) of various food items in the guts of *G. manmina*. Highest percentage of total points of plant parts (5.6%, July), Bacillariophyceae (7.5%, January), Chlorophyceae (5.9%, January), Cyanophyceae (3.2%, April), Euglenophyceae (2.2%, October and April), Cladocera (68.1%, January), Copepoda (34.4%, October), Rotifera (13.4%, March), Protozoa (4.1%, October) and miscellaneous (31.7%, July) were found in different months.

TABLE 3. PERCENTAGE OF TOTAL POINTS OF FOOD ITEMS IN 197 STOMACHS OF *G. MANMINA.*

Food items	No. of stomachs												Average of 12 months
	14	16	17	18	19	18	17	15	16	18	14	15	
	Months												
	S'95	O	N	D	J'96	F	M	A	M	J	J	A	
Plant parts	1.8	2.6	1.9	-	-	-	-	4.1	4.2	5.1	5.6	3.1	2.37
Bacillariophyceae	3.8	5.8	4.9	6.3	7.5	4.2	4.8	3.6	2.8	-	4.4	3.7	4.32
Chlorophyceae	4.1	4.2	3.3	4.4	5.9	4.6	3.9	2.2	2.5	3.1	-	2.9	3.43
Cyanophyceae	2.4	2.8	-	-	-	2.2	2.8	3.2	2.8	2.9	2.1	2.6	1.98
Euglenophyceae	1.4	2.2	1.9	1.6	-	-	1.6	2.2	2.1	1.8	0.9	1.7	1.45
Cladocera	39.3	20.6	33.3	50.7	68.1	42.7	47.4	31.8	59.2	32.4	25.4	35.2	40.50
Copepoda	27.9	34.4	29.8	22.2	8.8	28.2	12.6	29.2	-	22.3	17.1	15.3	20.56
Rotifera	5.9	11.6	9.6	-	5.4	8.4	13.4	9.9	8.5	12.4	10.6	8.9	8.71
Protozoa	2.4	4.1	1.4	-	-	1.8	2.2	-	1.1	0.8	2.2	2.8	1.57
Miscellaneous	11.1	11.7	13.9	14.8	4.3	8.9	11.3	13.8	16.8	19.2	31.7	23.8	15.11

Index of preponderance (IP)

Fig.1 shows the volumetric positions of the gut contents by Index of preponderance (IP) which considered both percentage of points and percentage of occurrence. IP indicated that zooplanktons were the most preferable food items of *G. manmina.* Among the gut contents, first, second and third positions were occupied by Cladocera (IP-65.34%), Copepoda (IP-20.96%) and miscellaneous (IP-8.89%) items respectively, while 4^{th}, 5^{th}, 6^{th}, 7^{th}, 8^{th} and 9^{th} positions were occupied by Rotifera (2.73%), Protozoa (2.73%), Bacillariophyceae (0.75%), Chlorophyceae (0.59%), plant parts (0.21%), Cyanophyceae (0.16%), and Euglenophyceae (0.13%) respectively. In aggregate, zooplankton was more than

91% of the total volume which indicated that the fish was mainly zooplanktivore (Table 4).

TABLE 4. INDEX OF PREPONDERANCE (IP) AND RANKS OF DIFFERENT FOOD ITEMS IN THE GUTS OF *G. MANMINA* ON THE BASIS OF PERCENTAGE OF POINTS AND PERCENTAGE OF OCCURRENCE.

Sl. No.	Food items	% of points	% of occurrence	IP	Rank
1	Plant parts	2.37	2.11	0.21	7
2	Bacillariophyceae	4.32	4.22	0.77	5
3	Chlorophyceae	3.43	4.18	0.61	6
4	Cyanophyceae	1.98	1.94	0.16	8
5	Euglenophyceae	1.45	2.08	0.13	9
6	Cladocera	40.50	38.1	65.34	1
7	Copepoda	20.56	24.08	20.96	2
8	Rotifera	8.71	7.61	2.81	4
9	Protozoa	1.57	1.78	0.12	10
10	Miscellaneous	15.11	13.89	8.89	3

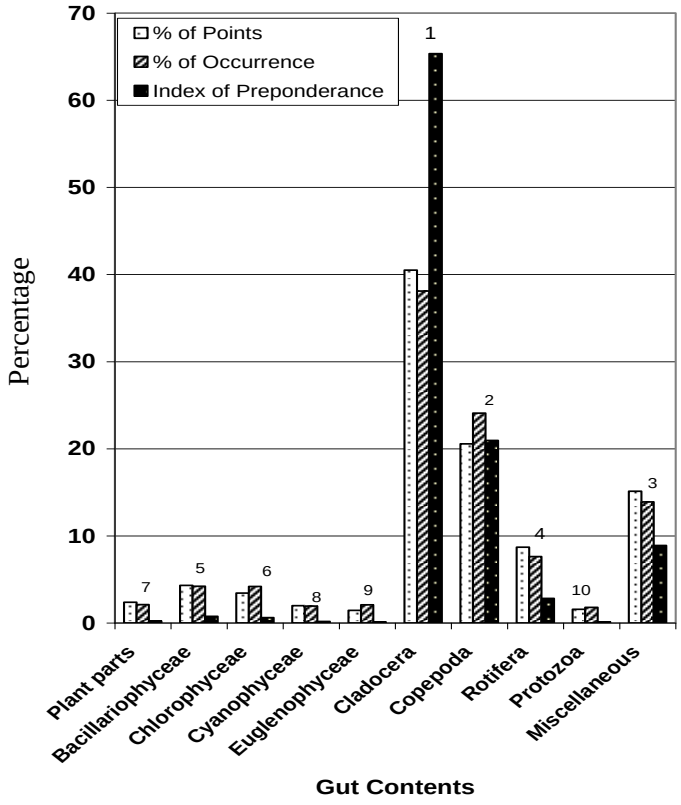

Fig. 1. RANKS OF FOOD ITEMS IN THE GUT CONTENTS OF GONIALOSA MANMINA BY THE INDEX OF PREPONDERANCE (IP)

Table 5 shows relationships between the total length (TL) and total gut length (TGL), total length (TL) and stomach length (StL) and total length (TL) and intestine length (IL) of 197 *G. manmina* which were positively correlated and highly significant at 0.01 level. The relative body length and gut length ratio was 1:1.31. Gut length was a little bit longer than the body length. Das and Moitra (1956) recorded a ratio of 1:1.17 for fish length versus gut length of *Gudusia chapra* and classified the fish as an omnivore. According to Das and

Moitra (1956) herbivorous fishes show highly long, coiled and thin alimentary canal while omnivorous fishes show a little bit shorter, less coiled and differentiated alimentary canal. They further opined that a fish may be designated as carnivore when more than 70% of the total gut contents are consisted of animal nature foods. Their findings showed close similarities with the present findings in respect of total length versus gut length and in respects of food contents which consisted of more than 91% of animal nature foods. Therefore, the fish might be said as a surface feeder zooplanktivore (carnivore) in Kaptai Lake.

TABLE 5. RELATIONSHIPS BETWEEN TOTAL LENGTH (TL) AND TOTAL GUT LENGTH (TGL), TOTAL LENGTH (TL) AND STOMACH LENGTH (STL), AND TOTAL LENGTH (TL) AND INTESTINE LENGTH (IL) OF *G. MANMINA*

Relation between variables		Relationships (Arithmetic and logarithmic)	'r'	't'	Level of significance
Independent (X)	Dependent (Y)				
TL	TGL	$TGL=2.09799TL^{0.89677}$ or Log TGL=0.3218+0.89677 LogTL	0.963	10.22	P<0.01
TL	StL	$StL=0.18447TL^{0.7599}$ or LogStL= -0.7340+0.7599LogTL	0.997	39.92	P<0.01
TL	IL	$IL=0.99105TL^{1.0256}$ or Log IL= -0.0039+1.0256LogTL	0.985	16.37	P<0.01

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