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Research Article

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Food and feeding of hilsa shad *Tenualosa Ilisha* (Hamilton, 1822) of the river tentulia in Bangladesh

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Keywords

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Abstract

For this research work, fishes were sampled from July 2009 to June 2010. Gut content, seasonal changes of food and feeding habits and size group relationship with their food and feeding habits were analyzed in the research work. To know the above condition we can use various methods such as numerical method, frequency of occurrence method, index of fullness method and point's method were done to conduct the work. Fourty four genera of phytoplankton were found in the gut content of *T. ilisha.* Among phytopldnkton, Bacillariophyceae (10genera), Chlorophyceae (23genera), Cyanophyceae (9genera) and Euglenophyceae (2 genera) were found in the gut content of *T. ilisha* and Eight genera of zooplankton belonging to Copepoda (2 genera), Rotifera (5 genera) and Cladocera (1genera) were recorded from the guts. Among the phytoplankton, Chlorophyceae was observed highest in abundance, and Cyanophyceae, Bacillariophyceae and Euglenophyceae took second, third and fourth position respectively. Among the zooplankton, Rotifera was dominant group and Cladocera was the least one. *T. ilisha* fed phytoplankton much more than zooplankton. Higher amount of stomach content was found in May, June and July February March April than other months of the year. There was no empty stomach found throughout the study period. Maximum plankton was found in the stomachs of the fishes of size group-2 (20-25 cm) and minimum was found in the stomachs of the fishes of size group-1 (15-20 cm). From the study, it was found that *T. ilisha* was a planktivorus fish species with preference for phytoplankton to zooplankton. From the study of gut contents of fishes, it was observed that Chlorophyceae was the most preferable food item to Hilsa shad *T. ilisha*. Hilsa shad *T. ilisha* is very tasteful and play important role in our national economy.

Introduction

The riverine Bangladesh is one of the finest gifts of nature. It has many water resources that have a good potential for fisheries. It is situated in the northeastern part of the south Asian sub-continent, has an area of 1, 47,570 square kilometers. The country is blessed with a vast area of 28 million hectares (ha) of both marine and inland waters. There are about 4,009,694 ha of inland and 16, 607, 30 ha of marine waters. The contribution of fisheries resources in the national income of Bangladesh is very significant. The contribution is increasing day by

day in the national income. Fish is a major food item and plays a very important role to food and nutrition security in Bangladesh. Fish and fisheries are inseparable part in life and culture of the people of this country. The economy of Bangladesh basically depends upon agriculture, livestock and fisheries. Fisheries play an important role in supplying food, providing employment opportunity and earning foreign exchange. Fish is the main source of animal protein and essential nutrients in the people's diet throughout the country. It alone provides about 60% of total animal protein intake. It also contributes 3.74% of total national income and 22.23% to agricultural earning (DoF, 2009). The fisheries resources of Bangladesh produce annually about 27.01 lakh metric ton fish (2008-09). Whereas the minimum requirement is about 38g for normal physical growth. Therefore, a quantity of about 2.5 million metric tons of fish is needed to ensure the required animal protein in Bangladesh. Fisheries contribute about 58% to the nation's animal protein intake (DoF, 2010). Hilsha fish is national fish of Bangladesh. People in our country like this fish very much. It is very delicious and nutritious. There is a proverb that 'Vat-e Mas-e Bangali' (Bangladeshis are fond of rice and fish). Pohela Boishakh (1st Day of Bengali Year) is celebrated by eating fried Hilsa fish with Panta- Rice. New or rich guests are entertained by the Hilsa fish. We get sufficient protein from Hilsha fish. Our national economy is being developed by exporting Hilsa Fish. Not only have these, Hilsa fishes also contribute 1% in our GDP. In the world about 60% Hilsa fishes are found in Bangladesh. Hilsa is primarily a plankton feeder and its food includes blue-green algae, diatoms, desmids, copepods, cladocera, rotifers, etc. The feeding habit may vary according to the season and age of the fish.

Materials and Methods

Description of the study area

Tentulia is a very beautiful river of Barisal District. Tentulia River, with a latitude of 22.25 (22° 15' 0 N) and a longitude of 90.62 (90° 37' 0 E), is a hydrographic (distributary) located in Bangladesh that is a part of Asia south (173°) of the capital Dhaka. A 100 square km area around Tentulia River has an approximate population of 4563899 (0.045639 persons per square meter) and an average elevation of 1 meters above the sea.

Collection of fish sample

Fish was sampled from the part of the Tentulia River near Barisal district once in a month from July 2009 to June 2010 in the morning within 12:00 AM to 13:00 PM. The fishing gears included fine meshed seine nets in order to ensure all size groups of *T. ilisha* population available in the catch. At each sampling, emphasis was given to ensure collection of at least 20 fish specimens. In total 510 fish samples were collected randomly and preserved with 10% neutralized formalin in a small plastic container as soon as possible. Eventually formalin preserved sample was brought to the laboratory.

Table 1. Collection records of *T. ilisha* from the Tentulia river of Barisal district.

Collection date (2009-10)	Gear used	Number of fish examined	Size range	
			SL(cm)[1)]	BW (g)[2)]
July 2009	Gill & Seine net	10	23.0-29.40	274.50-524.50
August2009	Gill & Seine net	10	22-29.20	228.40-510.0
September2009	Gill & Seine net	10	19.10-31.0	108.0-838.40
October2009	Gill & Seine net	10	18.60-29.10	79.50-480.60
November2009	Gill & Seine net	10	17.5-23.0	129.20-329.60
December2009	Gill & Seine net	10	19.0-26.0	118.50-404.90
January2010	Gill & Seine net	10	17.30-24.70	120.0-329.0
March2010	Gill & Seine net	10	15.40-25.30	81.50-329.10
April2010	Gill & Seine net	10	17.80-23.3	116.20-398
May2010	Gill & Seine net	10	19.6-27.70	227.0-598.0
June2010	Gill & Seine net	10	15.70-28.80	272.0-1002.0

1), Standard length; 2), body weight

Preservation of fish samples

After immediate return to laboratory, 10 fishes were randomly selected. To prevent further digestion of food materials and to stop the enzymatic activity of the gut, 10% formalin was injected into stomach region at the ventral region of each fish. The fishes were kept in a container labeled collection date and sample number.

Collection of stomach

Ten fishes were chosen randomly to study the stomach contents at each month. The fishes were washed with tap water and soaked with tissue paper. Standard length (SL) and body weight (BW) of 10 fishes at each case were measured to the nearest centimeter and to 0.01 respectively. The stomach of individual fish was dissected out very carefully and preserved with 5% formalin in a labeled small plastic container until examination.

Examination of stomach content

Each stomach contents were analyzed separately. The body cavity of fish was carefully opened and the alimentary canal was dissected out into a clean Petri dish and preserved in 10% formalin in a small plastic bottle instantly to prevent digestion of the food materials in the gut. Food contents of a stomach were taken out and were diluted in 5 ml distilled water using the methods adopted by Dewan *et al*. (1985). One ml sub-sample from 5 ml sample was transferred by a pipette to a Sedgewick-Rafter cell. Ten fields out of 1000 quadrates of the counting cell were chosen randomly and the total number of plankton found in the 10 fields were counted and multiplied by 500 to get the total number of plankton in the stomach. By using a binocular microscope (Olympus BH-2 with phase contrast facilities) all organisms were counted and identified up to genus level.

Methods to know Food and Feeding

There are several methods used for the determination of food items taken by the fish, these are-

i) Numerical method;
ii) Frequency of occurrence method;
iii) Index of fullness method; and
iv) Points method.

Results

The stomach contents of hilsha shad *T. ilisha* were analyzed to describe three aspects of food and feedings.

A. General investigation of diets

i) Food items found in the stomach of *T. ilisha*.

Seven major groups were identified in the stomach content of *T. ilisha.* Four groups of phytoplankton (91.52%) including Bacillariophyceae, Chlorophyceae, Cyanophyceae, and Euglenophyceae and three groups of zooplankton (8.48%) including Copepoda Rotifera and Cladocera were found.

ii) Monthly pattern of feeding

Stomach contents

The stomach of the examined *T. ilisha* was found to contain various groups of phytoplankton, plant parts and zooplankton.

Percentage of empty stomach

All the individuals investigated were found fed and no empty stomach was observed over the study period from July 2009 to June 2010 (Below Table). A few fish specimens, however, were found partially fed in some months.

Average index of fullness

The values of average index of fullness fluctuated and revealed monthly variations. The highest index value (3.6) was recorded in July and the lowest was (1.00) in January in Table.

Table 2. Average composition of stomach contents of *T. hilsha* shad based on percentage of occurrence and total points.

Month	Items			
	No. of fish examined	No. of stomach with contents	Percentage of empty stomach	Average index of fullness
July	10	10	0	3.6
August	10	10	0	2.8
September	10	10	0	3.4
October	10	10	0	2.3
November	10	10	0	2.5
December	10	10	0	2.4
January	10	10	0	1.0
March	10	10	0	1.2
April	10	10	0	2.5
June	10	10	0	1.2

B. Seasonal variations of feeding

Seasons were classified as Autumn from July to September, Winter from October to December, Summer from January to March and Spring from April to June. As a whole it showed that seasonal variations of the mean number of food items per stomach varied in food and feedings of *T. hilsha* (Fig. 5). The fish started feeding from late winter and fed much in spring and summer months and there after gradually decreased feeding in autumn.

Table 3. Average composition of stomach contents of *T. hilsha* shad based on percentage of occurrence of total points.

Food group	No. of fish examined	No. of fish in which occurred	Percentage of occurrence	Percentage of total point
Bacillariophyceae	110	110	100	36.48
Chlorophyceae	110	110	100	38.27
Cyanophyceae	110	110	100	10.56
Euglenophyceae	110	70	63.63	8.66
Copepoda	110	100	90.90	0.14
Rotifera	110	90	81.81	2.11
Cladocera	110	60	54.54	3.78

C. Relationship between fish size and pattern of feeding ecology

A total of 110 fish specimens belong to three size groups, viz., size group-1 (15-20cm), size group-2 (20-25cm) and size group-3 (25-30cm) were studied to determine the relationship between of size of fish and feeding pattern. The results based on percent of empty stomach and average index of fullness were presented in Table.

Table 4. Relationship between size and fullness of stomach of *T. ilisha* based on average index of fullness and average points

Items	Size group-1 (15-20 cm)	Size group-2 (20-25 cm)	Size group-3 (25-30 cm)
No. of fish examined	28	52	30
Average index of fullness	3.50	3.84	3.10
No of fish with empty stomach	0.00	0.00	0.00
Percentage of empty stomach	0.00	0.00	0.00

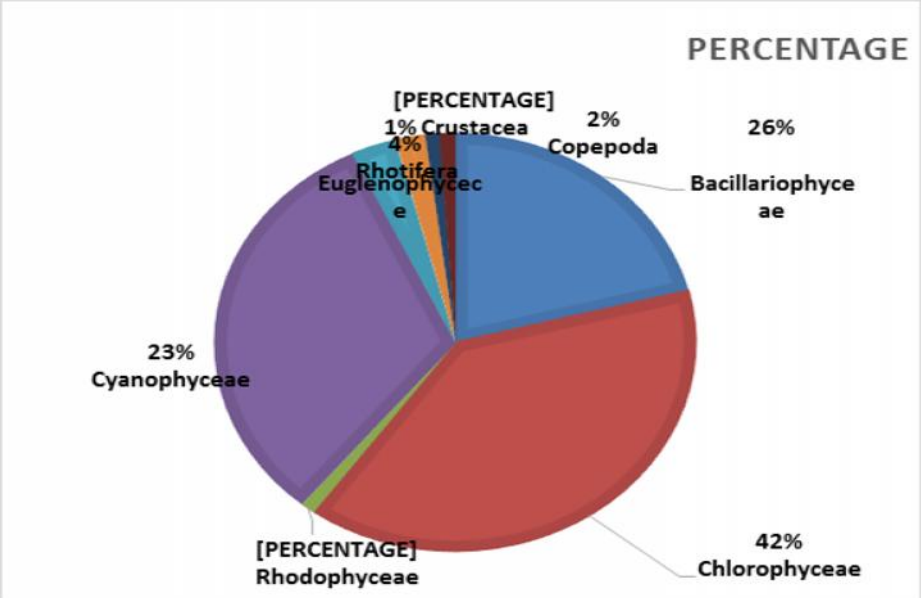

Figure: Percentage composition of Plankton of *T. ilisha*

Discussion

During the experimental period total numbers of 52 genera belonging to 7 planktonic groups were identified from the stomach contents of the examined fishes. All phytoplankton mainly composed of 4 major phytoplankton groups: Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae and zooplankton composed of 3 groups: Copepoda, Rotifera and Cladocera. The present recording of 44 genera of phytoplankton belonging to Bacillariophyceae (10), Chlorophyceae (23), Cyanophyceae (9) and Euglenophyceae (2) agreed with the findings of Ahmed et al. (1993) who recorded 27 genera of phytoplankton composed of Bacillariophyceae (4), Chlorophyceae (15), Cyanophyceae (6) and Euglenophyceae.

In the present study, Chlorophyceae was the dominant group among the phytoplankton which is supported by Wahab *et al.* (1995), Nirod (1997), Kohinoor (2000), Raihan (2001) and Uddin (2002). Chlorophyceae dominated the plankton population in terms of number where as the abundance of Bacillariophyceae, Euglenophyceae, and Cyanophyceae was the 2nd, 3rd and 4th position in the phytoplankton population in terms of number respectively. Among the genera of phytoplankton, the most dominant genera were *Cyclotella*, *Chlorella* and *Stichococcus* which were closely followed by, *Euglena*, *Cocconies* and *Gomphospheria*.

The result obtained from the percentage of total points indicates that Chlorophyceae (43.88%) and Bacillariophyceae (27.103%) were the main food items. The next preferred food item was Cyanophyceae (22.86%) and was followed by Euglenophyceae (8.81%), Rotifera (6.07%), Copepoda (3.00%) and Cladocera (0.886%) occupied the successive position. Results obtained from the occurrence method indicated that Chlorophyceae and

Bacillariophyceae were the dominant food groups occurred (100%) in all months. Cyanophyceae, Euglenophyceae, Rotifera and Crustacea also occurred 100% in all months. The values of average index of fullness revealed monthly variations. The highest value was recorded in January (3.6) and the lowest in August (2.0). Some particles were found in the stomachs of examined fishes but were not properly identified. They may be debris, plant parts or anything else. Therefore, from the findings of stomach content by numerical, average index of fullness, frequency of occurrence and point methods, it is confirmed that *T. ilisha* is a plankton feeder and the fish showed highest preference for Chlorophyceae. The fish is also pelagic planktivorous in the column of waterbody.

Conclusion

The ontogenetic diet variations were analyzed by organizing the standard length of specimens into 3 size classes. All the fishes under investigation were divided into size group-1 (15-20 cm), size group-2 (20-25 cm) and size group-3 (25-30 cm). The diet of the species showed no clear pattern of feeding with respect to various size groups but it was evident that the fish increased feeding on phytoplankton and zooplankton gradually with the increase of size. The study concluded that the Hilsha shad *T. ilisha* of the river Tentulia was planktivorous feeding on phytoplankton predominately followed by zooplankton in water column.

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