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GUT CONTENT ANALYSIS OF Labeo calbasu AT DIFFERENT SEASONS IN DEKHAR HAOR, SUNAMGONJ, BANGLADESH

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ABSTRACT

This research was conducted to find out the seasonal (monsoon and post monsoon) variation in gut contents of Labeo calbasu from June to November, 2016 in Dekhar haor of Sunamgonj district, Bangladesh. Three orders of phytoplankton were identified from the gut content viz. Bacillariophyceae (11 genera), Chlorophyceae (9 genera), and Cyanophyceae (4 genera). Bacillariophyceae (6.98±1.61×10^3 cell/L) were identified as the most dominant phytoplankton group. Two types of zooplankton viz. crustacean (5 genera) and rotifer (5 genera) were identified. Crustaceans (0.88±0.4×10^3 cell/L) were identified as the dominant group among zooplankton. Feeding intensity (average index of fullness, Gastrosomatic index) was higher in the post monsoon season compared with the monsoon season. The findings concluded that L. calbasu prefers phytoplankton over zooplankton, and the plankton consumption was slightly higher in the post-monsoon season than in the monsoon season. This research is expected to be crucial in the management and conservation of endangered L. calbasu in open waters, as well as provide baseline work for future research and open the path for captive aquaculture.

Keywords: Gut content, phytoplankton, zooplankton, haor, Labeo calbasu

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INTRODUCTION

The freshwater fish, *Labeo calbasu* is a member of the Cyprinidae family of the Cypriniformes order. It is a key component of the commercial fish catch of the Sylhet basin. This fish is an important food fish and is referred to as the "Black Rohu" in several regions (Rana and Jain, 2018). The study of gut content analysis of fishes is crucial for proper culture and management practice of fisheries resources, conservation and ecological studies. Most fish species' nutritional requirements vary as they get older. Changes in the content of dietary living creatures occur at different periods of the year, resulting in a variance in fish stomach content. These alterations might have a significant impact on ecological relationships, notably competition and predation among species, as well as changing the composition of food organisms. As a result, they may have an impact on fish feeding patterns throughout the year.

In the early 1980s, Kalibaus, along with three other IMCs, Rohu (*Labeo rohita*), Catla (*Catla catla*), and Mrigal (*Cirrhinus mrigala*) were extremely significant commercially, but because of a scarcity of seeds from natural or artificial sources, fish farmers lost interest. Over exploitation, habitat destruction, water contamination, dam construction, and a number of other anthropogenic issues have all had a severe influence on the natural populations of this fish species, affecting feeding migration and reproduction (Hasan et al., 2013; Hossain et al., 2010; Das and Barat, 1990; CAMP, 1998). Presently, *L. calbasu* is assessed as least concern (IUCN-Bangladesh 2015) despite the fact that it was formerly deemed endangered in Bangladesh (IUCN-Bangladesh 2000). Considering the issue, immediate measures are essential to protect and conserve this species.

Thus, it is high time to save this species by more study, particularly artificial reproduction. However, in order to achieve these goals, this fish must first be domesticated, which requires knowledge of its gut content as well as feeding biology. Apart from this limited data on the fish's population and nutrition, no published data on the gut content of *L. calbasu* has been found in Bangladesh, especially from the Sylhet basin. In consideration of this predicament, research was conducted to learn more about this species' gut content in the hopes that the results may aid in the effective management of *L. calbasu* wild populations, pave the road for domestication, and provide a baseline for future research.

MATERIALS AND METHODS

The research work was done with the fishes of the Dekhar haor, which is located at Dakshin Sunamgonj upazilla in the Sunamgonj district of Bangladesh. Approximately 10 to 12 fishes
were collected randomly from different fishermen of Purbo Pagla Bazaar, which were harvested from Dekhar haor in each month (June to November, 2016) for microscopic and macroscopic observation of gut contents. In the laboratory, the fish were thoroughly cleaned with running tap water and soaked in tissue paper. Each fish's body weight (BW) was measured in grams using an electric balance (Ohaus corp., USA). The sample was dissected from the ventral side of the fish and stretched interiorly along the belly of the fish to the head area. The gut weight of fish was measured in grams using an electric balance after it was dissected. Each gut's macroscopic condition was examined with naked eyes. The guts were then stored in a tiny plastic vial with 10% formaldehyde for microscopic examination of the stomach contents.

**Index of fullness method**

This method was used to track the feeding intensity. The gut of the fish was categorized as full, three-quarter full, half full, and one-fourth full and empty using this approach, as proposed by Pillay (1952).

**Gastrosomatic index**

The gastrosomatic index (GaSI) was used to track feeding intensity on a monthly basis.

\[ \text{GaSI} = \frac{\text{weight of gut}}{\text{weight of fish}} \times 100 \]

**Microscopic observation of the gut**

The contents of a gut were collected and diluted in 10 ml of distilled water using the procedures of Miah and Siddique (1992) and Dewan et al. (1985). From a 10 ml sample, a pipette was used to transfer a one ml sub-sample to a Sedgewick-Rafter cell. Of a total of 1000 fields in the counting cell, ten fields were selected at random, and the total number of planktons detected in those ten fields was counted and multiplied by 1000. All species have been identified to genus level using a binocular microscope (Olympus, model-CX41RF) using keys from Prescott (1962), Belcher and Swale (1976), and Bellinger (1976).

The formula for calculating plankton in a concentrated sample is as follows:

\[ N = \frac{A \times 100 \times C}{V \times F \times L} \]

Where,

- \( N \) = Number of plankton cell
- \( A \) = Total number of planktons counted
C= Volume of final concentrated sample in ml
V= Volume of a field in cubic mm
F= Number of fields counted
L= Volume of original water in litter

**Volumetric measurement**

Volume is a good way to analyze herbivorous and mud-feeding fishes, as Hynes (1950) pointed out, because numerical techniques "become meaningless as well as incorrect." The following methods were used to determine the number of food items found in the gut contents of *L. calbasu*:

1) **Eye estimation method:** This is arguably the simplest method of calculating the volume of food components. The results of this type of analysis are subjective, and they can be swayed significantly by the researcher's personal convictions. Expertise gained via the analysis of large samples and frequent evaluation of estimated values in the same sample can reduce this complication. This estimating approach is an alternative to the numerical method for analyzing diets with food components that cannot be enumerated, such as plant material and detritus.

2) **Points (Volumetric) method:** Rather than assessing proportion by appearance, as in the previous technique, every foodstuff in the gut is given a numerical value depending on its volume. The following formula was used to compute the percentage volume within each sub sample:

\[
\alpha = \frac{\text{Number of points allocated to component } \alpha}{\text{total points allotted to subsamples}} \times 100
\]

Where, \( \alpha \) is the percentage volume of the prey component \( \alpha \).

**RESULTS AND DISCUSSION**

**Different parameters of wild *Labeo calbasu***

The average weight of fishes ranged from 125.6±43.52 to 192±19.81g where the average gut weight ranged between 7.24±2.25 and 12.48±1.45 which are presented in Table 1.
Table 1. Observation of different parameters of *Labeo calbasu* at different seasons at Dekhar haor in Sunamgonj

| Months  | Weight of fish (g) | Weight of gut (g) | GaSI* |
|---------|-------------------|-------------------|-------|
| **Monsoon** |                   |                   |       |
| Jun     | 172.1±26.02       | 8.21±1.82         | 4.55±0.50 |
| Jul     | 176.91±31.44      | 8.32±1.62         | 4.70±0.41 |
| Aug     | 125.6±43.52       | 7.24±2.25         | 4.97±0.22 |
| Sep     | 164.54±25.38      | 8.21±1.19         | 5.0±0.22  |
| **Post Monsoon** |           |                   |       |
| Oct     | 186.54±19.66      | 12.08±1.42        | 6.47±0.38 |
| Nov     | 192±19.81         | 12.48±1.45        | 6.49±0.16 |

*GaSI: Gastro somatic index*

**Gastro somatic index**

The Gastro somatic index (GaSI) was measured on a monthly basis, which was compiled in Table 1. It ranged from 4.55±0.50 (June) to 6.49±0.16 (Nov) (Table 1). The average GaSI in the monsoon was 4.8 and in the post monsoon it was 6.48 (Table 3). Prakash (2015) noticed quantitative variance in food contends during the investigation, which was confirmed by an examination of the GaSI. It was found that the gastro somatic index was lowest (3.425±0.152) during the monsoons and highest (5.874±0.145) during the post-monsoon season, with an annual average of 4.257±0.141. The findings showed that the fish consume voraciously during the monsoon season, i.e. the spawning season, and quickly rise after spawning, i.e. post monsoon season, to compensate for energy loss during the breeding season (monsoon season). As a result, decreased gastro somatic index values during the research period may be attributed to gonadal maturation. Similar findings were reported by Rao et al. (1998) on Channa, Hatikakoty and Biswas (2003) on Tilapia, and Lalit et al. (2015) on Catla. Sarkar and Deepak (2009) assessed the gastro somatic index of *Chitala chitala* and found that it was highest during the pre-monsoon and lowest during the monsoon season.
Table 2. Percentage of empty gut and averages index of fullness at different seasons at Dekhar haor in Sunamgonj

| Months       | No. of fish Examined | Feeding intensity (%) | Average index of fullness |
|--------------|----------------------|-----------------------|---------------------------|
|              |                      | Full | 1/2Full | 1/4 Full | 3/4 Full | Empty |
| **Monsoon**  |                      |      |         |          |          |       |
| Jun          | 10                   | 10   | 10      | 40       | 10       | 30    | 1.34  |
| Jul          | 11                   | 9.09 | 18.18   | 36.36    | 9.09     | 27.27 | 1.27  |
| Aug          | 10                   | 20   | 30      | 20       | 10       | 20    | 2     |
| Sep          | 11                   | 18.18| 27.27   | 18.18    | 18.18    | 18.18 | 2     |
| **Post Monsoon** |                  |      |         |          |          |       |
| Oct          | 11                   | 36.36| 36.36   | 18.18    | 9.09     | 0     | 3     |
| Nov          | 12                   | 50   | 8.33    | 8.33     | 33.33    | 0     | 3.25  |

Table 3. Gut content of *L. calbasu* at different seasons at Dekhar haor in Sunamgonj

| Season        | GaSI | Average index of fullness | Percentage of full gut | Percentage of empty gut |
|---------------|------|---------------------------|------------------------|-------------------------|
| Monsoon       | 4.8  | 1.65                      | 14.32%                 | 0%                      |
| Post Monsoon  | 6.48 | 3.13                      | 43.18%                 | 23.86%                  |

**Guts in different degrees of fullness**

The percentage of an empty gut was absent in the post-monsoon months. The proportion of full gut was noticed to be higher (36.36%) in October and 50% in November (Table 2) and the average percentage of full gut was 43.18% in the post monsoon months (Table 3). It indicates the high intensity of feeding in the post-monsoon months. These results strongly concur with the research findings of Kumar and Siddique (1989). A minimum intensity of feeding was noticed during the monsoon months (June to September) and most of the gut either contained little food or was empty. The feeding activity rose in October and active feeding was recorded up to February. From March, the feeding intensity started declining and has fallen to its lowest value in the monsoon months.
Average index of fullness

November had the highest index value (3.25) while June had the lowest (1.27) and the average value in the monsoon was (1.65) and post monsoon was (3.13) (Table 3). The averages in the fullness index varied, indicating seasonal variations. According to Rahman (2013), the greatest index value (4.00) was recorded in September and October, while the lowest (3.20 percent) was reported in January. It might be related to the growth of the gonad, which takes up the majority of the abdominal cavity. The prevalence of mature fish feeding decreases during the breeding season compared to non-season, as reported by Ujjania (2003).

Food items found in the gut of *L. calbasu* at different seasons in Dekhar haor

**Phytoplankton:** During the research period, the stomach contents of the investigated fishes resulted in a total of 25 phytoplankton genera belonging to three planktonic groups. Bacillariophyceae, Chlorophyceae, and Cyanophyceae are the three primary planktonic groupings discovered. According to Vinci and Sugunan (1981) and Gupta (2001), the most common phytoplankton group was Bacillariophyceae.

**Bacillariophyceae:** Eleven genera of Bacillariophyceae were identified in the gut content of the fish. Among the phytoplankton groups, Bacillariophyceae was found to hold the first position in terms of numbers in the gut. Bacillarioceae were found to occur regularly in the guts of examined fishes (*Cyclotella* sp., *Amphora* sp., *Fragilaria* sp., *Cymbella* sp., *Gyrosigma* sp., *Gomphonema* sp., *Melosira* sp., *Navicula* sp., *Tabellaria* sp., *Nitzschia* sp., *Synedra* sp.). Their maximum amount (55%) was found in October and the minimum (41%) was found in July and the group in a total formed (48%) of the gut contents among phytoplankton. Ahmed et al. (1993) identified four genera of *Bacillariophyceae*. Shafiqul (2000) investigated the food and feeding habits of Dhela (*Osteobrama cotio*) and found that Bacillariophyceae accounted for 17.57 percent of the primary food items. The occurrence of Bacillariophyceae gradually increased from monsoon to post monsoon and the maximum occurrence (9±1.61×10³ cell/L) was found in the month of October and the lowest (4.8±1.61×10³ cell/L) was found in July (Table 4).

**Chlorophyceae:** The Chlorophyceae family includes the genera (*Cosmarium* sp., *Ankistro desmus*, *Scenedesmus* sp., *Coelastrum* sp., *Pediasstrum* sp., *Oedogonium* sp., *Spirogyra* sp., *Ulothrix* sp., *Zygnema* sp.) The present study revealed that phytoplankton belonging to Chlorophyceae was the second dominant group in the gut of fish (Table 4). There were nine genera and formed the second most abundant group and made up (41%) of the gut contents among the phytoplankton. Ahmed et al. (1993) identified 15 different genera. In the current
investigation, \((7.1\pm0.66\times10^3\text{cell/L})\) was identified in November and \((5.3\pm0.66\times10^3\text{cell/L})\) was discovered in August. The largest percentage of Chlorophyceae (49%) was discovered in July, while the lowest amount (37%) was discovered in October (Table 4).

**Table 4. Plankton number \(\times10^3\text{cell/L}\) found in the gut of \(L.\) calbasu at different seasons at Dekhar haor in Sunamgonj**

| Group           | Jun | Jul | Aug | Sep | Oct | Nov | Mean± SD |
|-----------------|-----|-----|-----|-----|-----|-----|----------|
| Chlorophyceae   | 5.6 (38) | 5.8 (49) | 5.3 (31) | 5.4 (40) | 6.1 (37) | 7.1 (41) | 5.88 ± 0.66 |
| Bacillariophyceae | 7.2 (49) | 4.8 (41) | 6.2 (45) | 6.1 (37) | 9 (55) | 8.6 (50) | 6.98 ± 1.61 |
| Cyanophyceae    | 1.8 (12) | 1.2 (10) | 2.2 (16) | 1.9 (14) | 1.2 (7) | 1.5 (9) | 1.63 ± 0.40 |
| **Total phytoplanктон** | **14.6 (95)** | **11.8 (88)** | **13.7 (8)** | **13.4 (92)** | **16.3 (92)** | **17.2 (91)** | **14.5 ± 1.98** |
| Crustacea       | 0.3 (43) | 0.7 (44) | 0.8 (44) | 0.7 (58) | 0 (0) | 0.6 (37) | 0.51 ± 0.31 |
| Rotifera        | 0.4 (57) | 0.9 (56) | 1 (56) | 0.5 (42) | 1.5 (100) | 1 (62) | 0.88 ± 0.4 |
| **Total zoo plankton** | **0.7 (5)** | **1.6 (12)** | **1.8 (12)** | **1.2 (8)** | **1.5 (8)** | **1.6 (9)** | **1.4 ± 0.39** |
| **Total content** | **15.3** | **13.4** | **15.5** | **14.6** | **17.8** | **18.8** | **15.9 ± 2.02** |

**Cyanophyceae:** The Cyanophyceae family includes the genera *Anabena* sp., *Oscillatoria* sp., *Microcystis* sp., *Phormidium* sp., and *Anabena* sp. Four genera represented this group and were found to occur throughout the study period. Among the phytoplankton, Cyanophyceae was found to be the lowest group and made up 11.24% of the gut contents. The number of planktons in this group ranged from \(1.5\pm0.40\times10^3\) to \(2.2\pm0.40\times10^3\) cell/L. Chowdhury et al. (2007) found the abundance of cyanophyceae was highest in September and lowest in December-January. In this study, the highest percentage (16.06%) of Cyanophyceae among phytoplankton were found in August and the lowest percentage (7.36%) were found in the month of October (Table 4).

**Zooplankton recorded in the gut of *L. calbasu*:** Two planktonic groups of zooplankton were identified in the gut content of *L. calbasu*, viz., crustaceans and rotiferans. Alam et al. (2002) found seven species of zooplankton. Laghari et al. (2015) discovered that zooplankton (Protozoan larvae, Dipteran larvae, Rotifers, Cladocerans, and Crustaceans appendages) and fish eggs made up 0.67 percent of the overall food content. Throughout the year, it was present in small quantities.
Crustaceans: About 5 genera of crustaceans were identified in the diets of fish. Dewan et al. (1991) identified five genera of Crustacea. In the present study, the abundance of crustaceans was higher (0.8 ±0.31×10³ cell/L) in August and was absent in October. This group made up 37% of gut content among zooplankton. Chowdhury et al. (2007) found the Crustacean was the most prevalent zooplankton category, accounting for 71% of the overall zooplankton population.

Rotifers: Five genera, namely Brachionus, Trichocerca, Asplanchna, Notholca, and Keratella, belong to this group and were identified in the diets of fish throughout the year. Chowdhury et al. (2007) identified five genera of Rotifera. In the current study, the highest number of Rotifers (1.5±0.4×10³ cell/L) was identified in the month of October and the lowest (0.4±0.4×10³ cell/L) in June. This group made up 63% of gut content among zooplankton. The abundance of rotifers was high in the post-monsoon season and low in the monsoon season.

Percentage volume of different food items

In the current study, the average percentage of gut content was 70.88% detritus, 11.81% mud, 8.3% Bacillariophyceae, 6.75% Chlorophyceae, 1.73% Cyanophyceae, 0.45% Rotifera, 0.24% Crustaceans, and 0.08% miscellaneous. There is a lot of similarity between the current observations and those of the pioneers. Organic detritus matter was discovered to be the most preferred diet at 80.72 percent, followed by Bacillariophyceae 8.89 percent, dirt 7.08 percent, Chlorophyceae 7.08 percent, and Cyanophyceae 2.98 percent. The diet and feeding behaviors of carp (L. calbasu) were examined by Laghari et al. (2015). According to his observations, L. calbasu feeds predominantly on organic debris (71.98%), followed by sand and mud particles (8.56%), blue-green algae, diatoms, and zooplankton.

Table 5. Percentage volume of different food items found in gut of Labeo calbasu at different seasons at Dekhar haor in Sunamgonj

| Months | Detritus | Mud | Bacillariophyceae | Chlorophyceae | Cyanophyceae | Rotifera | Crustacean | Miscellaneous |
|--------|---------|-----|------------------|--------------|-------------|----------|-----------|--------------|
| Jun    | 64.74   | 16.18 | 8.84            | 7.49         | 2.02        | 0.25     | 0.21      | 0.27         |
| Jul    | 78.15   | 8.38 | 4.48            | 5.17         | 3.31        | 0.29     | 0.22      | -            |
| Aug    | 71.68   | 13.44 | 6.36            | 4.74         | 2.86        | 0.37     | 0.31      | 0.23         |
| Sep    | 71.59   | 13.42 | 7.6             | 5.45         | 1.43        | 0.25     | 0.26      | -            |
| Average| 71.54   | 12.85 | 6.82            | 5.71         | 2.40        | 0.29     | 0.25      | 0.25         |
Detritus: It was made up of unidentifiable plants and animal debris that was found frequently in the intestines throughout the year and served as the major food source in the gut contents (70.88% by volume). In June, a minimum of 64.74 percent was observed (Table 5). According to Singh and Singh (2000), *L. calbasu* feeds mostly on organic debris, which was found in the stomach contents of more than 80% of the animals examined and the stomach content was noticed to be changed on a monthly basis.

Mud mixed with sand: This item occurred throughout the gut contents, ranging between 8.38% in July to 16.18% in June by volume (Table 5). The average percentage was 11.81% by volume. Kumar and Siddique (1989) explained that sand and mud particles formed 12.24%, 11.76%, 11.32%, and 5.40% of the total gut contents of the river Ganga, Yamuna, Kali, and reservoir fishes, respectively. In the current investigation, a lot of sand and mud was detected in the guts of the fish in June, August, and September. The rest of the three months have seen a considerable amount of sand and mud. The mud in the gut came from the decaying organic waste that had been deposited on the bottom's sand and mud.

### CONCLUSION

This study establishes a crucial baseline for the feeding biology of *L. calbasu*. The current research on *L. calbasu* gut content analysis revealed that the fish is a bottom feeder that feeds on decaying organic materials. The percentage of empty guts and the index of fullness showed seasonal fluctuation, with the number of empty guts being absent in post monsoon months and greater in monsoon months, and the index of fullness being higher in the post monsoon season than in the monsoon season. The study's findings would be a useful tool for conservation biologists, and managers to develop early management methods for the long-term protection of this species' populations. This aids in the selection of appropriate species for cultivation with the least amount of interspecies competition for natural food. It also gives crucial information for designing additional feed for this species.

|          | Oct | Nov | Average | Post Monsoon |
|----------|-----|-----|---------|--------------|
|          | 71.18 | 9.12 | 11.57 | 6.56 | 0.27 | 1.16 | - | - |
| Detritus | 68.35 | 10.5 | 11.02 | 8.96 | 0.51 | 0.37 | 0.29 | - |
| Mud      | 69.76 | 9.81 | 11.29 | 7.76 | 0.39 | 0.76 | 0.29 | - |
| Sand     | 71.18 | 9.12 | 11.57 | 6.56 | 0.27 | 1.16 | - | - |
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CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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