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# Food and feeding habit of *Labeo gonius* (Ham.) from Brahmaputra

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**Abstract:** The anatomical features of *Labeo gonius* revealed that it is a herbivorous fish. Inferior mouth, thick lip, extremely long alimentary canal, seemed best suited for its herbivorous feeding habit. The food of *L. gonius* mainly consisted of decayed organic matter, mud, sand and both phytoplankton and zooplankton. Zooplankton appeared to be the main food of fly and fingerling. In adult, detritus and mud were found to substitute the planktonic food. As the fish is bottom feeder, some amount of sand was encountered in the stomach of all the fish. Zooplankton was completely absent in fish of larger size-group. Among planktonic food, Bacillariophyceae formed a greater proportion of food composition. Seasonal variation was also noticeable in the gut content of L. gonius. Planktonic food was maximum during the period from September to March, which was substituted by detritus and mud during the monsoon months. Feeding intensity was higher during October to November. During winter (December to January), the gastrosomatic index (GST) was low. GSI registered an increasing trend from February to April. A diminishing trend in GSI during May to August indicated towards low feeding intensity in both the sexes, especially in female and this could be ascribed to maturation of gonad during the period. During monsoon months heavy rainfall caused dilution of food items, leading to scarcity of food, and hence intensity of feeding was low during this period. Intensity of feeding was higher in juvenile than the adult fish. There was no significant difference in GSI of male and female fish. However, feeding intensity was slightly lower in female fish. Relative gut length (RLG) was found to increase with the size of the fish. As the fish shifted from planktivorous to herbivorous feeding habit, their RLG increased subsequently.

**Key words:** Brahmaputra; feeding habits; *Labeo gonius*.

## 1. Introduction

Investigation on food and feeding habit is an important aspect of study on fish biology. Food plays an important role in fish growth, development and reproduction. It gives information about abundance of fish in a particular habitat or water body. Likewise, composition of food of a fish reflects its habitat. Fish show a greater range of feeding habit than any other vertebrate, which may differ with size, stages of growth, maturation or sex even in the same species (Nikolsky, 1963). Depending upon the type of food they consume, fish are classified into herbivorous, carnivorous and omnivorous. Information on food and feeding habit of fish is, therefore, necessary for successful fishery management.

The food and feeding habit of fish were studied, in detail, by Nikoisky (1963) who classified them into euryphagic, stenophagic and monophagic type depending on the type of food consumed. Further, he also categorized food of fish into four major types on the basis of their relative importance such as basic food, secondary food, incidental food and obligatory food.

In India, the various aspects of food and feeding habit of fishes have been studied by a number of workers in the past. Food and feeding habit of Indian major carps were reported by Mookerjee and Ghosh (1945), Chakrabarty and Singh (1963), and Natarajan and Jhingran (1963), Das and Moitra (1955, 1956 ) classified Indian major carps into three groups depending upon their feeding zone viz., surface feeder, mid feeder and bottom feeder. Qayyum and Qasim (1964b) studied the food and feeding habits of *Barbus stigma.* Moitra and Sinha (1971) studied

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the morphohistology of alimentary canal of *Chagunius chagunio* (Ham.). Food and feeding habit of *Puntius sarana subnasutus and P. vittatus* was studied by Sobhana and Nair (1980) and Geetha *et al.* (1990), respectively. De and Datta (1990) studied certain aspects of the morphohistology of Hilsa in relation to its food and feeding. Dasgupta (1996) studied the alimentary canal of *Catla catla* (Ham.) in relation to its food and feeding habit at different stages of growth. Kohli and Goswami (1996) studied the feeding habit of *Heteropneustes fossilis* (Bloch) from the Brabmaputra river system, Assam. Das and Goswaini (1997) studied the food spectrum of Acrossochellus hexagonolepis. Dasgupta (2002) made contribution on the feeding habit and adaptation of alimentary canal of freshwater fishes, Hatikakota (2004) studied length weight relationship and condition factor of *Oreochromis mossambicus*, Kausar *et al*. (2010), worked on seasonal fluctuation in the gut contents of *Schizothorax esocinus* and *Shizothorax curvi* frons, Shafi *et al.*(2012) studied the Biology of *Cyprinius carpio communis* from Dal lake, Kashmir with reference to food and feeding habits, length-weight relationships and fecundity and Naik *et al.*(2015) worked on food and feeding habits of *Cyprinus carpio* var. communis.

Many workers have studied the food and feeding habit of Labeo spp. Kamal (1967a) studied the food and alimentary canal of *L. rohita* (Ham.). Vinci and Sugunan (1981) investigated the food and feeding habit of *L. calbasu* (Ham.). Biswas (1986, 1987) studied the food and feeding of *L. pangusia* (Ham.) and *L. dero* (Ham.) from North-east India and observed their detritus feeding behaviour. Chatterji *et al.* (1992) studied the food and feeding habits of *L. bata.* Kurup (1993) studied the feeding biology in *L. dussumieri* (Val.) from river Pampa. Food and feeding habit of *L. gonius* from the river Kali was studied by Chatterji *et al.* (1978), Ayoade (2011) studied length weight relationship and diet of *Labeo ogunensis* (Boulenger, 1910), Adadu *et al.* (2014) studied Food and Feeding habits and condition factor of *Labeo coubi,* Md. Abdur Razaq (2014), worked on seasonal occurrence of Food and Feeding habit of *Labeo bata* (Hamilton) (Cypriniformes: Cyprinidae), Shinkafi and Ajoku (2015), worked on Food and feeding habits of *Labeo senegalensis* (Valenciennes 1842) in river Rima, North-Western Nigeria. Although some work appeared on the food and feeding habit of *L. gonius* from Sibsagar tank of Assam (Parameswaran *et al.*, 1974), information on this fish from the river Brahmaputra is almost lacking. During the present investigation an attempt has been made to study different aspects of food and feeding of *L. gonius* from the Branmaputra River.

## 2. Materials and Methods

Monthly samples of *L. gonius* were collected during the period of 2 years. A total of 550 specimens of this species in the size range from 10 to 500 mm (total length), were examined to analyze the gut content. The samples were brought to the laboratory. After recording their length and weight, the specimens were dissected and their digestive tracts were carefully taken out in a Petri dish. After uncoiling, gut length and weight were taken. The adhering tissues were removed from the gut. Three pieces, measuring about 10 cm each, were taken from different parts of the gut and their contents scrapped out carefully into petridishes. The contents were preserved in 5% formalin. The weight of the empty gut was also recorded in each fish. The content of gut was investigated under a microscope and the organism(s) identified as far as possible, up to generic level, and counted.

For analyzing the data, the entire length range of the specimens examined was arbitrarily split into different size-groups to observe whether the choice of food differs with size. The gut content was analyzed on monthly basis to elucidate seasonal variations in composition of food item. The following methods were employed for the study of food and feeding habit.

### Volumetric method

The total volume of the entire gut content was determined by water displacement, using a graduated cylinder. Next, the different food items were segregated and volume of each determined in the same manner. Finally, volumetric values of different items were expressed as percentage of the total volume of

entire gut content. The volumetric assessment of planktonic organisms was done by point method (Hynes. 1950). Food items in the gut of each fish were listed and allotted a point depending upon their relative size. The total number of individual organism was then multiplied with their respective point and their relative percentage in the gut determined.

**Occurrence method**

The occurrence method was based on the presence or absence of a particular food item in the gut. The number of gut containing such food item was expressed as percentage of the total guts examined.

$$\% \text{ Occurrence} = \frac{n_i \times 100}{N}$$

Where,

$n_i$ = total number of gut in which the given food item i was present

N = total number of gut examined

The Index of Preponderance (I) was also worked out using the following formula (Natarajan and Jhingran, 1961):

$$I = \frac{V_i O_i \times 100}{V_i O_i}$$

Where,

$V_i$ and $O_i$ represent the percentage of volume and occurrence of food items, respectively.

The feeding intensity was studied by calculating the gastrosomatie index (GSI), using the formula:

GSI = weight of gut (g)/body weight (g) x 100

The ratio between gut length and total length (RLG) was estimated with the following formula:

RLG=GL/TL

Where,

GL = total length of gut (mm)

TL = total length of fish (mm)

The number of fish with empty guts in each month was expressed as percentage of the total number of fish examined in that month.

## 3. Results

The study of food and feeding habit of *L. gonius* reveals that the fish is herbivorous. The inferior mouth, narrow gape and thick lips, fringed with a distinct inner fold along with the entire circumference, seemed best suited for its herbivorous feeding habit. Absence of teeth in the jaws and presence of well-developed pharyngeal teeth also seemed an adaptation to herbivorous feeding habit of this fish.

**Food composition:**

The gut content analysis of fry of 10-30 mm total length revealed that zooplankton dominated in the gut, forming 80% of the total food content (Fig. 1). Among the zooplankton, Cladocerans formed 52%, which included *Moina, Bosmina, Alonella, Daphnia and Ceriodaphnia.* Rotifers (38%), the second largest group were represented by *Brachionus, Keratella, Polyarthra, and Monostyla.* Copepoda, which formed 6% which included *Cyclops* and their nauplii. Protozoans were low in number (4%) and included *Difflugia, Arcella* and ciliates. In the gut of fry, phytoplankton were less in quantity in comparison to zooplankton. It contributed only 13% of the gut content. Bacillariophyceae constituted the major proportion, almost 57%, of phytoplankton and included species of *Melosira, Fragilaria, pinnularia, Surirella, Anomoeneis, Gomphoneis, Amphora, Cymbella, Synedra, Navicula, Diatoma and Gyrosigma.* Chlorophyceae formed 35% of the phytoplankton and was represented by *Ankistrodesmus, Pediastrum, Selenastrum, Staurastrum, Spirogyra, Scenedesmus, Tribonema, Crucigenia, Cosmarium, Ulothrix, Microspora, Closterium and Closteriopsis.* Euglena were few in number, forming only 8% of phytoplankton. Detritus and mud formed 7% of the total content in the gut.

In the gut of fingerling (30-50 mm total length), zooplankton formed 58% of the total food, and included cladoceran (49%), rotifer (32%), copepod (12%) and protozoa (7%). Phytoplankton contributed 19% of the gut content. Among phytoplankton, Bacillariophyceae and Chlorophyceae contributed 65% and 35%, respectively. Detritus and mud constituted 19%, while sand formed 4% of the total content in the gut (Fig. 2).

The gut content of fry and fingerling *L. gonius* showed the dominance of

Bacillariophyceae such as *Navicula, Pinnularia and Gomphonema*. Chlorophyceae included both filamentous and non-filamentous algae. Among the filamentous algae, *Spirogyra* constituted the major portion. Detritus and mud also formed a major component in the gut content.

**Food composition of juvenile and adult fish**

Variations in food composition in juvenile and adult fish were recorded. Juvenile mainly consumed phytoplankton and zooplankton. Chlorophyceae, Bacillariophyceae and Myxophyceae were the phytoplanktonic group found in the guts of juvenile fish. Among the planktonic group, Bacillariophyceae formed the bulk percentage. Cladoceran, copepod and rotifer were found in the gut content of juvenile fish but in lesser percentage. Detritus and mud also contributed a considerable percentage to food composition in juvenile.

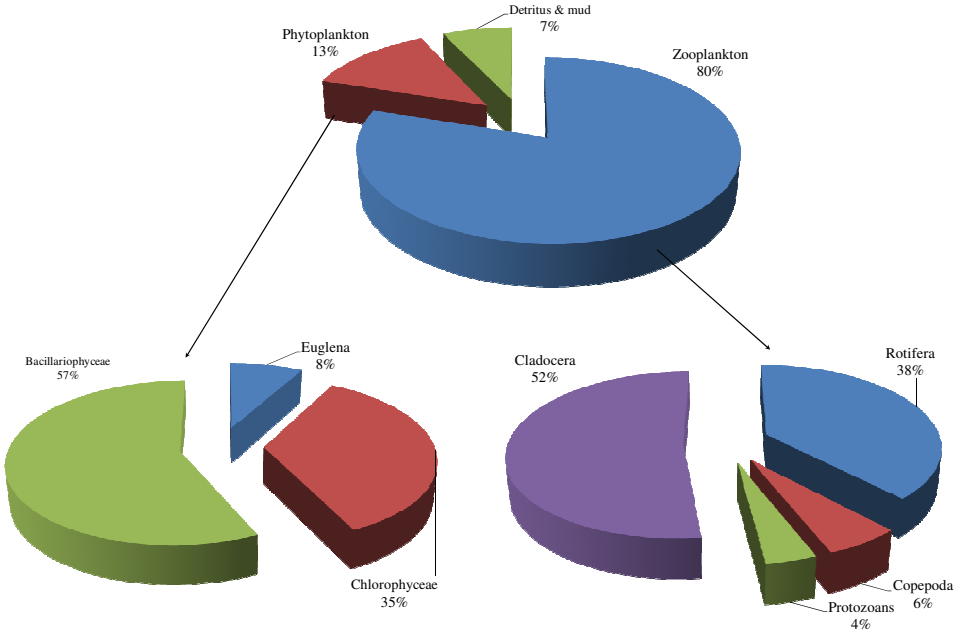


**Fig 1.** Composition of food in *L. gonius* of 10-30 mm size-group

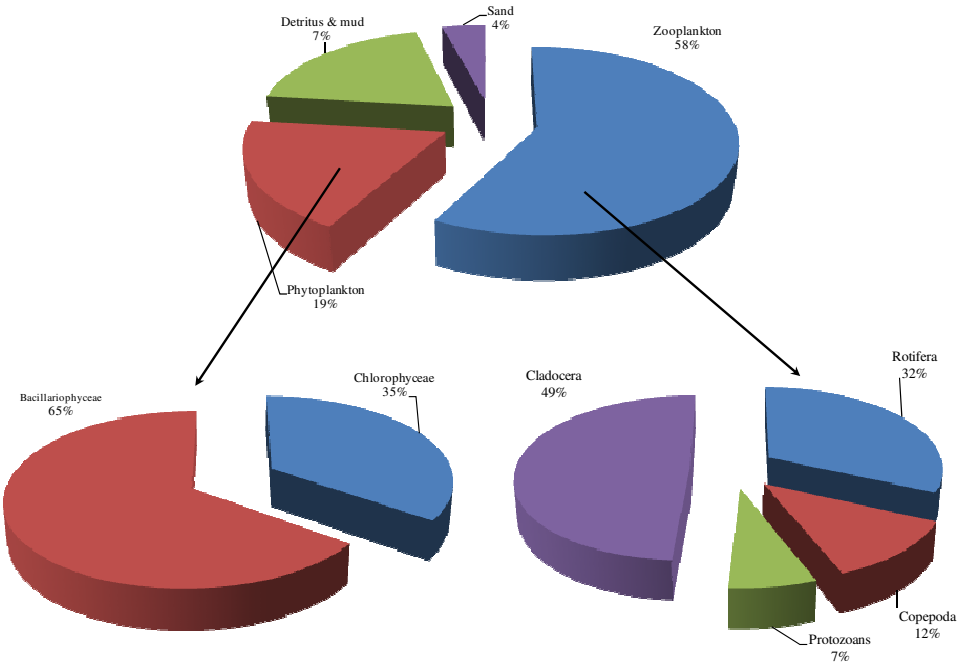


**Fig 2.** Composition of food in *L. gonius* of 30-50 mm size-group

In adult fish, detritus and mud were found in fairly large amount. Other food items such as phytoplankton and zooplankton were present in lesser quantity (Table 1). There was no difference in food composition of male and female fish.

**Table 1.** Variation in food composition (%) in different size-groups of *L. gonius*

| Composition of gut | Size –group (mm) | | | | | |
|---|---|---|---|---|---|---|
| | 50-100 | 100-200 | 200-300 | 300-400 | 400-500 | Average |
| Detritus | 44.04 | 50.06 | 63.69 | 66.95 | 70.03 | 58.95 |
| Mud | 6.25 | 15.13 | 16.80 | 17.10 | 18.00 | 15.00 |
| Sand | 2.53 | 3.10 | 2.90 | 3.24 | 3.70 | 3.01 |
| Bacillariophyceae | 1.80 | 3.60 | 2.80 | 4.00 | 4.30 | 3.30 |
| Chlorophyceae | 7.16 | 6.50 | 4.16 | 2.10 | 0.50 | 4.00 |
| Myxophyceae | 21.92 | 16.01 | 7.45 | 5.40 | 3.40 | 10.83 |
| Euglena | 6.64 | 5.22 | 2.20 | 1.50 | 0.30 | 0.17 |
| Rotifera | 3.21 | 1.05 | 0.33 | 0.15 | 0.50 | 0.75 |
| Copepoda | 2.40 | 0.43 | 0.05 | - | - | 0.37 |
| Unidentified Vegetable matter | 3.10 | 0.40 | 0.01 | - | - | 0.30 |

The percentage volume, occurrence, and Index of Preponderance of various food items in juvenile and adult fish are given in Table 2. In juveniles, planktonic group (Myxophyceae) showed a higher value (37.13) for Index of Preponderance, whereas in adult fish higher value was observed for detritus (77.43), followed by mud (9.61).

**Table 2.** Index of Preponderance in juvenile and adult *L. gonius*

| Gut content | Adult | | | | Juvenile | | | |
|---|---|---|---|---|---|---|---|---|
| | $V_i$ | $O_i$ | $V_iO_i$ | $\frac{ViOi \times 100}{\sum ViOi}$ | $V_i$ | $O_i$ | $V_iO_i$ | $\frac{ViOi \times 100}{\sum ViOi}$ |
| Detritus | 38.10 | 9.43 | 359.28 | 31.71 | 62.13 | 23.80 | 1478.69 | 77.43 |
| Mud | 7.63 | 5.66 | 43.18 | 3.81 | 12.06 | 15.23 | 183.67 | 9.61 |
| Sand | 1.90 | 4.71 | 8.90 | 0.78 | 2.20 | 23.86 | 52.49 | 2.74 |
| Bacillariphyceae | 3.15 | 5.66 | 17.82 | 1.57 | 12.10 | 9.52 | 115.19 | 6.03 |
| Chlorophyceae | 7.52 | 14.15 | 106.40 | 9.35 | 3.29 | 7.61 | 25.03 | 1.31 |
| Myxophyceae | 25.13 | 16.98 | 420.70 | 37.13 | 4.16 | 9.52 | 39.60 | 2.07 |
| Euglena | 6.50 | 9.43 | 61.29 | 5.41 | 2.50 | 4.76 | 11.90 | 0.62 |
| Rotifers | 4.33 | 11.32 | 49.01 | 4.32 | 5.50 | 2.85 | 1.42 | 0.07 |
| Copepod | 3.14 | 9.43 | 21.61 | 2.61 | 0.60 | 1.90 | 1.14 | 0.05 |
| Unidentified Vegetable matter | 2.60 | 14.15 | 36.79 | 3.24 | 0.46 | 0.95 | 0.43 | 0.02 |

**Seasonal variation in food composition:**

An examination of gut content of *L. gonius* revealed variation in food composition with season (Table 3).

**Detritus:** It occurred throughout the year. Higher percentages of detritus were found during May to August. It contributed 59.89% of the total food intake of this species.

**Mud:** Mud constituted 13.83% of the total gut content. Higher volume was observed in July and August.

**Sand:** Sand was found in the gut throughout the year, ranging from 1.12 to 4.25% of the total gut content.

**Bacillariophyceae:** Bacillariopbyceae was found to be the most important and dominant

group among the phytoplankton. It constituted around 8.43% of the food items present in the gut. Diatom was represented by 12 genera *(Melosira, Fragilaria, Pinnularia, Surirella, Anomoeneis, Gomphoneis, Amphora, Cymbella, Synedra, Ncivicula, Diatoma, and Gyrosigma)* and formed the main food of the fish. They were found in higher percentages (6.25-15.86%) from September to March and lower (1.13 to 3.4%) during April to August. Among the diatoms, *Navicula, Fragilaria and Cymbella* were found to occur in maximum percentages and prevailed throughout the year. *Diatoma, Surirella, Pinnularia* were recorded only in few months.

**Chlorophyceae:** It constituted 5.4 1% of the gut content. During September to March it was noticed in higher percentage in almost all the gut of different size-groups of fish. Chlorophyceae was represented by 13 genera *(Ankistrodesmus, Pediastrum, Selenastrum, Staurastrum, Spirogyra, Scenedesmus, Tribonema, Crucigenia, Cosmarium, Ulothrix, Microspora, Closterium and Closteriopsis)*. Among *Chlorophyceae,* 60% contribution was made by *Spirogyra, Tribonema and Ulothrix. Ankistrodesmus, Pediastrum, Selenastrum and Crucigenia* were encountered in the gut in greater percentages during September to March.

**Myxophyceae:** Blue green algae formed 2.60% of the gut content in *L. gonius.* Myxophyceae was represented by 7 genera which included *Phormidium, Rivularia, Anabaena, Merismopedia, Oscillatoria, Microcystis and Polycystis. Rivularia* formed a major portion among the blue green algae, constituting almost 50% of these algae, followed by *Oscillatoria.*

**Euglenophyceae:** Excepting for few months, Euglenophyceae occurred in the gut almost round the year. It formed only 0.62% of food composition and included the genera like *Euglena and Phacus*.

**Rotifera:** Among zooplankton, rotifers constituted 2.61% of the total gut content. The group was represented by *Keratella, Brachionus, Notholca and Filinia. Keratella* was the dominant food item among the rotifers, forming 55.66% of the rotifers. *Notholca* was recorded, in negligible percentages, only during October and November.

**Copepoda:** Copepoda formed a very small percentage (0.36%) of food composition. It included cyclops and their nauplii.

**Unidentified vegetable matter:** The unidentified vegetable matter included items like leaf, shell, etc. It formed 3.70% of the total food composition and occurred almost throughout the year. The maximum vegetable matter was found in fish food during the months of August to September.

**Table 3.** Percentage composition of food items in the gut of *L. gonius* in different months

| Food items | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sep. | Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Detritus | 42.84 | 48.11 | 51.25 | 50.66 | 55.02 | 59.22 | 62.07 | 65.24 | 75.31 | 67.04 | 71.80 | 60.22 | 59.89 |
| Mud | 12.33 | 11.10 | 15.17 | 12.22 | 14.05 | 12.02 | 12.36 | 13.18 | 11.29 | 18.05 | 19.06 | 15.20 | 14.41 |
| Sand | 4.25 | 1.52 | 2.51 | 3.02 | 2.92 | 3.82 | 2.52 | 3.11 | 2.99 | 2.59 | 1.12 | 3.50 | 2.82 |
| Bacillariphyceae | 14.87 | 15.86 | 12.50 | 13.77 | 11.13 | 10.72 | 3.04 | 4.75 | 3.07 | 4.16 | 1.13 | 6.25 | 8.43 |
| Chlorophyceae | 11.26 | 9.75 | 7.83 | 8.99 | 5.96 | 6.63 | 2.75 | 4.06 | 0.95 | 1.44 | 0.29 | 5.02 | 5.41 |
| Myxophyceae | 4.64 | 5.14 | 3.82 | 4.44 | 3.84 | 2.22 | 1.82 | 1.06 | 0.95 | 1.44 | 0.33 | 1.56 | 2.60 |
| Euglena | 1.89 | 1.26 | - | 0.65 | 0.14 | 1.11 | 1.33 | - | - | - | 0.04 | 1.06 | 0.62 |
| Rotifers | 3.82 | 4.11 | 3.04 | 4.09 | 2.88 | 1.60 | 2.60 | 3.56 | 1.14 | 1.89 | 0.01 | 2.60 | 2.61 |
| Copepod | - | 0.72 | 0.34 | 0.63 | 0.89 | 0.16 | 0.85 | 0.06 | 0.17 | - | 0.01 | 0.52 | 0.36 |
| Unidentified Vegetable matter | 4.02 | 2.85 | 3.72 | 1.56 | 3.10 | 2.15 | 3.64 | 5.51 | 4.20 | 3.39 | 6.23 | 4.08 | 3.70 |

Values are mean of 24 month data

**Food composition in different size-groups of fish**

Variation in food composition was noticed in different size- groups of fish. In larger size-groups of fish, a gradual increase in the amount of detritus and mud in the gut was noticeable. Maximum (70.03%) detritus was observed in fish of 400-500 mm size-group. The increase in detritus intake of fish was accompanied by reduction of phytoplankton and zooplankton in the gut. Euglena and copepod were absent in the gut of fish above 300 mm.

**Feeding intensity in different seasons**

Intensity of feeding of *L. gonius* in different seasons is shown in Table 4. Monthly observations revealed variation in GSI of fish with season. Intensive feeding activity was noticed during October and November whereas in December-January a decrease in GSI value was noticeable. Intensity of feeding increased again during February- April. Diminishing GSI during May onwards indicated low feeding intensity. Minimum feeding was seen in both sexes during July and August. GSI showed an inverse relationship with the occurrence of empty stomach.

**Table 4.** Gastro-somatic index and empty gut % of *L. gonius* in different months

| Month | Male | | Female | |
|---|---|---|---|---|
| | GSI | Empty gut% | GSI | Empty gut% |
| Oct | 4.80 | 10 | 4.50 | 15 |
| Nov | 5.20 | 8 | 4.73 | 10 |
| Dec | 4.09 | 15 | 4.00 | 25 |
| Jan | 3.05 | 20 | 2.70 | 30 |
| Feb | 3.26 | 15 | 3.02 | 20 |
| Mar | 4.05 | 12 | 3.06 | 18 |
| Apr | 4.25 | 15 | 3.85 | 20 |
| May | 3.30 | 20 | 2.57 | 50 |
| Jun | 3.10 | 25 | 1.50 | 80 |
| Jul | 2.60 | 40 | 1.16 | 90 |
| Aug | 2.50 | 26 | 1.05 | 70 |
| Sep | 3.02 | 10 | 2.30 | 7 |

*Values are mean of 24 month data

**Intensity of feeding in different size-groups of fish**

Maximum intensity of feeding was noticed in fish of smaller (100-200 nun) size-group. Feeding intensity was lower in larger size- group (300-400 mm). The lowest feeding intensity was seen in fish of 400-500 mm total length (Fig. 3).

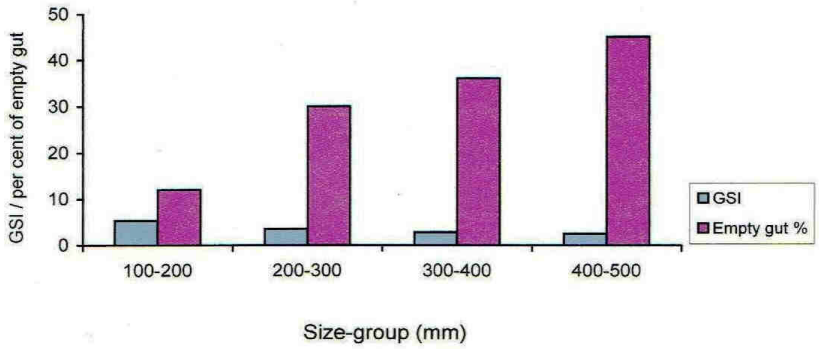


**Figure 3.** Gastro-somatic index (GSI) and empty gut per cent in different size-groups of *L. gonius*

**Intensity of feeding in different stages of life**

Feeding intensity was high in maturing fish. Lower feeding intensities were recorded in ripe and spent fish (Fig. 7).

**Intensity of feeding in male and female fish**

Intensity of feeding remained higher in male fish throughout the year (Table 4). The males indulged in relatively higher feeding than the females in different stages of maturation. Maturing virgin and recovering spent fish in both the sexes exhibited maximum intensity of

feeding. However, in comparison to ripe male, ripe female showed lower feeding intensity.

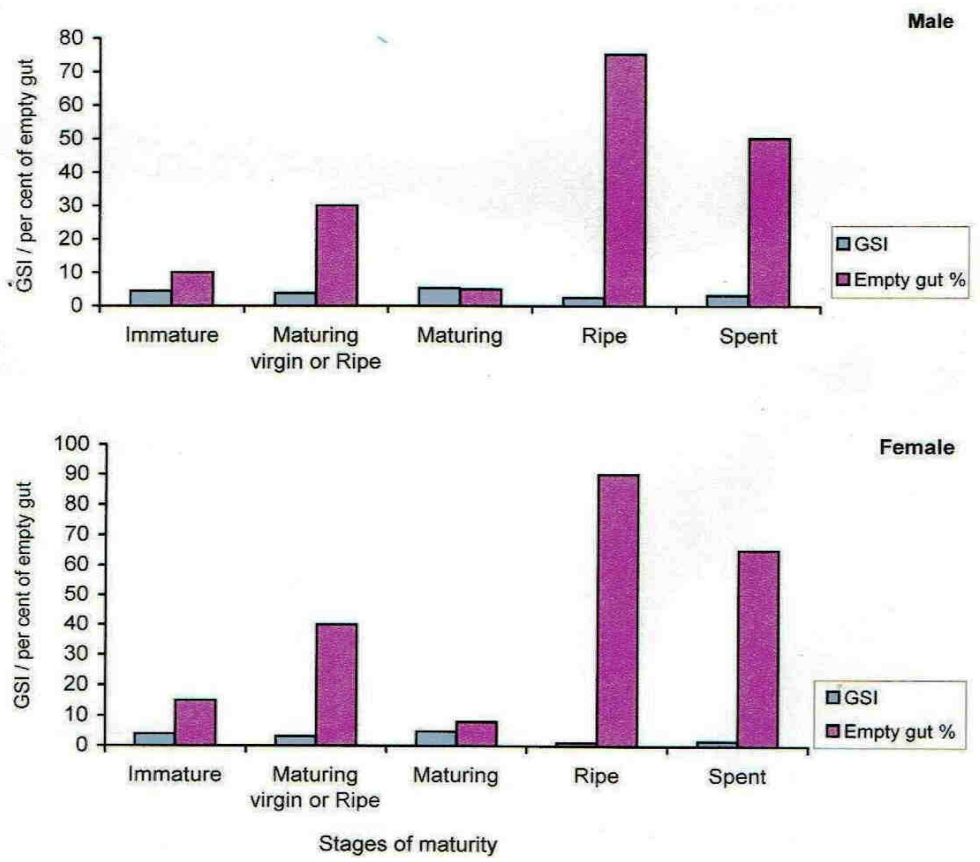


**Figure 4.** Gastro-somatic index (GSI) and empty gut per cent in different stages of maturation in *L. gonius*

### Relative gut length

Relative gut length (RLG) was found to increase gradually from fingerling to adult fish. Fish below 50 mm in total length had RLG of 25.60 mm, whereas maximum RLG (131.50 mm) was recorded in fish of 450-500 mm total length (Table 5). In larger size-group, RLG increased with changes in feeding habit. While smaller fish fed mainly on plankton, adults were found to switch over from herbivorous to omnivorous feeding habit.

**Table 5.** Relative gut length in different size-groups of *L. gonius*

| No. of observation | Size-group (mm) | RLG (mm) |
|---|---|---|
| 45 | <50 | 25.60 |
| 35 | 50-100 | 52.00 |
| 50 | 100-150 | 67.20 |
| 25 | 150-200 | 71.00 |
| 40 | 200-250 | 85.00 |
| 30 | 250-300 | 104.04 |
| 25 | 300-350 | 110.20 |
| 30 | 350-400 | 129.00 |
| 26 | 400-450 | 125.00 |
| 18 | 450-500 | 131.50 |

## 4. Discussion

The inferior mouth, thick lip, extremely long, highly coiled guts in *L. gonius* appeared fully suited for its herbivorous feeding habit. Similar structural modifications were reported in other cyprinids (Mookerjee and Ganguly, 1948; Pillay, 1952; Das and Moitra, 1956). Nikolsky (1963) was also of the opinion that position of the mouth, presence or absence of teeth, gape of mouth, etc., help to understand the nature of food and mode of feeding in fish. Presence of pharyngeal teeth is also an adaptation encountered in herbivorous fish feeding on vegetable matter, algae and detritus (Lagler *et al*., 1962).

Changes in food composition in different size-groups were noticed in *L. gonius.* Fry and fingerling of this fish fed on zooplankton, while in the juvenile and adult, detritus and mud formed the major part of food, indicating that in early phase of its life the species remains a selective feeder, showing preference to zooplankton and phytoplankton, which form the basic food of the species. Similar findings were reported by Chatterji *et al*. (1978) in *L. gonius* from the river Kali. Alikunhi (1952), Mitra and Mahapatra (1956), Kamal (1964, 1966, 1967a), and Khan and Siddiqui (1973) reported preference of zooplankton as food in early stages of life in Indian major carps. Variation in food components in different size-group of fishes were noticed in *L. fimbriatus* (Bhatnagar and Karamchandani, 1970) and (Kurup, 1993). Increased proportion of detritus, mud and sand in adult fish are attributed to their bottom feeding and browsing habit. Varely (1967), Sobhana and Nair (1980) and Vinci and Sugunan (1981) reported variations in the composition of diet in other cyprinids. Similar shift in diet was reported in various species of Barbus (Barak and Mohamed, 1982; Kumar *et al*., 1986, and Magalhaes, 1992). Junger *et al.* (1989) attributed this shift in diet of cyprinid to increase in the gut passage time, leading to the improvement in assimilation of plant material by the fish. Ontogenic difference in feeding activity prove to be an effective means to avoid intra specific competition when two or more classes are fed on the same food (Helfman, 1978).

Detailed observations on the gut content of juvenile and adult *L. gonius* revealed that the species is herbivorous. The very large percentage of detritus, mud and sand noticed in the gut throughout the year indicate that the fish browses on the bottom deposits. Seasonal variations observed in the composition of food of *L. gonius* during different months of the year seemed related to variation in the availability of various food items in the environment. Phytoplankton such as Bacillariophyceae, Chlorophyceae and Myxophyceae increased in the guts during September-March, whereas from April onwards their percentage declined. Decrease in planktonic food during monsoon was found to be compensated by detritus and mud. This may be the result of abrupt changes in ecological condition due to heavy showers. The suspended solid particles also increased in water due to erosion of hillocks during this season. Similar changes in composition of diet with season was reported for *Barbus bocagit* and attributed to the availability of the food resources (Magalhaes, 1992). Karamchandani and Misra (1978) also reported higher percentage of detritus and mud in the gut of *L. boggut* during monsoon. A similar observation was made on *Tor putitora* by Nautiyal and Lal (1985) who stated that due to scarcity of food during monsoon the fish switches over to obligatory food. Seasonal variation in dietary composition in fishes was also reported by Sobhana and Nair (1980).

The variations observed in the intensity of feeding of *L. gonius* in different months could be attributed to availability of food in different seasons as a result of changes in environmental condition as well as the physiological state of the fish. Low feeding intensity noticed during June-August may be due to the attainment of gonadal maturity as a major portion of space in abdominal cavity was found occupied by developed gonad. Similar reduction in feeding during breeding season has been reported in other fish species (Chatterji *et al.*, 1978; Sobhana and Nair, 1980; Biswas, 1987; Geetha *et al.*, 1990; Kurup, 1993; Basudha and Vishwanath, 1999).

According to Das and Moitra (1963), feeding in herbivorous fish increases during April to June but decreases during July and August when the fish reproduce, feeding also becomes poor during winter months in Indian environment. In the present study on *L. gonius,* more or less similar phenomenon was noticed. Abiotic factors like water temperature and photoperiod, besides other factors, are known to influence food supply as well as intensity of feeding in fish (Nikolsky, 1963). Seasonal fluctuation in feeding intensity and dietary composition in fish are influenced not only by maturation of gonad but also by non- availability of food in the habitat (Sobhana and Nair, 1980). Intensity of feeding was seen to be slightly higher in male than the female *L. gonius*. Similar difference in feeding intensity of the two sexes was reported earlier in this fish (Chatterji *et al.*, 1978).

Gradual increase in RLG was noticed with the increase in fish size in *L. gonius.* Several workers have studied the correlation between alimentary canal and food habit of fish in the past (Al-Hussaini, 1949; Alikunhi and Rao,

1951; Das and Moitra, 1955). In adult fish, the alimentary canal was extremely long and highly coiled to provide a larger surface area for absorption of detritus. Smaller fish bad shorter gut length which could be related to their planktivorous feeding habit. According to Mookerjee and Ghosh (1945) the proportion of gut length to body length among carps vary due to varied nature of the diet at different stages of their development. RLG value increases gradually from fingerling to adult fish, which indicate a change from animal to plant feeding habit. Das and Srivastava (1979) also reported rise in RLG value from fingerling to adult stages in *Cirrhinus mrigala, C. reb*a and *L. calbasu* due to change from animal to plant feeding habit. Similar findings were reported in *L. rohita* and *C. mrigala* by Kamal (1964, 1967a) and in *O. belangeri* (Basudha and Vishwanath, 1999).

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