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CONSERVATION BIOLOGY OF COBITID FISH *LEPIDOCEPHALUS GUNTEA* (HAMILTON-BUCHANAN): FOOD AND FEEDING HABITS

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The paper deals with the analysis of food and various aspects of feeding biology of a rare hill stream fish *Lepidocephalus guntea* (Ham -Buch). The fish was observed to be a carni-omnivore which feeds mostly on insect larvae and nymphs. Gastro-somatic index was recorded high during March- April and lowest in the month of August which indicated that the better feeding environment was in spring which is favorable for the growth of insects and their larvae. The GaSI minima was due to monsoon floods. Slight change in feeding preference was recorded in small and large size fishes. Low values of RLG confirmed the carni-omnivorous feeding nature of *Lepidocephalus guntea*.

Analysis of food and feeding habit is one of the important aspects of fish conservation biology. It helps us in understanding the food preference of fish and also the congenial environment which supports growth of food in nature. According to Pillay[1], a comprehensive study of all available age groups, covering all the seasons and environment of its occurrence is essential in order to obtain a correct picture of nutrition and feeding adaptations. The study of ditery habits based on stomach content analysis is widely used in feeding biology[2-7]. In the present study an attempt has been made to understand the food prefernce of *Lepidocephalus guntea* (Ham -Buch), a rare hillstream fish, and its various aspects related to feeding biology from the river Mandal in Garhwal Himalaya (Fig.1)

MATERIAL AND METHODS

After recording the morphometric characters of fish, the alimentary canal was removed and its length and weight was measured with food and without food so that the relative length of gut (RLG) and Gastro-somatic Index (GaSI) can be calculated. The gut contents were removed and preserved in 4 % formaline solution. The condition of fullness of gut was noted to find out the feeding state. The food was analyzes quantitatively as well as qualitatively.

(A) Quantitative Analysis: Several researchers have employed a number of methods for the quantitative estimation of food in fresh and marine water fishes. Hynes[8] studied the stomach contents of fresh water sticklebacks by point methods and Bhimachar and George[9] worked on the basis of point and number method. In the present study the gut contents were identified with the help of microscope. The

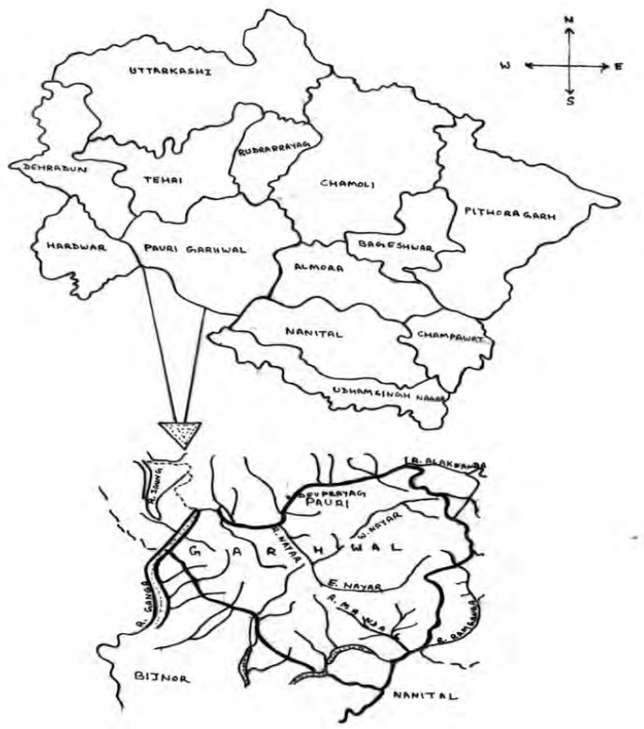

Fig. 1. Location of river Mandal in Uttarakhand

percentage of food composition was detected by the point method. Points were allotted on their relative volumes as assessed by visual estimation and converted into percentages. Some important feeding indices calculated as follows:

The Gastro- Somatic Index was calculated as:

Weight of food contents/ Weight of Fish x 100

The relative length of gut (RLG) was calculated as:

Total length of Gut/ Total length of fish

Feeding Intensity (F.I.): The feeding intensity was recorded based on the state of fullness of gut and the amount of food contained in it as:

E = when the gut is empty,

P = Poor intensity when gut is ¼,

G = Good intensity when gut is ½ to ¾,

H = High intensity when gut is more than 3/4.

RESULTS AND DISCUSSION

Monthly observations: Monthly variation in percental values of the gut contents of *Lepidocephalus guntea* during August, 2011 to July 2012 are presented in Table 1. It was noted that the dominant food items in the diet of *Lepidocephalus guntea* were Insect larvae and nymphs (50.20±9.24 in August to 73.60±11.12 % in April), Green algae (04.80±1.09 in August to 22.40±1.52 % in November) and Diatoms (8.20±2.67 in August to 18.30±5.02 % in May). The sand and debris was also found in good percentage (36.80±9.47 % in August) which indicates the bottom feeding nature of fish. Thus on the basis of quantity, it was concluded that the insects were the primary food and algae the secondary food.

Seasonal observations: Seasonal variation in the food contents of *L. guntea* are represents in Fig. 2-5. The highest percentage of Insects parts (76%) was recorded in the spring season and the minimum in monsoon (51%). The maximum percentage of Green algae was 16% in winter and minimum 4% in monsoon. Diatoms (14%) were abundant in the summer season and least (8%) in the monsoon season. Sand and debris was at its peak during monsoon 37%). Low feeding during monsoon also coincides with its breeding as also reported by several workers[10-12].

Different Food Items in Different Size Groups: To examine the pattern of food intake at different stage of life, the fish was grouped into various sizes and the consumed quality of food was noted. The results of study are presented in Table 2. It was noted that the insect food intake was more in bigger size. Nikolsky[13] suggested that variation in the composition of the food with age and size is a substantial adaptation towards increasing the range of food supply of population by enabling the species as a whole to assimilate a variety of food.

Monthly variations in Gastro-Somatic Index and Relative length of Gut: Monthly average values of Gastro-somatic Index (GaSI) and Relative Length of gut (RLG) in of *L. guntea* during August 2011 to July 2012 are presented in Table 3. The GaSI was highest in April (6. 557±2.51) from where onward it continuously decreased to reach at the lowest in August (1.216±0.92). From August onward when the quality of environment became congenial, the value of Ga SI increased and finally reached at its peak in April. Gasto-somatic index is thus an indicator of feeding status and also the availability of

Table 1. Monthly variation in percental value of the gut contents of *Lepidocephalus guntea* during 2011- 2012.

Months	Insect	Diatoms	Green algae	Sand & Debris
Aug.2011	50.20±9.24	8.20±2.67	04.80±1.09	36.80±9.47
Sep.	55.30±4.12	10.90±1.76	6.80±2.40	27.00±8.12
Oct.	59.11±8.24	12.25±2.91	07.90±3.21	20.74±1.16
Nov.	56.30±4.12	10.10±2.05	22.40±1.52	15.20±1.60
Dec.	62.10±5.07	12.80±3.72	18.05±2.20	1.05±0.04
Jan.2012	70.20±3.79	11.70±2.64	15.00±1.27	3.10±0.22
Feb.	72.10±4.67	14.20±3.12	10.60±1.96	3.10±0.27
Mar.	76.10±9.12	16.00±1.26	10.00±0.97	1.90±0.06
Apr.	73.60±11.12	10.0±4.81	15.58±0.64	1.60±0.51
May	65.40±7.09	18.30±5.02	08.00±1.53	8.30±0.35
Jun.	60.70±6.52	10.50±3.25	13.30±0.06	15.50±4.23
Jul.	51.10±7.25	08.50±0.42	02.50±0.19	37.90±3.61
Annual average	62.68±8.43	11.95±2.87	11.24±5.54	18.01±12.61

food in surroundings. Relative length of gut is an indicator of food preference of fish. In present study the RLG was observed in a range of 0.544±0.048 to 0.889±0.271 during September and April respectively. This range of values supports the observation that the fish is carni-omnivore slight increase in April is due to better feeding environment.

Table 2. Variation in food quality based on body size in *Lepidocephalus guntea*

S.No.	Size group 4.0-5.0	% of Food Items
1	Insect	79.00
2	Diatoms	10.00
3	Green matter	04.00
4	Sand and Debris	07.00
S.No.	**Size group 5.1-6.0**	**% of Food Items**
1	Insect	74.00
2	Diatoms	08.00
3	Green matter	10.00
4	Sand and Debris	08.00
S.No.	**Size group 6.1-7.0**	**% of Food Items**
1	Insect	80.00
2	Diatoms	06.00
3	Green matter	08.00
4	Sand and Debris	06.00
S.No.	**Size group 7.1-8.0**	**% of Food Items**
1	Insect	83.00
2	Diatoms	05.00
3	Green matter	05.00
4	Sand and Debris	07.00
S.No.	**Size group 8.1-9.0**	**% of Food Items**
1	Insect	87.00
2	Diatoms	03.00
3	Green matter	05.00
4	Sand and Debris	05.00

Seasonal observations on GaSI and RLG: The seasonal values of Ga SI are presented in Fig 6. It clearly indicates the better feeding environment in spring season (5.692±0.85) and the worst in monsoon (1.367±0.151).

Seasonal variation in Relative length of Gut: The data on the seasonal variation in RLG values is presented in Fig. 7. It showed lowest value in autumn (0.596±0.047) and highest in spring (0.874±0.015).

Feeding intensity: The high feeding intensity fishes (¾ to full gut) were observed during February- April when the environmental conditions were conducive for the growth of insect larvae and green algae. However the poor and empty stomach was recorded during monsoon season due to ecological and physiological stress (breeding). The occurrence of low feeding in other fishes coincide with their peak breeding has been reported by several workers[5, 14].

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Table 3. Monthly average values of Gastro-somatic Index (GaSI) and Relative Length of gut (RLG) in of *L. guntea* during August 2011 to July 2012.

Month	GaSI	Remark	RLG	Remark
Aug.	1.216±0.92	Decreasing	0.603±0.064	Decreasing
Sep.	1.692±1.56	Increasing	0.544±0.048	Increasing
Oct.	1.987±1.40	Increasing	0.587±0.087	Increasing
Nov.	2.689±1.49	Increasing	0.658±0.092	Increasing
Dec.	2.997±1.78	Increasing	0.743±0.053±	Increasing
Jan.	3.091±0.85	Slow increasing	0.724 ±0.261	Slow Down fall
Feb.	3.429±0.80	Increasing	0.747±0.142	Increasing
Mar.	4.849±1.52	Increasing	0.859±0.128	Increasing
Apr.	6. 557±2.51	High	0.889±0.271	High
May	5.021±1.63	Down fall	0.862±0.122	Down fall
Jun.	1.944±0.87	Decreasing	0.751±0.029	Decreasing
Jul.	1.518±1.39	Decreasing	0.647±0.043	Decreasing

(Average ± SD)

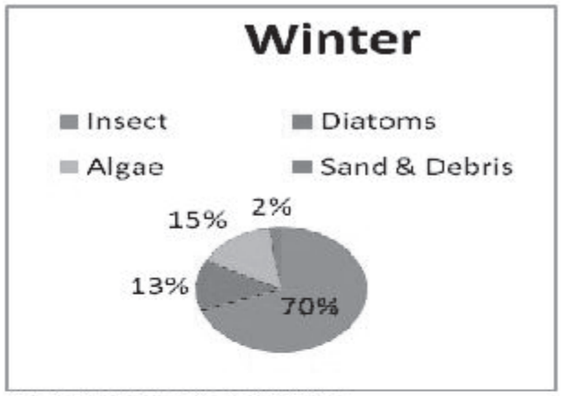

Fig. 2. Food percentage in Winter.

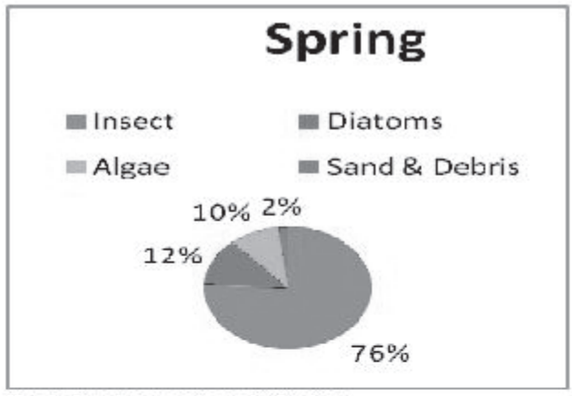

Fig. 3. Food percentage in Spring

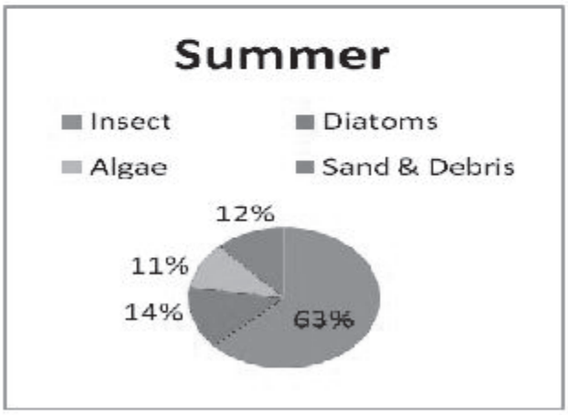

Fig. 4. Food percentage in Summer.

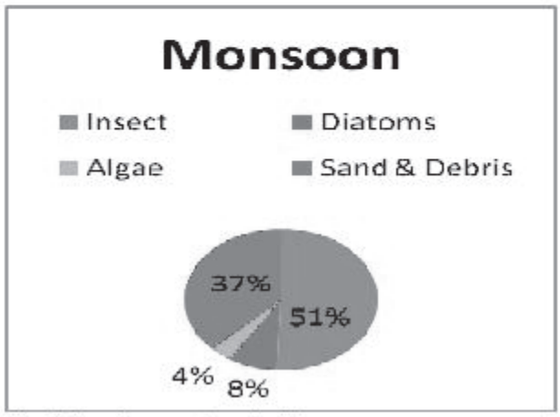

Fig. 5. Food percentage in Monsoon

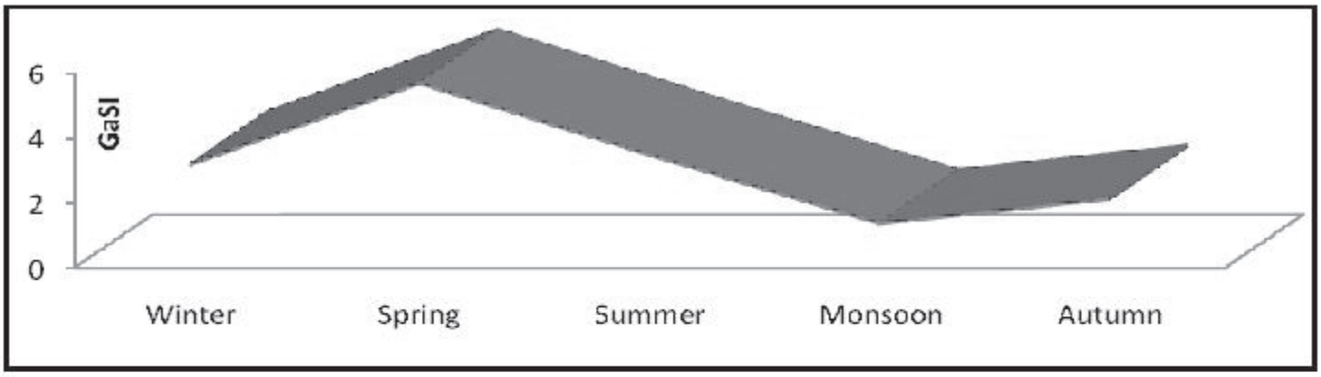

Fig. 6. Seasonal average value of Gastro-Somatic Index (GaSI) in *L. guntea* during August 2011 to July 2012.

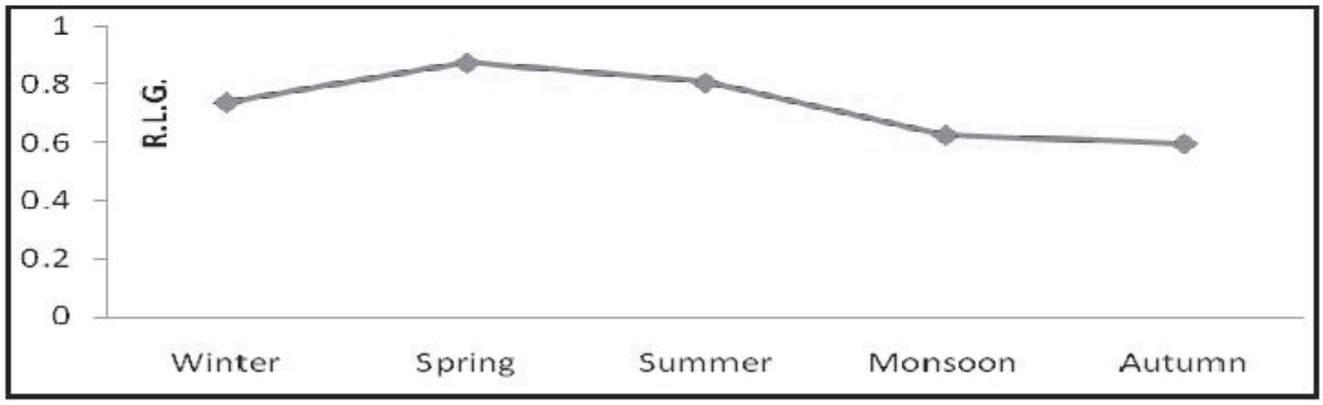

Fig. 7. Seasonal average value of Relative length of gut (RLG) in *L. guntea* during 2011 to July 2012.

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