

Investigating the Gut Contents of the Indian Major Carp (*Labeo catla*) in Bargi Reservoir, Jabalpur, Madhya Pradesh: An Exploration of Dietary Patterns

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Abstract:- This research delves into an examination of the gut contents of the Indian major carp, *Labeo catla*, sourced from the Rani Awanti Bai Sagar reservoir (Bargi reservoir) in Madhya Pradesh, India. Over the period from September 2022 to January 2023, monthly samples were systematically collected for a detailed analysis of the fish's dietary habits. The study aimed to elucidate the quantity and composition of food components consumed by *Labeo catla*, offering insights into its feeding behavior. Key parameters such as the examination of *Labeo catla* dietary patterns involved the utilization of various metrics, including the percentage volume of food items (% Vi), the percentage of occurrence of specific food items (%Oi), the Index of Preponderance, and the grading of food items. These parameters were employed to comprehensively assess the feeding habits of *Labeo catla* without replicating existing content. The results underscore a planktivorous feeding habit in the Indian major carp, revealing its predominant reliance on plankton. These findings contribute to a comprehensive understanding of the ecological dynamics and dietary preferences of *Labeo catla* in the Rani Awanti Bai Sagar reservoir, providing a foundation for informed fisheries management strategies and conservation efforts.

Keywords:- Gut Content Analysis, Index of Preponderance, *Labeo catla*, Bargi Reservoir.

I. INTRODUCTION

Fish play a vital role in human existence by serving as a significant source of protein and providing various valuable products and economic food for many nations. However, the depletion of commercial fish stocks due to overexploitation and habitat alterations has led to the emergence of fish biology as a scientific field. Fisheries management aims to address economic, social, and biological factors affecting fish stocks in order to develop strategies that meet societal feeding requirements without depleting fish populations (FAO, 2003)

India, endowed with abundant marine and inland resources, including expansive reservoirs, holds the potential to enhance its fish production. Reservoirs, such as the Rani Awanti Bai Sagar reservoir in Madhya Pradesh, exhibit a coexistence of lacustrine and fluvial conditions. This study aims to gather crucial biological information on the commercially significant diversity of fish species,

specifically focusing on Indian Major Carps, within the Rani Awanti Bai Sagar reservoir. The biological insights are gleaned through the comprehensive examination of the gut contents of these fish species.

Gut content analysis stands as a pivotal aspect of studying aquatic communities, offering insights into trophic relationships and alterations in fish life histories. The examination of stomach contents provides valuable information on the actual eating habits and dietary composition of fish species. Examining the gut contents of fish offers crucial insights into their feeding patterns, enabling both qualitative and quantitative assessments of their feeding habits. The data on diet and food habits play a valuable role in decision-making processes concerning natural resources, as highlighted by Kido (1996). Qualitative and quantitative dietary analysis conducted in natural habitats enhances our understanding of fish growth, abundance, and water body productivity (Nansimole *et al.*, 2014). It also helps describe food habits and feeding patterns of fish species (Ekpo *et al.*, 2014). Analyzing stomach contents contributes significant information to fisheries management, as it integrates important ecological components such as behaviour, condition, habitat use, energy intake, and inter/intra-specific interactions (Zacharia, 2017).

Understanding the significance of different food items in the gut contents of fish, based on their index of preponderance and grading, is vital for assessing factors like growth, survival, size distribution, and reproductive success. This knowledge is crucial for effective management and conservation of valuable fish resources. Profound insights into gut content analysis, including food and feeding habits, serve as essential criteria for selecting cultivable species and ensuring success in fish farming. By studying the dietary composition of Indian Major Carp, the research will offer insights into the growth patterns and overall health of the population, aiding in the development of effective scientific management strategies.

II. MATERIALS AND METHODS

The study aimed to investigate the gut contents of Indian major carp *Labeo catla* from the Bargi reservoir.

➤ *Location of Field Study –*

The samples of experimental fish *Labeo catla* were collected from Bargi reservoir of district Jabalpur, Madhya Pradesh, India as shown in figure 01. From September 2022 to January 2023, experimental fish samples of *Labeo catla*

were gathered from the Bargi Reservoir in the Jabalpur district of Madhya Pradesh, India. The collaboration with local fishermen streamlined and facilitated the sample collection process. The Bargi Reservoir, also known as Rani Awanti Bai Sagar, is positioned 43 km downstream of Jabalpur city, with geographical coordinates at latitude 22°56'30"N and longitude 79°55'30"E. It boasts a substantial catchment area covering 14556 km² and spans a length of 5374.39 m. Situated near the village of Bargi in the Jabalpur district, the reservoir plays a significant role in this study.



Fig 1 Location and Catchment Area of Rani Awanti Bai Sagar Reservoir in Madhya Pradesh www.mapsofindia.com

➤ *Site Selection –*

The Fish samples were collected from the two landing centers of the Bargi reservoir in Jabalpur. The fish catch obtained from the reservoir by the fishermen was brought to the two weighing centres.

Table 1 Location of the Sampling Sites

Site	Location	Place	Coordinates	
			Latitude (°E)	Longitude (°N)
A.	Zero tanky	Bargi, Jabalpur	22°92'480	79°90'290
B.	Papri	Bargi, Jabalpur	22°94'726	79°96'461

➤ *Fish Sample Collection, Identification and Preservation*–

Fish samples were collected from both the sampling stations. The samples collected were sorted, identified, and measured for their corresponding length and weight. The total stock of the Bargi reservoir comprises of many different species. Out of these the required fish species were identified and graded by their size. Fishes were identified using the identification guides of Day (1888), Jayram (2010) and Talwar and Jhingran (1991). The specimens were then taken for the analysis of the gut contents in the ice box to the laboratory of Department of Fisheries resource management, College of Fishery Science, Nanaji Deshmukh Veterinary Science University, Adhartaal, Jabalpur.

➤ *Experimental Work* –

The experimental work was done at the laboratory in the Department of Fisheries Resource Management, College of Fishery Science, Jabalpur (M.P.). Fish was brought to the laboratory dissected and the stomach of the fish was removed. Total Gut Length and weight of the stomach of the collected fish specimens was measured. The stomach was then longitudinally cut and all the gut contents were taken out in a petri dish and examined under the microscope.

➤ *Estimation of Gut Contents* –

The gut content analysis was done using the percent composition of each food item through the frequency of occurrence (Numerical method) and volume displacement method (Hynes, 1950). The food items were identified under a microscope by following the keys of Prescott (1951), Ward and Whipple (1959) and Needham and Needham (1962).

• *Volumetric Method* –

Volume Percentage of each food item evaluated by the following formula (Hynes, 1950). The volume of specific food is expressed as the ratio between volume of individual food item and total volume of gut contents.

Percentage by Volume (Vi%)

$$= \frac{\text{Volume of individual food item (} V_i)}{\text{Total volume of gut contents (} V_t)} \times 100$$

• *Occurrence Method* –

The number of stomachs in which each item occurs recorded and expressed as a percentage of the total number of stomachs examined (Bagenal,1978).

Frequency of Occurrence (Oi)

$$\% = \frac{\text{Number of times an item occurred (} N_i)}{\text{Total number of stomachs analyzed (} N_t)} \times 100$$

• *Index of Preponderance* –

The Index of Preponderance, as introduced by Natarajan and Jhingran (1961), serves as a tool for identifying the most significant food item consumed by fish. However, it is important to note a limitation of this technique: it does not differentiate between the importance of food items based on weight or occurrence, making it unsuitable for dietary comparisons, as pointed out by Marshall and Elliott (1997). The Index of Preponderance was calculated using the following formula.

$$I_i = \frac{V_i \times O_i}{\sum V_i \times O_i} \times 100$$

Where, V_i and O_i are the volume and occurrence index of food item i .

III. RESULTS

The collected *Labeo catla* specimens ranged in length from 20.2 cm to 58.4 cm, with weights ranging from 913.21 g to 3473.56 g. The study observed a higher abundance of *Labeo catla* within the length groups of 20-25 cm and 35-40 cm. In this study, the examination of *Labeo catla* stomachs involved the collection of two to three specimens of each species during each sampling period for subsequent laboratory analysis. The gut content analysis, employing various parameters, yielded crucial insights into the Indian Major Carp (IMC) population in the Bargi reservoir. Notably, the presence or absence of food in the stomachs varied from month to month among the sampled specimens. The results, including the Index of Preponderance and the Grading of different food items in the gut contents of *Labeo catla*, are presented in Table 2.

Table 2 Index of Preponderance and Grading of Various Food Items of Gut Contents of Fingerlings of Indian major Carp, *Labeo catla* from Bargi Reservoir of District Jabalpur, Madhya Pradesh, India.

Food components	% composition of food contents		Vi * Oi	Preponderance index	Grading
	Volume (Vi)	Occurrence (Oi)			
Zooplankton	52.02	50.16	2609.323	70.176	I
Phytoplankton	32.18	30.74	989.213	26.604	II
Insects	8.04	10.32	82.972	2.231	III
Plant matter	4.96	5.62	27.875	0.749	IV
Decay matter	2.80	3.16	8.848	0.237	V
TOTAL	100	100	3718.232	100	

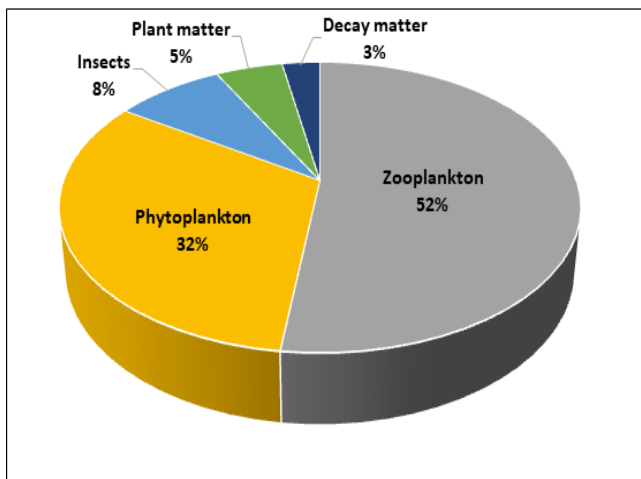


Fig 2 Composition of Food Contents in Volume % in *Labeo catla*

In the stomachs of *Labeo catla*, zooplankton emerged as the dominant item, constituting 52.02% by volume and 50.16% by occurrence. The study also identified the presence of diverse phytoplankton groups, encompassing Chlorophyceae, Cynophyceae, Euglenophyceae, and Bacillariophyceae, within the Bargi reservoir. Diatoms, specifically, were identified as the predominant phytoplankton group in the fish gut. Microcystis represented the Cynophyceae category. The fish gut also contained various zooplankton, including rotifers, protozoa, cladocaras, and copepods, with copepoda and rotifera being particularly abundant. Based on these findings, it can be conclusively stated that *Labeo catla* exhibits planktivorous feeding habits, primarily relying on zooplankton as a significant dietary component in the Bargi reservoir.

IV. DISCUSSION

The investigation utilized the index of preponderance and index of fullness to gain valuable insights into the favored food choices and feeding habits of Indian major carps. The findings notably demonstrated that *Labeo catla* exhibited a marked preference for zooplankton, indicative of its planktivorous nature, a trend consistent with earlier studies conducted by Hora and Pillay (1962) and Lalit et al. (2015). The observed correlation between the availability of food items and the preferences of *Labeo catla* provides valuable information about the species' feeding habits, offering potential guidance for fisheries management strategies in aquatic environments.

This aligns with the findings of Verma et al. (2020), who reported a predilection of major carps for phytoplankton and vegetable matter. Moreover, historical studies by Mookerjee (1944), Mookerjee, Gupta, and Choudhary (1946), Chacko and Kurien (1950-51), Misra (1953), Das and Moitra (1955), and Prowse (1957) have also delved into the dietary preferences and related aspects of these fish species. The collective body of research underscores the significance of understanding the food choices and feeding patterns of Indian major carps, providing a foundation for effective fisheries management and conservation strategies in aquatic ecosystems.

V. CONCLUSION

In light of the current investigation, our findings lead to the conclusion that the Indian Major Carp, *Labeo catla* (*catla*), predominantly functions as a plankton feeder, engaging with a diverse diet that includes zooplankton, phytoplankton, insects, plant matter, and decay matter. The Index of Preponderance emerged as a valuable tool, elucidating the preferred food components present in the fish's gut. Notably, in *Labeo catla*, the highest percentage was attributed to zooplankton, designating this species as a planktivorous fish. The observed positive selection for zooplanktonic organisms in the sampled fish specimens further underscores the significance of this component in the diet of *Labeo catla*. This comprehensive understanding of the feeding preferences and habits of *Labeo catla* contributes valuable insights to the broader knowledge of its ecological role and informs potential avenues for effective fisheries management and conservation efforts.

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