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Gut content analysis of *Labeo rohita* from Belan River, Prayagraj

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Abstract
The feeding profile of *Labeo rohita* in Belan River in India was studied to understand their feeding habits and dietary preferences. In order to the study of food and feeding habit of Indian Major Carp, *Labeo rohita* samples were collected from the commercial catches during 2021 December to February 2022 at two different sites of Belan River at Prayagraj, Uttar Pradesh. During this sampling process, I have collected 247 samples of *Labeo rohita* in which 124 are male and 123 are female. The analysis of gut content of the *Labeo rohita* revealed that phytoplankton formed main food item, next important food item is plant items and remaining of unidentified items. It was also seen that there were considerable variations in the percentage of different food items in the gut of fishes. The results showed that *Labeo rohita* are herbivorous. However, *Labeo rohita* had a higher preference for plant-based food items. The study also highlighted the importance of environmental factors such as water temperature and flow rate in determining the feeding habits of these fish.

Keywords: Gut content analysis, *Labeo rohita*, Belan river

Introduction

Gut content analysis is a fundamental method in ecological studies used to understand the feeding habits and dietary preferences of aquatic organisms. In the context of freshwater fish species, such as *Labeo rohita* (Rohu), this analysis provides crucial insights into their ecological roles, food web interactions, and habitat preferences.

With the advent of more advanced molecular and isotopic techniques, direct analysis remains favored in most biological studies due to its simplicity, cost-effectiveness, and reliability (Braga *et al*., 2012) [2]. Its great potential lies in providing accurate and immediate insights into the feeding behavior of fish, making it a valuable tool in both research and applied fisheries management. The gut content analysis of *Labeo rohita* is a vital tool for fisheries science, providing key information on their dietary habits, ecological roles, and implications for aquaculture and conservation efforts. Direct gut content analysis, usually performed by dissecting or evacuating the digestive tract, continues to be the most commonly used and straightforward method for examining the diets of aquatic organisms. This approach entails analyzing the gut contents to identify and measure the consumed food items (Manko, 2016) [12].

Fish is an excellent source of protein, as well as essential vitamins and minerals (Tiwari *et al*., 2014) [16]. New insights into the role of omega-3 fatty acids in human physiology, along with their abundance in fish, have highlighted the growing importance of fish in health and nutrition (Dwivedi *et al*., 2016) [7]. The analysis of their gut contents can help elucidate the availability of different food sources in their habitats and how these fish utilize these resources throughout their growth stages.

Purpose of Study

The present study will be the first study in the Belan river at Prayagraj region to determine the fish biology of *Labeo rohita*. This fish species are overexploited in the Ganga river and their large tributaries. Due to overexploitation and invasion of exotic fish species, stocks especially brooders (matured fishes) are dramatically declined in the Ganga river. Shortage of brooder, recruitment process and stock of IMC are unbalanced in the Ganga river. Current time, proper recruitment and stock maintenance of IMC are maintaining by small rivers or tributaries in the Ganga river system. Therefore, it will be interesting to know food and feeding of *Labeo rohita* from the Belan river. This study will be a revolutionary for the near future, in view of industrialization, urbanization and anthropogenic activities in the Belan Valley region or Belan river basin.

Material and Method

Study Area: The Belan River is a perennial river and joins the Tons River at Chakghat, which flows north ward to the Ganga Plain south of Prayagraj, Uttar Pradesh. It originates from western part of Sonbhadra district then flows in southern part of Mirzapur and Prayagraj districts, Uttar Pradesh. The river Belan is a central Indian river occupies a low-relief valley cut into Proterozoic quartzite of the Vindhyan Group about 80 km southeast of Prayagraj (Gibling *et al*. 2008) [8]. For the present study, we will collect the samples from two different sites namely Devghat and Bhogan village in Prayagraj district, Uttar Pradesh.

Sampling: Food and feeding estimated by drop method. The guts were analysed qualitatively as well as quantitatively, volumetrically (Pillay 1952) [13] and occurrence method (Hynes 1950) [9] for evaluating the relative importance of all food items. The Indian major carp, *Labeo rohita* can be collected from the two selected sites of Belan River and from its fish market. Their intestine removes out from those samples. The intestine was placed in 10% formalin also label the sample with date, place of collection and number of the samples. The collected samples will preserve and bring to the laboratory for the further identification.

Result

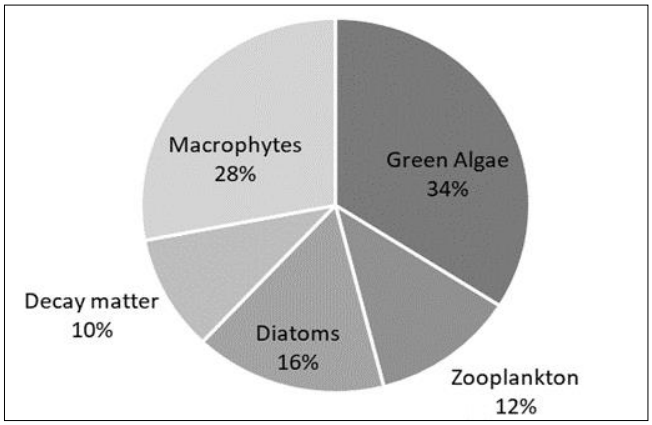
Rohu primarily feeds in the bottom and mid-water columns of its aquatic habitat. At this early stage, young fry relies

heavily on zooplankton, which provides essential proteins and amino acids necessary for rapid growth and development. Fingerlings start to incorporate more plant-based material into their diet, including vegetable debris and minute aquatic plants. This shift reflects their transition towards an herbivorous diet as they grow. Adult Rohu are primarily herbivorous, feeding on a variety of plant-based materials. Their diet includes vegetable debris, small aquatic plants, detritus, and even mud, which may contain organic matter and microorganisms. This diverse diet helps sustain their nutritional needs and supports their overall health and growth. The diet of *Labeo rohita* changes significantly from zooplankton in the fry stage to predominantly plant-based materials in adulthood. These feeding adaptations reflect the fish's ability to exploit different food resources available in its habitat, ensuring optimal growth and survival at each life stage. The inclusion of detritus and mud in the adult diet indicates an opportunistic feeding strategy, allowing the fish to obtain a broad spectrum of nutrients from various sources.

Name of Gut content	**Site 1**	**Site 2**			
Blue-green algae			Nitzschia	+	+
Nostoc	+	+	Synedra	+	+
Polycystis	+	+	Surirella	+	+
Merismopedia	+	+	Aulcoseria	+	+
Anabaena	+	+	Achnanthidium	+	+
Oscillatoria	+	+	Achnanthes	+	+
Spirulina	+				
			Desmids		
Green algae			Cosmarium	+	+
Ankistrodesmus	+	+	Closterium	+	+
Chaetophora	+	+			
Chlorella	+	+	**Diptera**		
Chlorococcus	+		Chironomus	+	+
Chladophora	+	+	Forciponiya	+	+
Microsporas	+	+	Tabanus	+	+
Oedogonium	+	+	Tipula		+
Pediastrum	+	+			
Phacus		+	**Protozoans**		
Scenedesmus	+	+	Acrella	+	+
Selenastrum	+	+	Chilidon	+	+
Spirogyra	+	+	Difflugia	+	
Tetraspora	+	+	Epistylis	+	+
Ulothrix	+	+	Euglena	+	+
Volvox	+	+	Paramecium	+	+
Zygnema	+		Vorticella	+	
Stylonichia	+				
Scenedesmus	+	+	**Rotifer**		
			Asplanchana	+	
Diatoms			Brachionus		+
Bacillaria	+	+	Keratella	+	+
Cymbella	+	+	Filina		+
Diatoma	+		Polyarthra	+	+
Neidium		+	Monostyla	+	+
Nupela	+				
Epithemia		+	**Annalida**		
Cyclotella	+	+	Tubifex	+	+
Aulcoseria	+	+	Lumbriculus	+	+
Frustulia	+	+			
Rhopalodia		+	**Crustacea**		
Melosira	+	+	Cyclops	+	+
Gomphonema		+	Diaptomus	+	+
Amphora	+		Mesocyclops	+	
Fragilaria	+	+	Daphnia	+	+
Navicula	+	+	Eurycerus	+	+

Analysis of Gut Content of *Labeo Rohita*

Understanding the feeding habits of *Labeo rohita* is crucial for effective management in aquaculture and natural habitats, ensuring that appropriate food resources are available to support the health and growth of this important species.



Different Food Materials Present in Gut of *Labeo Rohita*

The provided pie chart illustrates the gut content composition of *Labeo rohita*, a species of freshwater fish commonly known as Rohu. The chart is divided into five distinct categories, each representing a different type of consumed matter. The percentage values indicate the proportion of each category found within the gut content.

Conclusion

Gut content analysis showed that the availability and preference of food items by the fish helps to find out the feeding habit of fish and accordingly fisheries management in the water-body. From the present study, it was concluded that the gut contains of major carps consists of phytoplanktons, zooplanktons, diatoms, decaying plant and animals' organic material which confirms the feeding habits of the major carps. On the basis of present study, it can be concluded that the adult *Labeo rohita* is a herbivorous and column feeder, preferring phytoplankton and submerged aquatic plants. It is reported that *Labeo rohita* had a positive selection for most phytoplanktonic organisms as well as submerged macro-vegetation. In the present study, decay matter was the dominant food component followed by phytoplankton, zooplankton, plant materials and insects in the fish gut.

Overall Analysis

Biodiversity and Adaptability: Both sites exhibit a diverse range of organisms, with many genera present at both locations, indicating common environmental features that support a wide variety of species.

Site-Specific Conditions: The presence of certain taxa only at one site suggests differences in environmental conditions such as pH, nutrient levels, or habitat types. For example, the presence of Spirulina at Site 1 but not Site 2 suggests alkaline conditions at Site 1, while differences in algae and diatom communities indicate variations in nutrient availability or water quality.

Diatom Diversity: The diversity in diatoms, with some genera appearing only at one site, may reflect differences in water chemistry or nutrient availability between the sites.

Ecological Implications: The data suggests that both sites have relatively healthy aquatic environments but with some specific differences that affect the distribution of various organisms.

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