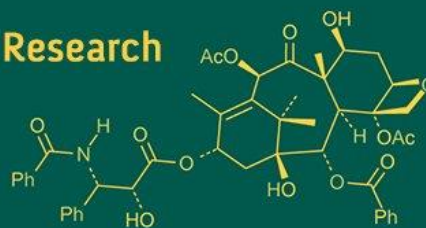
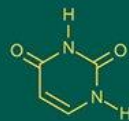
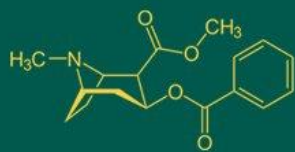


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Comparative study of relative gut length in *Puntius sophore* and *Rasbora daniconius*

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Abstract

The present study investigated the relative gut length (RGL) and feeding habits of two small indigenous fish species, *Puntius sophore* and *Rasbora daniconius*, collected from Tighra Dam, Gwalior, Madhya Pradesh. Fish specimens were collected throughout the study period, and morphometric measurements including total length, body weight, and gut length were recorded. RGL was calculated as the ratio of gut length to total length and used as an indicator of feeding behaviour. The annual mean RGL of *P. sophore* females (1.12 ± 0.04) and *R. daniconius* females (1.38 ± 0.10) indicated omnivorous feeding habits, whereas *P. sophore* males (0.83 ± 0.05) exhibited a tendency towards carnivory. Statistical analysis revealed a significant difference in RGL between *P. sophore* and *R. daniconius* females ($p < 0.05$). The findings demonstrate that relative gut length is a reliable morphometric index for assessing feeding adaptations, trophic ecology, and resource utilization in small indigenous freshwater fishes.

Keywords: *Puntius sophore*, *Rasbora daniconius*, Relative gut length, Feeding habit, Small indigenous fish species

Introduction

Small indigenous fish species (SIS) have gained significant attention in recent years due to their exceptional nutritional value. According to Sinha *et al.* (2024)^[9], SIS are nutrient-dense, widely available in rural waterscapes, and commonly eaten whole, delivering bioavailable vitamin A, iron, zinc, calcium, vitamin B12, quality protein, and omega-3 fatty acids. The relative gut length (RLG) is a significant morphometric parameter that indicates the feeding behaviour of fish species. RLG is determined as the ratio of gut length to total body length and act as a marker of dietary preference. Recent comprehensive studies on diet and habitat as determinants of intestine length in fishes have established that intestinal indices differ significantly between dietary groups, with freshwater fish showing significantly longer intestines than marine species (Duque-Correa *et al.*, 2024)^[2].

Both *Puntius sophore* and *Rasbora daniconius* demonstrated omnivorous feeding habits, feeding on algae, aquatic plants, Zooplankton and organic detritus. Comparative analysis of gut morphology and RLG between these species will provide information into their ecological niches, dietary segregation, and potential for polyculture systems.

Materials and Methods

Collection of Experimental Fish

Specimens of *Puntius sophore* and *Rasbora daniconius* were collected from Tighra Dam Gwalior, Madhya Pradesh habitats during the study period using cast nets and hand nets. After collection, the fish were cleaned thoroughly using freshwater and transferred carefully to the laboratory in ice containers to maintain their freshness.

Species Identification

The collected specimens were identified using standard taxonomic keys based on their external morphological and meristic characteristics.

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Recording of Morphometric Measurements

The total length of each fish was measured from the anterior tip of the snout to the posterior end of the caudal fin using a measuring scale. Body weight was determined using a digital weighing balance for accurate measurements.

Dissection and Measurement of Gut Length

Each specimen was carefully dissected along the ventral surface using sterilized dissecting tools. The alimentary canal was gently removed to avoid damage to the intestine. Gut length was accurately measured using a thread and a measuring scale after removing excess moisture.

Estimation of Relative Gut Length

Relative Gut Length (RGL) was determined by dividing the gut length by the total body length using the following formula:

$$\text{RGL} = \text{Gut length} / \text{Total Length}$$

The calculated RGL values were used to compare the feeding adaptation and dietary behavior of both fish species.

Statistical Analysis

All collected observations were arranged systematically in tabular form and are represented as mean $\pm$ standard deviation. A comparative evaluation of RGL between the two species was performed using appropriate statistical methods and graphical presentations.

Result and Discussion

Relative Length of Gut (RLG) and Feeding Habits

The Relative Length of Gut (RLG) is a widely used morphological indicator of the feeding habit and trophic level of fish species (Al-Hussaini, 1949; Ward and Whipple, 1959; Karachle and Stergiou, 2010) [1, 4, 10]. It is calculated as $\text{RLG} = \text{Gut Length} / \text{Total Length}$. The classification criteria are: $\text{RLG} < 1$ indicates carnivorous feeding (shorter gut for rapid digestion of protein-rich animal food); RLG between 1 and 3 indicates omnivorous feeding (intermediate gut length for mixed diet); and $\text{RLG} > 3$ indicates herbivorous feeding (longer gut for digestion of cellulose-rich plant material). This classification, while simplified, has been widely validated and remains a useful first-order indicator of dietary preference in field studies where detailed gut content analysis is not feasible for all specimens (Kapoor et al., 1975) [3].

Table 3.1: Monthly variation in Relative Length of Gut (RLG) of *P. sophore* and *R. daniconius* from Tighra Dam, Gwalior

Month	<i>P.s</i> ♀ RLG	<i>P.s</i> ♂ RLG	<i>R.d</i> ♀ RLG
January	0.69 $\pm$ 0.06	--	1.56 $\pm$ 0.32
February	1.48 $\pm$ 0.22	1.00 $\pm$ 0.28	1.56 $\pm$ 0.34
March	1.15 $\pm$ 0.11	0.90 $\pm$ 0.29	0.90 $\pm$ 0.22
April	1.34 $\pm$ 0.19	0.52 $\pm$ 0.08	1.37 $\pm$ 0.19
May	1.07 $\pm$ 0.20	0.97 $\pm$ 0.19	1.82 $\pm$ 0.64
June	1.21 $\pm$ 0.16	0.81 $\pm$ 0.16	1.26 $\pm$ 0.32
July	1.31 $\pm$ 0.11	0.76 $\pm$ 0.14	1.29 $\pm$ 0.22
August	0.93 $\pm$ 0.08	--	1.00 $\pm$ 0.23
September	1.18 $\pm$ 0.08	0.88 $\pm$ 0.07	1.16 $\pm$ 0.00
October	0.97 $\pm$ 0.12	0.80 $\pm$ 0.12	1.41 $\pm$ 0.20
November	1.00 $\pm$ 0.21	0.93 $\pm$ 0.11	1.97 $\pm$ 0.76
December	0.66 $\pm$ 0.01	0.72 $\pm$ 0.27	1.21 $\pm$ 0.10
Annual	1.12 $\pm$ 0.04	0.83 $\pm$ 0.05	1.38 $\pm$ 0.10

Feeding: $\text{RLG} < 1$ = Carnivorous; $1 < \text{RLG} < 3$ = Omnivorous; > 3 = Herbivorous (Al-Hussaini, 1949) [1]

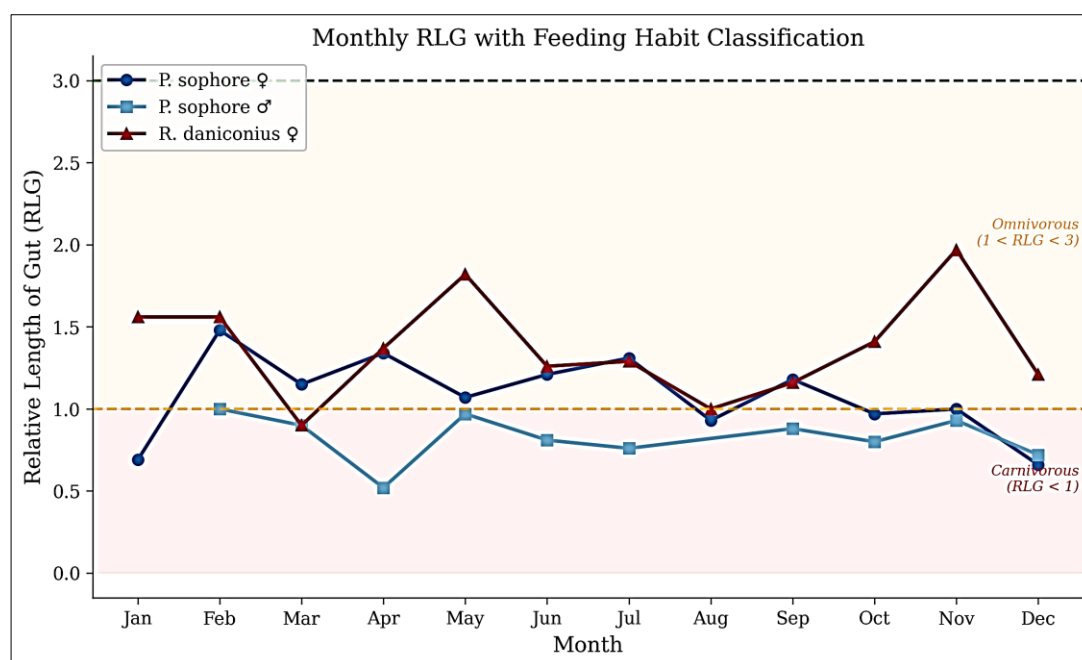


Fig 3.1: Comparative bar/line graph showing monthly RLG of *P. sophore* (♀, ♂) and *R. daniconius* (♀) with horizontal reference lines at $\text{RLG} = 1$ and 3 for feeding habit classification

The annual mean RLG for *P. sophore* females (1.12 ± 0.04) classifies this species as omnivorous, while the male annual mean (0.83 ± 0.05) suggests a carnivorous tendency. *R. daniconius* females showed the highest RLG (1.38 ± 0.10), also classified as omnivorous but with a tendency towards plant-based feeding. The independent t-test revealed a significant difference between *P. sophore* and *R. daniconius* females ($t = -2.289$, $p = 0.024$, Cohen's $d = 0.36$).

The omnivorous classification of *P. sophore* is well-supported by published literature. Mitra et al. (2006) described *P. sophore* as herbivorous, while Kiran (2015) reported a mixed diet with phytoplankton dominance, and Risal et al. (2019)^[5, 6, 7] documented omnivorous feeding with green algae dominance (40.6%) in the Singhiya River, Nepal. The discrepancies in reported feeding habits likely reflect the opportunistic feeding nature of this species and habitat-specific food availability (Shafi and Quddus, 2001)^[8]. The sex-specific difference in RLG observed in the present study (females omnivorous, males tending towards carnivorous) may indicate differential dietary preferences between sexes, possibly related to sex-specific nutritional requirements during the reproductive season, where females may consume more plant material for energy storage during vitellogenesis (Wootton, 1990)^[11].

Conclusion

The findings of the present investigation revealed clear differences in the relative gut length (RGL) of *Puntius sophore* and *Rasbora daniconius*, which may be associated with variations in their feeding behavior and dietary preference. Differences in gut structure indicate that both species utilize available food resources differently within the freshwater environment. The study also showed that relative gut length is a useful parameter for evaluating the feeding adaptation and trophic characteristics of fishes. Overall, this investigation

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