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Morphology and Meristic Biology of *Puntius chola* (Hamilton 1822) (Cyprinidae: Cypriniformes): A Freshwater Species of Ramgarh Lake, Gorakhpur, Uttar Pradesh, India

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Abstract: *Puntius chola*, a freshwater fish species of the family Cyprinidae was described by Hamilton (1822). The species is widely spread almost all parts of India. It also has high economic value because of its high consumption rate and it is also famous for its morphological features. This study represents the morphological and meristic characters of this threatened species. 30 specimens of *P. chola* were collected from Ramgarh lake during the period of July 2023- January 2024 by the help of local fishermen. A magnifying glass was used to count the fin rays. Moreover, total of eight, different lengths (e.g., TL, SL, PrDL etc.) were determined by using slide caliper and the total body weight (BW) was recorded by an electronic balance with 0.01 g accuracy for each individuals. Maximum and minimum size of this fish are - total length (TH) is 47.3-64.8 mm and body weight (BW) 1.5-3.9 g. The fin formula of *P. chola* is dorsal fin rays (DFR) 8-10. Pectoral fin rays (PcFR) 1; anal fin rays, (AFR) 3-5 and caudal fin rays 16-18 lateral line scale (LLS) 26-28. The study will be helpful in species identification and stock assessment of Ramgarh lake and its adjacent aquatic ecosystem.

Keywords: Morphology, Meristic count, *Puntius*, Fin rays, Cyprinidae

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Introduction

Earlier time due to the lack of genetic, physiological, behavioral, and ecological research, fish morphological traits have historically been the key source of knowledge (Kapuri *et al.*, 2020). Tropical freshwater fish *Puntius* belong to the Cyprinidae family. *Puntius chola* was described

by Hamilton (1822) from West Bengal, India. *Puntius*, are known to be abundant and to inhabit every niche. There are more than 140 species, mostly from the Eastern and Western Ghats and the Eastern Himalayas, form the genus *Puntius*. However, Sinha (1994) and Sarma *et al.* (2004)



Fig. 1: Ramgarh lake, Gorakhpur, Uttar Pradesh, India (Source: Google map).

reported 12 species of *Puntius* from north eastern India and 7 species from the Brahmaputra valley zone. Barman (2007) mentioned ten species that are native to West Bengal. *P. chola* is one of the most common species among them and commonly called as swamp barb. Naturally, for systematic ichthyologists, morphology continues to be the principal source of taxonomic features. Species can be recognized, identified, and classified due to their distinctive shapes, sizes, colour patterns, fin dispositions, and other outward characteristics, and the fish species may be easily and accurately identified in laboratories and in their natural environments with the aid of morphometric and meristic features (Jayaram, 1999). The Greek terms "morph," which means shape or form, and "metron," which means measurement, are the roots of the word "morphometrics" while the word meristic word is also greek word which means modification in number (Chaudhary and Dutta, 2013). These methods focus on measuring shape variation both within and across samples, typically to address concerns of evolution and development concerning the evolution of shape during growth. Studies on the morphological and meristic characteristics of fish provide an important information about the precise species identification key (Dhanya *et al.*, 2004). The

identification of fish species and their habitat, together with ecological parameters in any stream, lake, or sea, depends on morphometric features. The study of variation and change in the form (size and shape) of organisms or things is known as morphometrics (Rohlf, 1993). Three primary methods are used in traditional morphometrics to attempt to separate shape from size variation: regression, multivariate factor or component analysis, and ratios (Humpheries, 1981; Bookstein *et al.*, 1985). Morphometric measurements are commonly used to identify and classify fishes (Begenal and Tesch, 1987).

To accurately identify them, ascertain the relationship between different features, and estimate various statistical values based on morphometric data, morphometric and meristic characterization have been conducted. *Puntius* genus is very significant since it contains a large number of food-producing, ornamental, oil-extracting, and medicinal species, among other species. In fisheries biology, morphometric features are frequently employed as effective instruments for assessing the discreteness and interrelationships between diverse taxonomic groups (Quilang *et al.*, 2007). This study represents the morphological and meristic characters of a freshwater fish *Puntius chola*.

Table 1: Morphometric measurement of the *Puntius chola* (Hemilton, 1822) (n=30) captured from Ramgarh lake, Gorakhpur, India

S. No.	Measurement	Minimum (mm)	Maximum (mm)	Mean (mm)	Standard derivation
1.	Total length	47.3	64.8	58.04	6.11
2.	Standard length	37.4	53.1	47.49	5.58
3.	Pre – dorsal length	15.1	30.4	25.17	5.21
4.	Pre- pectoral length	8.30	16	12.93	2.73
5.	Pre- pelvic length	12.2	28.1	23.35	5.02
6.	Pre-anal length	24.9	38	33.73	4.59
7.	Post- dorsal length	18.4	31.2	26.74	4.36
8.	Body Weigth (g)	1.5	3.9	3.01	0.7

Materials and Methods

The current study was carried out in the Ramgarh lake of Gorakhpur district of Uttar Pradesh (latitude is 26.7321°N; 83.4056°E). A total of 30 individuals of *Puntius chola* were collected between July 2023 and January 2024. The fish was collected by fishermen with the help of various customary fishing gears such as cast net (mesh size: 1.0-2.0 cm), gill nets (mesh size: 1.5-2.5 cm), and square lift nets (mesh size: ~1.0 cm). The collected specimen were preserved in 10% buffered formalin and brought to the laboratory (Department of Zoology, St. Andrews College, Gorakhpur, UP, India).

Instrument for measurement:

Using a magnifying glass, the total number of fin rays was counted. An electronic balance was used to determine total body weight (BW) (to the nearest 0.01 g) of each individual fishes. However, a digital slide caliper was used to measure length in various dimensions to the nearest 0.01 cm.

Results and Discussion

Understanding the relationships between the various bodily parts is aided by morphometric modeling. Morphometric analysis makes use of the

proportion of each body part to its overall length. Morphological characteristics are known to be highly malleable to variations in environmental factors, including temperature and food availability. Fish are generally more variable in their morphological characteristics within and between populations than any other vertebrate, and they are also more vulnerable to morphological alterations caused by their environment. In the present study, it has also been noted that meristic counts are body size dependent, meaning that meristic counts vary with fish size.

The body of *Puntius chola* is short, deep and compressed (Acharjee and Saibal, 2015). The body colour was silver bright and has a bright reddish strip along the entire mid body during breeding season while bright silvery colour in other period. The minimum and maximum total length are 47.3 and 64.8 mm while mean and standard deviation are 58.04 ±6.11 mm (Table 1).

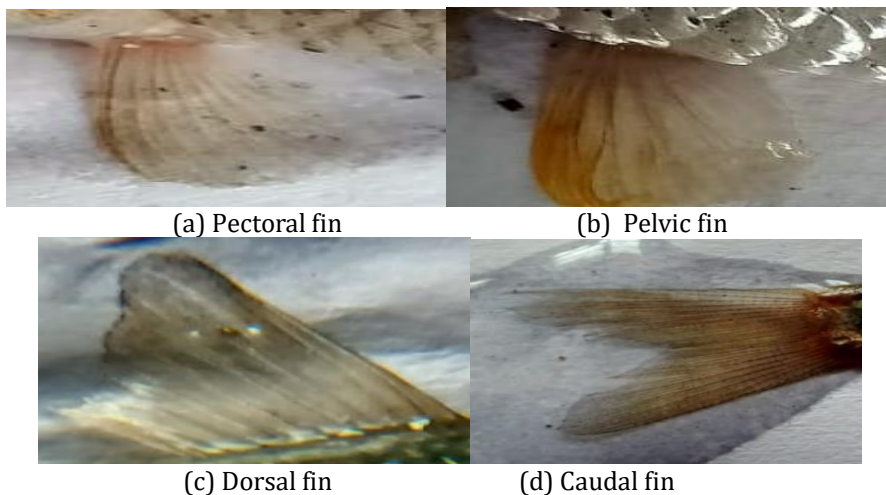
This fish has a compressed, deep, and elongated body. The dorsal region of fish has a little greenish tint, while the body is silvery in color. The caudal, pectoral, anal, and dorsal fin tips are all tinted orange (Plamoottil and Maji, 2020). From the base of the caudal fin to the tip of the



Fig. 2: *Puntius chola* collected from Ramgarh lake, Gorakhpur.

Table 2: Meristic count of *Puntius chola* (Hemilton, 1822) (n=30) captured from Ramgarh lake, Gorakhpur, India

S. No.	Meristic count	Minimum	Maximum
1.	Branched dorsal fin rays	VIII	X
2.	Branched anal fin rays	V	VIII
3.	Unbranched anal fin rays	III	V
4.	Branched pelvic fin rays	VIII	X
5.	Unbranched pelvic fin rays	I	I
6.	Branched pectoral fin rays	XII	XIV
7.	Unbranched pectoral fin rays	I	I
8.	Caudal fin rays	XVI	XVIII
9.	Lateral line scale	XXVI	XXVIII
10.	Circumferential scale	XXII	XXIV



operculum there is an orange band. Also a dark spot is present between the second and fifth fin rays, near the base of the dorsal fin (Fig. 2) and another light spot is present between the 23rd and 25th scales, which is close to the caudal fin base. There are 26 to 28 lateral line scales. The base of the anal and dorsal fins have 8-10 and 3-5 counts, respectively.

Meristic analysis

Meristic features are those that are countable, like scales, fin rays, and vertebrae. The ten meristic characters were analyzed in this fish. Fin rays come in two varieties: divided rays, also known as soft rays, and undivided rays (Nayak *et al.*, 2021) and also known as spines (Jayaram, 1981; FAO, 2013). This genus's adult size is from 47.3 to 64.5

mm (Table 1). They are occasionally have bright patterns and colours.

Fins

Dorsal fin rays 8-10; anal fin rays 5-8; pelvic fin ray, 8-10; pectoral fin rays 12-14; and caudal fin rays 16-18 (Table 2). The various fins of *Puntius chola* are depicted in Figure 3.

It is evident that in all fish specimens with varying body lengths, the number of a given *Puntius* species' dorsal, pectoral, ventral, anal, and caudal fin rays stayed constant. It demonstrates that in the current research, meristic numbers are unaffected by body size and do not alter as body length increases. The findings of this study derives support from the observations of Vladykov (1934), Talwar and Jhingran (1992), and Muhammad Zafar *et al.* (2002) Identification of specimens and experimental investigations both benefit from an understanding of morphometric and meristic features.

Ethical Statement

The authors confirm that all ethical issues have been dealt with the research ethics guidelines provided by the organization.

Author Contributions

Kumari Vandana: conducted the data collection and primary investigation for the study, and writing manuscript; *Vijayakumar C.*: supervised the research, provided guidance throughout the study, and reviewed the final draft; *Km. Ranjana* and *Singh Akhand Pratap* assisted in manuscript writing and formatting. All authors have read and agreed to the published version of the manuscript.

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Conflict of Interest

The authors declare no conflicts of interest.

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