

## Research Article

# Age and growth increment of *Labeo calbasu* (Hamilton 1822) from the Vindhyan region, Central India

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## Abstract

*Labeo calbasu* is an important game fish in the ponds and reservoirs where it can be cultivate along with Indian major carp and exotic major carp. The present study provides comparative information of age and growth of *L. calbasu*. Age and growth increment was recorded by obtaining samples of *Labeo calbasu* during 2003-2004 from the fish market along the Ken river, Paisuni river and Tons river (Bundelkhand region). The age of fishes was recorded to be 6+ in the Ken river, 5+ in the Paisuni river while 7+ in the Tons river. The formation of growth ring occurred annually. The maximum mean length 21.3 cm was recorded for in 1+ age from the Paisuni river. Overall, mean length of fishes for 2+, 3+, 4+, 5+ and 6+ age groups was recorded higher in the Tons river compared to Paisuni and Ken rivers. Hence, the Tons river is more suitable for the growth of *L. calbasu*.

## Introduction

*Labeo calbasu* is a medium size freshwater fish species belonging to the family Cyprinidae under the order Cypriniformes and is an ecologically significant (example habitat restoration, manage keystone species and maintain food web) for both commercial and recreational fisheries in tropical and sub-tropical waters. *Labeo rohita*, *L. calbasu* and *L. bata* species are very frequently appearing in the lotic ecosystem in the Indian subcontinent. The second most important of these is the *L. calbasu* which has a very wide distribution, formed choiceable fishery and resistant to disease. *L. calbasu* supports an important commercial fishery in the rivers (Example Ganga, Yamuna, Narmada, Godavari, Ken, Paisuni and Tons), wetlands, dams, lakes and reservoirs of India [1-6]. *L. calbasu* is a riverine fish especially in India, Pakistan, Bangladesh, Myanmar and Nepal but also well established in many large natural water bodies [7-10] and are able to tolerate a wide range of environmental conditions (example temperature, pollution). It is also culture with Indian major caps group fishes (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*) and also exotic major carp

fishes (*Ctenopharyngodon idella*, *Hypophthalmichthys molitrix* and *Cyprinus carpio*) in India, Bangladesh and Pakistan [11-13]. It is a bottom feeder in habit with herbivour. Accurate fish growth rates are important for growth analysis, age structure analysis and mortality rate estimation. The information of fish age and growth increment is also necessary to perceptive a species life history, reproductive biology, population dynamics, biomass and fisheries sustainability [8,14-18].

Fish are very diverse animals and can be categorized in many ways in form of biology. The age and growth study was conducted by [19] from the Ganga river [20] from the Yamuna river [21] from the Ganga and Yamuna rivers [22] from the Ghaghra river. But nothing is known for the Ken, Paisuni and Tons rivers that are a part of the Ganga river system in the Ganga Plains, India.

## Material and methods

Present study was conducted from the three rivers namely Ken, Paisuni and Tons rivers, Bundelkhand region, India (Map 1). The Ken and Paisuni rivers are right bank tributary of the

Yamuna river while the Tons river is a right bank tributary of the Ganga river. Fish samples of *L. calbasu* were collected seasonally during 2003–2004 from the Ken, Paisuni and Tons rivers. The scale method has been used for estimation of age and growth in the present investigations. The key scales were removed from the row above lateral line and below dorsal fin region [23–26]. The scales were cleaned in 5% KOH solution to remove adhering tissues and finally washed in distilled water. The scales were then pressed while drying in order to avoid their curling. The season with “minimum width in the terminal part of the anterior field of the scale” was designated as the period of ring formation. Since this condition occurred only once a year, the ring was designated as annuli. The total length and growth rate were recorded as differences between-at-age.

## Result and discussion

The formation of growth ring occurred annually. The ring formation was closed with increasing of fish age in all fishes (Plate 1). The fishes of 1+ to 5+, 1+ to 6+ and 1+ to 7+ age groups were recorded in the Paisuni river, Ken river and Tons river, respectively (Table 1). *Labeo calbasu* is slow growing riverine fish. The key scales depicting different age are presented in Plate 2. The differences in growth may be observed when same species inhabit different rivers of the same ecoregion. The mean

length was maximum in juvenile stage (1+ age group) in the Paisuni river compared to Tons and Ken rivers. The maximum growth rate was recorded in the Tons river in adult and old stock (Table 1). The growth compensation was recorded in 6+ age class form Tons river fishes. The growth rate was observed 19.2, 11.5, 7.7, 5.4, 3.4 and 2.3 cm for 1+ to 6+ age groups in the Ken river. The growth rate recorded for the Paisuni river was 21.3, 10.5, 7.7, 3.2 and 1.9 cm from 1+ to 5+ age groups. Similarly in the Tons river 20.9, 11.8, 7.5, 6.7, 4.5, 3.1 and 3.5 cm from 1+ to 7+ age was observed (Table 1). These growth rates indicated that the ecological condition of the Tons river was most suitable for the growth of *L. calbasu*.

The maximum growth percentage of *L. calbasu* was recorded in first year in the Paisuni river (47.76%) compared to Ken river (38.79%) and Tons river (36.03%) (Figure 1). The growth percentage varied from age to age and river to river (Figure 1). The lowest growth percentage was recorded in 5+ age group (4.26%) from the Tons river. The growth compensation was estimated from the Tons river in 6+ age group and difference was 0.69% (Figure 1). The growth rate of fishes was not found in systematic order (increasing or decreasing order). The fluctuations in fish length indicate the fish growth, compensation. It is very common in almost all natural stocks of fishes (fresh water, brackish water and marine water).

In case of scales the study of annual growth is based on the fact that most temperate and the sub-arctic fishes of Northern and Southern continents have their rate of metabolism and therefore growth strongly influenced by the seasonal variations. Summer is a period of activity resulting in brisk and fast or heavy growth and winter a period of slow or no growth resulting in differential growth and thus deposition of layers forming alternating growth zones, year after year [27]. It is for these reasons that the use of scales for age determination is most reliable for temperate fishes. On the other hand, in tropics, temperature is uniform throughout the year, daylight is fairly constant and fish tend to spawn several times in a year, besides, the occurrence of wide fluctuations in food composition and chemical composition of water due to the rains, organic load and floods. Thus, the fish inhabiting tropical regions show growth rings, which do not necessarily represent year marks. In the tropical regions, the annuli develop as result of cessation of growth during unfavourable periods such as poor availability of food caused by various factors like low water level or maturation of the gonads [28,29].

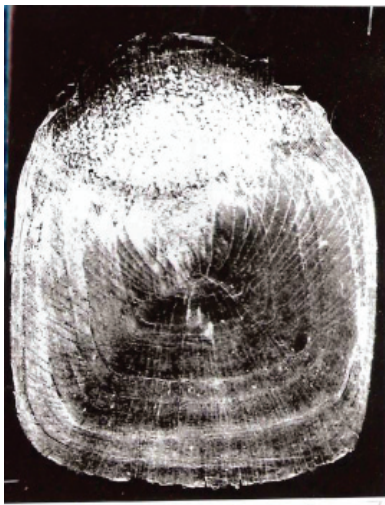
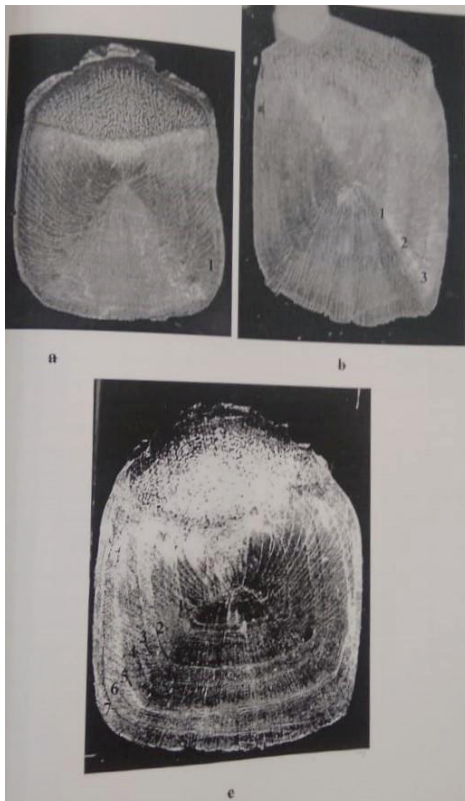


Plate 1: Transparent and opaque zone in the scale of *L. calbasu* and growth ring appearance closed with increasing of fish age.

Table 1: Mean length and growth rate of *Labeo calbasu* at various ages estimated by scale methods from the Ken, Paisuni and Tons rivers, Bundelkhand region, India.

| Age | Ken river        |                  |                            | Paisuni river    |                  |                            | Tons river       |                  |                            |
|-----|------------------|------------------|----------------------------|------------------|------------------|----------------------------|------------------|------------------|----------------------------|
|     | Mean length (cm) | Growth rate (cm) | Von Bertalanffy's fit (cm) | Mean length (cm) | Growth rate (cm) | Von Bertalanffy's fit (cm) | Mean length (cm) | Growth rate (cm) | Von Bertalanffy's fit (cm) |
| 1+  | 19.2             | 19.2             | 19.7                       | 21.3             | 21.3             | 21.6                       | 20.9             | 20.9             | 21.6                       |
| 2+  | 30.7             | 11.5             | 31.1                       | 31.8             | 10.5             | 32.2                       | 32.7             | 11.8             | 33.4                       |
| 3+  | 38.4             | 7.7              | 38.8                       | 39.5             | 7.7              | 40.2                       | 40.2             | 7.5              | 40.8                       |
| 4+  | 43.8             | 5.4              | 44.2                       | 42.7             | 3.2              | 43.1                       | 46.9             | 6.7              | 47.3                       |
| 5+  | 47.2             | 3.4              | 47.9                       | 44.6             | 1.9              | 45.1                       | 51.4             | 4.5              | 51.7                       |
| 6+  | 49.5             | 2.3              | 50.2                       |                  |                  |                            | 54.5             | 3.1              | 54.2                       |
| 7+  |                  |                  |                            |                  |                  |                            | 58.0             | 3.5              | 58.4                       |



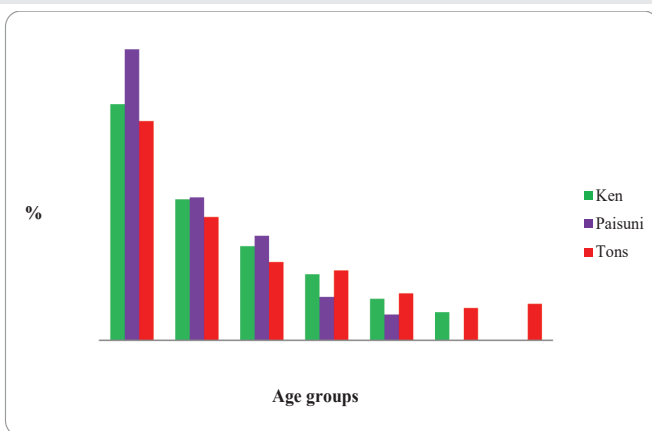
**Plate 2:** The key scale from the dorsal fin region depicting age of *Labeo calbasu*

a- 1+ age  
b- 3+ age  
c- 7+ age

Our findings very clearly indicated that the age and growth increment of *L. calbasu* was different between habitats. Habitat variation in the age and growth of *L. calbasu* are generally reported.

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**Figure 1:** Growth increment (%) of *L. calbasu* from the Ken, Paisuni and Tons rivers, Bundelkhand region, India.

The productivity of aquatic ecosystems influences the age and growth, stock and size structure of the fishes [19,30–31] was recorded mean length of *L. calbasu* of 188.5, 291.0, 381.0, 468.5, 543.5, 618.5, 681.0 and 731.0 mm for 1<sup>st</sup> to eight years of the life cycle, respectively from the Yamuna river at Allahabad [21] recorded more or less similar findings in *L. calbasu* from the Yamuna and Ganga rivers at Allahabad. Several factors can account for the fluctuation in the growth rate as like quantity and quality of available food, richness of species, density of exotic species (Example especially *Cyprinus carpio* and *Oreochromis niloticus*) quality of the water (Example organic load, heavy metal concentration) and maturity [32–40].



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