Journal of the Kalash Science, Volume-3, Number-1, 2015 : 61-66 ISSN 2321-7634

# Studies on age and growth of *Labeo bata* (Hamilton, 1822) from the middle stretch of the Ganga river, India

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Accepted : 9 May 2015

## Abstract

The sampling was done during the month of February to April 2015 from the middle stretch of the Ganga river. One hundred nine fishes were collected for the present study. The size ranges of *Labeo bata* varied from 11.5 to 27.2 cm in the Ganga river at Allahabad. The 17.1-19.0 cm size group of fishes dominated (29.35%) in the catch. 1+ to 4+ age group was determined with the help of scales in *L. bata*. The mean length of fishes were recorded 13.1 cm for 1+, 17.41 cm for 2+, 23.16 cm for 3+ and 26.65 cm for 4+ years of the life. The growth increment was recorded maximum in 1+ and minimum in 4+ age groups. The growth increment was observed 13.1 cm, 4.31 cm, 5.75 cm, and 3.49 cm for 1+ to 4+ age classes, respectively. The urn shaped pyramid was recorded in present study. The age group 2+ dominated by virtue of numbers in the middle stretch of the Ganga river (59.6%).

**Keywords:** *Labeo bata*, Ganga river, age and growth, age pyramid

## Introduction

Age and growth of fishes play a very important role in the management of fishery (Rizvi *et al.* 2012). The purpose of growth studies of fish is to determine the amount of fish that can be produced with respect of time (Mayank *et al.* 2015). Growth of an organism is reflected either in size or bulk or both in the time scale of its birth maturity and death. Thus, it is essential to know at what age/size of their life history they become exploitable or become profitable to fish. The studies on age and growth in different fish species by hard part have been worked by many researchers (Jhingran 1959, Kamal 1969, Rao & Rao 1972, Dwivedi *et al.* 2010, Johal *et al.* 1999).

The ability to age of fish accurately is essential in understanding the dynamics of fish population. The annual variations in a fishery depend upon its growth pattern. It is after desirable to segregate catch on the basis of age group to the fishing gear. Age composition of the catch has been used in different fishes of the world to predict the future available stock (Johal & Tandon 2006). Age and growth estimation is useful in solving the basic life history problem of the species and is essential prerequisite for understanding the population dynamics of the fish (Jhingran 1959, Natarajan & Jhingran 1963, Kamal 1969). The sudden increase appearance and disappearance of a fishery or mere fall in the catches bring in management problem for a fishery biologist. Hence, the knowledge of the ages, lengths and weights of the sample catches can be conveniently used to study the changing trend in a fishery (Johal & Tandon 2006). However, only one work has been conducted on the age and growth of *L. bata* (Hamilton) from the Kali river (Chatterji 1979).

*L. bata* (Hamilton) is a freshwater medium sized Indian minor carp, normally attains a length of 20-25 cm in pond and 30-50 cm in large tanks, reservoir and rivers. It forms an attractive pond fishery in west Bengal, Assam Orissa of India

and Bangladesh for high market demand (Chondar 1999). It has herbivorous feeding habit. It is predominantly a bottom feeder (Das & Moitra 1963). The natural distribution of *L. bata* is mainly in India, Bangladesh and Nepal (Talwar & Jhingran 1991). It breeds during July and August (Siddique *et al.*1976). It is listed as a threatened species by IUCN in Bangladesh. The aim of the present study, age and growth, size composition with exploitation pattern and age pyramid of *Labeo bata* from the middle stretch of the Ganga river at Allahabad.

## Material and methods

The fishes were collected from the commercial fish landing centre at Daraganj. Daraganj fish market is just by the right side of river Ganga and major part of fish catch from the middle stretch of the river is brought to this market for disposal. The sampling was done in the month of February to April 2015. One hundred nine (109) fishes were collected for the present study.

### Age determination through scales

The scales were gently removed from the lateral line in such a way that while removing the scale no damage is done to the scale. Immediately after their removal they were cleaned thoroughly until all extra matter got completely removed and then the cleaned scale is mounted intact in between two glass slides only such scales should be used in which the focus is sharp scales with disorganized focus should be discarded. The key scales should be placed in an envelope with the information such as date length age. After collection of scales the envelop should be kept in the sunlight for hours to absorb moisture otherwise fungus may develop on the scales. The scales is then viewed under microscope or by using hand lens .The ring formation was determined according to the criteria suggested by Bagenal & Tesch (1978).

### Size composition

The monthly data obtained from the Ganga river was classified into a series of size groups of 2.0 cm intervals. The range and mode were computed for each size class fish samples and expressed as percentage of total number of fishes in that size groups.

### Age pyramid

During the study period 109 specimens of *L. bata* were examined for the estimation of age pyramid. According to Odum (1971) three kinds of distribution can be depicted by age pyramid. The number of each age group was recorded separately for *L. bata*. The number of fish of each age group were recorded and converted into percentage to obtain a pyramid. This pyramid represents the status of the fish stock.

## Results and Discussion

### Size composition and exploitation pattern of *L. bata* from the Ganga river

The size ranges of *L. bata* varied from 11.5 to 27.2 cm in the Ganga river at Allahabad. Size group is made by taking interval of 2.0 cm. The 17.1-19.0 cm fishes dominated (29.35%) in the catch of *L. bata* (Table 1). 15.1-17.0 size group was shared a sizeable proportion with 20.18%. Small size groups of fishes were constituted small proportion which was 4.58% and 3.66% for 11.1 to 13.0 cm and 13.1 to 15.0 cm, respectively (Fig. 1). The exploitation of fishes was suddenly increased in case of 15.1-17.0 cm size group which was 20.18%. The middle size groups of fishes were highly exploited compared to higher and lower size groups. The exploitation pattern indicated that the *L. bata* was unsystematic exploited in the middle stretch of the Ganga river at Allahabad. The growth of fishes can be affected by many factors such as sex, maturation level, food limitations, changes in behavior and environmental conditions (Beamish &

McFarlane1983). Most wild fish stocks in Indian rivers have been overexploited or have reached their maximum sustainable yield due to over fishing, habitat degradation and pollution (Sinha 2001, Gupta & Acosta 2004).

**Table 1 Size composition and exploitation pattern of *Labeo bata* from the middle stretch of the Ganga River.**

| S. No. | Size group (cm) | No. of sample | Exploitation percentage |
|---|---|---|---|
| 1 | 11.1-13.0 | 5 | 4.58 |
| 2 | 13.1-15.0 | 4 | 3.66 |
| 3 | 15.1-17.0 | 22 | 20.18 |
| 4 | 17.1-19.0 | 32 | 29.35 |
| 5 | 19.1-21.0 | 14 | 12.84 |
| 6 | 21.1-23.0 | 10 | 9.17 |
| 7 | 23.1-25.0 | 14 | 12.84 |
| 8 | 25.1-28.0 | 8 | 7.33 |

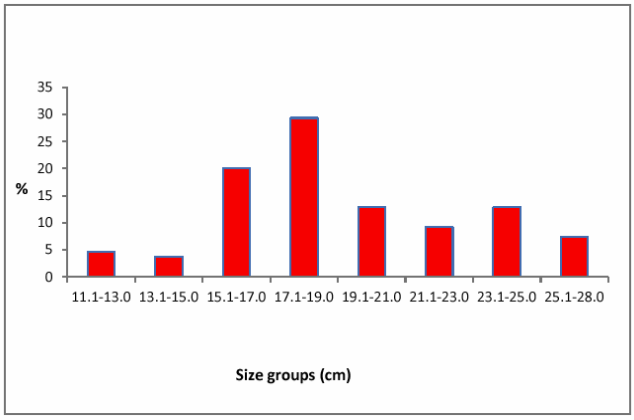



**Fig. 1 Exploitation pattern of *Labeo bata* from the Ganga River**

## Formation of growth checks

In *L. bata* continuous circuli surround the focus of scale. The formation of transparent and opaque zones was common in both species in fish of all age groups. These uniform (irregular spaced) small compact zones occured with regularity in the anterior field implying their formation or deposition at regular intervals in fish of different age groups. The opaque zone varied in these species. The compact zones are areas registering check in the growth. In fact the transparent zones represent the beginning of faster growth, whereas the zone of diminished growth is represented by the concentric band of closely packed circuli just inside the transparent zone. They appear as opaque zone when seen under low magnification as circuli are laid close to each other in certain parts of the scale. As found by Jhingran (1959), the present study also showed the presence of varying number of rings on scales of different size, their number proportionally increasing in large fish and vice versa. The distance between adjacent rings also progressively decreased as the fish size increases (Plate I).

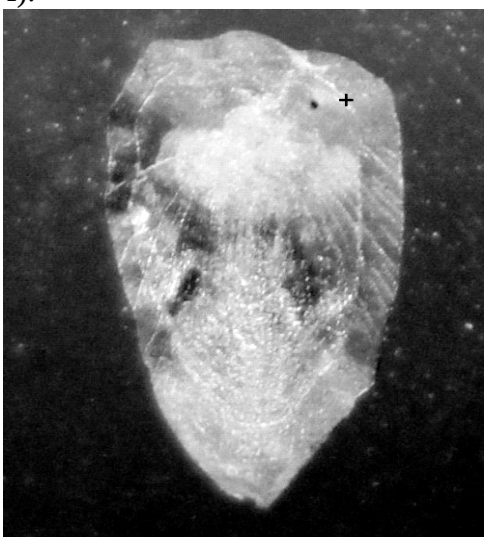


**Plate I Key scales from dorsal fin region depicting age of *L. bata* (1 year).**

## Age and growth of *Labeo bata* from the Ganga river

Age of 1+ to 4+ was determined with the help of scales in *L. bata*. The mean length was recorded 13.1 cm for 1+, 17.41 cm for 2+, 23.16 cm for 3+ and 26.65 cm for 4+ years of the life. The growth increment was maximum recorded in 1+ and minimum in 4+ age groups (Table 2). The growth increment was observed 13.1 cm, 4.31 cm, 5.75 cm, and 3.49 cm for 1+ to 4+ age

classes, respectively. Chatterji *et al.* (1979) was observed mean length of *L. bata* 13.1, 19.4, 23.6, 27.7, 31.4, 34.1 and 36.4 cm at the end of the 1st to 7th years of the life cycle from the Kali river. *L. bata* is a slow-growing fish (Chondar 1999). The 0+ to 8+ age group of *L. bata* was recorded from the Ganga river by Dwivedi *et al.* (2011). *L. calbasu* from the river Yamuna at Allahabad had a mean length of 188.5, 291.0, 381.0, 468.5, 543.5, 618.5, 681.0 and 731.0 mm, for 1 to 8 age groups, respectively (Gupta & Jhingran 1973). *L. calbasu* from Godavari had length of 20.22, 30.18, 38.21, 45.15, 50.94, 54.73 and 61.62 cm for age groups 1 to 7, respectively (Rao & Rao 1972).

**Table 2 Age and growth of *L. bata* from the middle stretch of the Ganga river**.

| Age groups | Size ranges (cm) | Mean length (cm) | Growth increment (cm) | % of growth increment |
|---|---|---|---|---|
| 1+ | 11.5-14.9 | 13.1 | 13.1 | 49.1 |
| 2+ | 15.1-20.5 | 17.67 | 4.57 | 17.14 |
| 3+ | 20.3-25.7 | 23.16 | 5.49 | 20.60 |
| 4+ | 26-27.2 | 26.65 | 3.49 | 13.09 |

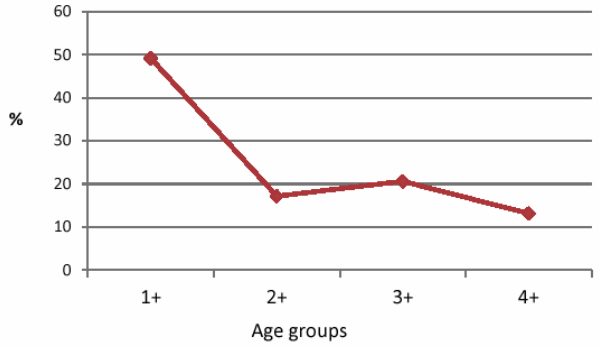


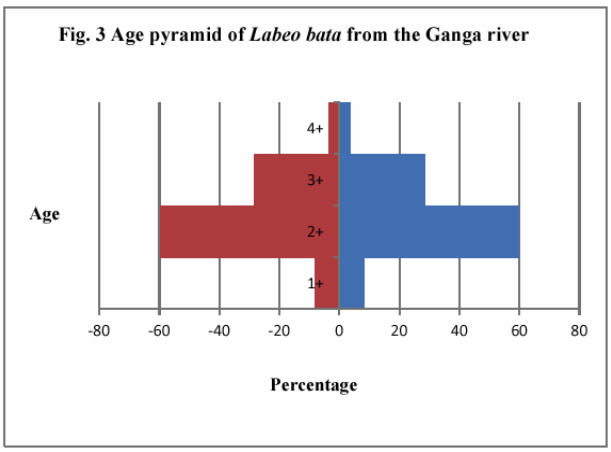

**Fig. 2 Growth increment (%) of *L. bata* from the Ganga river**

## Age pyramid

109 fishes were studied for estimation of age pyramid. The age groups varied from 1+ to 4+. Urn shaped pyramid was recorded in case of *L. bata* from the Ganga river at Allahabad. The age group 2+ dominated by virtue of numbers in the lower stretch of the Ganga River (59.6%). The percentage was suddenly increased between 1+ to 2+ age groups and difference was 51.35%. The present studies indicated that the age class 2+ was more vulnerable to the gear and was dominant in the catches. The age group 1+ was constituted 8.25%. The higher age group contributed only 3.66% (4+). This type pyramid shows unstable stock of *L. bata* in the Ganga. In present study we recorded urn shaped pyramid. Dwivedi & Nautiyal (2010) also reported urn shaped pyramid in *L. calbasu* from the Ken river. Warkantine & Rachlin (1984) studied the age pyramid of Atlantic salmon *Menidia menidia*. The analysis revealed only 2+ age group in the population, in which < 95 mm were 0+ while > 95 mm were 1+. The former accounted for 97% while 1+ only 3%, indicating a very short life span. Bhatt *et al.* (2000) determined the age structure of the Himalayan Mahseer (*Tor putitora*) in the foothill section of the Ganga river and reported that the samples comprised of 1+ to 9+ age groups individuals. Of these 2+ and 4+ age groups constituted 66.01%, while 1+ was merely 8.07% of the total stock.

**Table 3 Percentage of fishes in different age groups**

| Age | Samples | Percentage |
|---|---|---|
| 1+ | 9 | 8.25 |
| 2+ | 65 | 59.6 |
| 3+ | 31 | 28.44 |
| 4+ | 4 | 3.66 |



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