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Age and Growth Related Investigations on Major Carps in the Riverine Environment of River Ghaghra at and Around Faizabad

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ABSTRACT

A considerable population of India is suffering from malnutrition. This problem can be solved up to some extent when we add fishes in our food. Fishes are good source of protein and vitamins. To ensure the availability of fishes to masses we have to improve the production in our available water resources. Rivers in India are a good source of freshwater fish production. Ghaghra is an important river of North India. It has sufficient water around the year. The present investigation was carried out to observe the comparative growth of *Cirrhinus mrigala,Labeo rohita,Labeo calbasu and Catla catla* in riverine environment of Ghaghra.The back-calculation method was adopted to assess the age and growth of these fishes. It was observed that the growth rate of *Labeo calbasu* is maximum among above four fishes.

Key words: Cirrhinus mrigala, Catla catla,Labeo rohita,Labeo calbasu,Major carps, Ghaghra, Ayodhya, age and growth

INTRODUCTION

Growth reflects the adaptive property of the species. It is the change in size over time. This is one of the most intensively studied aspects of fishery biology. Study of age composition, rate of growth per year is essential in understanding the dynamics of fish population and for prediction of fishery stocks. The annual variation in the fishery of aquatic bodies depends upon the growth pattern of fishes. Fishes bear on their scales permanent marks in the form of annulus rings. These rings are formed every year. These marks are faithful evidence not only of the age but of the growth as well at the end of each year of the life. This fact forms the basis of estimating year to year changes in growth and also of back-calculating

body length. A direct relationship thus exists between the annuli and the growth pattern of the individual. Body lengths may be determined, assuming certain relationship to exist between the scale size and the body. It must be mentioned that growth pattern and growth rate are highly species-specific. Thus scale is best way for calculating the growth of fishes.

Ghaghra is an important river of North India. It has sufficient water around the year. Major carps are most edible fishes of North India and mostly cultured in small water bodies. Study of major carps in riverine environment is necessary for exploitation of fresh water resources. As per available literature though the study on age and growth drew attention fishery biologist in other parts of the country but this region has remained ignored. Therefore, to fill gap in our knowledge the present investigation was carried out.

MATERIALS AND METHODS

We studied fishes in river Ghaghra and collected the key scales of selected fishes from selected places and washed in water with tip of finger and brush. After that it was dried with the help of Blotting paper and made 50 slides of fishes in different age group by using above method. Photo of these slides were taken from NBFGR which is given. With the help of magnifying glass, Scale and Calculator, we derived the Total scale radius and distance of *first, second, third* and so on annulus from focus this is showed in observation as L_1, L_2 L_3 etc. The L_1 shows distance between focus and first annual ring, L_2 shows distance between focus and second annual ring and so on.

By using formula, which is given below, we calculated the back-calculated length of selected fishes in different age group.

$$\frac{S^1}{S} = \frac{L^1}{L} \quad \frac{S^1}{S} = \frac{L^1}{L}$$

Where S^1 = length of scale radius to annulus X.

S = length of total scale radius

$$L^1 = \frac{S^1}{S} L \quad L^1 = \frac{S^1}{S} L$$

Or

L^1= length of fish when annulus X was formed.

L= length of fish when scale sample was obtained.

By using back- calculated length of different age group, we derived the growth rate of fish and plotted graph.

OBSERVATION

Labeo rohita

During the period of observation we examined seven fishes of *Labeo rohita* in zero age group in river Ghaghra. The lengths of these fishes were 12.5, 14.1, 15.5, 16.4, 17.2, 18.3, 20.1 cm respectively.

Three fishes were examined in first year age group and found their lengths were 22.4, 24.3 and 25.2 cm respectively. The l_1 of these three fishes were 0.25, 0.4 and 0.41cm respectively.

We examined 17 fishes in second year age group. The lengths of these fishes were 26.1, 27.5, 28.31, 29.21, 31.1, 31.21, 32.5, 33.48, 34.25, 35, 36.2, 37.3, 38.1, 39.5, 41.2, 45.72, 46.2 cm respectively. The l_1 of these fishes were 0.41, 0.42, 0.43, 0.44, 0.45, 0.46, 0.48, 0.5, 0.35, 0.36, 0.37, 0.38, 0.38, 0.4. 0.45, 0.45, 0.45, 0.46 cm respectively. The l_2 of these fishes were 0.61, 0.62, 0.63, 0.64, 0.65, 0.66, 0.68, 0.7, 0.55, 0.56, 0.57, 0.58, 0.59, 0.6, 0.65, 0.65, 0.66 cm respectively.

Five fishes were observed in three year's age group and found that the length were 47.5, 48.3, 49.45, 50.1, 51.2 cm respectively. The l_1 of these fishes were 0.45, 0.45, 0.5, 0.5, 0.55 cm respectively, l_2 were 0.65, 0.65, 0.7, and 0.75 cm respectively and l_3 were 0.8, 0.81, 0.83, 0.85, 0.85 cm respectively.

Fourth year's investigation revealed that the length of nine fishes were 53.5, 54.1, 55.3, 57.2, 59.1, 61.5, 62.1, 63.3, 64.6 cm. The l_1 of these fishes were 0.5, 0.55, 0.55, 0.55, 0.6, 0.6, 0.65, 0.65, 0.65 cm respectively. The l_2 of these fishes were 0.7, 0.75, 0.75, 0.75, 0.8, 0.8, 0.85, 0.85, 0.85 cm respectively. The l_3 of these fishes were 0.8, 0.85, 0.9, 0.9, 1.0, 1.0, 1.05, 1.1 cm respectively. The l_4 of these fishes were 0.9, 0.95, 1.0, 1.0, 1.0, 1.1, 1.1, 1.2, 1.2 cm respectively.

We examined nine fishes in five year age group, their length were 67.7, 69.9, 70.1, 71.3, 73.2, 74.2, 76.3, 77.1, 79.8 cm respectively. The l_1 of these fishes were 0.65, 0.65, 0.65, 0.65, 0.7, 0.7, 0.7, 0.7 cm respectively. The l_2 of these fishes were 0.85, 0.85, 0.85, 0.85, 0.9, 0.9, 0.9, 0.9, 0.9 cm respectively. The l_3 of these fishes were 1.0, 1.0, 1.0, 1.0, 1.1, 1.1, 1.15, 1.15, 1.2 cm respectively. The l_4 of these fishes were 1.1, 1.2, 1.2, 1.2, 1.25, 1.25, 1.3 cm respectively. The l_5 of these fishes were 1.2, 1.25, 1.25, 1.3, 1.3, 1.35, 1.4, 1.45, 1.5 cm respectively.

We examined four fishes in sixth year age group, their length were 81.2, 82.5, 84.1, 85.2 cm respectively. The l_1 of these fishes were 0.75, 0.75, 0.8, 0.8 cm respectively. The l_2 of these fishes were 0.95, 0.95, 1.0, 1.0 cm respectively. The l_3 were 1.25, 1.25, 1.3, 1.3, cm respectively .The l_4 were 1.35, 1.35, 1.4, 1.4, cm respectively. The l_5 were 1.5, 1.5, 1.55, 1.55 cm respectively. The l_6 were 1.55, 1.55, 1.6, 1.65 cm respectively (Fig-4).

Cirrhinus mrigala

During the period of observation we examined seven fishes of *Cirrhinus mrigala* in river Ghaghra in zero age group and found their length were 21.1, 23.1, 24.5, 26, 27.1, 28.2, 30.1 cm respectively.

We examined four fishes in first year age group, their length were 31.2, 32.5, 33, 35.6 cm respectively. The l_1 of these fishes were 0.8, 0.85, 0.85, 0.9 cm respectively.

We examined five fishes in second year age group, their length were 36.4, 37.1, 39.7, 40.64, 41.63 cm respectively. The l_1 of these fishes were 0.45, 0.45, 0.45, 0.5, 0.55 cm respectively. The l_2 of these fishes were 0.62, 0.63, 0.65, 0.65, 0.65 cm respectively.

We examined five fishes in third years age group, their length were 42.2, 43.1, 45.35, 48.2, 49.1 cm respectively. The l_1 of these fishes were 0.45, 0.45, 0.45, 0.5, 0.55 cm respectively. The l_2 of these fishes were 0.65, 0.65, 0.65, 0.7, 0.75 cm respectively, the l_3 of these fishes were 0.75, 0.8, 0.85, 0.9, 0.95 cm respectively.

We examined nine fishes of fourth years age group, length were 50.7, 52.1, 53.3, 55.4, 57.1, 58.25, 60.0, 62.01, 63.1 cm respectively. The l_1 of these fishes were 0.55, 0.55, 0.55, 0.6, 0.6, 0.6, 0.65, 0.65, 0.65 cm respectively. The l_2 of these fishes were 0.75, 0.75, 0.75, 0.8, 0.8, 0.8, 0.85, 0.85 cm

respectively. The l_3 of these fishes were 0.95, 1.0, 1.0, 1.0, 1.0, 1.05, 1.10, 1.15, 1.2 cm respectively. The l_4 of these fishes were 1.0, 1.1, 1.1, 1.15, 1.2, 1.25, 1.3, 1.35, 1.4 cm respectively.

We examined four fishes of fifth year age group, length were 65, 66.6, 69.2, 71.05 cm respectively. The l_1 of these fishes were 0.7, 0.7, 0.75, and 0.75 respectively. The l_2 of these fishes were 0.9, 0.9, 0.95, 0.95 cm respectively. The l_3 of these fishes were 1.15, 1.15, 1.2, 1.2 cm respectively. The l_4 of these fishes were 1.35, 1.35, 1.4, 1.4 cm respectively. The l_5 of these fishes were 1.4, 1.45, 1.45, 1.5 cm respectively.

We examined three fishes of sixth years age group, length were 73.5, 75.1, 78.5 cm respectively. The l_1 of these fishes were 0.8, 0.8, 0.81 cm respectively. The l_2 were 1.0, 1.0, 1.1cm respectively. The l_3 were 1.2, 1.2, 1.25 cm respectively. The l4 were 1.3, 1.3, 1.35 cm respectively. The l_5 were 1.4, 1.4, 1.45 cm and the l_6 were 1.5, 1.55, 1.55 cm respectively.

We examined five fishes of seventh years age group, length were 80.5, 82.2, 83.2, 85.5, 86.2 cm respectively. The l_1 of these fishes were 0.85, 0.85, 0.85, 0.9, 0.5cm respectively. The l_2 were 1.2, 1.2, 1.2, 1.25, 1.25 cm respectively. The l_3 were 1.3, 1.3, 1.35, 1.4, 1.4 cm respectively. The l_4 were 1.4, 1.4, 1.45, 1.5, 1.5 cm respectively. The l_5 were 1.5, 1.5, 1.55, 1.6, 1.6 cm respectively. The l_6 were 1.6, 1.6, 1.65, 1.7, 1.7 cm and l_7 were 1.65, 1.7, 1.7, 1.75, 1.8 cm respectively.

We examined two fishes of eight years age group. The length of these fishes were 88.5 and 90.2 cm respectively. The l_1 of these fishes were 0.9, 0.9cm respectively. The l_2 were 1.25, 1.25 cm respectively. The l_3 were 1.4, 1.42 cm respectively. The l_4 were 1.5, 1.52cm respectively. The l_5 were 1.6, 1.62 cm.The l_6 were 1.7, 1.73 cm.The l_7 were 1.8, 1.83 cm and the l_8 were 1.85, 1.9 cm respectively(Fig-2).

Catla-catla

During the period of observation of *Catla-catla* in river Ghaghra, we examined three fishes of the zero year's age group. The length of these fishes were 23.1, 24.5 and 25.1 cm respectively. We examined two fishes in one year age group, the length of these fishes were 28.4 and 30.1 cm. The l_1 of these fishes were 0.2 and 0.21 cm.We examined 03 fishes in two year's age group the length of these fishes were 32.2, 34.1, 36.2 cm . The l_1 of these fishes were 0.22, 0.24, and 0.3 cm. The l_2 of these fishes were 0.40, 0.42, 0.5 cm respectively.

We examined 12 fishes in three year's age group, the length of these fishes were 38.7, 40.1, 41.4, 43.18, 43.5, 44.2, 45.3, 46.4, 48.2, 49.3, 52.4, 53.3 cm respectively. The l_1 of these fishes were 0.4, 0.5, 0.5, 0.55, 0.56, 0.56, 0.58, 0.6, 0.65, 0.7, 0.75, 0.8 cm. The l_2 of these fishes were 0.6, 0.7, 0.7, 0.7, 0.72, 0.72, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0 cm. The l_3 of these fishes were 0.8, 0.9, 0.9, 1.0, 1.5, 1.05, 1.1, 1.0, 1.05, 1.1, 1.15, 1.2 cm respectively. We examined 06 fishes in four years age group, the length of these fishes were 55.3, 56.2, 58.2, 60.3, 61.1, 63.3 cm respectively. The l_1 of these fishes were 0.85, 0.9, 0.95, 1.0, 1.05, 1.1 cm. The l_2 of these fishes were 1.05, 1.1, 1.15, 1.2, 1.25, 1.3 cm. The l_3 of these fishes were 1.25, 1.3, 1.35, 1.4, 1.45, 1.5 cm. The l_4 of these fishes were 1.45, 1.5, 1.55, 1.6, 1.65, 1.7 cm respectively.

We examined 03 fishes in five year's age group. The length of these fishes were 64.4, 65.5, 67.2 cm. The l_1 of these fishes were 1.15, 1.15, 1.2 cm. The l_2 of these fishes were 1.35, 1.35, 1.4 cm. The l_3 of these fishes were 1.55, 1.55, 1.6 cm. The l_4 of these fishes were 1.75, 1.75, 1.8 cm. The l_5 of these fishes were 1.8,

1.85, 1.9 cm respectively. We examined four fishes in six year's age group, the length of these fishes were 70.1, 72.2, 75.5, 76.2 cm. The l_1 of these fishes were 1.2, 1.21, 1.21, 1.25 cm. The l_2 of these fishes were 1.4, 1.41, 1.45 cm. The l_3 of these fishes were 1.6, 1.61, 1.61, 1.65 cm. The l_4 of these fishes were 1.8, 1.81, 1.82, 1.85 cm. The l_5 of these fishes were 1.9, 1.91, 1.92, 1.95 cm. The l_6 of these fishes were 1.95, 1.96, 1.97, 2.0 cm respectively.

We examined 02 fishes in seven year's age group, the length of these fishes were 80.1, 82.2 cm. The l_1 of these fishes were 1.25, 1.3 cm. The l_2 of these fishes were 1.45, 1.5 cm. The l_3 of these fishes were 1.65, 1.7 cm. The l_4 of these fishes were 1.85, 1.9 cm. The l_5 of these fishes were 1.95, 2.0 cm. The l_6 of these fishes were 2.0, 2.1 cm. The l_7 of these fishes were 2.1, 2.2 cm respectively (Fig-1).

Labeo calbasu

During the period of observation of *Labeo calbasu* in river Ghaghra, we examined 05 fishes in zero age group, their length were 20.3, 23.1, 24.3, 25.5, 28.3 cm respectively. We examined 08 fishes in one year age group, their length were 30.3, 31.2, 32.3, 33.6, 35.5, 36.6, 38.2, 40.1 cm. The l_1 of these fishes were 0.5, 0.51, 0.52, 0.53, 0.54, 0.55, 0.56, 0.58 cm respectively.

We examined four fishes in two year's age group, their length were 45, 47.7, 48.3, 50.1 cm. The l_1 of these fishes were 0.6, 0.62, 0.64, 0.65 cm. The l_2 of these fishes were 0.7, 0.72, 0.74, 0.75 cm respectively. We examined 06 fishes in three year's age group, and their lengths were 51.2, 52.3, 53.1, 54.4, 55.0, 56.0 cm. The l_1 of these fishes were 0.7, 0.71, 0.72, 0.73, 0.75, 0.75 cm. The l_2 of these fishes were 0.8, 0.81, 0.82, 0.83, 0.85, 0.85 cm. The l_3 of these fishes were 0.9, 0.91, 0.92, 0.93, 0.95, 0.95 cm respectively.

We examined four fishes in four year's age group, their length were 60.3, 61.0, 62.2, 64.4 cm. The l_1 of these fishes were 0.8, 0.85, 0.9, 0.9 cm. The l_2 of these fishes were 0.9, 0.95, 1.0, 1.0 cm. The l_3 of these fishes were 1.0, 1.05, 1.1, 1.1 cm. The l_4 of these fishes were 1.1, 1.15, 1.2, 1.25 cm respectively. We examined 04 fishes in five year's age group, their length were 66.6, 67.7, 68.7, 70.0cm. The l_1 of these fishes were 0.9, 0.95, 0.95, 1.0 cm. The l_2 of these fishes were 1.0, 1.05, 1.05, 1.1 cm. The l_3 of these fishes were 1.14, 1.15, 1.15, 1.2 cm. The l_4 of these fishes were 1.2, 1.25, 1.25, 1.36 cm. The l_5 of these fishes were 1.3, 1.35, 1.4, 1.45 cm respectively (Fig-3).

Back calculation

During the period of investigation scale sample of 56 specimens of *Labeo rohita* in river Ghaghra, ranging in length from 12.5 to 88.7 cm and belonging to 0 to 7 age classes were examined. The maximum number of specimens belonged to age class two. The mean back calculated lengths (in cm) obtained by the analysis of pooled key scale samples were 29.18, 41.53, 55.2, 62.96, 72.83, 79.82, 83.17 for first to seventh age classes respectively (Fig. 1).

During the period of investigation scale sample of 35 specimens of *Catla catla* in river Ghaghra, ranging in length from 23.1 to 82.2 cm and belonging to 0 to 7 age classes were examined. The maximum number of specimens belonged to age class three. The mean back calculated lengths (in cm) obtained by the analysis of pooled key scale samples were 29.89, 40.53, 51.93, 62.25, 67.86, 72.04, 78.41 for first to seventh age classes respectively (Fig. 2).

During the period of investigation scale sample of 44 specimens of *Cirrhinus mrigala* in river Ghaghra, ranging in length from 21.1 to 90.2 cm and belonging to 0 to 8

age classes were examined. The maximum number of specimens belonged to age class four. The mean back calculated lengths (in cm) obtained by the analysis of pooled key scale samples were 29.13, 42.60, 53.60, 62.66, 69.65, 76.36, 82.22, 86.97 for first to eight age classes respectively (Fig.3).

Fig1-Scale of *Catla catla*

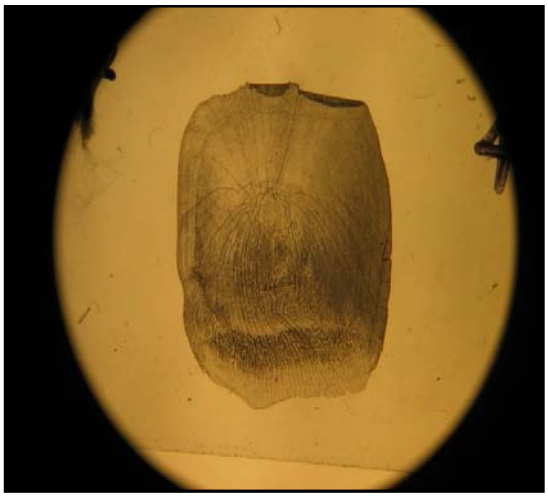

Fig2- Scale of *Cirrhinus mrigala*

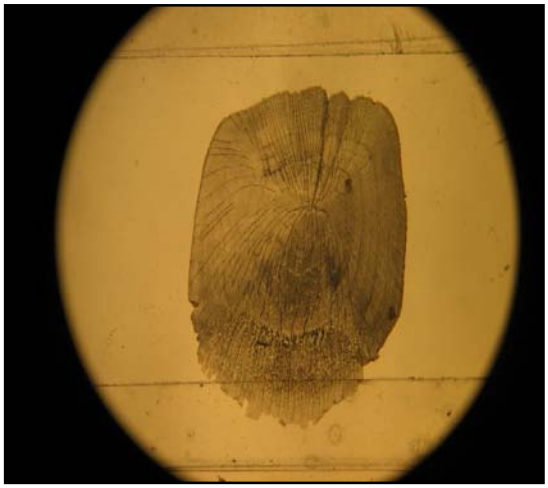

Fig-3Scale of *Labeo calbasu*

Fig-4 Scale of *Labeo rohita*

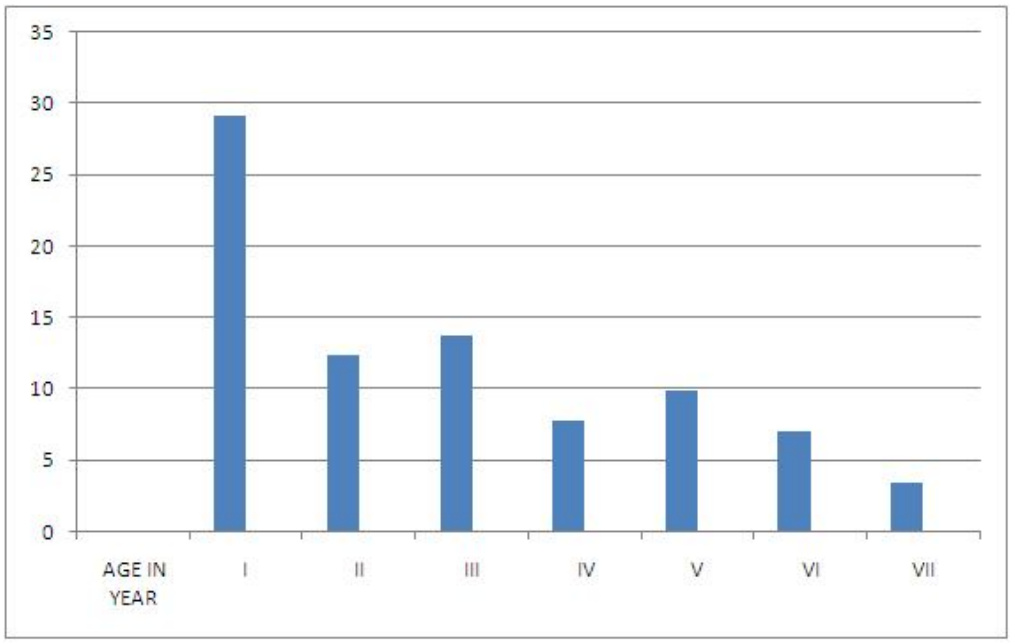

FIG. GROWTH RATE OF LABEO ROHITA IN GHAGHRA

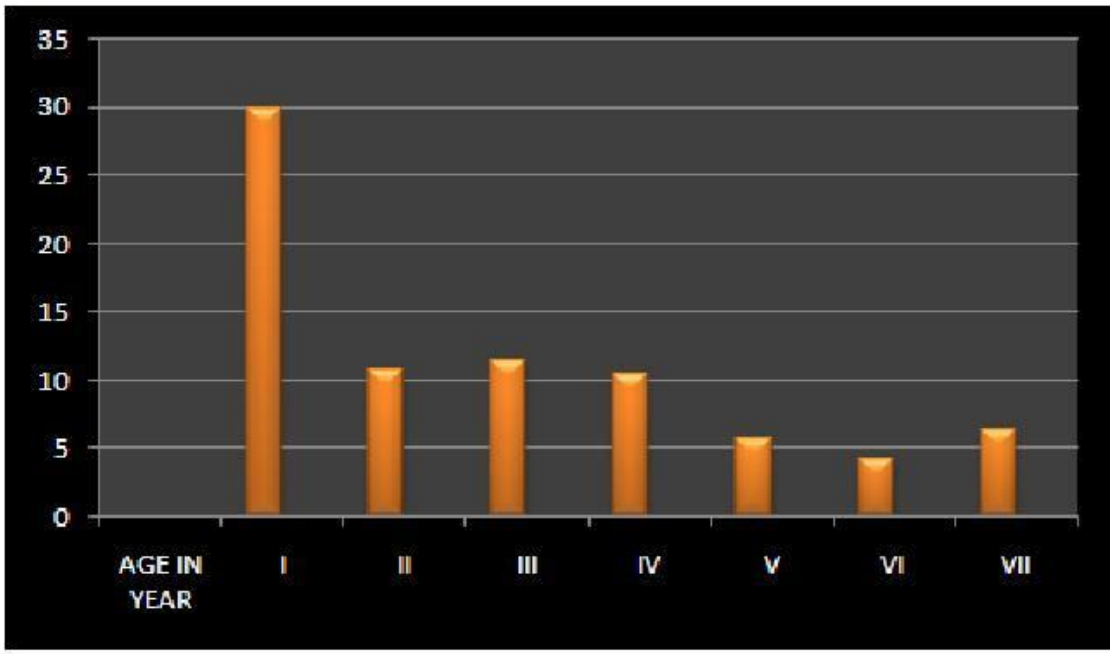

FIG. GROWTH RATE OF CATLA CATLA IN GHAGHRA

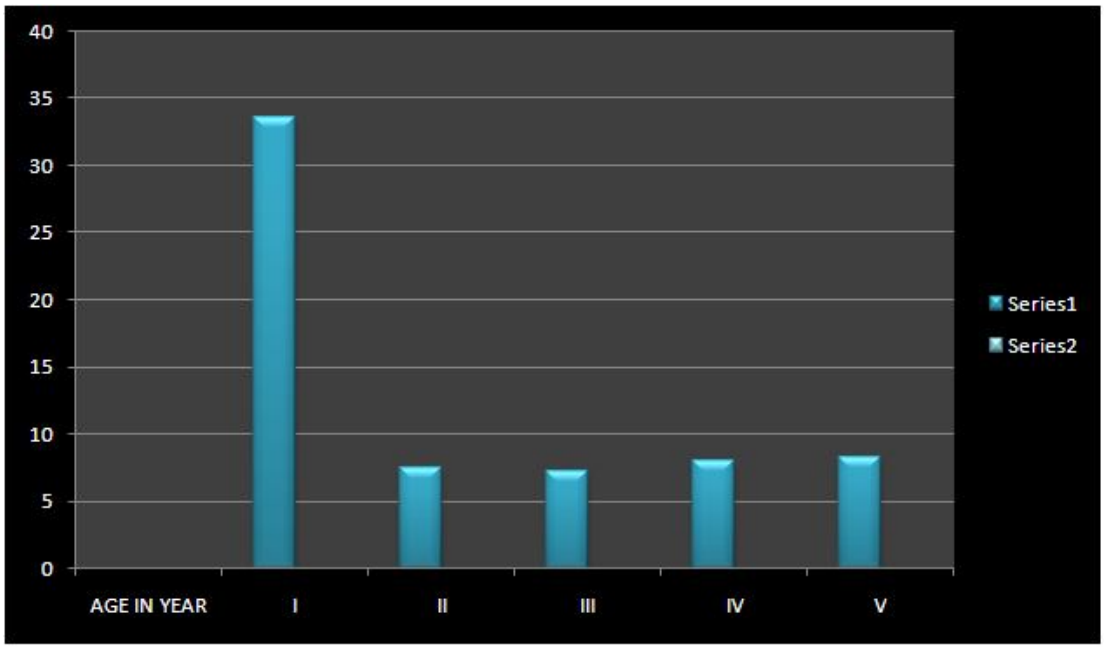

FIG. GROWTH RATE OF LABEO CALBASU IN GHAGHRA

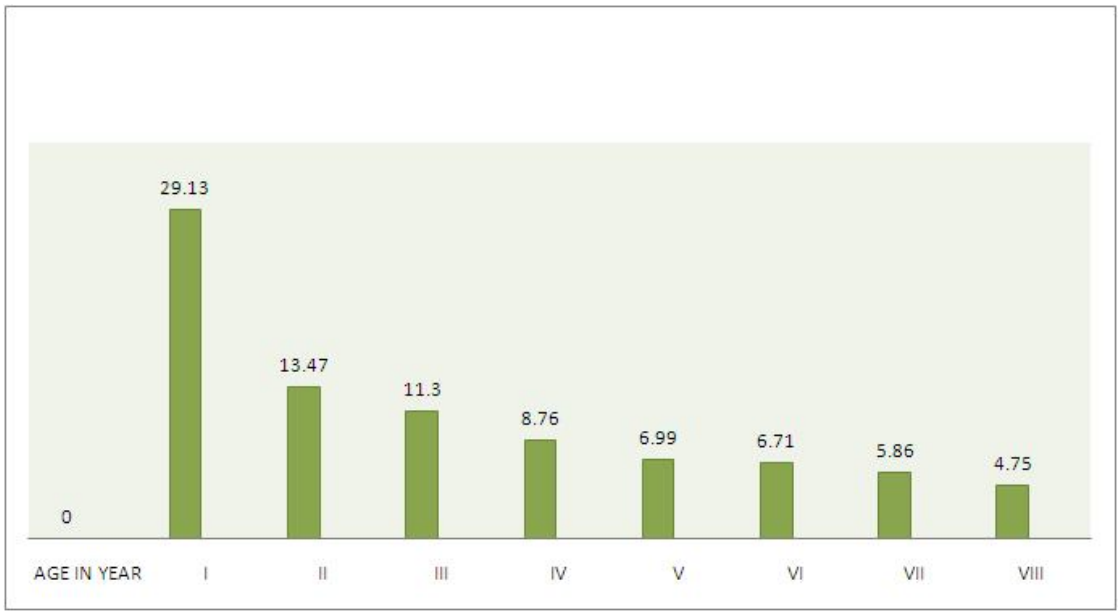

Fig. Growth rate of cirrhinus mrigala in ghaghra

During the period of investigation scale sample of 31 specimens of *Labeo calbasu* in river Ghaghra ranging in length from 20.3 to70 cm and belonging to 0 to5 age classes were examined. The maximum number of specimens belonged to age class one. The mean back-calculated lengths (in cm) obtained by the analysis of pooled key scale sample were 33.55, 41.02, 48.32, 56.38, 64.71 for first to fifth age classes respectively (Fig.4).

DISCUSSION

Jhingran (1957, 1959) investigated the age growth of *Cirrhinus mrigala* in detail from the river Ganga at Buxar (Bihar). He described that decline in the feeding intensity during summer and spring months are responsbile for the formation of annual rings. Tandon and Johal (1983a) described the age and growth of mirror carp *Puntius sarana* from the river Ghaggar, Rajasthan and Sukhana Lake, Chandigarh. The spawning mark formed during March-May has been considered valid for age determination.

We studied the growth of *Cirrhinus mirgala* from river Ghaghra. We recorded the growth rate (in cm) which was 29.13, 13.47, 11.3, 8.76, 6.99, 6.71, 5.86 and 4.75 cm for one to eight age classes respectively (Fig.)

Johal (1982) worked on growth of *Catla catla* in Gobindsagar, Rangmahal and Harike. They found that the l_1 in Gobindsagar was 25.89 cm. The l_2 in Gobindsagar was 45.33 cm, in Rangmahal 52.11 cm, in Harike 48.77 cm. The l_3 in Gobindsagar was 60.75 cm, in Rangmahal 65.56 cm, in Harike it was 64.73 cm. The l_4 in Gobindsagar was 77.99 cm, in Rangmahal 77.15 cm, in Harike it was 74.34 cm. The l_5 in Gobindsagar was 90.49 cm, in Rangmahal 85.77 cm, in Harike 82.44 cm. The l_6 in Gobindsagar was 96.15 cm, in Rangmahal 91.97 cm, in Harike 88.85 cm. The l_7 in Gobindsagar was 99.31 cm, in Rangmahal 85.58 cm, in Harike 94.67 cm respectively.

We worked on growth of *Catla catla* in river Ghaghra. We found that the l_1 was 29.89 cm, l_2 was 40.53 cm, l_3 was 51.93 cm, l_4 was 62.25 cm, l_5 was 67.86 cm, l_6 was 72.04 cm and l_7 was 78.41 cm respectively (Fig.)

Johal (1981) studied the growth of *Labeo rohita* from Gobindsagar and Rangmahal. He recorded the growth rate (in cm) in Gobindsagar was 23.81, 16.64, 13.24, 10.48, 6.30, 4.54 and 3.06 cm for one to seven age classes respectively. He also recorded the growth rate (in cm) in Rangmahal was 28.65, 14.78, 11.36, 10.25, 10.58, 4.52, 2.31 and 3.56 cm for one to eight age classes respectively.

According to my investigated the growth rate of *Labeo rohita* in river Ghaghra was 29.18 cm,41.53 cm,55.2 cm,62.96 cm,72.83 cm,79.82 cm and 83.17 cm from one to seven year's age group respectively(Fig.)

Rao and Rao (1972) examined the growth of *Labeo calbasu* in river Godavari. He found that the l_1 of this fish was 20.22 cm, the l_2 was 30.18 cm, l_3 was 38.21 cm, l_4 was 45.15 cm, l_5 was 50.94 cm, l_6 was 54.73 cm, l_7 was 61.62 cm respectively.

Johal and Kingra (1988) also worked on growth of *Labeo calbasu* in Jaismand Lake. They found that the l_1 of this fish was 14.81 cm, l_2 was 21.27 cm, l_3 was 27.82 cm, l_4 was 33.36 cm, l_5 39.14 cm, l_6 was 41.34 cm respectively.

We worked on growth of *Labeo calbasu* in river Ghaghra.The l_1 of this fish was 33.55 cm, l_2 was 41.02 cm, l_3 was 48.32 cm, l_4 was 56.38 cm and l_5 was 64.71 cm respectively(Fig.)

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Fruit Rot of Ananas

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During extensive Survey of local market in 2014 at Hathras, Aligarh and Agra (U.P.). Several fruits of Ananas (Ananas Comocus Roxb) was found infected. The fruits exhibited Whitish-Blue and brownish patches, which later on, embraced the whole fruit. In the advance stage, the diseased fruits were irregularly depressed due to intensive tissue maceration. Such fruits were collected from the market. The extent of rotting ranged from 15-18% a time, the whole consignment is rendered unfit for human consuption. The effect tissues were soft, Blueish and watery. Under humid conditions brown blue mass of spores appeared on the surface of rotten tissues and emitted bad smell. (Fig.1)

To isolate the pathogen diseased fruits were surface sterilized with 0.1% $Hgcl_2$. and cut in to small bits, which plated on P.D.A. and Czapek's agar media and incubated at $28^0C \pm 2^0C$. The fungi was isolated as Panicillium Italicum Thom and the pathogenicity was tested with replicates by artificial inoculation method of Tandon and Mishra (1969). Inoculated fruits were incubated at $28^0C \pm 2^0C$. Corresponding controls were maintained.

The fungi produced soft rot on fruits within 4-5 days and reisolation from the yielded the same organism.

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