ON THE AGE AND GROWTH OF *LABEO ROHITA* (HAMILTON) FROM RIVER PADMA

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The age and growth of *Labeo rohita* (Hamilton) from river Padma at Lalgola, Dist. Murshidabad (W. B.) have been described. Length-frequency data involved 135 fish specimens, while 36 scales were employed for this purpose. Von Bertalanffy’s growth equation was as: \( L_t = L_{\infty} \left[ 1 - e^{-0.12(t + 1.81)} \right] \). The fish attained 440mm, 564mm, 674mm, 771mm and 858mm at the end of I, II, III, IV and V years of life respectively. The maximum growth (65.73%) was attained during the first two years of life. Subsequently the growth was slow. The study of age and growth described in this paper, therefore, are useful for judicial exploitation and management of the fishery of this species.

The knowledge of age and growth of a fish is an important prerequisite in understanding the dynamics of fish populations. In fishery yield studies, growth is basic variable determining the exploitable stock and yield from the fishery\(^1\). The age and growth of different Indian major carps have been documented by earlier investigators\(^2\)-\(^7\), *Labeo rohita* which an important fish has received little attention in this line of research. It is against this background, the studies on the age and growth of *Labeo rohita* were taken.

MATERIALS AND METHODS

Materials for this investigation were obtained from fish market at Lalgola, Dist. Murshidabad (W. B.) during 1980 - 1983 from river Padma. During the period, about 135 fish specimens (size: 52 - 999mm) measured and utilized for studying the age and growth through Petersen’s length frequency method, due to nonavailability of specimens in large number\(^2\)-\(^8\). The length frequency data were grouped into 50mm class interval for analysis of different age group. To overcome with the above mentioned shortcoming, 36 scales of *L. rohita* were used to study the age and growth. The scales were picked up from the
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region below the dorsal fin and above the lateral line and prepared for observations. Length attained by the fish at the time of ring formation of each annulus was back-calculated for individual fish by using the formula:

\[ \log L = \log a + b \log S \]

where \( L \) = fish length, \( S \) = Scale dimension, \( a \) and \( b \) are two constants. The relationship between the fish length and scale radius was statistically calculated to derive a logarithmic formula:

\[ \log S = \log a + b \log L \]

Von Bertalanffy's growth equation was fitted to age groups which can be expressed as:

\[ L_t = L_\infty \left[ 1 - e^{-k(t-t_0)} \right] \]

where \( L_t \) = length at age \( t \), \( L_\infty \) = ultimate or asymptotic length, \( e \) = base of neparian logarithm, \( k \) = coefficient of metabolism, \( t \) = age of fish and \( t_0 \) = arbitrary origin of growth curve.

**RESULTS**

**Peterson's Length frequency analysis**: Since *L. rohita* has only a single and short breeding season (monsoon months), the age determination by length frequency method was found to be easily applicable. The analysed length-frequency data of four years 1980-1983 which involved 135 specimens (size: 52.099mm) were plotted (Fig. 1). Six distinguishable modes emerged from length-frequency data. The first mode falls on class mark 50-100 mm and represents the fish of the year i.e. '0' year group. The second mode falls on 425 mm and represents the 1 year age. Third, fourth, fifth and sixth modes fall on 525 mm, 675 mm, 775 mm, and 875 mm represent the fishes of II, III, IV and V years respectively.

**Age determination through scales**: Thirtysix scales of *L. rohita* were used for determination of age and growth. The annulus formed on the scales in the month of July-August was considered valid for this investigation. The limiting factor in examining larger number of specimens has been described by earlier workers.

A log-log transformation of total fish length and corresponding scale radii showed that the relationship can best be explained by calculating a regression as:

\[ \log S = -2.8426 + 1.416 \log L \ (r = 0.86) \]

A high correlation co-efficient (0.86) between the growth of the fish and growth of the scales forms the very basis of elucidating the growth history of the fish by studying the scales.
The intermediate lengths were back calculated individually in all the specimens by the application of the following formula:

\[ \log L = 2.0737 + 0.6517 \log S. \]

Where \( L \) = fish length and \( S \) = Scale radius, were well accounted for the length of the fish at the time of the scale formation as indicated by the value of \( a \). The back calculated fish lengths and through length-frequency methods were in close agreement (Table 1). This agreement gave sufficient strength and to the sound conclusion that this marking on the scales are laid annually and therefore, they may be correctly interpreted as a true indicators of age.

**Fitting Von Bertalanffy's growth equation:** The growth equation was fitted to age groups by the following equations:

\[ L_t = L_\infty \left[ 1 - e^{-kt_{t_0}} \right] \]

The parameter \( L_\infty \), \( k \) and \( t_0 \) were calculated following Ricker and found to be:

\( L_\infty = 1537, \quad k = 0.12, \quad t_0 = -1.81 \)

Substituting the above values, the Von Bertalanffy's growth equation for *L. rohita* can be written as:

\[ L_t = 1537 \left[ 1 - e^{-0.12(t + 1.81)} \right] \]

The theoretical length at different ages as calculated by this growth equation and given in Table II have been showing very high degree of agreement with lengths arrived at both by the study of scales and length-frequency analysis (Table I).

The data of length at ages and weight at ages were further analysed to determine the yearly increment, percent of total growth, annual growth of percentage and the instantaneous rate of growth as shown in Table III. As seen from the above mentioned Table, maximum growth (65.73%) was attained during the first two years of life. Subsequently the growth was slow.

**DISCUSSION**

While a growth of 14" - 16" (350 - 400 mm.) can normally be expected in
Age & Growth of *L. rohita*

**Table—1.** Length attained by *Labeo rohita* at the end of various years through various methods (Average length in mm.).

<table>
<thead>
<tr>
<th>Years</th>
<th>Petersen’s method</th>
<th>Scale method</th>
<th>Von Bertalanffy’s equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>425</td>
<td>437</td>
<td>440</td>
</tr>
<tr>
<td>II</td>
<td>525</td>
<td>550</td>
<td>564</td>
</tr>
<tr>
<td>III</td>
<td>675</td>
<td>670</td>
<td>674</td>
</tr>
<tr>
<td>IV</td>
<td>775</td>
<td>766</td>
<td>771</td>
</tr>
<tr>
<td>V</td>
<td>875</td>
<td>847</td>
<td>858</td>
</tr>
</tbody>
</table>

**Table—2.** Length-at-ages ascertained from Von Bertalanffy’s growth equation of *Labeo rohita*.

<table>
<thead>
<tr>
<th>Age (t)</th>
<th>$t - t_0$</th>
<th>$-k(t - t_0)$</th>
<th>$1 - e^{-k(t - t_0)}$</th>
<th>$L_t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2.81</td>
<td>-0.3372</td>
<td>0.2861</td>
<td>440</td>
</tr>
<tr>
<td>II</td>
<td>3.81</td>
<td>-0.4572</td>
<td>0.3670</td>
<td>564</td>
</tr>
<tr>
<td>III</td>
<td>4.81</td>
<td>-0.5772</td>
<td>0.4386</td>
<td>674</td>
</tr>
<tr>
<td>IV</td>
<td>5.81</td>
<td>-0.6972</td>
<td>0.5021</td>
<td>771</td>
</tr>
<tr>
<td>V</td>
<td>6.81</td>
<td>-0.8172</td>
<td>0.5583</td>
<td>858</td>
</tr>
</tbody>
</table>

$L_\infty = 1537$; $'k' = 0.12$, $t_0 = -1.81$, $L_t = 1537 [1 - e^{-0.12(t + 1.81)}]$ Where $L_t =$ length at age $t$, $L_\infty =$ ultimate or asymptotic length, $e =$ base of neparian logarithm, $k =$ coefficient of metabolism, $t =$ age of fish and $t_0 =$ arbitrary origin of growth curve.

**Table—3.** Growth rate of *Labeo rohita*.

<table>
<thead>
<tr>
<th>Age</th>
<th>Av-length at ages (mm)</th>
<th>Increment (mm)</th>
<th>Percent of total growth</th>
<th>Av weight at ages (g)</th>
<th>Annual growth (%)</th>
<th>Instantaneous rate of growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>440</td>
<td></td>
<td>51.28</td>
<td>1169</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>II</td>
<td>564</td>
<td>124</td>
<td>14.45</td>
<td>2469</td>
<td>111.21</td>
<td>0.7477</td>
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<tr>
<td>III</td>
<td>674</td>
<td>110</td>
<td>12.82</td>
<td>4222</td>
<td>71.00</td>
<td>0.5365</td>
</tr>
<tr>
<td>IV</td>
<td>771</td>
<td>97</td>
<td>11.31</td>
<td>6330</td>
<td>49.93</td>
<td>0.4050</td>
</tr>
<tr>
<td>V</td>
<td>858</td>
<td>87</td>
<td>10.14</td>
<td>8734</td>
<td>27.98</td>
<td>0.3219</td>
</tr>
</tbody>
</table>
Pandey

*L. rohita* in the first year in a well stocked pond\(^4\). Saxena *et al.*\(^{15}\) reported a growth rate ranging from 0.23 to 1.03 mm. with a mean value of 0.65 mm. per day based on the recovery of tagged rohu in the Ganga river system. A growth rate of 0.72 to 0.73 mm. day\(^{-1}\) was observed in Gularia reservoir\(^{16}\). *Labeo rohita* grows to a length of 241-331 mm. in Nagarjuna Sagar reservoir\(^{17}\) and 226 mm. in Getalsud\(^{18}\).

In present case the first year growth was 440 mm. and growth rate comes to 1.21 mm day\(^{-1}\) from river Padma. The growth rate was par with the growth observed by Alikunhi\(^{14}\). The growth rate was found to be better in the river Padma in comparison to the river Ganga and the reservoirs mentioned above.

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REFERENCES