Length-weight relationship and relative condition factor of pond-reared mahseer, *Tor putitora* (Ham.)

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Abstract

The study deals with the length-weight relationship and relative condition factor (Kₜ) of mahseer, *Tor putitora* reared for 150 days in ponds. The logarithmic form of equation for the relationship was found to be \( \log W = -1.727 + 2.875 \log L \) or \( W = 0.01875 L^{2.875} \). The graphical presentation of the parabolic and logarithmic forms showed respectively the curvilinear and linear relationships between length and weight of the fish. The mean value (±sd) of relative condition factor was found to be 0.95±0.12. The exponential value \( 'b' \) was found to be 2.96 and the coefficient of correlation \( 'r' \) was 0.965, which showed strong and highly correlated relationships between length and weight of the fish.

Key words: Length-weight relationship, *Tor putitora*

Introduction

Mahseer (*Tor putitora*) is an important cyprinid fish famous for its lucrative appearance and delicious taste and is highly popular among people of the Southeast Asian countries, particularly in the Indian subcontinent, including Nepal (Mirza 1993 and 1994a&b, Nath et al. 1994, Shrestha 1994). There are seven species of mahseer in Southeast Asia but only two species, namely, *Tor tor* and *Tor putitora* are reported in Bangladesh. They are distributed in the hill streams of Sylhet, Mymensingh, Dinajpur Districts and the Kaptai reservoir of Rangamati (Rahman 1989). Although reported to occur in some areas of Bangladesh (Ahmed 1969, Chandra and Haque 1982a&b, Rahman 1989, Azadi et al. 1990) it has not yet been possible either to develop a commercial fishery of mahseer in its natural habitat or to introduce the fish into commercial aquaculture of Bangladesh. Recently, the fish is gaining special attention because of its rapid disappearance from natural environment. To establish the fish in its natural habitat, scientists are becoming increasingly concerned with the biology and management of the fish.

Length-weight relationship is a very important aspect of the biology of any fish, particularly when the fish is to be reared commercially. Due to variations in season, food
composition and multiple spawning, growth fluctuations are more common in fishes of tropical and subtropical waters (Lagler 1956). However, in most fishes, length and weight bear a specific relationship from which the physical well being of a fish can be ascertained for a given body at a given time (Doha and Dewan 1967). The study of length-weight relationship in fishes helps to determine the mathematical relationship between the two variables and to calculate the variation from the expected weight for length of individual or groups of fishes (Le Cren 1951).

Many works have so far been undertaken on the length-weight relationships of different species of fishes. However, very few reports are available on the length-weight relationship of fishes under the genus *Tor*. Dasgupta (1991) studied the length-weight relationship of *Tor putitora* from Meghalaya, India and Javaid et al. (1992) from Islamabad, Pakistan. Study on the length-weight relationship of *Tor* fishes in Bangladesh is also of considerable importance. In the present study, attempt has been made to establish the length-weight relationship of pond-reared *Tor putitora*.

Materials and methods

Hatchery produced fingerlings of mahseer with average total length of 11.80 cm and body weight of 12.50 g were reared with supplementary feeding under fertilized condition for a period of 150 days in earthen ponds of Bangladesh Fisheries Research Institute, Mymensingh. At harvest, average total length and weight were 20.25 cm and 85.60 g, respectively. Fish were sampled fortnightly and total length and weight of individual fish were recorded. Therefore, large volume of data on length and weight of fish at different ages and sizes were obtained.

Total length (from snout to the end of the tail) of each individual fish was measured to the nearest centimeter (cm) on a scale. Weight was taken to nearest gram (g) on a sensitive digital electronic balance. For calculation, the data were divided into 12 class intervals and the frequency for each class interval was found out. The regression line of length-weight relationship was drawn by plotting the body weight data against the total length data. Again, all the mid-values (cm) of the class intervals and the corresponding average weight (g) were converted to base $\log_{10}$ to obtain straight-line relationship between length and weight. The non-linear equation $W = aL^b$ representing the length-weight relationship in fishes as proposed by Le Cren (1951) was used, which is the linear equation of the type $Y = a + bX$, where $Y = \log W$, 'a' and 'b' are constants and $X = \log L$. The constants 'a' and 'b' were estimated by least square method. The regression coefficient (b) and correlation coefficient (r) were determined by a programme scientific calculator.

The relative condition factors were also calculated separately for each class interval by the following formula (Le Cren 1951):
Kn = \frac{W}{\hat{W}}

Where, \(Kn\) = relative condition factor
\(W\) = observed body weight (g)
\(\hat{W}\) = calculated body weight (g)
\(\hat{W}\) was calculated by using the following formula:

\[
\hat{W} = \text{antilog} (\log a + n \log L)
\]

Results and discussion

The results of the length-weight relationships are shown in Table 1. The logarithmic form of equation obtained for the length-weight relationship of *Tor putitora* was represented by \(\log W = -1.727 + 2.875 \log L\), or, \(W = 0.01875 L^{2.875}\). The parabolic and logarithmic relationships between the length and weight are given in Figs. 1 and 2. The length-weight relationship in parabolic equation usually lies between 2.5 and 4.0 (Hile 1936). In a typical fish that maintains constant shape, ‘b’ will be 3.0, i.e., growth is isometric (Andrade and Campos 2002). However, the condition of fish is subject to variations with a number of factors including reproductive cycles and availability of foods (Thompson 1943, Rounsefell and Everhart 1953, Lagler 1956, Morato et al. 2001). Such variations may also be related to the environmental factors and the age and the physiological state of the fish (Brown 1957). Dasgupta (1991) reported that the length-weight relationship of mahseer, *Tor putitora* follows the cube law, indicating an isometric pattern of growth. He also stated that the condition factor ‘K’ and the relative condition factor (Kn) vary with season, age of the fish and feeding intensity. Javaid et al. (1992) determined the value of regression slope to be \(b = 2.93\) in case of *Tor putitora*. The variations in results obtained in the present study might be due to the factors mentioned above.

The value of the correlation coefficient ‘r’ recorded in the present study was 0.965 (Table 1), which indicates strong and highly correlated relationship between length and weight of the fish. Roy (1987) also observed strong and highly correlated relationship between length and weight in three species of carps.
Table 1. Length-weight relationship and relative condition factor of *T. putitora*

<table>
<thead>
<tr>
<th>Class intervals (TTL)</th>
<th>Mid value (cm)</th>
<th>Frequency (f)</th>
<th>Av. Wt. (W) (g)</th>
<th>logL</th>
<th>logW</th>
<th>Calculated Kn</th>
<th>Av r</th>
<th>(K_n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-13</td>
<td>12.5</td>
<td>10</td>
<td>25.58</td>
<td>1.097</td>
<td>1.408</td>
<td>33.46</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>13-14</td>
<td>13.5</td>
<td>12</td>
<td>29.84</td>
<td>1.130</td>
<td>1.475</td>
<td>37.23</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>14-15</td>
<td>14.5</td>
<td>16</td>
<td>33.90</td>
<td>1.161</td>
<td>1.530</td>
<td>41.17</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>15-16</td>
<td>15.5</td>
<td>21</td>
<td>35.75</td>
<td>1.190</td>
<td>1.553</td>
<td>45.22</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td>16-17</td>
<td>16.5</td>
<td>23</td>
<td>54.90</td>
<td>1.217</td>
<td>1.739</td>
<td>47.93</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td>17-18</td>
<td>17.5</td>
<td>27</td>
<td>62.76</td>
<td>1.243</td>
<td>1.798</td>
<td>56.66</td>
<td>1.11</td>
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</tr>
<tr>
<td>18-19</td>
<td>18.5</td>
<td>29</td>
<td>69.65</td>
<td>1.267</td>
<td>1.843</td>
<td>66.16</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>19-20</td>
<td>19.5</td>
<td>35</td>
<td>76.38</td>
<td>1.290</td>
<td>1.883</td>
<td>76.74</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>20-21</td>
<td>20.5</td>
<td>30</td>
<td>85.82</td>
<td>1.312</td>
<td>1.934</td>
<td>88.43</td>
<td>0.97</td>
<td></td>
</tr>
<tr>
<td>21-22</td>
<td>21.5</td>
<td>12</td>
<td>97.03</td>
<td>1.332</td>
<td>1.987</td>
<td>100.60</td>
<td>0.96</td>
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</tr>
<tr>
<td>22-23</td>
<td>22.5</td>
<td>7</td>
<td>109.56</td>
<td>1.352</td>
<td>2.039</td>
<td>114.45</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>23-24</td>
<td>23.5</td>
<td>3</td>
<td>121.80</td>
<td>1.371</td>
<td>2.086</td>
<td>129.36</td>
<td>0.94</td>
<td>0.96</td>
</tr>
</tbody>
</table>

The graphical representation of regression lines for length-weight relationships of the fish indicated that the weight of fish has curvilinear relationships with total length. The regression lines obtained by plotting the log data (log length against log weight) were straight, which indicate that the log length of the fish has linear relationship with log weight. These findings agree with that reported by Shrivastava and Pandey (1981), who observed straight-line relationship in carps. The relative condition factor (Kn) ranged between 0.76 and 1.15 with a mean (±sd) value of 0.95±0.12. The Kn values recorded for the fish indicate good condition of the fish. Kn values were found to show an increasing trend with higher age groups but a decreasing trend was observed with further increase in age (Fig. 3). Le Cren (1951), Shafi and Mustafa (1976) and Azadi *et al.* (1991) also reported variations in Kn values with different age and size groups of fishes.

*Tor* fishes are poorly studied group among the carps. Little is known about the different aspects of biology and culture potential of this fish. The present study indicates an isometric pattern of growth and a strong and highly correlated relationship between length and weight of the fish. However, it is recommended that the length-weight relationship and condition of the fish should be studied further both for cultured and wild populations.

References


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