Length-weight Relationship, Condition Factor and Harvesting Records of Silver Pomfret (Pampus argenteus) in the Southwestern Region of Bangladesh

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Abstract: The length-weight relationship and condition factor of silver pomfret, (Pampus argenteus), collected from the southwestern region of Bangladesh (Khulna, Bagerhat and Pirojpur) were studied for a period of twelve months. In total, 317 fish (sex combined) were sampled in monthly intervals. Standard length-weight relationship of P. argenteus was obtained to be $\log W = -1.1004 + 2.7931 \log L$. The co-efficient of correlation ($r$) was found to be 0.989. Standard errors of $S_w$ and $S_p$ were 2.955 and 8.287, respectively. The calculated t-test also indicated that the correlation between length and weight was significant. The mean value of condition factor (K) was found to be 44.27. The peak and lean harvesting volumes of this fish were recorded during the winter and summer months, respectively.

Key words: Length-weight relationship, condition factor, harvesting records, Pampus argenteus

INTRODUCTION

The silver pomfret, Pampus argenteus locally known as ‘Rupchanda’ is an endemic marine fish species of Bangladesh. Commercially, it is one of the most important fish and highly valued for domestic consumption due to tastiness, as well as for foreign exchange earnings. The species is widely distributed both in highly saline water zone throughout the Sundarban region (natural mangrove forest) and the Bay of Bengal[1].

Studies on the biology of silver pomfret require adequate knowledge on length-weight conversions, because only measurement of weight rather than length has previously been recorded. Although many scientists have worked on length-weight relations and catch assessment of different fish and shrimp species[2-10], such type of researches have been lacking on Pampus argenteus in Bangladesh.

In view of the above, an attempt was made to determine the peak harvesting season, length-weight relationship and condition factor of Pampus argenteus in southwestern region of Bangladesh. It was also aimed to gather some important information through statistical analysis of the regression coefficient that might have the important implication towards its conservation and management.

MATERIALS AND METHODS

Sample collection and sites: The experiment was conducted for a period of twelve months (from July, 2001 to June, 2002) from four fish landing centers (Khulna, Bagerhat and Pirojpur) in the southwestern region of Bangladesh. Fishes were randomly sampled from the landing centers once a month. In total, 317 fishes (sex combined) were collected and studied throughout the period of study.

Length-weight data: During the study of length-weight relationship, standard length (SL) of individual fish was measured in nearest centimeter (cm). The length was measured from the most anterior projecting part of the head to the distal tip of the caudal fin with the caudal ray squeezed together. The weight of individual fish was measured in nearest 0.01 g on a precision single pan balance. The excess water present on the body of fish was removed by blotting papers just before taking the weight of fish.

The length and weight data were used to determine the length-weight relationship, regression co-efficient (slope), correlation co-efficient($r$) and intercept. All data were converted to log$_{10}$ values to have straight line length-weight relationship.

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The length-weight relationship was calculated by using the following formula given by Leoren\textsuperscript{[9]}:

\[ W = aL^n \]

Where, \( W \) = weight of the fish; \( L \) = length of the fish; \( a \) = constant; and \( n \) = exponential value.

The values of ‘\( a \)’ and ‘\( n \)’ were calculated for standard length-body weight relationship using log-log relation of the formula, \( \log W = \log a + n \log L \) and the values of \( \log a \) and \( n \) were calculated by using the mathematical relationship\textsuperscript{[10]}, as follows:

\[
\log a = \frac{\sum \log W \cdot (\log L)^2 - \sum (\log L) \cdot (\log L \cdot \log W)}{N \cdot (\sum \log L)^2 - (\sum (\log W)^2)}
\]

\[
 n = \frac{\sum \log W \cdot (\log L)}{\sum \log L}
\]

Where, \( W \) = weight in g; \( L \) = length in cm and \( N \) = sample size.

The co-efficient of correlation, ‘\( r \)’ was calculated as follows:

\[
r = \frac{\Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{\{ [\Sigma x^2 - ((\Sigma x)^2/N)] \cdot [\Sigma y^2 - ((\Sigma y)^2/N)] \}}}
\]

In calculating standard errors for regression \( y \) on \( x \) and vise-versa, the following formula was used:

\[ S_2 = \delta_x \sqrt{(1 - r^2)} \text{ and } S_y = \delta_y \sqrt{(1 - r^2)} \]

\( t \)-test was done by the formula:

\[ t = \frac{r \cdot (N - 2)}{\sqrt{(1 - r^2)}} \text{ with degree of freedom.} \]

The condition factor (K) was determined as per Hile\textsuperscript{[7]} using the formula:

\[ K = \frac{(W \times 10^3)}{L^3} \]

Where, \( K \) = condition factor; \( W \) = weight of fish and \( L \) = length of the fish. Number \( 10^3 \) is the factor bringing the ponderal index or condition factor (K) near the unity\textsuperscript{[8]}.

\textbf{RESULTS AND DISCUSSION}

The values of length-weight relationship and condition factor obtained from the present study were shown in Table 1. The values of the \( \log a \) and \( n \) for the combined sex of \textit{P. argenteus} were found to be \(-1.1004\) and \(2.7931\), respectively. So the logarithmic form of equation for standard length and body weight relationship was \( \log W = -1.1004 + 2.7931 \log L \). The value of ‘\( n \)’ obtained from the study was 2.793, which indicated that the growth of \textit{P. argenteus} was allomeric\textsuperscript{[13]} and also revealed that \textit{P. argenteus} species strictly followed the cube law. The result agreed with the findings of Narasaj\textsuperscript{[17]}, Hossain\textsuperscript{[9]} and Hardjamula et al.\textsuperscript{[20]}.

The value of co-efficient of correlation between log length and log weight was found to be 0.989 and the standard error of \( S_x \) and \( S_y \) were calculated to be 2.955 and 8.287, respectively. The value of co-efficient of correlation (\( r \)) indicated that the relationship between length and weight was significant or not. The calculated value of ‘\( t \)’ was obtained to be 2.238 and the tabulated value of ‘\( t \)’ at 5% level of probability was 1.960\textsuperscript{[21]}. The calculated value was greater than the tabulated value, indicating that the correlation between length and weight was highly significant.

The mean standard length was plotted against the corresponding mean weight of the group (Fig. 1). The calculated weight was also plotted in the same graph and an exponential curve was obtained. The curve suddenly ascended from the lower left to the upper left that might be due to much gain in weight with increasing length of the fish. On the other hand log length was plotted against log weight and a linear relationship was obtained (Fig. 2). Both the conditions were the conformity for the exponential growth of this species. Similar results were also obtained by Aliakbar and Ali\textsuperscript{[3]}, Hossain et al.\textsuperscript{[9]} and Rahman et al.\textsuperscript{[10]}.

In total, 317 specimens measured from the random samplings (Table 1). Length and weight of fish were ranged between 10 to 25 cm and between 40 to 570 g, respectively (Fig. 3) indicating an exponential relation between length and weight. The general co-efficient of allometry was 0.975. Similar results were obtained by Chien-Chung Hau\textsuperscript{[12]} and Andrade and Campos\textsuperscript{[14]} on different marine fish species.

The mean condition factor of this species was found to be 44.27. The fluctuating curve in Fig. 4 obtained by plotting the observed K values against the standard lengths showed the variation in the condition factor of fish. This might be associated with the collection, size of fish, sample size, development of gonad and feeding conditions.
Table 1: Standard length-weight relationship, calculated weight and condition factor of *Pampus argenteus*

<table>
<thead>
<tr>
<th>Length group (cm)</th>
<th>Sample size</th>
<th>Mean standard length (L cm)</th>
<th>Mean body weight W (g)</th>
<th>Log L</th>
<th>Log W</th>
<th>Log L x Log W</th>
<th>Calculated weight W (g)</th>
<th>Condition factor K=Wx100 exp.-1</th>
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<tr>
<td>10-10.99</td>
<td>14</td>
<td>10.43</td>
<td>47.95</td>
<td>1.0182</td>
<td>1.6806</td>
<td>1.7113</td>
<td>1.0569</td>
<td>1.7449</td>
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<tr>
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<td>21</td>
<td>11.28</td>
<td>65.24</td>
<td>1.0523</td>
<td>1.8145</td>
<td>1.9089</td>
<td>1.1074</td>
<td>1.8400</td>
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<tr>
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<td>23</td>
<td>12.26</td>
<td>94.13</td>
<td>1.0884</td>
<td>1.9737</td>
<td>2.1484</td>
<td>1.1848</td>
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<tr>
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<td>13.22</td>
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<td>17.19</td>
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<td>2.3657</td>
<td>2.9224</td>
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<td>570</td>
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<td>2.7559</td>
<td>3.8525</td>
<td>1.9532</td>
<td>2.8055</td>
</tr>
</tbody>
</table>

Correlation co-efficient (r) = 0.989; t = 22.58 and P<0.05.

Fig. 1: Relationship between Standard length and weight of *Pampus argenteus*

Fig. 2: Relationship between Log L (Standard length) and Log W (weight) of *Pampus argenteus*

Figure 5 showed the monthly harvesting volumes of *P. argenteus* in the southwestern region of Bangladesh. The peak-harvesting months were from October to

Fig. 3: The length-weight relationship of *P. argenteus* in arithmetic scale from pool data

Fig. 4: Relative condition factor at different lengths of *Pampus argenteus*

February. In this period harvesting volume were recorded to be 40.56 to 51.7 M tons. Among these months, the highest harvesting obtained in January (51.7 M tons) due to winter season when the sea condition was calm as
Fig. 5. Monthly variation of harvesting volumes (combined) of *P. argenteus* from the four fish landing centers in the southwestern region.

well as suitable for the fishermen to catch fish. March to September were the lean harvesting months as the volumes of fish varied from only 0.4 to 20.98 M tons. The poorest harvesting month was June, when only 0.4 M ton of fish were caught. The reason behind this was the occurrence of frequent natural disasters (such as cyclone, flood, heavy rain storm etc.), which might eventually affected the fishermen to catch large volume of fish.

This is the first successful attempt to assess the harvesting status, length-weight relationship and condition factor of silver pomfret (*P. argenteus*), which has been serving as one of the most important marine fish for both domestic and commercial purposes. Although the fish has not yet been treated as a culture rather than capture fishery from the wild stocks and there have been no much records on their biology, ecology and distribution patterns. Therefore, the findings of the present study would immensely be helpful towards formulating the future strategies for the development of mariculture techniques, conservation and rehabilitation of *P. argenteus* to a greater extent.

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REFERENCES
