Ompok pabo (Hamilton, 1822) of Tripura, India: an Endangered Fish Species in Relation to Some Biological Parameters

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Abstract

Ompok pabo (Hamilton, 1822) is an endangered fish having greater commercial importance. This fish species did not receive proper attention in aquaculture viewpoint. Occurrence and abundance of this species is greatly declined due to ecological degradation of the habitat, environmental pollution and over exploitation. In order to get some biological information Length-weight relationship and condition factor (K) of this fish species is noticed in the present studies. Length weight relationship followed the cube-law indicating an isometric pattern of growth. The variation of regression co-efficient (b) noted in this species may be due to sex size, seasonal environmental change etc. The ‘r’ value indicates positive correlation of the length and weight. Variation in the condition factor may be due to the influence of gonadal maturity, spawning season etc. The results of condition factor (= 1.0) probably indicates that the overall physical and physiological features are considerable. Condition factor of the studied fish species also reflects its gonadal maturity and spawning season. As per IUCN assessment Ompok pabo is placed at near threatened category version 3.1.

Keywords: Length-Weight Relationship, Condition Factor, Ompok pabo, Tripura

1. Introduction

Ompok pabo (Hamilton, 1822), an endangered and freshwater fish species, is a preferred fish to the large number of consumer and so it has larger market demand. In aquaculture viewpoint this fish species did not receive sufficient attention. Occurrence and abundance of this species is greatly declined due to ecological degradation of the habitat, environmental pollution and indiscriminate fishing of gravid stock (Ng & Tenzin 2010). Therefore, knowledge of length-weight relationship is important (Jhingran, 1984; Pillay, 1990; Banik et al 2011; 2012 and Banik & Bhattacharjee 2011). In fisheries assessment viewpoint this parameter may be used as an important tool for studies of various aspects of biology. For example, i) to determine the mathematical and biological relationship between the two variables length and weight, ii) to understand the relative condition for the assessment of the general well being and nature of growth, whether it is isometric or allometric iii) and also to observe the potential yield per recruit in order to find out the fish population dynamics.

In fish, the growth pattern usually follows the cube law (Brody, 1945; Lagler, 1952 and 1956). During such relationship the results will be valid when the fish grows isometrically. In such cases, the exponential value must be exactly 3. However, the actual relationship between length and weight may differ from the ideal value due to environmental condition or condition of fish (Le Cren, 1951). Several workers followed this equation for different fish species of different habitat. Some of the worth mentioning works are those of Talwar (1962), Mercy et al (2002), Oscoz et al (2005), Serajuddin
The present work communicates the length-weight relationship and relative condition in order to find out the general condition of the studied fish species. Studies of length-weight relationship have a significant role in fisheries. This relationship also has various applications since some vital biological aspects viz., general well being, appearance on first maturity, onset of spawning, fecundity etc. can be assessed with the help of condition factor through this relationship (Le Cren, 1951). Determination of suitable size of fish to harvest maximum sustainable yield is directly related to fish weight. The increment in fish weight is usually considered to see the application of hypothetical cube law. Length-weight relationship of fish varies depending upon the condition of life in the environment. The variation in this relationship shows a measure of condition of the fish and the quality of its environment.

Information on length-weight relationship and condition factor of various fishes have been reported by Le Cren (1951); Lal & Dwivedr (1965); Narasimham (1970); Pathak (1975); Soni & Kathal (1979); Shrivastava & Pandey (1981); George et al (1985); Dasgupta (1988); Dhasmana & Lal (1993); Azadi & Nasar (1996) and Narezo et al (2002). In this context knowledge of those parameters are lacking with Ompok pabo. A study related to length-weight relationship is also important for understanding the population dynamics and selection of suitable species for productive aquaculture.

2. Materials and Methods

Live individuals of Ompok pabo were collected from some particular sites of the Feni River (Latitude 23º 00’ 02” N and Longitude 91º 51’ 11” E) and Gomati River (Latitude 23º 15’ 33” N and Longitude 91º 28’ 03” E) of South Tripura District during January to December 2011. Geographically, these river ecosystems are located at an elevation of 3.8 m above MSL. A total of 55 individuals were sampled so far for which the length and weight were recorded. The length-weight relationship was estimated separately for male and as well as for female. Similar data was also noticed with the Juvenile stage. The data noticed in the present studies were pooled together using the linear form of formula:

\[ W = a L^b \] (Le Cren, 1951)

Where:

- \( W \) = Weight of the Fish; \( L \) = Length of the Fish; \( a \) and \( b \) are constants

The equation had been transformed into the logarithmic form:

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

The values of ‘a’ and ‘b’ were determined empirically. The weight was plotted against the length to examine the nature of parabola. The regression of log-weight on log-length has been calculated adopting the method of “Least-Squares” by grouping the sample data into several length groups at 10 mm interval. In the present investigations, condition factor or Ponderal index was determined using the formula:

\[ K = \frac{W x 10^5}{L^3} \]

Where:

- \( K \) = Condition factor; \( W \) = Weight of the Fish; \( L \) = Length of the Fish; \( 10^5 \) is a factor to bring the Ponderal index (K) near to unity (Carlander, 1970)

3. Results and Discussion

The length-weight data of Ompok pabo were incorporated into the equation:

\[ \log W = 2.509328 + 3.177 \log TL \quad (r = 0.903) \]

A positive correlation between length and weight was found out where correlation coefficient = 0.902. The parabolic equation was: \( W = 0.003095080L^{3.177} \)

The ‘b’ value had been 3.177 indicated that the length-weight relationship followed the cube law showing isometric growth. On plotting the observed average weight of Ompok pabo against the observed length a parabolic curve is seen. A logarithmic graph prepared for male, female and juvenile showing a straight line relationship (Figures 2, 3 and 4). The regression equation on length-weight relationship of Ompok pabo is presented in Table 1.

3.1. Length-Weight Relationship in Males and Females of Ompok pabo

The length-weight relationship in males is based on the examination of specimens ranging from 142.0 mm to 207.0 mm and that of females from 160.0 mm to 190.0 mm in total length. The regression equation for male Ompok pabo was estimated to be \( \log W = -2.509328 + 3.177 \log TL \quad (0.973) \).

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The parabolic equation for males were found to be \( W = 0.002467838 L^{3.182} \)

The regression equation for female was \( \log W = -2.969078432 + 3.48 \log TL \) \((r = 0.88)\). The parabolic equation for females of *Ompok pabo* was \( W = 0.001073795471 L^{3.48} \).

### 3.2. Length-Weight Relationship in Juveniles of *Ompok pabo*

The length-weight relationship in juveniles is based on the examination of specimens ranging from 20.0-80.0 mm. The regression equation for juvenile was \( \log W = -1.817752986 + 2.86 \log TL \) \((r = 0.98)\).

The parabolic equation for juvenile was \( W = 0.015214126 L^{2.863} \).

### 3.3. Condition Factor (K) in *Ompok pabo* at Different Length Groups

The condition factor (K) has been calculated for each 10 mm length groups (Table 2).

<table>
<thead>
<tr>
<th>Length Groups (mm)</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr. I (70-80)</td>
<td>1.66</td>
</tr>
<tr>
<td>Gr. II (81-90)</td>
<td>1.18</td>
</tr>
<tr>
<td>Gr. III (91-100)</td>
<td>1.19</td>
</tr>
<tr>
<td>Gr. IV (101-110)</td>
<td>1.00</td>
</tr>
<tr>
<td>Gr. V (111-120)</td>
<td>0.80</td>
</tr>
<tr>
<td>Gr. VI (121-130)</td>
<td>0.63</td>
</tr>
<tr>
<td>Gr. VII (131-140)</td>
<td>0.53</td>
</tr>
<tr>
<td>Gr. VIII (141-150)</td>
<td>0.41</td>
</tr>
<tr>
<td>Gr. IX (151-160)</td>
<td>0.41</td>
</tr>
<tr>
<td>Gr. X (161-170)</td>
<td>0.51</td>
</tr>
<tr>
<td>Gr. XI (171-180)</td>
<td>0.51</td>
</tr>
<tr>
<td>Gr. XII (181-190)</td>
<td>0.48</td>
</tr>
<tr>
<td>Gr. XIII (191-200)</td>
<td>0.50</td>
</tr>
<tr>
<td>Gr. XIV (201-210)</td>
<td>0.42</td>
</tr>
</tbody>
</table>

The ‘K’ value shows its peak at length Group I (70-80 mm) and then declines to length group VIII (141-150 mm) and group IX (151-160). Then it rises steadily and then declines again after spawning (Figure 1).

The length and weight relationship of the studied fish species shows significant correlation (0.902). The exponential value (b) of the length-weight relationship is slightly greater than ‘3’ and so indicating isometric growth pattern in this fish species. Also this indicates that the length-weight relationship in *Ompok pabo* follows cube law as well as isometric growth. The variations in the exponential value ‘b’ may be due to several reasons such as environmental change, physiological conditions, sex, gonad development, nutrition variation in the habitat etc (Le Cren, 1951). Significant variations in ‘b’ values were found in juveniles and adult stages.

![Figure 1. Condition Factor of Ompok pabo (K-Values)](image)

Lal & Dwivedr (1965), Sekheran (1968) and Dasgupta (1988) have also observed an intraspecific difference in the power function ‘b’ regarding length related to body weight in *Rita rita, Sardinella albella, S. gibbosa* and *Acrossocheilus hexagonolepis* respectively at different growth stages. Hughes et al (1974) studied the effects of growth on gills and accessory respiratory organs of *Heteropneustes fossilis* and suggested that the value of b \((\approx 3.325)\) indicates compressed body shape of the studied fish species.

George et al (1985), Jhingran (1952), Khan & Hussain (1945) found that the ‘b’ values greater than 3.0 in case of
Labeo rohita. Isometric pattern of growth was also observed by Narejo et al. (2002) in Monopterus cuchia. Pathak (1975) reported that the value of regression coefficient in Labeo calbasu was 3.0. Similar observations were also reported by Dhasmana & Lal (1993) in Garra gotyala from river Bhagirathi. Rizvi et al. (2002) in Strongyliura leuura and Ablestes lians: Dasgupta (1988) in A. hexagonolepis and Raje (2002) in Nemipterus japonicus.

Pathak (1975) reported that the value of regression coefficient in Labeo calbasu was 3.0 from Loni reservoir, M.P. India. Al-Nasiri & Mukhtar (1988) observed regression coefficient = 3.16 for Tenualosa ilisha (in males and females) sampled from Iraq. Azadi & Naser (1996) noticed that the values of ‘b’ = 3.16 for males and 3.20 for females in Labeo bata sampled from Bangladesh. Narejo et al. (1999) calculated the value of ‘b’ = 3.02 for males and 3.03 for females in Tenualosa ilisha caught from Pakistan. Similar values were also recorded in some other fish species (Hile, 1936; Martin, 1949 and Tesch, 1968). Narasimham (1970) noticed that in carnivorous fish the value of ‘b’ usually increases which is found to be similar to the present observations in Ompok pabo. Soni & Kathal (1979) reported the higher ‘b’ value (4.36) in Cirrhinus mrigala which may be due to the presence of larger quantities of sand and mud particle in the stomach causing enhancement in body weight. Hile (1936) and Martin (1949) in their observation found that the values of regression coefficient (b) usually ranging from 2.5-4.0. Tesch (1968) also noticed that ‘b’ value ranging from 2.0-4.0, which may be due to changing environmental characteristics. However, Allen (1938) opined that the ‘b’ value usually found to be closer to ‘3.0’. Therefore, the present studies are in line with the aforesaid observations.

3.4. Condition Factor

Mean ‘K’ value is presented in Table 2 for Ompok pabo. Several workers (Le Cren, 1951; Jhingran, 1972 and Bashirullah, 1975) pointed out that the variation of condition factor may be due to different reasons, such as...
environmental variability, variation in the quality and quantity of food and the gonadal maturity etc.

According to some workers (Le Cren, 1951; Jhingran, 1972 and Bashirullah, 1975) change in the condition value may also be due to size at first maturity, variation with the increasing length, the ‘K’ values in *Ompok pabo* showed a peak at length group I (70-80 mm) and thereafter decreased continuously. From length group V (140-150 mm) it again increased steadily (Figure 1). From this observation, it is pointed out that juveniles have relatively better condition factor. Many workers (Menon, 1950; Pillay, 1954; Sarojini, 1957; Verghese, 1961 and Nasar & Kaur, 1984) have also observed higher ‘K’ values in juveniles of different fish species. The present results showing similarity with the views of Wheatherley (1972) which stated that even among the individuals of a particular population, sampled on a single date, there may be variation in condition with length. Wheatherley (1972) further opined that the fish populations exhibit variation in average condition, reflecting normal seasonal fluctuations in their metabolic balance, pattern of maturation and subsequent release of gamates (Goswami, 2008). Even complete development of the alimentary canal may influence ‘K’ factor (Wheatherly, 1972).

Hence, the results showing that *Ompok pabo* followed the isometric pattern of growth in the studied habitat although the occurrence of this species is not so common in natural freshwater ecosystem (Banik & Bhattacharjee, 2011). *Ompok pabo* is considered as a preferred fish species to the consumer of North-Eastern India, U.P. and Bangladesh and so it has greater market value. Therefore, *Ompok pabo* needs to be conserved and in view of conservation *Ompok pabo* requires complete attention in both biological and ecological view points.

**Acknowledgement**

The authors gratefully acknowledge Dr Abir Shib, Research Associate-Bioinformatics Centre of Tripura University; Pritam Goswami, JRF and Tanmoy Acharjee, PA of DBT-Twinning Project of Aquaculture Research Unit, Department of Zoology, Tripura University for their cooperation in sampling *Ompok pabo* from different rivers of Tripura. Thanks are due to the Head, Department of Zoology, Tripura University for providing laboratory facilities.

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