CHAPTER V

LENGTH-WEIGHT RELATION OF *CIRRHINA MRIGALA* (HAMILTON)

FROM COMMERCIAL CATCHES AT ALLAHABAD.
INTRODUCTION

Length-weight relationship studies have considerable use in fishery work, as information on this aspect of fish is needed in studies on condition, growth and sexual maturity and in investigation of the exploited species to obtain weight yields by size and age groups from length- and age-frequency samples of the catches. Ideally, such data should be available for all the common species, and it is considered that the information presented here will have some immediate applications since it is for the first time that such a huge data has been employed to describe the length-weight relationship in mrigal, Cirrhina mrigala (Hamilton).

Jhingran (1952) described the length-weight relationship of mrigal based on specimens received from various sources, viz. rivers, canals, tanks and ponds. Jhingran (1959) and Chakraborty and Singh (1963) have reported similar observations on mrigal from riverine environments, whereas Pantulu et al. (1966) described the length-weight relationship in mrigal from some reservoirs. Pantulu et al. (1966) stated that generally, the differences in length-weight relationships, if significant, are attributed to racial differences within a given species, but in the absence of other biometrical studies it is difficult to express any opinion as to whether these differences do reflect any differences in racial characters or they are the result of some varying environmental factors vital for the well being of the fish. It seems reasonable to assume that the heavier fish of a given length are
in better general health.

The main object of this communication has been to derive an appropriate mathematical formula, correlating the two variables length and weight in a very general manner for calculating one from the other from commercial point of view. The mathematical formula, presented here, is based on the vast data (5798 specimens) covering an extensive size-range (155 mm to 1020 mm) from the riverine commercial catches spread over all the months of a year from the same fish assembly centre and, therefore, is likely to be most useful from practical viewpoint.

MATERIAL AND METHODS

The length and weight measurements of 5798 specimens of *mrigal*, recorded during the year 1962 as part of the investigations on the commercial fish landings of the river Ganga and Yamuna at Sadiapur fish assembly centre, Allahabad, were analysed to derive the length-weight equation for this species. Sufficient number of specimens could be obtained during each month of the year, as shown in Table VIII. Care was taken to see that no selection as to size or sex was made while recording the lengths and weights. However, the larger fish were, at times, sampled out of proportion to their relative frequency in catches, in order to improve their representation in the samples.

According to Mraz (1964), a length-weight equation to be most useful should include fish of both sexes, sampled at various times of the year and over a period of years. Bias from annual and seasonal
TABLE VIII

Month-wise number of specimens of mrigal recorded during the year 1962

<table>
<thead>
<tr>
<th>Month</th>
<th>Number</th>
<th>Month</th>
<th>Number</th>
<th>Month</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>354</td>
<td>April</td>
<td>407</td>
<td>September</td>
<td>488</td>
</tr>
<tr>
<td>February</td>
<td>580</td>
<td>May</td>
<td>333</td>
<td>October</td>
<td>561</td>
</tr>
<tr>
<td>March</td>
<td>269</td>
<td>June</td>
<td>768</td>
<td>November</td>
<td>321</td>
</tr>
<tr>
<td>April</td>
<td>407</td>
<td>July</td>
<td>651</td>
<td>December</td>
<td>150</td>
</tr>
</tbody>
</table>

variations, sex differences, and maturity and state of sex organs is minimised by this procedure. Similarly according to Dryer and Beil (1964), in the case of lake Herring, the length-weight relation does vary according to port and year of capture, between ripe and fully spent females, but the best estimate of the general relation is one based on all available fish. Natarajan and Jhingran (1963), while analysing the length-weight data for *Catla catla*, have indicated the statistical justification in pooling the entire data on length-weight measurements into a single equation.

The length-weight data for mrigal, employed in the present calculations, meets the above stated requirements fairly well. Total length was recorded to the nearest millimeter, while the weight was
recorded in grams.

**OBSERVATIONS**

The corresponding values of lengths and weights recorded for mrigal, when plotted (Fig. 1), suggest that their relationship is of the form

\[ W = cL^b \]

where \( W \) = Weight, \( L \) = Length, \( c \) is a constant determined by the data and \( b \) an exponent approximately = 3, also determined from the data. This formula describes the length-weight relation of a sample of fish.

The least square regression of the logarithmic transformation

\[ Y = a + bX \]

in which \( Y = \log \text{Weight} \), \( a = \log c \), and \( X = \log \text{Length} \) has been used for estimating the values of \( c \) and \( b \).

The general length-weight equation for mrigal irrespective of size and age above 155 mm was found to be

\[ W = 1.009 \times 10^{-5} \times L^{2.99552} \]

or logarithmically

\[ \log W = -4.99627 + 2.99552 \log L \]

The coefficient of correlation between log length and log weight is 0.944.
FIG. 1. Length-weight relationship of Cirrhina mrigala (a. dots represent empirical weights; b. logarithmic relation).
GENERAL REMARKS

The reliability of the equation derived in this communication would be seen to be high from the coefficient of correlation value. The value of the regression coefficient \( b \) in the present equation indicates least deviation from the cube law as compared to the observations made by the earlier workers.

The value of \( b \) as calculated by Jhingran (1959) and Chakraborty and Singh (1963) was above 3, whereas Pantulu \textit{et al.} (1966) found it to be mostly less than 3 with only one exception when it was above 3. As is evident, in the present case the value of \( b \) has been found to be under 3. According to MacGregor (1966), theoretically, if \( n \) ( \( b \) in the present case) is less than 3, condition factor should decrease with the increase in length. He further states that the value of \( n \) can be influenced by the sampling irregularities, such as including in the samples fish from different environments or from different years or months when the length ranges of the fish are not comparable in the different sample components and the inclusion of both immature and adult fish in the same sample. While working out the length-weight relationship for mrigal in the present case, the data of a few fish below 155 mm in length was omitted so as to reach at a more useful equation from practical and commercial point of view.