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# Biometric Studies of *Hilsa ilisha* (HAMILTON) of Allahabad Waters (I): Length-Weight Relationship

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## Introduction

The author has investigated in this paper, the functional relationship between length and weight of *Hilsa ilisha* of Allahabad Waters. It is known that the length of fish is by far more easily measured than its weight and LECREN (1951) maintains that 'back calculations' of past growth from scales and other such characters usually yield data on length alone. It is, therefore, natural to try for an equation which gives the weight as an explicit function of the length. According to HILE (1936) and MARTIN (1949), the length-weight relationship of most fishes can be adequately described by the formula $W=AL^n$, where $W$ and $L$ stand for weight and length respectively, $A$ is a constant and $n$ an exponent which usually varies from 2.5 to 4.0. The 'ideal' fish in terms of length-weight relationship is characterised by a constant shape, and for such a one $n=3$; but most species of fish change in shape as they grow so that for the vast majority of instances the cube law fails to hold.

In a preliminary investigation of the length-weight relationship of *Hilsa ilisha* of the river Hooghly, PILLAY (1958) found that the law $W=CL^n$ was not as satisfactory as the 'exponential' growth equation: $W=Ae^{BL}$, where $A$ and $B$ are constants. Comparison of the calculated weights derived by the two equations, with the observed mean weights, clearly showed the superiority of the exponential law. When the residual errors associated with the two equations were compared, this was further confirmed.

In the present study designed to compare the data concerning *Hilsa ilisha* of Allahabad waters with that of its counterpart in the river Hooghly, the author has followed PILLAY in the choice of the type of hypothetical functional relation: $W=Ae^{BL}$.

The author is thankful to Dr. T. PATI, D. Phil., D. Sc. of the University of Allahabad for his kind help in the preparation of this paper.

## Material and Methods

These fishes were collected by the author directly from the fishermen's catches on the fishing spots. The collections were made at random twice a week throughout the years 1953 to 57 from the rivers Ganga, Jamuna and their tributaries covering a radius of about 40 miles around Allahabad. Various methods were employed for the catch of which some are exclusively meant for *Hilsa* e. g., Kamel net and Bandal; SWARUP, 1958.

The lengths of the specimens were measured on the usual fish-measuring board divided into millimeters. The weights of these specimens were recorded on a balance to the nearest milligram.

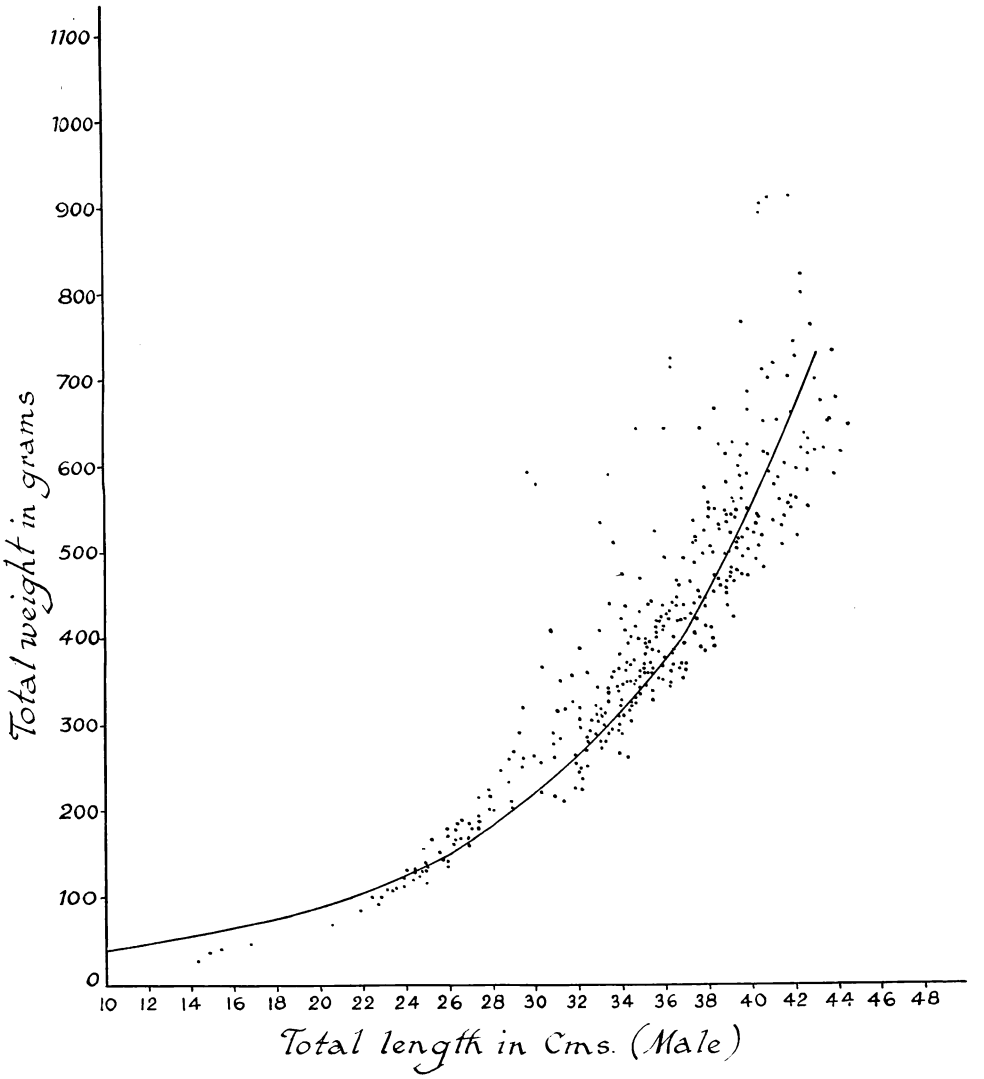


Fig. 1.

## Analysis of Data and Results

For the determination of the constants $A$ and $B$, the regression method of the least squares has been employed. The linear regression equation assumes the form:

$$\log_{10} W = \log_{10} A + BL/\log_e 10,$$

where $e$ is, as before, the base of the natural system of logarithm.

Regreession analysis has been carried out with degree of freedom 30 in each of the three cases: males, females and juvenile, the samples being chosen at random

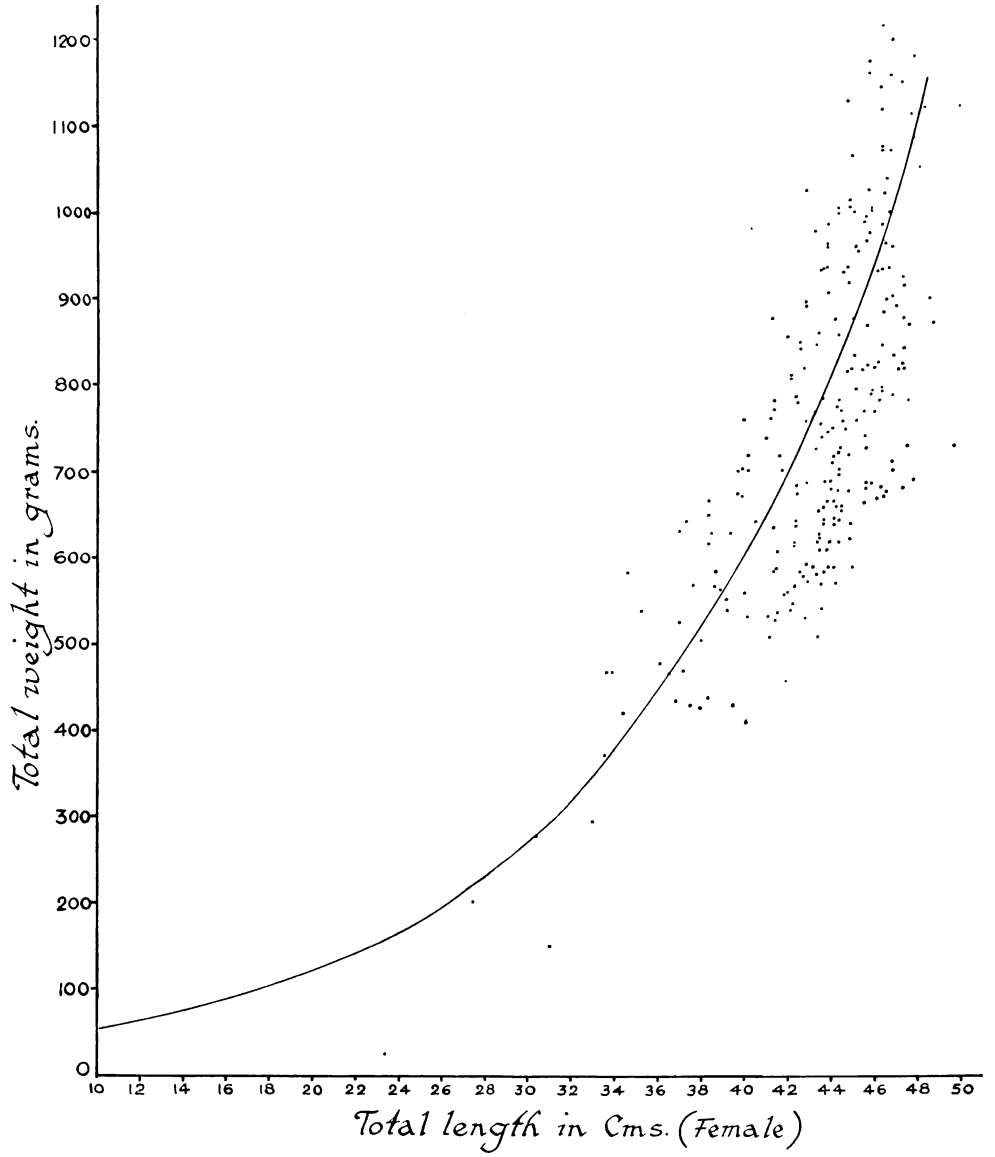


Fig. 2.

from 463 males, 260 females and 247 juveniles.

The values of $A$ and $B$ have been determined by the following formulae:

$$B=\frac{\frac{1}{N}\Sigma xy-\bar{x}\bar{y}}{\frac{1}{N}\Sigma x^2-\bar{x}^2}\cdot \log_e 10\,,$$

$$\log_{10}A=Y-\frac{B}{\log_e 10}\cdot x\,,$$

where $x=L$ and $Y=\log_{10}W$.

The graphical representation is done both ways, namely by plotting the weights against lengths and also the log-weight against lengths. In the latter graphs the linear regression equation written above has also been displayed for all the three cases.

The following equations expressing the length-weight relationship for males, females and juveniles of *Hilsa* of Allahabad waters are thus obtained.

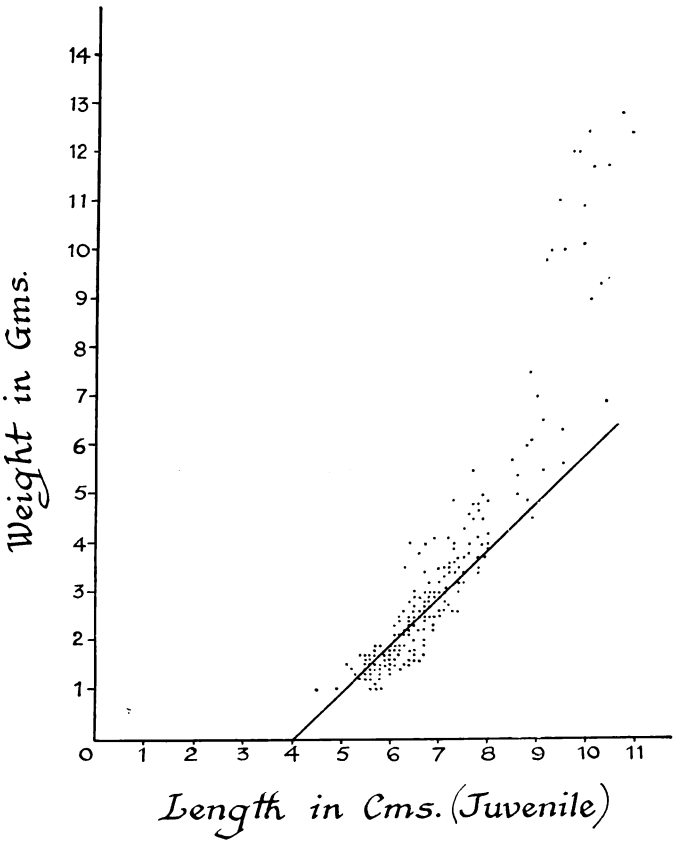


Fig. 3.

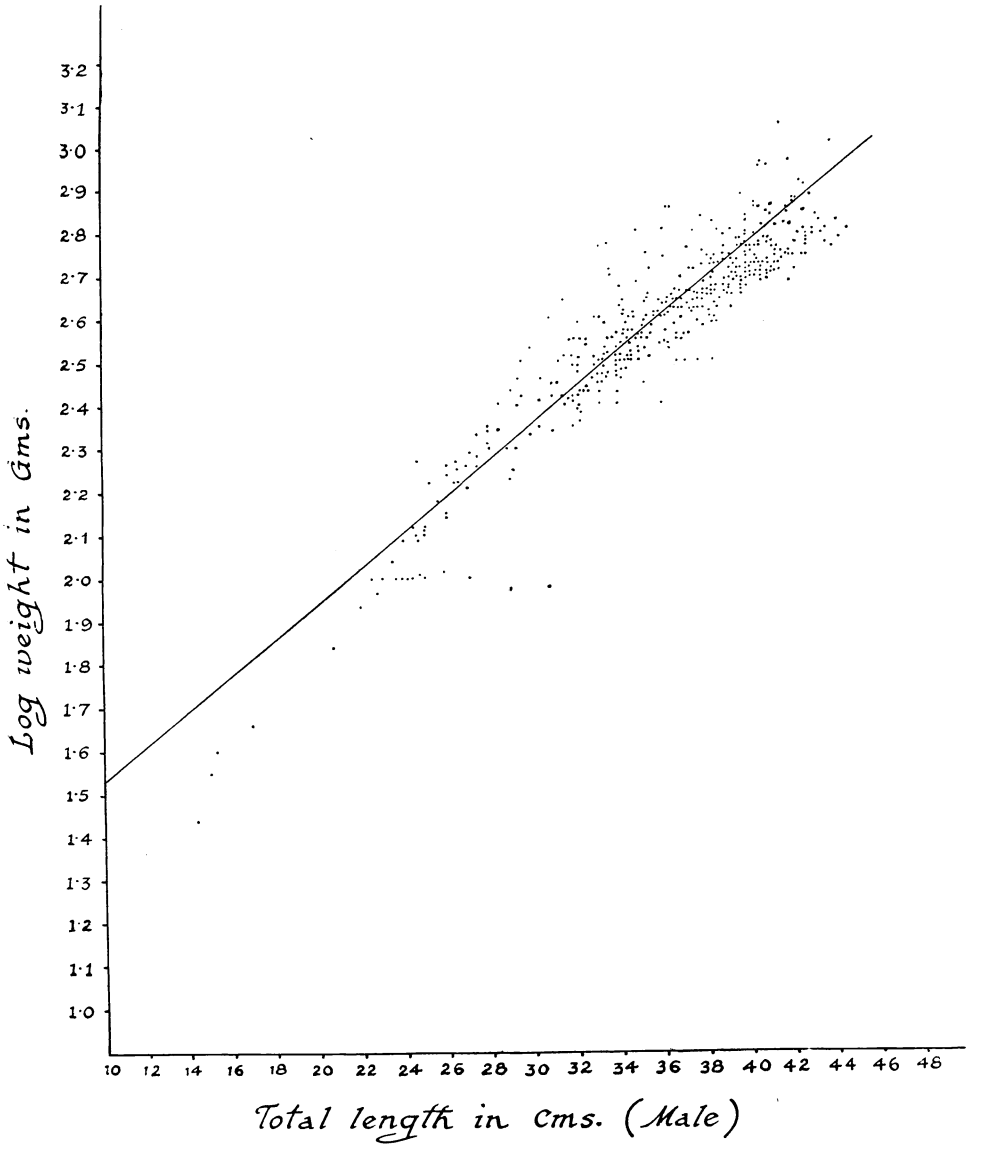


**Fig. 4.**

| | |
|---|---|
| Males | $W=14.76\ e^{\cdot 0907L}$ |
| Females | $W=24.32\ e^{\cdot 0777L}$ |
| Juveniles | $W=\ 1.66\ e^{\cdot 2012L}$ |

The length-weight relationship of males, females and juveniles are presented in Figures 1, 2 and 3 while the length-log weight relationship of males, females and juveniles are presented in Figures 4, 5 and 6.

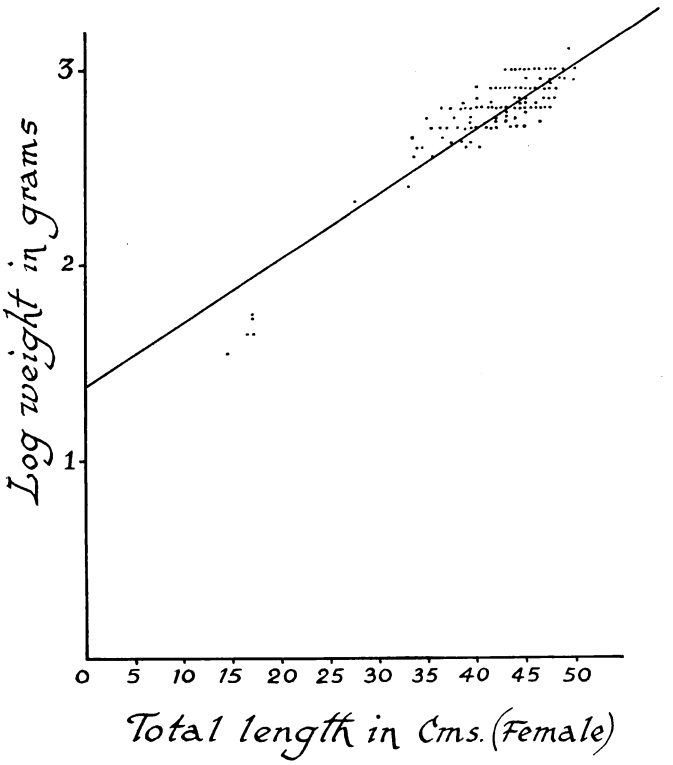
Log weight in grams
3
2
1
0 5 10 15 20 25 30 35 40 45 50
Total length in Cms. (Female)

Fig. 5.

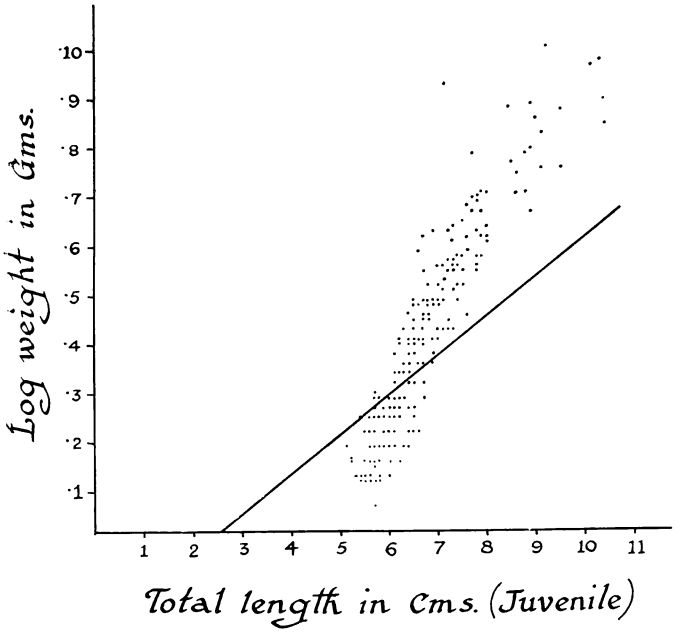
Log weight in Gms.
·10
·9
·8
·7
·6
·5
·4
·3
·2
·1
1 2 3 4 5 6 7 8 9 10 11
Total length in Cms. (Juvenile)

Fig. 6.

## Conclusions

It would be interesting, from the point of view of the study of races, to observe that in the study of the hilsa of Hooghly waters, PILLAY (1958) has obtained the following equations as the length-weight relationship for males, females and immatures (juveniles):

Males $W = 8.5178\ e^{0.1145L}$
Females $W = 24.2517\ e^{10.0871L}$
Immatures $W = 0.1516\ e^{0.3996L}$

In view of the disparity between the results obtained by the author and those obtained by PILLAY under the common assumption of the exponential law for the length-weight relationship, one is led to the study of the question if the more commonly accepted formula $W = CL^n$ is not more appropriate than the exponential formula for expressing the length-weight relationship of the *Hilsa ilisha* of Allahabad waters, and in case the exponential law turns out to be the more satisfactory one, whether the *Hilsa ilisha* of the Allahabad waters does not belong to a race different from that to which the *Hilsa ilisha* of the river Hooghly belongs. This study is being undertaken by the present author and the results will be published later on.

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