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Length-weight relationship of *Xenentodon cancila* (Ham.) (Teleostei: Belonidae)

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Abstract. The length-weight relationship of *Xenentodon cancila* (Ham.) was calculated for males and females. A total of 416 females and 141 males ranging from 101–230 mm in total length was used for the study. Results showed that there is a close relationship between the length and weight of fish. Significant difference was found between the regression coefficients of males and females of *Xenentodon cancila*. By testing the regression coefficients against the isometric growth values of 3, it was seen that for both males and females, the growth pattern agrees with the isometric growth formula.

Keywords. *Xenentodon cancila*; analysis of covariance; length-weight relationship; 't' test.

1. Introduction

While attempting a study of the biology of a fish, it is usual to analyse the mathematical relationship between its length and weight. This analysis will reveal the extent to which the two variables, length and weight, are related to each other, and thereby help one to calculate with ease one variable when the other is known.

In the natural habitat, the weight of a fish increases as the length increases, thereby showing that the weight of a fish is a function of length. Since length is a linear measurement and weight a measure of volume, it was generally found that, for fishes the relation between length and weight could be expressed by the hypothetical cube law,

$$W = CL^3,$$

where W represents the weight of the fish, L its length and C a constant. This cubic relationship holds good only in the ideal fish where the specific gravity and form remain unaltered as they grow. As pointed out by Le Cren (1951) since fishes normally do not remain the same shape or body outline throughout their life time and since the specific gravity of the tissues also may not remain constant, the actual relationship may sometimes depart significantly from this cubic relationship. In such fishes it is better to fit a general parabolic equation,

$$W = aL^n$$

where W represents the weight of the fish, L its length, a a constant equivalent to C and n a constant to be calculated empirically from the data. This relationship is usually expressed in its logarithmic form:

$$\text{Log } W = \log a + n \log L.$$

Xenentodon cancila forms an important minor fishery of Kerala state and details regarding its growth rates are entirely lacking. Hence an attempt was made to study the length-weight relationship in this species.

2. Material and methods

A total of 557 specimens of *X. cancila*, 416 females and 141 males ranging from 101–230 mm in standard length collected during April 1980–March 1981 were used for the present study. All the specimens were procured from the Vellayani freshwater lake in Trivandrum. For each specimen, the standard length in mm was measured from the tip of the snout to the base of the caudal fin and the weight was taken correct to mg in a chemical balance.

In order to find out whether the two sexes of *X. cancila* showed any difference in the length-weight relationship, analysis of covariance was employed (Snedecor and Cochran 1975). The relationship thus estimated was represented graphically to get an idea of the relation between the two variables, weight and length, and also the extent of variation, if any between the sexes. Prior to analysis, the values of W and L were converted to their logarithms, thus the length-weight relationship becomes $\log W = \log a + n \log L$.

3. Results and discussion

Table 1 represents the analysis of covariance to test if the regression coefficients are significantly different for the two sexes of *X. cancila*. It was found that the regression coefficients of the males and females were significant at 1% level, hence separate equations were worked out for the sexes. The relationship between the length and weight was therefore fitted separatedly for the two sexes which is as follows:

1. Females $Y = 2{\cdot}8333\, x - 5{\cdot}1918$
2. Males $Y = 2{\cdot}9014\, x - 5{\cdot}3470$.

Table 1. Analysis of covariance for testing differences in regression coefficients between males and females of *X. cancila* (Ham.)

Source of variation	Degree of freedom	Sum of squares	Mean of sum of squares
Females	414	3·1478	0·0076
Males	139	1·3061	0·0094
	553	4·4539	0·0081
Pooled within	554	4·4552	0·0080
Difference between slopes	1	0·0013	0·0013
Within + between	555	4·7637	0·0086
Difference between adjusted means	1	0·3085	0·3085

For comparison of slopes: Fs = 0·1621.
For comparison of elevations: Fe = 38·5625 (significant at 1% level).

The graphical representations of the same are presented in figures 1 and 2.

In the cube law $W = CL^3$, the value of the exponent n will be 3. For an ideal fish which maintains a constant shape, the value of n will be 3 (Allen 1938). While according to Hile (1936) and Martin (1949) the value of n lies between 2·5 and 4. Beverton and

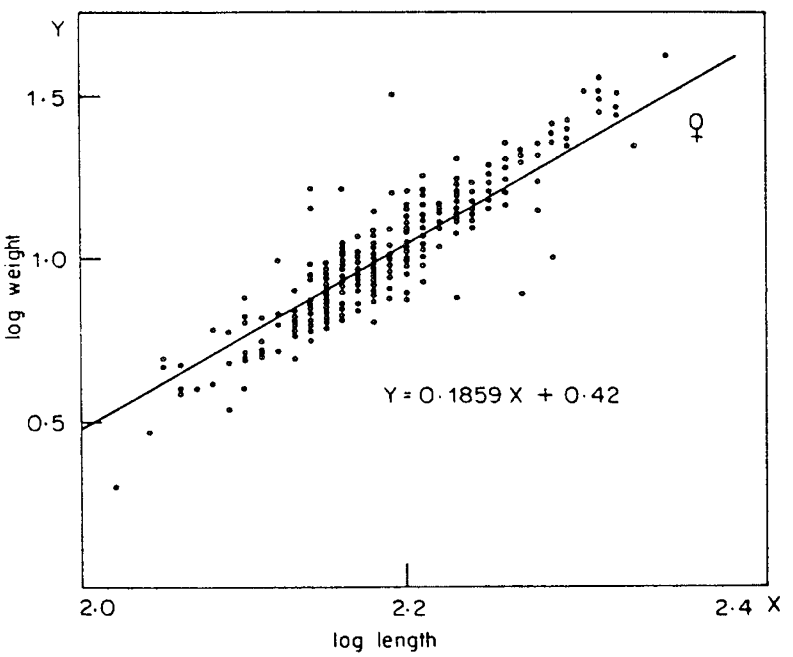

Figure 1. Length-weight relationship of females.

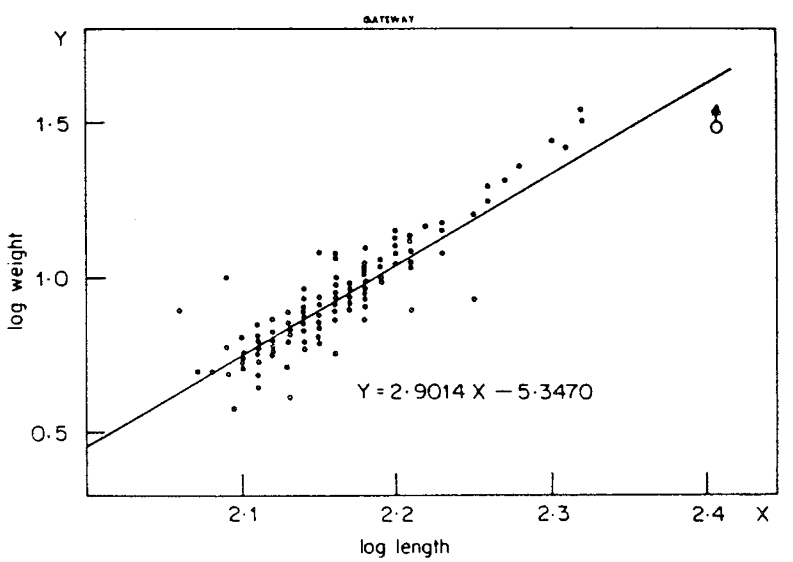

Figure 2. Length-weight relationship of males.

Holt (1957) are of the view that important departures from isometric growth in adult fishes are rare. In order to determine whether any significant variation occurred from the expected value of 3·0 for the ideal fish in the estimate of B for the female and the male of *X. cancila*, '*t*' test was applied using the formula:

$$t = \frac{|3.0 - B|}{S_B},$$

where S_B is the standard error of the estimate of B. The corresponding t values were 0·7569 and 0·3719 respectively for the female and male showing that in both cases the estimate of B is not significantly different from 3.0. Hence the cubic formula $W = CL^3$ would be a proper representation of the length-weight relation of both females and males of *X. cancila*. Both the sexes do not show any significant departure from the isometric growth pattern.

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