

LENGTH WEIGHT RELATIONSHIP OF NILE TILAPIA OF *OREOCHROMIS NILOTICUS NILOTICUS* (LINNAEUS, 1758) (FAMILY : CICHLIDAE)

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ABSTRACT

Length-Weight relationship was studied in Oreochromis niloticus niloticus, for a period of nine months from September 2012 to May 2013. The slope value (b) estimated for O. niloticus niloticus of both sexes was found to be 2.3133. The regression equations calculated for female was $\text{Log } W = -3.4168 + 2.3133 \text{ Log } L$. The correlations coefficient was found to be significant ($P < 0.01$). The significant difference between sexes of the species 'F' value was at 1% level. The b value differed from the ideal cube law of '3' as is with the case of length-weight relationship studied in this species else where. The slope value was compared here could be very useful for comparison with the tilapia species in other geographical locations.

Keywords: Oreochromis niloticus niloticus – length-weight relationship – regression analysis
Population dynamics

INTRODUCTION

Tilapia has been referred to as the 'aquatic chicken'. *Oreochromis niloticus* could be easily identified by dark bands of strips found on their bodies which are most prominent in mature forms. The study of length-weight relationship of Nile tilapia of *Oreochromis niloticus niloticus* (Linnaeus, 1758) (Family: Cichlidae) is having vital importance to fisheries biologists as it serves three purposes. First, it establishes the mathematical relationship between the two variables, length

and weight so that the unknown variable can be readily calculated from the known variables in practical fisheries problem. Secondly, the relative condition can be estimated to assess the general well being of the animals. Finally, it is used in the estimation of potential yield per recruit in the study of their population dynamics. The actual relationship between length and weight may part from the cubic value 3 and this may be due to environmental condition in which the animal lives and also due to the physiological condition of the animal. Length-weight relationship studies of

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any fish species is a pre requisite for the study of its population by (Le Cren, 1951). According to Le Cren (1951), knowledge of the length weight relationship of a fish is essential, since various important biological aspects, viz, general well being of fish, appearance of first maturity, onset of spawning, etc., can be assessed with the help of condition factor, a derivative of this relationship. Moreover, the length-weight of fish is an important fishery management tool because they allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relationship between the two (Beyer, 1987). As length and weight of fish are among the important morphometric characters, they can be used for the purpose of fish stock assessment.

Out of more than 100 species of tilapia, only 8 or 9 species have potential for aquaculture, of which, 2 species belonging to genus *Tilapia* (*T. zillii* and *T. rendalli*) and 4 species belonging to genus *Oreochromis* (*O. niloticus*, *O. aureus*, *O. mossambicus* and *O. andersonii*) are widely cultured in the world (Edwards, 2000). The estimation of yield per recruit in prediction models, and in the estimation of biomass from length observations and limited studies has been made on population dynamics. As no work has been done in this species region, in the present study, an attempt has been made to study the length-weight relationship of *Oreochromis niloticus niloticus*.

MATERIALS AND METHODS

The length frequency and catch data were collected from Barur Reservoir in

Pochampalli Taluk, Krishnakri District from August 2012 to January 2013. Monthly length frequency data of the species in the catch data was used to estimate length-weight relationship of *Oreochromis niloticus niloticus*. Length-weight relationship study was carried out in 189 specimens of *Oreochromis niloticus niloticus* (Fig 1) ranging from 97 to 160 mm in total length and weight range from 10 – 50g. The length-weight relationship was calculated by the method of least squares using the equation of LeCren (1951): $W = a \cdot L^b$, where W = weight in fish, L total length of fish and 'a' and 'b' are the exponents. The same in the logarithmic form can be written as $\log W = \log a + b \log L$. Analysis of covariance (Snedecor and Cochran, 1967) was employed to find out whether the regression coefficients differed significantly between males and females. The significance of difference in the estimate of 'b' in pooled data of sexes from the expected value of 3 (isometric growth) was tested by the 't' test as given by the formula.

$$t = \frac{b - 3}{S_b}$$

b = regression coefficient of log transformed data.

RESULTS AND DISCUSSION

The maximum length recorded for this species in the Thoothukudi region was 16.0 cm. The reported maximum length for this species is 30 cm (Eccles, 1992). *O. variabilis* also to the maximum length of 30 cm was recorded at Lake Victoria Africa (Van oijen, 1995). The linear equation was also fitted separately for both sexes. The correlation coefficient derived for the length-weight relationship for both sexes are given in Table.1. The regression

equations derived for both the sexes are presented below Table.2.

Log W = -3.4168 + 2.3133 Log L (Figure 2)

The results showed significant difference between sexes of the species and the 'F' value was found to be significant at 1% level (Table.3). The correlations coefficient was found to be significant (P<0.01). The observed total length plotted against total weight for both sexes are presented (Figure 1).

In fishes, generally the growth pattern follows the cube law (Lagler Karl, 1952). Beverton and Holt (1957) stated that major deviations from isometric growth are rare. Such cubic relationship for fishes will be valid when fish grows isometrically. But in reality, the actual relationship between the variables, length and weight, may depart from this, either due to environmental conditions or condition of fish (Le Cren, 1951). According to Martin (1949) the value of the exponent 'b' in the parabolic equations usually lies between 2.5 and 4. Depending upon the deviation of 'b' values from '3' fishes can be classified into three groups (i) b= 3 where the body form of fish remains constant at different lengths (isometric) (Allen, 1938), (ii) b<3 when fish becomes more slender as the length increases and (iii) b>3 (allometric) when fish grows more stouter with increase of length (Groner *et.al.*, 1976). The slope value (b) estimated for *O. niloticus niloticus* of both sexes was found to be 2.3133. The regression equations calculated for female was Log W = -3.4168 + 2.3133 Log L. The significant difference between sexes of the species 'F' value was at 1% level. In majority of the fishes the shape and density

change with increasing age, which often causes the regression coefficient of weight of length, depart from 3. The present observation is also in agreement with the above view and it can be concluded that the cube formula $W = al^3$ will not be a proper representation of the length-weight relationship for *Oreochromis niloticus niloticus* as the 't' value is significantly different and the growth is not isometric.

In this present study, *Oreochromis niloticus niloticus* compares favorably with Boghoyinge (1984) Log W= -4.47 + 3.21 Log L recorded for Tilapia mariae in Port Harcourt. It is also similar to Log W= -1.53 + 3.10 Log L (r=0.99) obtained in Bankole (1989) for *Oreochromis niloticus niloticus* on Tiga lake. This finding is also closely similar to the findings of Fafioye and Oluajo (2005) with b value of 3.04. Pauly and Gayannilo (1997) suggested that b values may range from 2.5 to 3.5 which supports result of this study. Beverton and Holt (1957) suggest that the value of 'n' is almost always near to 3. Several theories have been advanced by a number of workers as to what governs or influences the value of 'n' is dependent and governed by the feeding behavior of fish. Also the size of type of food consumed by the fish seems to have influence on the value of 'n'. For example, planktonivores, herbivores and predators have different ranges for the value of 'n' *Oreochromis niloticus niloticus* are undergoing progressive changes in shape and condition as they grow and consequently affecting the regression of the log of weight and log of length.

In fishes 'b' value is usually '3' in the length-weight relationship, but during growth

change in specific gravity of body contour, morphological changes due to age may also cause the coefficient of regression of logarithm on logarithm of length, to depart substantially from 3.0 (Rounsefell and Everhart, 1953).

Thus, comparing the slope of *Oreochromis niloticus niloticus* with other Cichlidae species, it could be concluded that the slope value is less than 3 for the both sexes of *Oreochromis niloticus niloticus*.

Table.1: Statistics in the length-weight relationship of males and females of *Oreochromis niloticus niloticus*

Sex	N	SX	SY	SX ²	SY ²	SXY
Males and Females	189	398.609	274.9414	838.6353	404.5434	580.1029

N= Number of fish

SX², SY², SXY = Sum of squares and product

SX, SY = Sum of logarithmic values of length and weight respectively.

Table. 2 :Regression data for the length-weight relationship of males and females of *Oreochromis niloticus niloticus*

Sex	Sum of Squares and Products					DF
	DF	X ²	XY	Y ²	b	
Male and Female	189	838.6353	580.1029	404.5434	2.3133	188

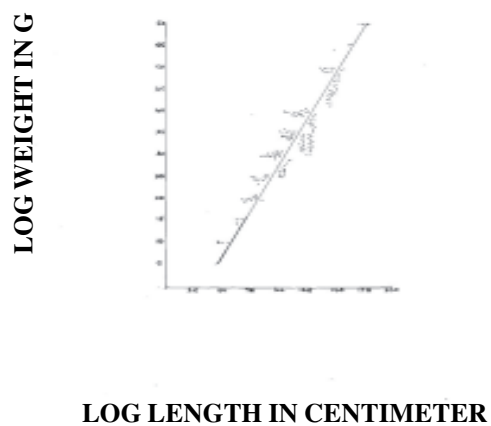
DF: Regression freedom

B: Regression Co-efficient

SS: Sum of Squares

Table.3 - Test of Significance

Source of Variation	DF	Sum of Square	Mean Square	Observed F
Deviation from individual within sexes	1	1243.1787	1243.1787	187.0004061
Difference between Regression	187	1243.1787	6.6480	
Deviation from Total Regression	186	2486.3574		Significant at 1% level



**Figure 1: Logarithmic relationship between length and weight of males and females
*Oreochromis niloticus niloticus***

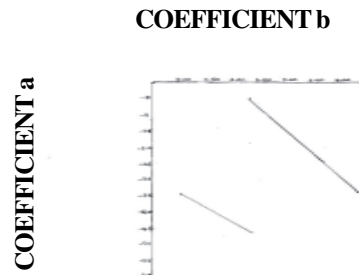


Figure 2 :Relationship between the regression coefficients a and b of *Oreochromis niloticus niloticus*

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