A. Dhakal, B. R. Subba / Our Nature (2003) 1: 53-57

Length-Weight Relationship of *Lepidocephalichthys guntea* of Pathri Khola, Morang District

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Abstract

Length and weight of fish were taken in fresh condition separately for male, female and juvenile of 'Pathri Khola', Morang and then converted into logarithmic values. The correlation coefficient of different samples showed very high degree of correlationship varying from 0.9153, 0.8591 and 0.8290 for female, male and juvenile respectively. The comparison of the samples of male, female and juvenile did not show any significant differences.

Keywords: *Lepidocephalichthys guntea*, Morang, Length-Weight relationship

Introduction

Growth of an organism means a change in length or weight or both with the increasing age. Increment in size is due to conversion of the food matter into building matter of the body by the process of nutrition. A vector diagram known as growth curve is obtained when length or weight of an individual are plotted against specified time. The curve appears as a sigmoid (S-shaped) curve. It may vary for the same fish of different localities or for the same fish at different seasons. The rate of growth is easily influenced by many physical factors. Different organs of body or even different organs have different rates of growth. Theoretically, it is expressed by the formula (cube law),

$$W = KL^3$$

Where, W = weight of fish
L = Length of fish
K = constant.

[For the fish showing symmetrical or isometric growth throughout]

But in nature, the body proportion of a fish continuously changes with ageing. So the simple cube law expression therefore does not hold good throughout the life history of fish, as the value of K is not constant but subject to great variation. Therefore, a more satisfactory formula is given as:

$$W = aL^n \text{ or } (\text{Log } w = \log c + n \text{ Log } L)$$

Where, W = Weight
L = Length
n = constant

The values of constant 'a and 'n' are determined empirically from data, as the coefficient of condition. These values may change with age, sex, seasons and system of measurement. In fisheries practice, knowledge of length - weight relationship is very useful. Plotting a graph called a dot diagram in which length and weight of each fish of random sample are plotted on a double logarithmic graph paper makes estimation of the length weight relationship. Approximate regression lines are drawn which represents the length and weight relationship.

Many workers have studied the length and weight relationship of fishes (Khan and Hussain 1941, Jhingran 1952, Alaga Raja 1962, Narasimham 1970, Majumdar 1971, Sinha 1972, Vinci and Kesavan 1974, Nautiyal 1985, Kaliyamurthy *et al.* 1986, Philip and Mathew 1996, Subba and Pandey 2000, Mehata 2002).

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Materials and Methods

A total of 129 fishes of 'Pathari Khola', Morang district of eastern Nepal, were collected out of which 42, 44 and 43 were female, male and juvenile respectively. The total as well as standard length and weight of every fish was measured. The minimum and maximum total length taken were 5cm and 9.4 cm. The weight of fish taken was 0.47 gm as minimum and 6.2 gm as maximum. The sex of fishes was determined by an internal examination of gonads. The data were computed using computer.

The equation,

$W = aL^n$ has been used to establish the length and weight relationship of fishes, where,

W = weight of fishes.

L = length of fishes.

'a' and 'n' constants were determined empirically.

After that, graphs were plotted for comparison the log weight of female, male and juvenile against log total length and log standard length. Average total length, standard length and body weight of females, males and juveniles with standard deviation shown in the table 1, 2 and 3 respectively. Table 4 and 5 showed Regression equation of weight on total length and standard length with correlation coefficient (r) and exponent value (n). Log/log plot showing the relationship between body weight with the total length and standard length of the females, males, juveniles, and combined are shown in figure 1 and 2.

Results and Discussion

In the present investigation, the total length as well as standard length have been taken as parameters. The exponent values (n) for female, male, juvenile and combined were 3.1814, 2.6898, 4.5776 and 3.4838 respectively in case of total length as parameter (Table 4). When the standard length was taken as parameter, the exponent values (n) for female, male, juvenile and combined were 3.5568, 2.4349, 3.6583 and 3.2167 respectively (Table 5). It was observed that the values of 'n' were higher in females than those of males may be due to the enormous growth of ovaries in the females as compared to that of testes in the males. High values of 'n' in juveniles may be due to the high feeding intensity of the juveniles. The increase in the weight in relation to the total length as well as standard length was well marked. Females were found to be heavier than the males up to the total length 7.1 cm and standard length remains 5.7 cm. Males were found to be heavier than females from 7.1 to 7.3 cm. total length and 5.7 to 5.8 cm as its standard length. Again the females were found to be heavier than males from 7.3 to 7.8 cm. total length (5.8 to 6.3 cm standard length) males and females were found to be of same weight when the total length ranged between 7.8 cm to 8.4 cm. (Standard length ranging between 6.3 to 6.9 cm). In short females were heavier in small and large sized fishes and males were heavier in medium sized fishes. The correlation coefficients(r) were 0.8810 and 0.8678 (Table 4 and 5) respectively in case of total length and standard length, as parameters. In both cases the correlation coefficient found to be higher than 0.5, showing the length-weight relationship is positively correlated and vice versa. The values of 'a' and 'n' differ not only in different species but in same species also due sex, maturity stage, feeding intensity etc. According to Hile (1936) and Martin (1949) the values of exponent 'n' usually ranges between 2.5 and 4. Allen (1938) suggested that the value of n remains constant at 3.0 for an ideal fish. Tesch (1968) viewed the exponent (n) values of '3', which indicates the specific gravity of the tissue remains constant throughout its life for an ideal fish. Probably due to this reason, the 'n' value is found to be very close to 3 in many cases. Hence it is generally called the cube law. However, fish normally do not retain same shape of the body throughout their life span and the relationship may depart from the cube law. Seasonal fluctuation in environmental parameters, physiological condition of the fish at the time of collection, gonad development and nutritive condition of the environment of the fishes are the causes for this variation. (Sinha 1973, Das Gupta 1982). The exponent value (n) of *Lepidocephalichthys guntea* for total length and standard length taking as parameters indicated that the values of slope 'n' showed variation around '3'. The exponent value of total length combined was 3.4838, 3.1840, 2.6898 and 4.5776 were for combined females, males and juveniles respectively (Table 4). When the standard length was taken as parameter, the values of (n) were 3.2167, 3.5568, 2.4349 and 3.6583 respectively for combined, females, males and juveniles (Table 5). Thus it can be concluded that *L. guntea* did not follow the cube law strictly. Chakraborty and Singh (1963) observed that value of 'n' in *Cirrhina mrigala* was considerably higher than 3. Khan (1972) observed that the value of 'n' in *Labeo rohita* of river to be 3.17 and 3.06 respectively. Sinha (1973) estimated a value of 3.02 in *Puntius sarana*. Jhingran (1952) found the values of 'n' were slightly departed from 3 i.e; 3.15, 3.02 and 3.01 in *C. mrigala, Catla catla* and *Labeo rohita* respectively. However, 'n' values of present observation show a clear departure from 3 while taking the both total length (3.4838) and standard length (3.2167) as parameters. The values of 'n' were different in females, males and juveniles in both cases

It has been observed that 'n' values of the females were higher than the values for males in both cases, which may be due to the enormous increase in weight of ovaries in females. 'n' values for juveniles were found to be higher in both cases, which may be due to higher feeding intensity of the juveniles.

Table 1. log weight, log total length and log standard length of female.

S. N.	Average log Wt.(gm)	Average log total Length.(cm)	Average log standard length (cm)
1	0.350	1.833	1.75
2	0.488	1.860	1.77
3	0.545	1.890	1.80
4	0.562	1.892	1.80
5	0.596	1.914	1.83
6	0.631	1.925	1.84
7	0.683	1.935	1.85
8	0.763	1.950	1.86

Table 2. log weight, log total length and log standard length of male.

S. N.	Average log Wt.(gm)	Average log total Length.(cm)	Average log standard length (cm)
1	0.319	1.828	1.744
2	0.381	1.842	1.757
3	0.414	1.850	1.761
4	0.460	1.850	1.763
5	0.491	1.880	1.787
6	0.550	1.890	1.800
7	0.650	1.934	1.840

Table 3. log weight, log total length and log standard length of Juvenile.

S. N.	Average log Wt. (in gm)	Average log total Length (in cm)	Average log standard Length (in cm)
1	0.290	1.712	1.62
2	0.115	1.7433	1.66
3	0.123	1.7877	1.70
4	0.1528	1.7877	1.70
5	0.2131	1.7891	1.71
6	0.241	1.7924	1.72
7	0.285	1.81	1.73

Table 4. Regression equation of weight on total length of *L.guntea* and their test of significances.

Source	Regression Coefficient (n)	Intercept (a)	Correlation (r)	Parabolic equation
Female	3.1814	-5.3148	0.9313	$W=0.48\times^{-5} L^{3.1814}$
Male	2.6898	-4.2436	0.8671	$W=0.57\times10^{-4} L^{2.6898}$
Juvenile	4.5776	-7.9366	0.8445	$W=1.16\times10^{-8} L^{4.5776}$
Combined	3.4838	-5.8317	0.8810	$W=0.62\times10^{-4} L^{3.4838}$

Table 5. Regression equation of weight on standard length of *L.guntea* and their test of significances.

Source	Regression Coefficient (n)	Intercept (a)	Correlation (r)	Parabolic equation
Female	3.5568	-5.3348	0.9153	$W=0.46\times10^{-5} L^{3.5568}$
Male	2.4349	-3.2169	0.8591	$W=0.61\times10^{-3} L^{2.4349}$
Juvenile	3.6583	-5.6272	0.8290	$W=0.23\times10^{-5} L^{3.6583}$
Combined	3.2167	-4.7263	0.8678	$W=0.43\times10^{-5} L^{3.2167}$

Acknowledgements

The first author is thankful to Royal Nepal Academy of Science and Technology for financial assistance. We would like to pay our sincere thanks to Mr. H. R. Gautam, lecturer in Management, P.G. Campus, Biratnagar, for computation of data.

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