Our Nature (2009) 7:218-221

Studies on Length-weight and Length-length Relationship of a Freshwater Fish *Gudusia godanahiae* from Biratnagar, Nepal

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Received: 21.11.2009, Accepted: 20.12.2009

Abstract

Present study describes the length-weight (LWR) and length-length (LLR) relationships of a freshwater fish *Gudusia godanahiae* from a fish pond of Sarochiya, Biratnagar, Nepal. 91 specimens of *G. godanahiae* were collected from fisherman's catch from Nov 2008 to Oct 2009, were used for this study. The slope value (b) of the LWR are not so close to isometric growth, (b=2.9017). Results for LLR (r^2>0.9) P<0.001 indicate that these are highly corrected and highly significant.

Key words**:** *Gudusia godanahiae*, length-weight, length-length, relationship

Introduction

The study of the length weight relationship of fishes is of vital importance to the fishery biologists, in setting up yield equations in the study of population dynamics, taxonomic differences, events in life history like metaporphosis, maturity (Le Cren, 1951), in determining the pattern of growth of stock and to the fisheries officials in evolving effective policies for the management and conservation. In fishes, generally the growth pattern follows the Cube law (Brody, 1945; Lagler, 1952) but the actual relationship may depart from this (Le Cren, 1951) either due to environmental factors or condition of fish. The mathematical relationship between length and weight of fishes is a practical index suitable for understanding their survival, growth, maturity, reproduction and general well being (Le Cren, 1951)

The relationship is generally expressed by the equation: $W=aL^b$. Several workers *viz*. Mohammed (1956), Jhingran (1959), Sinha (1973), Pandey *et al*. (1974), Pathak (1975), Kumar *et al.* (1979), Subba and Ghosh (2000), Subba and Pandey (2000), Dhakal and Subba (2003), Soomro *et. al*., (2007), Ansumala and Subba (2009) have been used this equation in different fish species obtained from different environmental condition.

Length-weight relationship are useful in fishery management for both applied and basic use (Pitcher and Hart, 1982) to (i) estimate weight from length observations; (ii) calculate production and biomass of fish population; and/or (iii) provide information on stock or organism condition at the corporal level. Length-length relationships (LLR) are also important in fisheries

management for comparative growth studies (Moutopoulos and Stergiou, 2002). Present work will provide baseline information for the growth of the fish *Gudusia godanahiae* on the basis of the length-weight and length-length relationship study.

Materials and methods

A total 91 specimens were collected from a local fish pond located at Sarochiya, Biratnagar, Nepal, from Nov. 2008 to Oct. 2009. Total length (TL) and fork length (FL) were measured using a divider and a scale (mm), while weight was determined as total weight (Wt) including gut and gonads, using a digital balance to the nearest 1/100gm. The specimens ranged from 1 to 34.8g in weight and 47 to 167 mm in total length. The values of constants *a* and *b* were estimated from the log transformed values of length and weight i.e. *log W=log a + b log L*, via least square linear regression (Zar, 1984). The coefficient *a* is the intercept, and the regression of coefficient *b* is an exponent, indicating isometric growth when equal to 3.0, a value larger or smaller than 3.0 shows allometric growth (Bagenal and Tesch, 1978). Furthermore, relationships in between FL v/s TL were also estimated by using the above least square linear regression equation. Relationship equations were established by least square method. Logarithmic transformations of the data were used for length-weight relationships.

Results and discussion

The body weight of *Gudusia godanahiae* showed a clear cut increasing trend with the increase in body length. When the logarithmic values of weight were plotted on the co-ordinate (Y-axis) against those of respective length on the abscissa (X-axis) they always gave straight lines in all cases as shown in figures 1 a, b, 3 and 4.

Regression equations for all forms (combined data) are as follows:

For length-length:

$TL = 1.228\ FL + 0.1349$

or $FL = 0.7995\ TL - 0.0432$

For length-weight:

$Wt = 0.0104\ TL^{2.9017}$

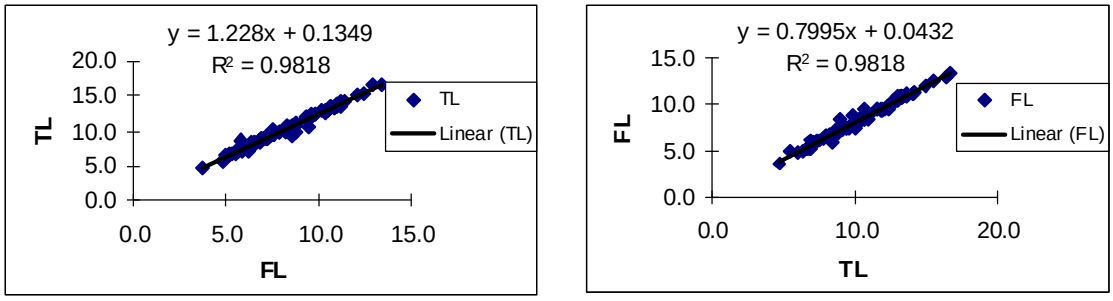
or $\text{Log } Wt = 2.9017\ \text{Log } TL - 1.9818$

$WT = 0.0213\ FL^{2.863}$

or $\text{Log } Wt = 2.863\ \text{Log } FL - 1.6709$

The exponent b values for the total length and weight is 2.9017 and that of forcal length and weight is 2.863. The values of regression coefficient (b) for all length-weight relationship came close to be 3.The b values show negative allometric growth. The value of 'b' is higher in the case of total length-weight relation than that of forcal length-weight relation. Results for LLR indicate that these are highly correlated $r^2 > 0.9$ i.e. $P < 0.001$.

All allometric coefficients *(b)* estimated in this study were within the expected range 2.5-3.5. According to Pauly and Gayanilo (1997), *b* values may range from 2.5 to 3.5 suggesting that the result of this study is valid. The value for correlation coefficient (r^2) for the length-length parameter was > 0.9, hence it is highly significant ($P<0.001$). In the case of length-length (Forcal length and total length) relationship, exponent 'b' values are -0.0075



a b

Figure 1. Graphs with regression equation and coefficient of determination (r^2) for all specimens showing length-length relation (a) TL = 1.228 FL + 0.1349 (b) FL = 0.7995 TL - 0.0432

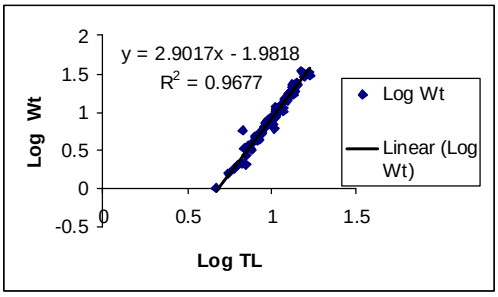


Figure 2. Graphs with regression equation and coefficient of determination (r^2) for all specimens

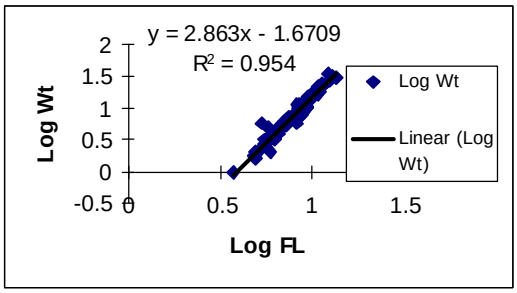


Figure 3. Graphs with regression equation and coefficient of determination (r^2) for all specimens showing length-weight relation WT = 0.0213 $FL^{2.863}$ or Log Wt = 2.863 Log FL - 1.6709

and 0.2207 the former reveals that forcal length is nearly 80% of the total length, whereas, the latter indicates that the total length is a little bit more than 120% of the forcal length.

The present study provides baseline information on LWR and LLR for *Gudusia godanahiae*. It will be useful for researchers and fishery managers.

The correlation coefficients (Figs. 1 a, b, 2, 3) in both cases are highly significant ($p < 0.001$).

Acknowledgements

Authors would like to acknowledge fishermen who did not neglect to inform us in the time of fishing.

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