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Length-weight relationship, condition factor of rainbow trout (*Oncorhynchus mykiss*) from Kashmir waters

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ABSTRACT

Length-weight relationship was studied in Rainbow trout (Oncorhynchus mykiss) collected from Kokernag and Verinag(Jammu and Kashmir). A total of 70samples of rainbow trout ranging from length 20 to 35.3 cm, weight ranging from 175 to 810 and breadth from 4.8 to 9.4. The length-weight relationships shows the b value were 3.39. During the present study, the length weight relationships of Rainbow trout increases proportionally with increase in length. The condition factor was found to be 1.83.

Key words: Rainbow trout, Length-weight, Condition factor and Jammu and Kashmir.

INTRODUCTION

Length weight relationship (LWR) of fishes is important in fisheries and fish biology because they allow the estimation of the average weight of a fish of a given length by establishing a mathematical relation between them (Sarkar*et al*., 2008: Mir *et al*., 2012). Length weight relationship like any other morphometric character can be used for the taxonomic units and the relationship changes with the various developmental event, growth and onset of maturity (Thomas *et al*., 2003). Length weight parameters (a and b) are useful in fisheries science in many ways: to estimate weight of individual fish from its length, to calculate condition indices, to compare life history and morphology of populations belonging to different regions (Sani*et al*., 2010). The length-width/weight relationship is regarded as more suitable for evaluating fish populations (Stickney, 1972: Petrakis and Stergiou, 1995: Dulcic and Kralijevic 1996). In fact, length-width and weight data are useful and standard results of sampling studies. Length-weight relationship and condition factor areextremely useful tools for understanding the biological changes in fish stocks (LeCren, 1951; Bagenal and Tesch, 1978). Huxley (1924) was the first to propose the allometricgrowth formula to describe the relationship between length and weight.

Condition factor is another wayof expressing the relationship between length and weightof a particular fish. There are three basic variations ofwell-being for the whole fish namely, Fulton's ConditionFactor (Fulton, 1904), Relative Condition Factor (Le Cren,1951) and Relative Weight (Wege and Anderson, 1978).The condition factor is often associated with fitness orwell-being of an organism. Condition factor andlength-weight regression analyses have been used to assessindividual trout health and habitat conditions, as well asthe condition of a population of trout inhabiting a streamor river (Reimers 1963; Cada et al., 1987; Murphy, 1988;Anderson, 1990; Ensign et al., 1990;Miranda and Jackson, 1990; Springer andMurphy, 1990; Filbert and Hawkins, 1995). A fishis said to be in better condition when the value of conditionfactor is more than 1 and in worse condition than an averageindividual of the same length, when its value is less than 1.

However, the stock status of the Rainbow trout in the valley is still unknown, due to poor knowledge of the biological parameters and statistics used for analysis. In addition, no detailed information about the biology of the rainbow trout is available. In this study therefore, some aspects of the biology of the rainbow trout, including data on length, width, weight, length or width-weight relationships, and size frequency distributions, from samples taken from the Kashmir valley were studied.

MATERIALS AND METHODS

Present study estimates LWRs of Rainbow trout (*Oncorhynchus mykiss*) procured from Verinag and Kokernag hatcheries from February 2013 to January 2014. 70 fish samples were collected using fishing gears such as drag nets and gill nets. After collection, the fish samples were measured and weighed. Total length (TL) of each fish was taken from the tip of the snout to the extended tip of the caudal fin nearest to 1mm by digital caliber and weighed to the nearest gram (g) by digital weighing machine.

Length -weight relationship (LWR): the relationship between length and weight of fish was analyzed by measuring length and weight of fish samples collected from study area. The statistical relationship between these parameters of fishes were established by using parabolic equation by Froese (2006).

$$W= aL^b$$

The relationship ($W=aL^b$) when converted into the logarithmic form gives a straight line relationship graphically

$$\text{Log } W= \text{Log } a+ b \text{ Log } L$$

Where b represents the slope of the line, Log a is constant.

The relationship between length and weight for mean samples were used to calculate Fulton's Condition Factor Index (CF; Ricker 1958), which is estimated using the following equation:

$$CF = \{W/L^3\} \times 100$$

where, L is the length in centimeters (cm) and W is the weight in grams (g).

RESULTS

During the present study 70 samples of Rainbow trout were procured. The mean weight found was 415.24 grams, mean length obtained was 28.28 cm and mean breadth was 7.29 cm. The b value for length-weight obtained was 3.39, for length-breadth b value was 1.49 and for breadth-weight b value was found to be 2.10. condition factor calculated was found to be 1.83. The coefficient of correlation (r) for various morphometric characters compared against total length ranged from 0,878 to 0.942

Width/length-weight relationship

The mean length (cm), breadth (cm), and weights (g) (± SE) used in the analysis of width/length- weight relationships and their standard deviation are given in Table 1. The linear regressions between width or length and weight were highly significant ($P < 0.01$).

Table 1: showing mean length, weight, breadth with standard deviation and correlation.

Parameters w.r.t. Total Length	Mean	S.D.	Correlation "r"	Regression equation Y = a + b(X)
Weight	415.24	71.02	0.86**	0.902 + 3.39 (X)
Breadth	7.29	0.97	0.785**	0.878 + 1.49 (X)

*** Correlation significant at the 0.01 level (2-tailed)*

Parameters w.r.t. Breadth	Mean	S.D.	Correlation "r"	Regression equation Y = a + b(X)
Weight	415.24	71.02	0.913**	0.942 + 2.10(X)

*** Correlation significant at the 0.01 level (2-tailed)*

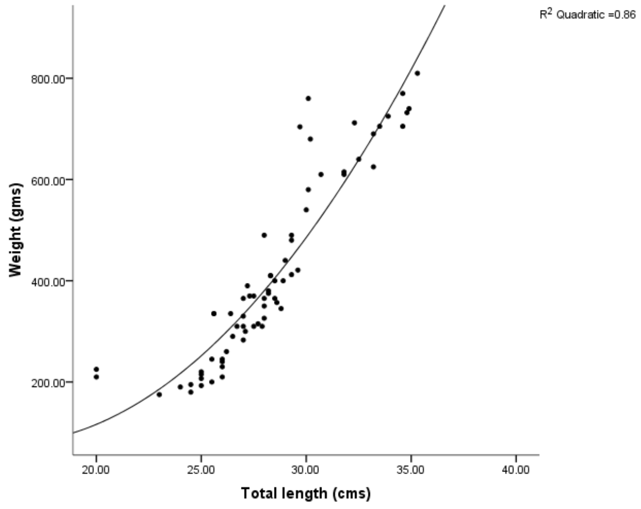

Fig 1: Length-weight relationship of *O. mykiss*

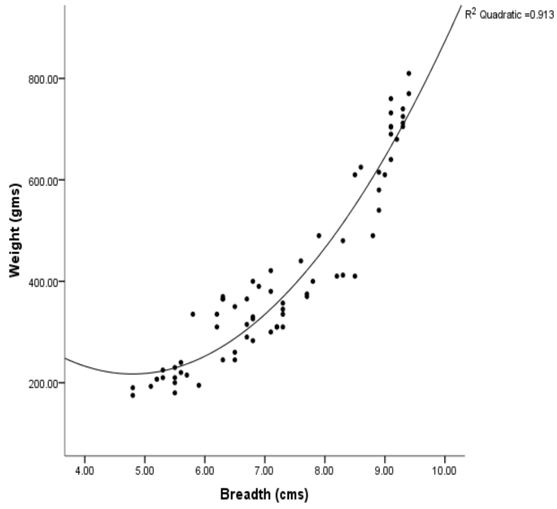

Fig 2: breadth-weight relationship of *O. mykis*

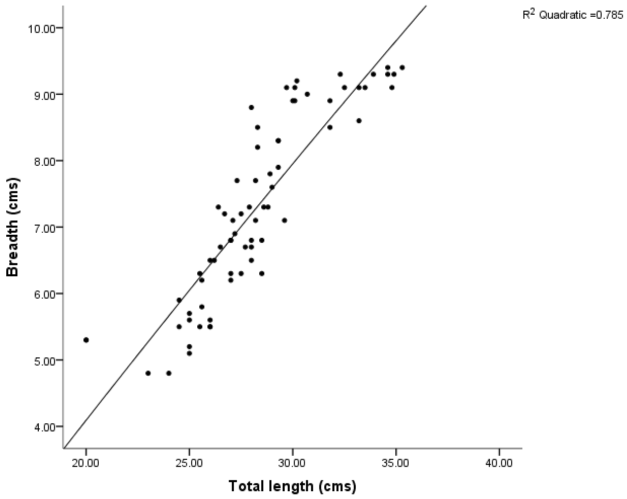

Fig 3: Length-breadth relationship of *O. mykiss*

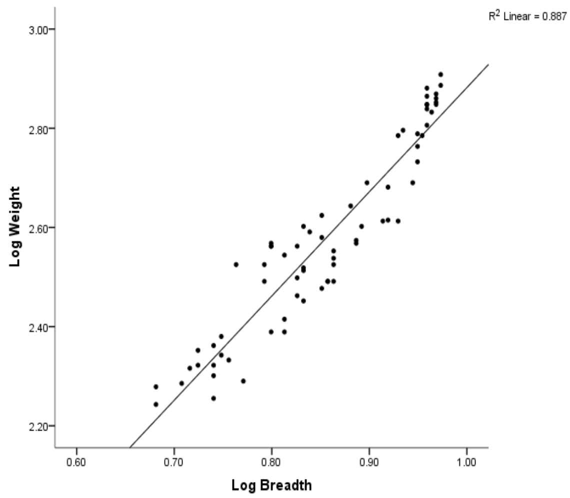

Fig 4: Logarithmic values of breadth and weight of *O. mykiss*

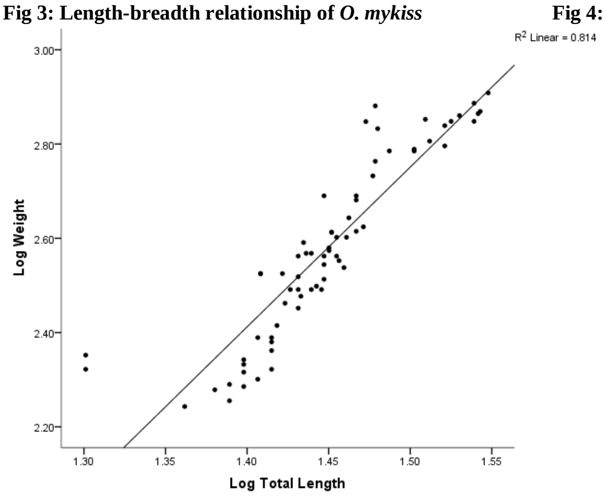

Fig 5: Logarithmic values of length and weight of *O. mykiss*

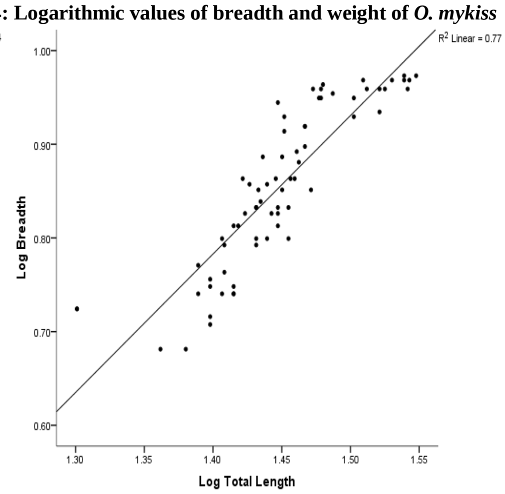

Fig 6: Logarithmic values of length and breadth of *O. mykiss*

DISCUSSION

It is universal that growth of fishes or any other animal increases with body length, thus it can be concluded that length and weight are directly interrelated. Length- weight relationship is expressed by the cube formula $W= aL^3$. The weight of the fish increased logarithmically with an increase in length, with the value lying between 2.5 and 3.5 but usually close to 3.0 (Carlander, 1950). The b value was calculated to find out whether the fish is growing allometrically or isometrically. If the b value is 3.0 the growth is isometric, and it holds good only when the density and form of the fish are constant. If it is allometric, the fish grows with weight increasing at slower ($b < 3.0$) or faster (> 3.0) relative to the increase in length. In the present study the value of "b" for rainbow trout for length-weight was 3.39 here length-weight was positively correlated. A similar case of "b" value was observed in Mugilcephalus by Luther (1968). Qasim (1973a) and Bal and Rao (1984) indicated that the values of a and b differed not only between different species but also within the same species depending on sex, stage of maturity and food habits. Beverton and Holt (1957) reported that cubic relationship between length and weight had the b value near to 3.0. Ricker (1958) observed that a fair number of species seem to approach this ideal. Hile (1936) proposed that the b value for an ideal fish might range between 2.5 to 4.0.

Goncalves*et al.*, (1997) and Ozaydin*et al.*, (2007) found that the parameter b unlikely may vary seasonally and even daily. Differences in the b values can be attributed to the combination of one or more factors such as: number of specimens examined, area/ seasonal effect, habitat, degree of stomach fullness, gonodal maturity, sex, health and differences in the observed length ranges of the specimens caught (wooten, 1998), all of these above mentioned parameters were not accounted in the present study.

The value of Fulton's condition factor in the presentstudy was found to be 1.83 which being very close to unity, indicates that the fish are in excellent condition. Similar values of condition factor for rainbow trout have been reported by various authors. Rabe (1967) reported the value of condition factor to be between 0.859 and 1.104 for rainbow trout in Alpine lakes.Cada*et al.* (1987) reported condition factors for rainbowtrout collected from southern Appalachian streams that ranged from 0.82 to 1.17.

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