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THE CONDITION FACTOR, LENGTH-WEIGHT RELATIONSHIP AND RELATIVE CONDITION OF *LABEO DUSSUMIERI* (VALENCIENNES, 1942) FROM MEENACHIL RIVER, KOTTAYAM, KERALA

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ABSTRACT
The paper provides information on the length-weight relationship, condition factor and relative condition of *Labeo dussumieri* (Valenciennes, 1942) belonging to different size classes from the lower reaches of Meenachil river. The total length of the fishes analyzed ranged from15.6 cm to 32 cm and the total weight ranged from 92 g to 400 g. From a sample size of 300 specimens collected during a period of six months (November 2014 and April 2015) K value was 1.29 and the exponential equation was $W=0.000388\ L^{3.061}$ indicating an isometric growth pattern. The slope value was lower than the critical isometric value of 3 exhibiting negative allometric growth in smaller length groups (< 25 cm). The relative condition factor of all specimens analyzed were greater than 1 indicating that the fish is in good growth condition. The study revealed that *Labeo dussumieri* in Meenachil River is in a stable environment and the medium sized fishes dominate the population

KEYWORDS: Length-weight relationship, Condition factor, Relative condition factor, *Labeo dussumieri.*

INTRODUCTION
Determination of the mathematical relationship between the variables length and weight of fishes is useful in assessing the well being of individuals in a population. In species of commercial importance, the length-weight relationship is found useful in converting the catch statistics of a particular species from weight to number in order to obtain the abundance of stock in space and time (Froese, 2006). The actual length-weight relationship may depart significantly from the cube law (LeCren, 1951) and the relationship provides information on the condition of the fish species on a spatio- temporal scale. Basically condition factor represents the quality of individual fishes which is actually the result of interaction between biotic and abiotic factors and their effect on the physiological condition of fish (Jhingran, 1972). Relative condition factor (Kn) is a measure of the variation from the expected weight of fish and permit comparison of a fish against a standard calculated weight. As such its use is limited to within population comparison, as for seasonal effect or sexual differences in growth (Ney, 1999), but valuable for the management of fishery resources in an ecosystem.

Labeo dussumieri (Valenciennes, 1942) is an indigenous carp of Kerala, commonly known as Malabar Labeo or Thooly or Pullan in central Kerala. The fish is an important delicacy of central Travancore and its fishery is of greater significance. In Kerala the species is known from the rivers Pampa, Achancovil, Manimala, Meenachil and Periyar (Kurup, 2000), but was under threat from indiscriminate fishing often with illegal gears and poor habitat quality (Kurup and Kuriakose, 1991). The population of the species has increased in the recent years and now assessed at 'Least concern' by IUCN. Spawning season of the species extends from June to August and in central Kerala *Labeo dussumieri* migrates massively during the monsoon season, a phenomenon locally known as 'Thooliyilakkam'.

Though the population of a particular species of fish from different river systems was found to be genetically homogenous, the morphometric analysis of a population from different river systems shows considerable fluctuations. The morphometric variations of organisms are believed to have been evolved as a result of the long term fluctuations in the environment prevailing in the particular ecosystem. The present study estimated the length-weight relationship and condition of *Labeo dussumieri* inhabiting the lower reaches of Meenachil river in Kottayam, Kerala.

MATERIALS AND METHODS
A total of 300 specimens of *Labeo dussumieri* collected from the lower reaches of Meenachil river were procured from a landing centre Near Kumarakom, Kottayam at

monthly intervals Between November 2014 and April 2015. The specimens were brought to the laboratory in fresh condition and total length to the nearest mm and total weight to the nearest 0.01g of individual fishes were measured using a measuring board and sensitive weighing balance respectively. Length-weight relationships were determined by linear regression analysis using the data analysis package in MICROSOFT EXCEL after log-transformations. The relationship was calculated for each 5 cm length category and for the total fishes collected. The length-weight relationship was worked out as per cube law given by Le Cren (1951)

$W=aL^b$

Where, W = weight of fish (g), L = the observed total length (cm), 'a' is the rate of change of weight with length (regression intercept) and 'b'is the weight at unit length (regression slope). The logarithmic transformation of the formula is

Log W = log a + b log L

When 'b' is equal to 3 isometric pattern of growth occurs, but when 'b' is not equal to 3, allometric pattern of growth occurs, which may be positive if >3 or negative if <3. Bailey's t- test (Snedecor and Cochran, 1967) was employed to determine if regression coefficients differed significantly from the isometric value of 3 following the formula,

t = b-3/Sb, where

b = regression coefficient of log transformed data and Sb= standard error of b

Condition factor (K), a measure of the well-being or plumpness of fish, was calculated following the equation proposed by Fulton (1904), assuming that the weight of a fish is proportional to the cube of length.

$K=100x\ (W/L^3)$

Where, W = body weight of the fish and L= total length of the fish

Relative condition factor (Kn) was estimated using the equation

Kn= w/w'

Where, W = the observed weight and w' = the calculated weight derived from the length-weight relationship

RESULTS AND DISCUSSION

The length-weight relationship of fish is an important fishery management tool. Its importance is pronounced in estimating the average weight at a given length group (Beyer, 1987) and in assessing the relative well being of fish population. The length-weight relationship of an ideal fish precisely follows the cube law (Allen, 1938) and according to Wootton (1990) the value of 'b' in the cube law will become exactly 3 when the fish retain the same shape and specific gravity. However, such an ideal fish with a 'b' value of 3 is very difficult to observe in natural conditions and in majority of fishes 'b' depart from 3, either less than or greater than3, representing negative allometric growth if the fish gets relatively thinner as it grows larger and positive allometric growth if it gets plumper as it grows larger respectively.

300 specimens of *Labeo dussumieri* observed in the present study varied in total length from 15.6 cm to 32 cm and in total weight from 92 g to 400 g. The length-weight relationship of combined sex and different length intervals (15-20 cm, 20-25 cm, 25-30 cm, 30-35 cm) were calculated in the study. Among the different length groups, the frequency of occurrence was maximum in 20-25 cm (65.3%), while the minimum frequency of occurrence 9.68%) in the 30-35 cm interval.

In the present study 'b' varied between 2.8328 and 3.092 in the various size categories. The length-weight relationship obtained for the various length intervals are presented in Table I. The slope value was lower than the critical isometric value of 3 in smaller length groups which indicates that the species is slender when the fish is younger whereas the 'b' value higher than 3 in large sizes indicates that the species become heavier for its weight as it grows longer. The growth was found significantly allomertric (t-test, $P<0.05$) only in smaller size groups whereas the allometric growth observed in the largest size categories observed was very close to 3 and not statistically significant, confirming the isometric growth of fish. The value of 'b' may range between 2.5 and 3.5 in most fishes (Le Cren, 1951; Wootton, 1992; Pauly and Gayanilo, 1997; Khan *et al*., 2011; Myla *et al*., 2012; Kuldeep Kumar *et al*., 2013; Preetha G Nair *et al*., 2015). Variations in the slope mostly reflect the change in the body form when the weight of the fish gets affected by environmental factors, life stages, sex, fishing area, fishing time and sample size variations (Ricker, 1973; Bagenal and Tesch, 1978; Kleanthids *et al*., 1999).Fig.1 shows the length-weight relationship of *Labeo dussumieri* in the Meenachil river.

Condition factor compares the well being of a fish and is based on the hypothesis that heavier fish of a given length are in a better condition (Bagenal and Tesch, 1978). Condition factor has been used as index of growth and feeding intensity (Fagade, 1979).Condition factor usually decrease with increase in length (Bakare,1970; Fagade,1979)and also influenced by the reproductive cycle in fish (Welcome,1979). Fluctuations in condition factor of many fishes were observed in relation to their reproductive cycle, feeding rhythms, and physico-chemical factors of the environment, age, physiological state or some other environmental factors (Kurup and Samuel, 1987; Kurup, 1990; Kalita and Jayabalan, 1997; Alex Nehemia *et al*. 2012). The values of condition factor calculated for *Labeo dussumieri* in the present study fluctuate from 0.77 to 2.42. The maximum value (mean) of K recorded (Table II) was in the lowest size group (15-20 cm) and the lowest value in largest size group (30-35 cm). The variations in condition factor in the different size groups can be attributed to factors like life stages, sample size variations, faster growth rate of the younger ones, changes in food reserves and food preferences etc.

The present study showed fluctuations in Kn values of *Labeo dussumieri* in the different length groups. The relative condition factor equal to or greater than 1 indicates that the fish is in good growth condition which is usually employed as a tool to assess the growth status of a fish. Kn values of all specimens analyzed were higher than 1. The fluctuations in the various length groups depend on several factors like different stage of maturity or spawning, feeding, environmental conditions etc. (Das *et al*., 1997; Sachidanandamurthy and Yajurvedi, 2008). Fig.2 illustrates the fluctuations (mean) of condition factor and relative condition factor.

The length-weight relationship of samples indicates that the population of *Labeo dussumieri* studied had a good growth ratio. The growth of *Labeo dussumieri* obeyed the cube law and the size distribution of the population collected indicates a population which has potential for growth. The values of condition factor and relative condition factor also showed that the population is in good condition, an indication of the healthy status of the population with more tissue energy reserves, increased reproductive potential and high survival. It is an indication of the ability of the habitat to sustain the population of *Labeo dussumieri*.

Table I. Length – weight relationship *of L. dussumieri* inhabiting Meenachil river,Kottayam

Length group (cm)	Regression equation	Parabolic equation
15-20	Log W= -3.8371+2.8328 log L	$W= 0.001452\ L^{2.8328}$
20-25	Log W= -4.0794+2.8411 log L	$W=0.000833\ L^{2.8411}$
25-30	Log w= -4.2809+3.0512 log L	$W=0.000137\ L^{3.0512}$
30-35	Log W= -4.8635+3.0920 log L	$W=0.000137\ L^{3.092}$
Total	Log w= -4.4103+3.061 log L	$W=0.000388\ L^{3.061}$

Table II. Fluctuations in condition factor and relative condition factor of *L.dussumieri* inhabiting Meenachil river Kottayam.

Length group (cm)	Condition factor		Relative condition factor	
	Min	Max	Min	Max
15-20	1.26	2.42	1.48	2.34
20-25	0.77	1.73	1.12	1.62
25-30	0.81	1.41	1.10	1.43
30-35	0.79	1.16	1.03	1.48
Total	0.77	2.42	1.03	2.34

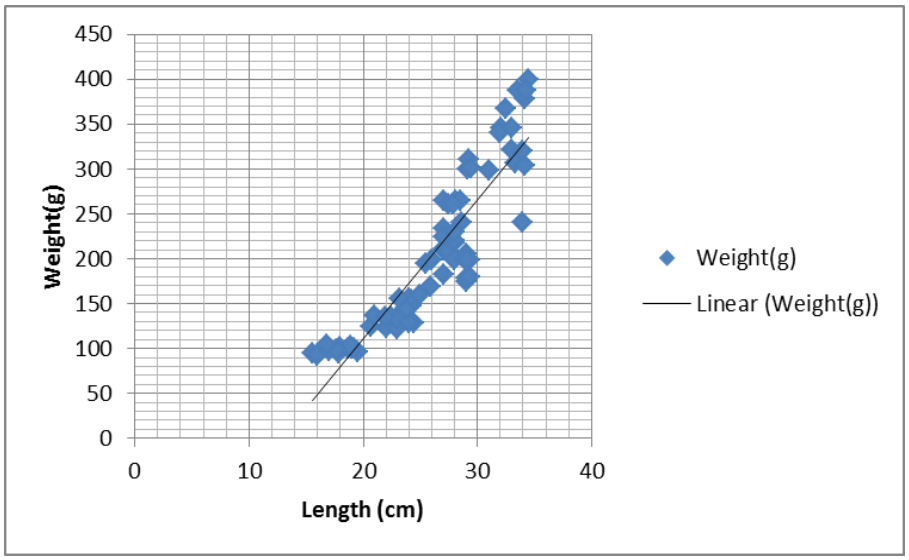

Fig.1 Length-weight relationship of *Labeo dussumieri*

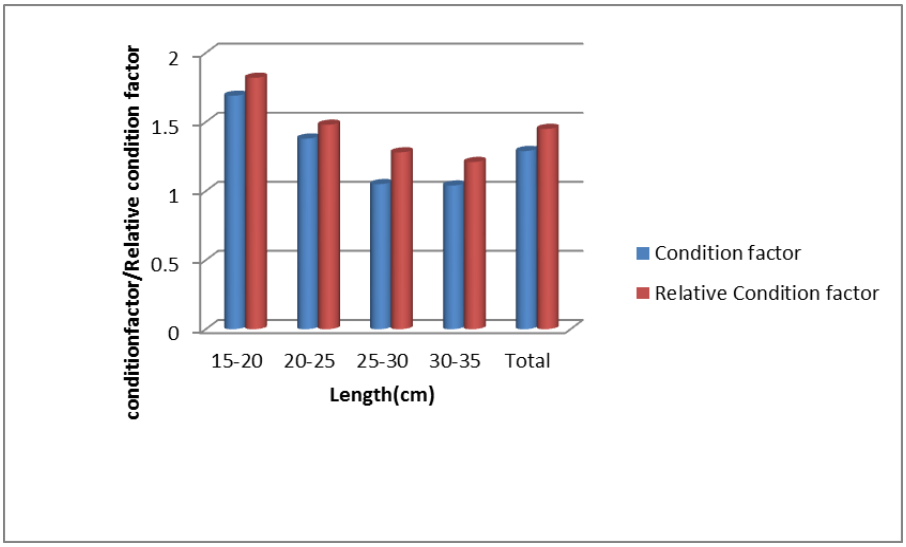

Fig 2: Fluctuations(mean) in condition factor and relative condition factor of *Labeo dussumieri*.

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