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LENGTH-WEIGHT RELATIONSHIP AND RELATIVE CONDITION FACTOR OF MRIGAL *CIRRHINUS MRIGALA* (HAMILTON) OF PANCHASAYAR WATERBODY OF WEST BENGAL

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ABSTRACT
The length-weight relationship and relative condition factor for *Cirrhinus mrigala* is described from samples collected between March 2007 and September 2007 from the panchasayar water body and local fish markets, which were mainly procured from different areas of North 24 – Parganas district. Samples of 350 fishes having size range of 191 mm to 340 mm were taken to estimate length-weight relationship. The regression equation was found as logW=-4.03+2.45 logL (r=0.965) for male, logW=-4.09+2.56 log*L* (r=0.971) for female of mrigal were found closer to unity and highly significant (P<0.01) indicating a strong relationship. It is found that total length-weight relationship does not follow the cube law and 'b' value was found as 2.45 and 2.56 for male and female respectably. It is observed that the 'b' value was significantly differing (P<0.01) from the value of '3' indicating allometric growth of fish. The mean relative condition factor (Kn) was found to vary from 0.98 to 1.17 during the period of investigation. A significant difference (P<0.05) was observed in relative condition factor of both the sexes during different months which was attributed to feeding and gonadal development.

KEY WORDS: Length-weight relationship, Relative condition factor, *Cirrhinus mrigala*.

INTRODUCTION

Fish and fisheries play an important role in economies of developing countries, contributing to animal protein intake, employment generation, household incomes and foreign exchange earnings. Surveys conducted by the World Fish Center and FAO show that fish has become an increasingly important source of protein over the last decade in most of the developing countries. Countries with low per capita gross domestic product tend to have a higher share of fish protein in their animal protein in their animal protein consumption (Kent, 1997). *Cirrhinus mrigala* inhabits the freshwater rivers, reservoirs, 'jheels', 'beels' and tanks. It is an excellent species for pond culture. Mrigal thrives well in all freshwater below an altitude of 549 m. and temperature seems to be a contributing factor limiting its distribution in river Ganga, Yamuna and Sarda in Uttar Pradesh. A temperature of 57^0 F is recorded to be minimum tolerable temperature (Jhingaran and Khan, 1979).

The knowledge of the length weight relationship of fish is a vital importance in fisheries science as is not only help to establish the mathematical relationship between the two variables *i.e*. the length and weight. The relationship is used for comparison of individuals within and between different populations (Lagler *et. al.,* 1962). Ricker (1975) stated that in Length-Weight relationship, there was sometimes marked difference between the same population in different year or in different of life, presumably associated with their nutritional condition. The relative condition factor is the ratio between observed weight and calculated weight of the fish. The values of this factor depend on physiological features of fish namely maturity, spawning, environmental factors and food availability in a water body (Ujjania *et al.*, 2012). Le Cren (1951) stated that the value of Relative condition factor (Kn) being more than one indicate good health of the fish and less than one opposite.

MATERIALS AND METHODS

Sampling site and size

Current experiment, total of 350 specimens of *Cirrhinus mrigala* was sampled for the 7 months period (January, 2007 to September, 2007). The samples were collected from the panchasayar water body and local fish markets, which were mainly procured from different areas of North 24-Parganas district. More than 50 specimens were examined in the laboratory during each month. Samples were collected twice in a month and examined usually at fortnightly intervals. Total length and standard length were measured in market itself by using the millimeter scale. Total weight was measured with a monopan balance for individual fish in grams.

Length Weight Relationship

This study was based on a total of 350 individuals of *C. mrigala.* The non linear equation in the form of $W = aL^b$ [Le Cren, 1951], which explains the length and weight relationship of fishes, was used in the present study. The equation in linear form is written as, $y = A + Bx$, where $y = logW$ where $A = loga$ and $x = logL$. The isometric or allometric growth was tested by't' test.

Relative Condition Factor (K_n)

The data used for length weight relationship were also utilized for calculating relative condition factor of the fishes. The relative condition factor is given by the formula,

$K_n = W_o / \widehat{W}$ Where, W_o = observed weight and $\widehat{W}$ = calculated weight. Monthly mean values of K_n were calculated and the average value was also found out.

Statistical Analysis

Correlation co-efficient between variable studied were calculated and regression equatin were found out following standard methods (Sukhamte and Amble, 1989). Allometric growth was tested by employing Fisher's't' test. Significance among mean of different biological parameters were tested employing standard statistical tools like Student's't', Analysis of variance technique ANOVA (Snedecor and Cochran, 1967) *etc*.

RESULT & DISCUSSION

Length weight relationship

During the period of study 350 individuals of *C. mrigala* were examined in the laboratory. Total length and weight varied from 191 mm to 340 mm and 56.2 gm to 240 gm respectively in the case of male. However the corresponding values in the case of female fish ranged from 192 mm to 270 mm and 68 gm to 185 gm. The computed length weight relationship of *C. mrigala* (Table 1.) was as follows:

TABLE 1. Length-weight relationship of *Cirrhinus mrigala.*

No.	Sex- wise	No. of sample	a	b	Logarithmic Equation
1	Male	170	0.0000933	2.45	$\log W = -4.03 + 2.45 \log L$ (r= 0.965)
2	Female	130	0.0000811	2.56	$\log W = -4.09 + 2.56 \log L$ (r= 0.971)

In the present study the exponent 'b' value was 2.45 in male and 2.56 in female samples. It was found to be significantly different ($P<0.01$) from the value of 3 exhibiting allometric growth. The b value of less than 3 indicates that the fish became slender with increase in length while a value greater than 3 indicates weight increases more compared to length (Senguttuvan and Sivakumar, 2012). The b value changes during the life stage because most fish changes their shape as they grow in length. The correlation coefficient (r) between length a between length and weight of both sexes (male, r= 0.965) and female, r=0.971) of *Cirrhinus mrigala* were found closer to unity and highly significant ($P<0.01$) indicating a strong relationship. Similar results have been worked out by Rao (1974) on *Cirrhinus mrigala*, Choudhury *et al.*, (1982) on *Labeo rohita.* Kurup (1993) *on Labeo calbasu*, Kar and Barbhuiya (2000) on *Gudusia chapara* and *Botia dario* in Assam Sarkar *et al.*, (1998) reported 'b' value of *Cirrhinus mrigala* 3.048618 for hatcheries and 3.113345 for bundh. Desai *et al.* (1990) observed that *C. mrigala* from Rihand reservoir (Uttar Pradesh) did not follow the 'cube law' exactly because the exponential value (b) was found to be little lower (2.9143) than 3. Choudhury *et al.* (1982) found that the 'b' value was found to be 2.3477 in *L. rohita.* But the little lower value in 'b' as in the present case can be attributed to the environmental factors (Swain, 1993), immature individuals frequency in the population and food availability (Andrain and Barbieri, 1992). Jhingaran (1968) while studying the biology of *Gudusia chapara* observed the lower value of 'b' (2.9746) in male while the same for females (3.0742) was closer to 3. Earlier Raitt (1933) too observed greater values of 'b' in female fishes and attributed this to the isometric growth of the ovaries. The present work on length-weight relationship of the carp, *Cirrhinus mrigala* indicated allometric growth of fish and it is in concurrence with earlier works in the locality.

Relative condition factor

The mean relative condition factor (K_n) calculated during different months is shown in Table 2.

TABLE 2. Variations (Mean ± SD) in the monthly mean relative condition factor (K_n)

Months	Male	Female
March	0.98±0.11	1.00±0.22
April	1.06±0.14	1.01±0.26
May	1.11±0.58	1.06±0.07
June	1.17±0.13	1.08±0.05
July	1.04±0.45	1.05±0.14
August	1.01±0.18	1.05±0.10
September	1.00±0.11	1.03±0.30

The mean value of relative condition factor (K_n) calculated during different months is shown in (Table 2). In the case of male *Cirrhinus mrigala* varied from 0.98±0.11 to 1.17±0.13 and while in female it varied from 1.00±0.22 to 1.08±0.05 which according to LeCren (1951), indicates good health of the fish as 'Kn' value more than one indicate a good condition of the fish and less than one being opposite to it. A significant difference ($p\leq0.05$) was observed in relative condition factors of both the sexes during different months which were attributed to variation feeding and gonadal development.

It was found that the K_n of fish was minimum during March (0.98) and maximum during the month of June (1.17). The K_n of male exhibited an increasing trend of variation from March to May and again decreased from July onwards. In female, the K_n ranged between 1.00to

1.08. It was found that the lowest value occurred during the month March (1.00) and highest during the month of June (1.08). It was noticed from April to May that the K_n value were in an increasing trend and from May to September it gradually decreases. The present results revealed that 'Kn' value of male and female were high during June (1.17) due to developing gonads. The 'Kn' values started increasing from April (1.06) onwards for male with peak in June for both male and female. Low relative condition factor in March is attributable to loss of weight for building up of gonadal matter for early spawners and party due to errors in random sampling. A fall in Kn was also observed during July to September which may be attributed due to spawning. Rao (1974) also observed similar trend in mrigal from Godavari River. The condition factor of fish can be influenced by a number of factors such as the onset of maturity (Hoda, 1987), spawning (Al-Daham and Whab, 1991), environmental condition, breeding season, feeding (Wijayaratne and Costa, 1988; Dhanze and dhanze, 1997), sex and maturity (Gowda *et al.*, 1987; Doddamani *et al.*, 2001) and pollution (Bakhoum, 1999). Doddamani *et al.*, (2001) studied the monthly mean value of Kn of *Stolephorus bataviensis* for male and female separately which were influenced by7 the gonadal development, feeding activity and other factors. Sarkar *et al.*, (1998) studied the relative condition factor during the early period of development of *Cirrhinus mrigala* spawned in bundh and a hatchery and found out that high 'Kn' values in larger fishes may be attributed to high feeding intensity

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