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Length-weight relationship and condition factor of *Cyprinus carpio var. communis* (Linnaeus, 1758) reared in bheries of South 24 Parganas district in West Bengal

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Abstract
An attempt was made to study length-weight relationship and condition factor of exotic carp, *Cyprinus carpio var. communis* reared in bheries at Bhamanghata of South 24 Parganas district in West Bengal. Samples of 344 fishes having a size range of 87 mm to 245 mm were taken to estimate the length-weight relationship. The regression equation was found as logW=-4.570+3.062 logL (r=0.898) for male, logW=-4.645+3.143 *logL* (r=0.889) for female and logW= -4.627+3.097 *logL* (r=0.903) for pooled sample and it exhibited significant correlation between length and weight. It was found that the exponent 'b' value was not significantly deviating from '3' indicating isometric growth. The mean relative condition factor (Kn) was found to vary from 0.93 to 1.19 during the period of investigation. It varied significantly ($F_{11, 11}$=17.60, P<0.01) during different months which were attributed to food and feeding habit of fish.

Keywords: Length-weight relationship, Relative condition factor, *Cyprinus carpio*.

1. Introduction
Fish and Fisheries play an important role in the economy of developing countries by contributing to animal protein intake, employment generation, household incomes and foreign exchange earnings. The existence of varied topography and different agro-climatic conditions in the state of West Bengal has bestowed upon a productive fishery resources.
Fish production in the country has increased from 3.8 million tonnes in 1990-1991 to 9.579 million tonnes during 2013-14 (DADF, Statistics 2014), registering an annual growth rate of 6% during the period. India has emerged as the second largest aquaculture producer in the world. Freshwater aquaculture showed an overwhelming ten- fold growth from 0.37 million tonnes in 1980 to 6.136 million tonnes in 2014; with mean annual growth rates of over 6%. Freshwater aquaculture has been able to meet the increasing fish requirement of the country when the production from marine capture and other open water system has remained almost stagnant. It is estimated that only about 40% of the available area of 2.36 million ha of ponds and tanks have been put to use and there exists scope for expansion of area under freshwater aquaculture.
Common carp was first introduced to India from Ceylon in 1939 and later again from Bangkok in 1957. The common carp is mainly bottom dwellers, but search for food in the middle and upper layers of the water body. Common carp can reach 0.6 to 1.0 kg body weight within one season in the polyculture fish ponds of subtropical/tropical areas. Growth is much slower in the temperate zone, where the fish reach the 1 to 2 kg body weight after 2 to 4 rearing seasons.
The length-weight relationship gives an idea about the mathematical relationship between length and weight. The variation is influenced by fatness, feeding intensity or gonadal development of the fish (Le Cren, 1951) [9]. The study of length-weight relationship in fishes is of primary importance in setting up yield equations (Ricker, 1958) [18], estimating the number of fish landed and in comparing population in the time and space (Chanchal *et al*., 1978) [2]. The general expectation is that weight of fish would vary as the cube of its length (Sekharan, 1968; Pandey *et al.,* 1974 and Pathak, 1975) [21, 15, 16]. But the actual relationship may depart significantly from it (Le Cren, 1951) [9] as fishes normally do not retain the same shape throughout their life span. The value of exponent 'b' in the equation $W = aL^b$ usually lies between 2.5 to 4.0 (Hile, 1936 and Martin, 1949) [4, 10]. The relative condition factor (K_n) is the important biological parameter which indicate the suitability of a specific water body for

the growth of fish (Le Cren, 1951) [9]. 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) [28].

2. Materials and Methods

2.1 Length Weight Relationship

This study was based on a total of 344 samples of *Cyprinus carpio var. communis* having size ranging from 85 mm to 245 mm collected from.bheries at Bhamanghata of South 24 Parganas district in West Bengal between July 2011 and June 2012. The total length and the total weight of the sample fishes were measured by using millimetre scale and monopan balance.

The nonlinear equation in the form of $W = aL^b$ [Le Cren, 1951] [9], 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.

2.2 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 for each species of fish and weighted average of the K_n was also calculated for the whole period (July 2011 to June 2012) for both the species of fish.

2.3 Statistical Analysis

The exponent (b value) in the length- weight relationship was tested for significance following Fisher's t- test.

3. Result and Discussion

3.1 Length weight relationship

During the period of study total length and body weight of 344 samples of *Cyprinus carpio* were recorded. In the case of male the total length and body weight varied from 87 mm to 245 mm and 32 grams to 557 grams respectively. Whereas in the case of female the total length ranged from 85 mm to 232 mm and body weight ranged from 36 grams to 548 grams. The computed length weight relationship of *Cyprinus carpio* (Table No.1) was as follows:

a. Male: $W = 0.0000269\ L^{3.062}$ $r^2 = 0.898$
b. Female: $W = 0.0000224\ L^{3.143}$ $r^2 = 0.889$
c. Pooled: $W = 0.0000236\ L^{3.097}$ $r^2 = 0.903$

Table 1: Length-weight relationship

1	Sex	No. of sample	a	b	Logarithmic Equation
1	Male	176	0.0000269	3.062	logW=-4570+3.062 *logL* (r= 0.898)
2	Female	168	0.0000224	3.143	logL=-4.649+3.143 *logL* (r= 0.889)
3	Pooled	344	0.0000236	3.097	logW=-4.627+3.097 *logL* (r= 0.903)

The length-weight relationship in the present study depicted that the 'b' value of 3.062 in male, 3.143 in female and 3.097 in case of pooled samples. The 'b' value was found to be not significantly different from 3 indicating isometric growth. A perusal of length-weight relationship, worked for mirror carp from Dal Lake, shows that the value of b was 2.98, slightly less than 3, thus not satisfying the cube law. It may be said that the weight of the fish in Dal Lake increases in proportion slightly less than the cube of its length (Sunder *et al.,* 1984) [27]. The reported regression values in the common carp (*Cyprinus carpio* var. *communis)* varied as 3.75 from Sagar Lake (Soni and Kathal, 1979) [24], 2.98 from Dal Lake (Sunder *et al.*, 1984) [27] and 2.42 from Gobindsagar (Sharma, 1986-'1987) [23]. Jhingran (1952) [6] also observed the deviations from isometric values of 2.9002 and 2.7088 in common carp, *Cyprinus carpio* var. *communis* and grass carp, *Ctenopharyngodon idella (*computed with total length) in composite fish culture in Himachal Pradesh.

A total weight of the fish increases as an exponential function of its length irrespective of its size (Chacko and Ganapati, 1951; Kamal, 1969; Srivastava and Pandey, 1981) [1, 8, 19]. The present study reveals that the length-weight relationship follows the cube-law. Therefore, it may be stated that this fish had an isometric growth. Hossain *et al*. (2010) [5] had shown an allometric growth of the species in Nasti *boar*, Bangladesh with observed b values 3.132 in February, 3.130 in March and a 3.112 in April with correlation coefficient (r) 0.992, 0.956 and 0.969 respectively.

3.2. Relative condition factor of *Cyprinus carpio*

The mean relative condition factor (K_n) calculated during different months is shown in Table No.2, and Figure No.1.

Table 2: Variations in the monthly average of Relative condition factor (K_n)

Months	*Cyprinus carpio*	
	Male	Female
July, 2011	1.1	1.19
August, 2011	1.03	1.04
September, 2011	0.94	0.95
October, 2011	0.93	0.96
November, 2011	1.08	1.09
December, 2011	1.09	1.15
January, 2012	1.07	1.12
February, 2012	1.02	1.03
March, 2012	0.96	0.96
April, 2012	0.97	1.02
May, 2012	1.04	1.1
June, 2012	1.09	1.17

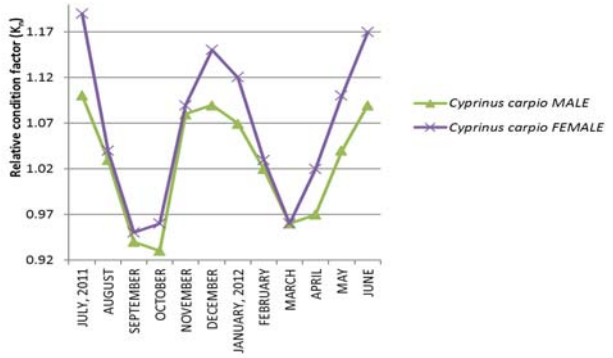

Fig 1: Variations in the monthly average of relative condition factor (K_n)

In the present study, the relative condition factor K_n of *Cyprinus carpio* varied from 0.93 to 1.10 in male and 0.95 to 1.19 in female. Thus the study indicated the fish in the polyculture pond have relatively good condition. The relative condition factor of common carp observed in the present study exibited significant difference ($F_{11, 11} = 21.00$) during different months at 1% level of significance. The K_n values also showed significant difference ($F_{1, 11}$=17.60, P≤0.01) between the sex of the fish which might be attributed to variation in feeding intensity and maturity. Sinha (1972) [27] reported that monthly condition values are known to be influenced by mainly three factors viz. maturity of gonads, amount of undigested food in the alimentary canal and changes in the amount of fat stored in body tissue.

Pandey and Sharma (1997) [14] studied the condition of four exotic carps and reported that only the common carp, *Cyprinus carpio* var. *communis* was found to have value above 1 (1.0109). Pandey & Sharma (1998) [14] reported high 'K_n' values for *Labeo rohita* (1.0129) and *C. catla* (1.0007) and low values for *Cirrhinus mrigala* (0.9967). The values of K_n of scale carp in Dal lake during different months was reported by Sunder *et al.* (1984) [26] indicated a peak in March (1.25) followed decline trend and a minimum in July (0.95). Thereafter, a gradual increase till December was recorded (0.98-1.21) and again declined during January (1.10). It was found that common carp exhibited two peaks in K_n during June- July as well as December-January which might be due to higher gonadal development. Higher K_n values during August and February can be attributed to more feeding after spawning. This is in agreement with the earlier workers such as Pillay (1954), Sarojini (1957) and Narasimham (1970) [17, 20, 11]. The changes in K_n value with increasing standard length depend on the size at first maturity (Jhingran 1972) [7]. The variations in condition of fish in the present study can be attributed to maturity as well as food and feeding of fish and it bears similarity with earlier works in *Decapterus russelli (*Panda *et al.,* 2011) [13], *Monopterus cuchia* (Narejo *et al.*, 2002) [12], *Notopterus notopterus* (Roy Choudhury *et al.,* 2013) [19]. One unique feature of this study was that availability of brood common carp during most of the samplings. It indicated mature fish were available frequently during several months. Therefore K_n value was exhibiting higher magnitude during the period of study.

4. References

1. Chacko PI, Ganapati SV. Bionomics of *Cirrhinus mrigala* in South Indian waters, J. Bombay Nat. Hist. Soc 1951; 50:13-19.
2. Chanchal AK, BN Pandey, SB Singh. Studies on some aspects of biology of *Anabas testudineus* (Teleostei: Anabantidae), Matsya 1978; 4:15-19.
3. Handbook on Fisheries Statistics. Department of Animal Husbandry and Dairying and fisheries, Indian Council of Agricultural Research, 2014, 5.
4. Hile R. Age and growth of Cisco, *Leucichthys artedi* (Le Sucer). In the Lakes of the North Estran Highlands. Winconsin, Bull. U. S., Burg. Fish 1936; 48:311-317.
5. Hossain MY. Morphometric relationships of length-weight and length-length of four Cyprinid small indigenous fish species from the Padma River (NW Bangladesh), Turkish Journal of Fisheries and Aquatic Sciences 2010; 10:213-216.
6. Jhingran VG. General length-weight relationship of three major carps in India, Proc. Nat. Inst. Sci. India 1952; 17:559-560.
7. Jhingran VG. Fluctuations in the ponderal index of the Gangetic anchovy *Setipinna phasa* (Ham.), J. Inld. Fish. Soc. India 1972; 4:1-9.
8. Kamal MY. Studies on the age and growth of *Cirrhinus mrigala* (Ham.) from commercial catches at Allahabad. Proc Natl Acad Sci India. 1969; 35B(1):72-92.
9. Le Cren ED. The Length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*), J. Anim. Ecol 1951; 20:201.
10. Martin WR. The mechanics of environmental control of body form in fishes, Univ. Toronto Stud. Biol, 58, Ont. Fish. Res. Lab 1949; 70:1-91.
11. Narasinham KA. On the length-weight relationship and the relative condition factor of *Trichiurus lepturus* (Linn.). Indian J. Fish. 1970; 23(1):90-91
12. Narejo NT, Rahmatullah SM, Rashid MM. Length-weight relationship and relative condition factor (Kn) of *Monopterus cuchia* (Hamilton). Indian J. Fish 2002; 49:329-333.
13. Panda D, Chakraborty SK, Jaiswar AK, Kumar T, Behera PK. Comparative length-weight relationship of two species of carangids *Decapterus russelli* (Ruppell, 1830) and *Megalaspis cordyla* (Linnaeus, 1758) from Mumbai waters, Indian J. of Fish 2011; 58(3):33-37.
14. Pandey AC, Sharma MK. A preliminary study on the relative condition factor of exotic carps cultivated in sodic soil pond, Indian J. Fish 1997; 44:221-223.
15. Pandey BN, Choubey BJ, Munshi JSD. Studies on some aspects of an airbreathing fish, *Heteropneustes fossilis* (Bloch). Indian J. Zool. 1974; 15(2):79-86.
16. Pathak SC. Length-weight relationship, condition factor and food study of *Labeo calbasu* (Ham.) from Loni reservoir (M. P.), J. Inland Fish. Soc, India 1975; 8:58-64.
17. Pillay TVR. Studies on food and feeding and alimentary tract of the gray mullet *Mugil tade* Forskal. Proc. Nat. Inst. Sci. Calcutta. 1954; 191(6):777-827.
18. Ricker WE. Hand book of computations for biological statistics of fish populations, Bull. Fish Res. Bd. Canada, 1958; 19:300.
19. Roy CS, Das SK, Sahoo AK, Behera BK. Length-weight relationship and condition of *Notopterus notopterus* (Pallas) from east Kolkata wet land, West Bengal. J. Inland Fisheries Society India 2013; 45(2):47-49.
20. Sarojini KK. Biology and fisheries of the grey mullets in Bengal, Indian J. Fish 1957; 4:160-207.
21. Sekharan KV. Length-weight relationship in *Sardinella albella* (Val.) and *S. gibbosa* (Bleeker), Indian. J. Fish 1968; 15:166-174.
22. Sharma BK. The biology and fishery of *Cyprinus carpio*

(Linn.) from the Gobindsagar reservoir, Himachal Pradesh, Matsya 1997; 12:231-237.
23. Sharma VK. The biology and fishery of *Cyprinus carpio* Linn, from the Gobindsagar Reservoir, Himachal Pradesh, India. Thesis Abst. Matsya. 1986-'87; 12 & 13: 231.
24. Shrivastava S, Pandey AK. Length-weight relationship and condition factor of three Indian major carps in composite fish farming, Matsya 1981; 7:70-74.
25. Soni DD, Kathal KM. Length weight relationship in *Cirrhina mrigala* (Val.) and *Cyprinus carpio* (Ham.), Matsya 1979; 5:69-72.
26. Sunder S, Kumar K, Raina HS. Food and feeding habits and length weight relaitonship of *Cyprinus carpio* var. *specularis* of Dal Lake, Kashmir, Indian. J. Fish 1984; 31(1):90-99.
27. Sinha N. Observation on the biology of *Puntius sarana* (Ham.) of Loni reservoir (M. P.). J. Inland Fish. Soc. Ind. 1972; 4:123-131.
28. Ujjania NC, Kolhi MPS, Sharma LL. Length-weight relationship and condition factors of Indian major carps (*C. catla, L. rohita and C. mrigala*) in Mahi Bajaj Sagar, India. Research Journal of Biology. 2012; 2(1):30-36.