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Pakistan Journal of Biological Sciences, 2(4): 1620-1622, 1999 **Research Article**

Length-weight Relationships and Condition Factor Studies in Three Major Carps Reared under Integrated Polyculture System

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bstract

ngth-weight relationships and condition factor of three fish species, viz. *Catla catla, Labeo rohita* and *Cirrhina mrigala* have en computed to see the responses of different fertilization regimes (nitrogen levels from broiler droppings) on the degree fish well-being. The fork length-weight relationships of three fish species under five nitrogen levels followed almost ometric pattern of growth except *Labeo rohita* under 0.10, 0.13 and 0.16 g nitrogen levels. However, among the three h species *Catla catla* exhibited significantly higher weight gains against fork length increments to follow the cube law isometric growth. The condition factor of all the three fish species in relation to size fluctuated significantly among eatments. This fluctuation was dependent upon the planktonic productivity indices of ponds that was regulated according the feeding habits, age and growth rates of fish.

troduction

:h, whether from sea or from freshwater has been torically regarded as a staple and dependable quality food cause of its being principal source of animal protein for er half of the global population (Ling, 1977). Fish culture considered today as one of the most promising sources animal protein. During the recent past, the potential and olific nature of fish culture has been directed towards its ge scale adoption and promotion in Pakistan. A reason for steady increase in aquacultural fish production and its iintenance is the expansion in areas under culture, provements in fish culture technology and maximum use experimentally established ecological potentials.

nd fertilization is one of the key factors in increasing the ximum carrying capacity of fish ponds (Javed, 1988). ved (1988) has described a positive relation in nutrient namics and fertilizer application in pond aquaculture nagement. In Pakistan, increasing attention has been d towards recycling of various agricultural and animal stes through aquaculture production process for hancing fish yield (Javed *et al.*, 1990; Javed and Sial, 91 and Javed *et al.*, 1992).

ngth-weight relationships in fish play an important role in neries investigation, because these relationships could be ed as characters for differentiation of small taxonomic ts like any other morphometric relationship. In addition the taxonomic character, it can help determine the ious events in the fish life history like metamorphosis l maturity (LeCren, 1951). The coefficient of condition can also be used to compare the relative heaviness and ability of the environment for fish culture (Javed *et al.*, 93). Factors like environment, food and parasitization can affect the condition factor directly and also indirectly ough changes in average size and fish growth rate. In a rt period of one year, life activities of fish like gonad le, feeding and growth in winter can affect the values of dition factor (Javed, 1988).

aterials and Methods

method adopted was the same as given by Hassan and Javed (1999). The values of "K" were determined by using the formula:

$$K = \frac{W \times 10^5}{L^3}$$

Where, W = Wet weight (g); L = Wet fork length (mm); Number 10^5 is the factor bringing the ponderal index or Condition factor (K) near the unity (Carlander, 1970).

Data were analyzed for analysis of variance and Duncan's Multiple Range tests. Correlation and regression analyses were performed to find-out relationships / trends among various parameters under study.

Results

Table 1 describes the regression equations computed for fork length-weight relationships of three fish species, separately, under six treatments. The high values of "r" for regression equations at each treatment level indicated the high precision of these regression models. Since "n" is the isometric growth factor (n=3) , the significance of difference among all the values of "n" for three fish species under five treatments were tested against the value of 3. The calculated values of "c" indicated that the values of "n" were non-significantly different from the value of 3 for all the three fish species under six treatments except for the species *Catla catla* and *Cirrhina mrigala* in the control (T6) and *Labeo rohita* and *Cirrhina mrigala* in T1. Hence, it may be concluded that the performances of three fish species under all the treatments (except *Catla catla* and *Cirrhina mrigala* in control and *Labeo rohita* and *Cirrhina mrigala* in T1) were isometric.

The data on the values of condition factor were subjected to statistical analysis by using analysis of variance and Duncan's Multiple Range test to compare the relative heaviness and suitability of the environment under different treatments for fish rearing. Table 2 reveals significant ($P < 0.01$) differences among treatments and species for the values of condition factor. However, the interaction able 1: Length-weight relationships of three fish species in fertilized and control treatments. (log^{-10} Transformed data)

reatment (litrogen level)	Mean		Regression Equation	r	R^2	Probability
	Fish Weight (g) (Y)	Fish fork length (mm) (x)				
atla Catla						
10g N level	2.36	2.28	Y = -4.31 + 2.928 (x) SE 0.231	0.9680	0.9370	P<0.01
13g N level	2.37	2.28	Y = -4.44 + 2.988 (x) SE 0.237	0.9351	0.9351	P<0.01
16g N level	2.35	2.29	Y = -4.56 + 3.024 (x) SE 0.184	0.9800	0.9604	P<0.01
19g N level	2.36	2.28	Y = -4.16 + 2.863 (x) SE 0.169	0.9810	0.9624	P<0.01
22g N level	2.38	2.29	Y = -4.11 + 2.837 (x) SE 0.197	0.9740	0.9487	P<0.01
ontrol ithout additives	1.84	2.14	Y = -3.27 + 2.384 (x) SE 0.103	0.9900	0.9801	P<0.01
abeo rohita						
	2.24	2.29	Y = -597 + 3.582 (x) SE 0.243	0.9760	0.9526	P<0.01
	2.29	2.29	Y = -5.27 + 3.295 (x) SE 0.190	0.09820	0.9643	P<0.01
	2.28	2.30	Y = -5.33 + 3.303 (x) SE 0.173	0.9850	0.7902	P<0.01
	2.31	2.32	Y = -4.96 + 3.130 (x) SE 0.113	0.9930	0.9860	P<0.01
	2.29	2.32	Y = -5.22 + 3.241 (x) SE 0.138	0.9900	0.9801	P<0.01
ontrol ithout additives	1.84	2.16	Y = -4.69 + 3.016 (x) SE 0.100	0.9940	0.9880	P<0.01
irrhina mrigala						
	2.32	2.29	Y = -3.88 + 2.704 SE 0.422	0.8880	0.7885	P<0.01
	2.32	2.55	Y = -3.62 + 2.894 SE 0.161	0.9470	0.8968	P<0.01
	2.34	2.32	Y = -4.29 + 2.863 SE 0.172	0.9810	0.9624	P<0.01
	2.32	2.33	Y = -4.89 + 3.095 SE 0.138	0.9890	0.9781	P<0.01
	2.27	2.31	Y = -4.85 + 3.077 SE 0.110	0.9930	0.9860	P<0.01
ontrol ithout additives	1.85	2.19	Y = -3.62 + 2.492 SE 0.086	0.9930	0.9860	P<0.01

= Correlation coefficient; R^2 = Coefficient of determination; S.E. = Standard error; N = Nitrogen;
= Dependent variable; x = Independent variable.

able 2: Condition factor of fish in fertilized and control treatments.

reatments	Means	Species	Means
.10g N level	2.817 a	*Catla catla*	3.322 a
.13g N level	2.830 a	*Labeo rohita*	2.351 b
.16g N level	2.677 a	*Cirrhina mrigala*	2.235 b
.19g N level	2.647 a	SE (Treatment)	0.2544
.22g N level	2.597 a	SE (Species)	0.1799
ontrol	2.248 b		

E = Standard error; N = Nitrogen.

etween *Labeo rohita* and *Cirrhina mrigala* for the "K" alues and the differences among the five fertilization reatments were statistically non-significant. However, ignificantly lower value of "K" (2.248) under control reatment than all the fertilization treatments made this omparison statistically significant.

Discussion

The logarithmic form of length-weight relationships in all the three fish species under six treatments, except in T6, (Table 1) are in agreement with the general model of LeCren (1951). A high degree of positive correlation between fork length and weight of all the three fish species is indicated by high values of correlation coefficients (r). These high values of "r" (nearly one) for each equation depicts high precision of these regression models. Shrivastava *et al.* (1981) and Javed *et al.* (1993) observed highly significant correlation between body weight and total length of *Labeo rohita, Catla catla* and *Cirrhina mrigala* reared under different fertilization treaments. Under all the five fertilization treatments the fork length - weight relationships in fish followed almost isometric pattern (with "b" nearly 3) except for *Labeo rohita* under T1, T2 and T3 (a value of 3 s considered isometric under conducive environment for sh rearing). Nautiyal (1985) observed the "b" value as .94 for *Tor putitora* from Garhwal Himalayas. Martin 1949) reported that the value of "b" usually ranged etween 2.50 and 4.00. Allen (1938) suggested that value f "b" remained constant at 3.00 for an ideal fish growth. owever, Beverton and Holt (1957) reported that the eparture of "b" value from 3.00 is rare.

able 2 shows non-significant differences among the three sh species for the calculated K values under all the five ertilization treatments showing no difference among the sh species for their length- weight relationships. However, ne differences were significant when the condition factor alue (k) of fish reared under control treatment compared ith all the five fertilization treatments. The condition actor values also varied significantly during different onths of the study period (Javed *et al.*, 1993). The resent data indicated that among the three fish species *atla catla* exhibited significantly higher weights against the ork length increments to follow the cube law of isometric rowth. However, in both *Labeo rohita* and *Cirrhina mrigala* eight increments were less than the fork length ncrements to follow the cube law of isometric growth. The bove findings show that the fluctuations in the condition actor values of all the three fish species in relation to size ppeared to be influenced by the status of ponds for their anktonic productivity indices which, in turn, controlled the eeding rhythm of the fish with age. The limnological nvironment under all the five fertilization treatments ended to be conducive for fish rearing. Some evidence, is so available, from different studies showing seasonal uctuations in condition factor of fish brought about by eeding rhythm of the fish (Kartha and Rao, 1990; Javed *et* ., 1993).

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