



LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF VILLAGE POND-REARED EXOTIC FISH (*Cyprinus carpio* Linnaeus, 1758)

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(Received 27 November, 2021; accepted 26 February, 2022)

ABSTRACT

The present study was aimed to assess the length-weight relationship and condition factor of exotic common carp (*Cyprinus carpio*). The morphological measures i.e., total length and weight of randomly selected 306 specimens of common carp, obtained from Atgam village pond Valsad (Gujarat), were measured in January 2021. The fish were divided into four length groups i.e., A, B, C and D at length distance of 5.0 cm. The result showed that the fish length and weight in population was in the range of 21.3 to 38.3 cm and 205 to 259 g, respectively. The length frequency was 34, 79, 104 and 89 for groups A, B, C and D, respectively which revealed that group C was dominant in the population, followed by group D, B and A. The length and weight variables were positively correlated ($r^2 = 0.886$) and growth constant or regression coefficient was 2.804 revealing that the growth of fish was negative allometric that was considered abnormal growth as the weight increment was less with respect to fish length. The mean value of condition factor for group A, B, C, D and pooled population were 1.77 ± 0.03 , 1.29 ± 0.01 , 1.41 ± 0.02 , 1.40 ± 0.01 and 1.41 ± 0.01 , respectively, which indicated that the condition of fish was good in the aquatic environment. The information generated may help in ecological and biological management of fish for enhanced production and revenue generation in village ponds.

Keywords: *Cyprinus carpio*, length-weight relationship, growth, condition factor

INTRODUCTION

The exotic fish, common carp (*Cyprinus carpio*, Linnaeus, 1758) belonging to family Cyprinidae and group Osteichthyes, are the most preferred and delicious fish that is omnipresent in aquatic resources (Swad *et al.*, 2006). *C. carpio* is a hardy fish that thrives in turbid waters (Kottelat, 2007) and tolerates low levels of salinity during culture, therefore is the popular example of stenohaline freshwater fish (Gupta and Hanke, 1982). In India, it was introduced in 1939 from Ceylon (Singh *et al.*, 2015) and presently has become a popular cultivable species in almost every water body of the country as they have fast growth rate and are easy cultivable (Lowe *et al.*, 2000).

The relationship of length-length and length-weight form important parameters that can be used to understand different factors which affect fish population. The length-length relationship is used to compare the growth in a fish population which is necessary for farming management practices (Alam *et al.*, 2012). The length-weight relationship is important to set up yield equations, estimate harvest and compare fish population in time and space (Chanchal *et al.*, 1978). It is vital in fish-biological studies, especially to differentiate the weight of a known fish group from the projected ones and to estimate parameters like breeding, feeding, fatness, appropriateness of

environment, etc. of a fish (Saha *et al.*, 2009). Further, the length-weight can be used to estimate fish biomass, changes in life history pattern, analyze population stock and fish condition factor (Moutopoulos and Stergiou, 2002). Condition factor (K) provides quantitative information/vital indices based on species length and weight of a fish which depicts physiological condition and feeding habit of a fish in given niche (Taymaa *et al.*, 2018). It also helps in assessing the fish maturity stage, spawning, biotic and abiotic factors, and food sufficiency in an environment (Ujjania *et al.*, 2012). Coefficient values from length-weight relationship are the products of condition factor and serve as a key to understand the life cycle of a fish (Esenowo *et al.*, 2016), which may be affected by abiotic and biotic environmental factors (Anene, 2005; Mansor *et al.*, 2012). The factors affecting the K values include sex, stages of maturity, and state of stomach contents (Gayanilo and Pauly, 1997). The morphometric studies with respect to the growth and condition of common carp have previously been described (Singh *et al.*, 2015; Al-jebory *et al.*, 2018; Andrabi *et al.*, 2021); whereas, Shafi *et al.* (2012), Arafat and Bakhtiyar (2020) and Wani *et al.* (2020) have reported length-weight relationship of common carp in different lotic and lentic waterbodies of India. In view of above, the length-weight relationship (LWR) and condition factor were evaluated to assess the growth status and condition of exotic fish common carp in village pond of Atgam, Valsad, Gujarat (India).

MATERIALS AND METHODS

Study area

The present study was conducted to determine the growth of common carp (*Cyprinus carpio*) in a village pond of Atgam, which is situated in Valsad district (Gujarat) and located at 20°39'05" N latitude and 73°00'27" E longitude. The pond is spread over an area of 6 ha and fall under seasonal water body category because water in this pond is available from monsoon to winter season only. The water of pond is mainly used for fisheries and partially for agriculture and domestic purposes.

Data collection

The morphometric data like length and weight of 306 randomly selected fish specimen were measured with the help of a measuring board and single pan balance, respectively. The length of fish was measured from tip of snout to the end point of longer lobe of caudal fin; whereas body weight was measured by an electronic single pan balance. The length of fish was divided into four groups e.g., A (20-25 cm), B (25-30 cm), C (30-35 cm) and D (35-40 cm).

Data analysis

The LWR was evaluated from the transformed data of length and weight by non-linear equation, $W = aL^b$ (Ricker, 1973) and liner equation, $\log W = \log a + b \log L$ (Pauly, 1983); where W is the fish weight, a is intercept, b is slope and L is fish length. Condition factor (K) was determined from the equation $K = W/L^3 \times 100$ (Htun-Han, 1978), where K is condition factor, W is weight (g), L is length. The statistical analysis was done by using tool 'MS office-Excel 2003'.

RESULTS AND DISCUSSION

The LWR is a mathematical relationship between length and weight which yields necessary information about the general condition, comparative growth patterns of a fish (Moutopoulos and Stergiou, 2002). In present study, the range and mean of length and weight of pooled population of *Cyprinus carpio* were 21.3-38.3 cm (31.66 ± 0.26 cm) and 205-896 g (472.10 ± 11.34 g), respectively (Table 1). The length range of different groups were; A, 21.3-25.0 (23.81 ± 0.19 cm);

B, 25.1-30.0 (27.67 ± 0.15) cm; C, 30.1-35.0 (32.93 ± 0.14) cm and D, 35.1-38.3 (36.69 ± 0.11) cm; whereas weight ranges were 205-259 (237.82 ± 2.09) g for group A, 245-315 (271.85 ± 2.00) g for group B, 305-602 (510.27 ± 11.74) g for group C and 600-896 (694.74 ± 10.73) g for length D. The Fig. 1 and 2 showed that group C was dominant one containing 104 fish i.e. 34% of population, followed by group D 89 (29%), group B 79 (26%) and group A 34 (11%). Billard (1995) reported average length and weight of fish as 40-80 cm and 2-14 kg, respectively) which were comparatively higher values than the present findings.

Table 1: Length and weight of *Cyprinus carpio* in the studied pond

Length group	n	Length (cm)	Weight (g)	Condition factor (K)
A (20-25 cm)	34	21.3-25.0 (23.81 ± 0.19)	205-259 (237.82 ± 2.09)	1.56-2.12 (1.77 ± 0.03)
B (25-30 cm)	79	25.1-30.0 (27.67 ± 0.15)	245-315 (271.85 ± 2.00)	1.08-1.56 (1.29 ± 0.01)
C (30-35 cm)	104	30.1-35.0 (32.93 ± 0.14)	305-602 (510.27 ± 11.74)	0.99-1.74 (1.41 ± 0.02)
D (35-40 cm)	89	35.1-38.3 (36.69 ± 0.11)	600-896 (694.74 ± 10.73)	1.19-1.67 (1.40 ± 0.01)
Pooled mean	306	21.3-38.3 (31.66 ± 0.26)	205-896 (472.10 ± 11.34)	0.99-2.12 (1.41 ± 0.01)

*A, B, C and D are length groups of the fish; The values in brackets show range (mean $\pm$ SE)

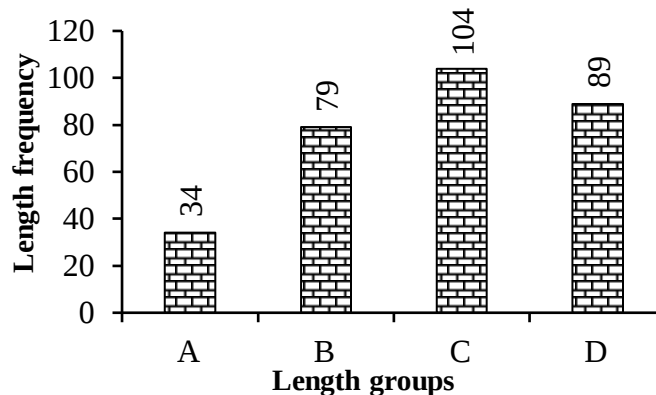


Fig. 1: Length frequency distribution (number) of different length groups A, B, C and D

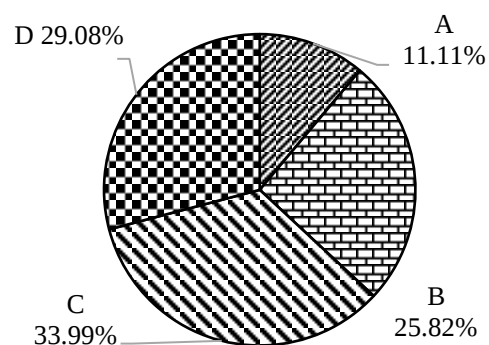


Fig. 2: Length frequency distribution (%) of different length groups A, B, C and D

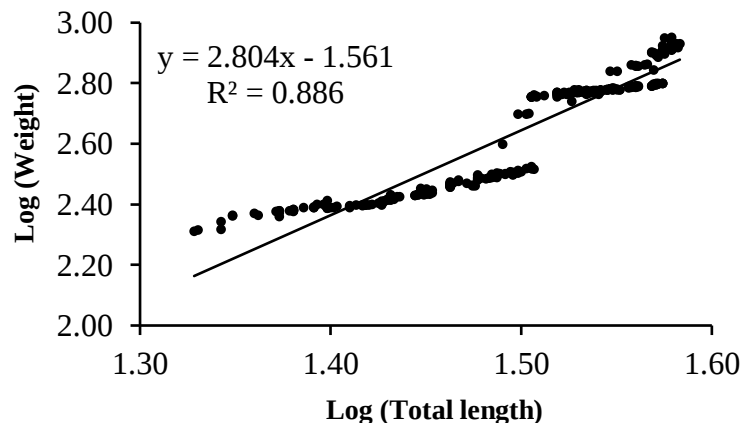


Fig. 3: Length-weight relationship of *Cyprinus carpio* in studied water body

be 2.80 (Table 2). The observed 'b' value was < 3.0 that reflects the sign of negative allometric growth of studied fish. Further, it revealed that the growth of fish was abnormal and increase in length was more with respect to the weight in village pond which may be due to the unavailability of feed and high stocking density in the pond. Callen *et al.* (2014), Fagbuaro *et al.* (2015) and Taymaa *et al.* (2018) have reported negative allometric for common carp which are close to the present study.

LWR allows the conversion of growth-in-length to growth-in-weight in standard valuation models (Silva *et al.*, 2015). The variables (length and weight) showed straight-line plot and correlation coefficient (r^2) was 0.880 for pooled data which indicated positive and strong linear relation between the variables (Table 2; Fig. 3). The slope (b) value of LWRs presented body weight increased isometrically with the length increased (Martin-Smith, 1996) and in this study it was observed to

Condition factor represents the degree of well-being of a fish population (Rodriguez *et al.*, 2017) and in present study, the minimum and maximum range of K was 0.99 to 1.74 (1.41 ± 0.02) and 1.56 to 2.12 (1.77 ± 0.03) for length group C and A, respectively; whereas the K value of 0.99 to 2.12 (1.41 ± 0.01) was noted for pooled population (Table 1). The K value was ≥ 1 that indicated uniform and good condition in term of interaction between living and non-living factors in the biological condition of studied fish population (Lizama *et al.*, 2002; Solanki *et al.*, 2020) and conducive aquatic environment of village pond. Similar result in common carp has been reported by Abowei *et al.* (2009) and Taymaa *et al.* (2018) in Nigeria and Iraq, respectively.

Conclusion: The present study on LWR and condition factor of common carp in a village pond of southern Gujarat revealed that the growth of fish was negative allometric in the studied pond. This indicated the need to alter farm management strategies for optimum growth of fish population. The fish population was dominated by large-sized fishes and in good condition in the studied pond environment. The K value was ≥ 1 indicating that the fish were in good condition and aquatic environment was conducive for their growth and survival. The information generated may guide to the correct path in ecological and biological management of common carp so as to enhance the production and revenue in village pond.

Acknowledgements: The authors express gratitude to the Head, Department of Aquatic Biology, Veer Narmad South Gujarat University, India for providing the laboratory facilities and also to the fish farmers who provided the information and data to make the work successful.

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