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GROWTH COEFFICIENT AND FECUNDITY OF *CHITALA CHITALA* (OSTEOGLOSSIFORMES: NOTOPTERIDAE) FROM THE RIVER RAVI, PAKISTAN

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ABSTRACT

Chitala chitala contributes much to the food as well as aquarium ornament of South Asian countries. The species deserves high conservatory impacts due to rapid decline of its natural habitats at alarming levels in addition to facing heavy pollution and fishing pressures in the last few decades. In the present study, 27 female specimens ranging from 50.6 to 68.4cm (60.6±5.29cm) total length and 937 to 2208g (1629±364g) wet body weight were collected from the village Nano Dogar, river Ravi, Pakistan. The relation between total length and weight of *C. chitala* was described by Log W= -1.4525 + 2.6133Log L indicating negative allometric growth. Mean absolute fecundity was calculated as 13431±2144 in sampled fish. To the best of authors' knowledge, length-weight relationship and fecundity of this species from the river Ravi, Pakistan is being reported for the first time. This study will be very helpful in conservation and management of the feather back chital.

Key words: Fecundity, gonado-somatic index, length-weight relationship, endangered species, river Ravi.

INTRODUCTION

The clown knifefish *Chitala chitala* (Hamilton - Buchanan) also known as feather back chital is a rheophilic important freshwater fish found widely in benthic waters and has been considered as an important freshwater food as well as ornamental fish (Ponniah and Sarkar, 2000; Ayyappan *et al.,* 2001). This species is widely distributed in deep and clear waters of rivers, beels, reservoirs and ponds located in India, Pakistan, Myanmar, Bangladesh, Sri Lanka, Nepal, Thailand and Indonesia (Azadi *et al.,* 1994; Mirza, 2004). Generally, the species is carnivorous and insectivorous but also feed on crustaceans and planktons and occasionally exhibit cannibalism as well (Sarkar *et al.,* 2006). Fish can attain maximum length up to 122 cm with maximum body weight of 14 kg (Chonder, 1999; Sarkar *et al.,* 2006). However, over exploitation, pollution and related anthropogenic pressures on their natural habitats have remarkably reduced the natural populations of feather backs by 50-60% during the last few decades and now it has been declared as an 'endangered species' (CAMP, 1998; Khan, 2000; Sarkar *et al.,* 2006).

The study of length-weight relationship is much significant in order to assess the growth of fish in different environments. This relationship is applicable in defining a population. Fish length is measured and predicted average weight is assigned to all fish in a given length group. This is often faster and more convenient than weighing fish individually, especially when large number of live fish is sampled. Length-weight relationship is used at commercial scale for population assessments (Steeby *et al.,* 1991; Ali *et al.,* 2000). Several authors have described the importance of length weight relationship for various fish species (Willis, 1989, Naeem *et al.,* 1992; Shakir *et al.,* 2008).

Fecundity is the measure of fertility and is assessed by sperm or egg count of an organism. Fecundity must be known to assess the reproductive potential and to evaluate the commercial potential of a fish stock and for the efficient fish culture and effective management (Mian and Dewan, 1984; Das *et al.,* 1989). Fecundity has a vital role in the selection of brooders for production purposes (Prasad *et al.,* 2005). Considerable work has been done on fecundity of fish in many countries by various researchers (Hussain *et al.,* 2008; Bahuguna and Khatri, 2009; Lone and Hussain, 2009).

Studies of threatened as well as commercially important animals deserve special attention for success in managing and conserving the natural fauna to the desired levels. Studies on length-weight relationships and fecundity of the fish (*Chitala chitala),* from Pakistan are very scanty. According to IUCN red list, this status of this species declared as near threatened because its populations have declined in Pakistan. Therefore, the purpose of the present study was to investigate total length and wet body weight relationship, condition factor, absolute fecundity and relative fecundity of this important fish collected from the river Ravi, Pakistan.

MATERIALS AND METHODS

Description of sampling site: A downstream sampling site situated near village Nano Dogar (31° 21′N and 74° 3′E) of Lahore (second largest city of Pakistan) was selected. The location receives effluents from four major untreated municipal wastewater pumping stations. Besides, there are two main drains namely Hudiara and Deg which dispose off their urban and industrial effluents into the river Ravi. The more detail about the sampling site have earlier been described by Shakir *et al.* (2013) and Shakir and Qazi (2013).

Sampling: Owing their low population density and sporadic appearances, 27 female fish specimens of *Chitala chitala* were collected on monthly basis during one year sampling. . After catching, each specimen was washed with water, kept in a separate polythene bag, placed on ice and immediately transported to the laboratory. Taxonomic identification of fish specimens was verified up to the species level following regional identification key (Mirza, 2003). Each fish specimen was dissected after subjecting to biometric studies using electronic digital top-pan balance scale and length measuring tray. The ovaries were removed carefully and weighed to the nearest milligram on electric balance and preserved in 10% formalin. Gonado-Somatic Index (GSI) was calculated according to Singh and Srivastava (1991) as: GSI=Gonads weight/Weight of fish × 100. Fecundity was determined following gravimetric method as described by Hussain *et al.* (2008) and Lone and Hussain (2009). Each ovary sample was teased with glass needles to separate the eggs for counting. Total number of eggs in both ovaries was used to calculate the absolute fecundity and relative fecundity (number of eggs/g wet body weight). The length weight relationship of the fish was studied by linear regression of Log W = Log a + b Log L; where, 'W' was the wet body weight in grams, 'L' total length in cm, and 'a' and 'b' indicate the intercept and growth coefficients, respectively following Shakir and Qazi (2013). To study the body weight and ovary weight relationship, body weight and absolute fecundity relationship, total length and ovary weight relationship and total length and absolute fecundity relationship, linear regression was also calculated. Condition factor (K) was calculated by standard relation $K= (W \times 100)/(TL)^3$.

RESULTS AND DISCUSSION

The sampled specimens ranged from 50.6 to 68.4 cm (60.6±5.29cm) in total length and 937 to 2208g (1629±364g) wet body weight (Table 1). The regression coefficient (0.97) showed significant correlation between length and weight of the sampled specimens. The mean condition factor value was 0.72±0.038g/cm^3 (Table 1). The growth coefficient (b) value of length-weight relationships provides useful information on fish growth. In the present study, b=2.61 (Table 2) indicated negative allometric growth pattern and specimens became lighter for their lengths as described by Wootton (1990). Comparable results for the female *C. chitala* specimens sampled from Bhagirathi (b=2.36), Ganga, Farakkha (b=2.19) and Saryu (b=2.35) rivers/drainages in India were reported by Shakar *et al.* (2009). Many researchers have reported allometric growth in different fish species (Shakir *et al.*, 2008; Lanes *et al.*, 2013; Liu *et al.*, 2013; Shakir and Qazi, 2013). Observed variations in *C. chitala* growth coefficient from various populations may be attributed to the different habitats on which their biology depends, including the growth phase, gonadal development, degree of stomach fullness, and health condition (Tarkan *et al.*, 2006). Growth coefficient may show temporal or spatial variations due to differences in reproductive activities, size range, developmental stage and environmental factors such as water temperature and quality, food quality and availability, diseases and competition (Bagenal and Tesch, 1978; Wootton, 1990). However, these factors did nott account directly in the present study. Therefore pollution might be a factor affecting these standards. Shakir *et al.* (2013) reported that Ravi at sunder (sampling site) appeared to be highly polluted indicated by high values of total suspended solids (909 mg/l) and sulphate (964 mg/l) in comparison to the respective values of 150 and 600 mg/l being suggested as the safer values of drinking water by the National Environmental Quality Standards. While reduction in 'b' value for same site of the river Ravi in different fish species corresponding to aquatic pollution has also been reported earlier (Shakir and Qazi, 2013).

Condition factor (K) is an indicator of favorable environmental supplies. Fish specimens with a low K value are lighter for their length (Wootton, 1990). In the present study, the K value of the sampled specimens from the polluted site ranged from 0.65 to 0.78 g/cm^3 and may indicate disturbances in fish physiology, biochemistry and reproduction as reported by Lohner *et al*. (2001) and Hedayati and Safahieh (2011). Enzymatic, biochemical and hormonal responses of fishes are influenced by physico-chemical profiles of aquatic medium, seasons, fish nutrition status, age, health and presence of toxic substances. The decrease in 'K' value in *Labeo rohita*, *Cirrhinus mrigala* and *Catla catla* collected from the same sampling site (sunder near village Nano Dogar) of river Ravi have been reported by Shakir and Qazi (2013).

The mean ovary weight and gonadosomatic index were 127±20g and 7.96±1.03%, respectively, whereas, absolute fecundity ranged from 10171 to 17833 (13431±2144) in the sampled population (Table 1). The regression coefficient (r^2) showed strong correlation between wet body weight and ovary weight (0.746) and absolute fecundity (0.748). Similar correlation have been

reported by several workers (Joshi, 2008; Bahuguna and Khatri, 2009; Lone and Hussain, 2009). The fecundity of an individual female varies in relation to many factors including species, age, size, and environmental conditions, such as water temperature, food availability, and salinity (Simpson, 1951). Environmental factors and food supply are known to affect the fecundity of fish (Bagenal and Tesch, 1978). The variations in fecundity of the *C. chitala* may be attributed to several of such factors that might have been prevailing in the river Ravi. The results of this study give useful insight for management and conservation of the threatened fish species and demand for urgent measures for controlling water pollution in the region.

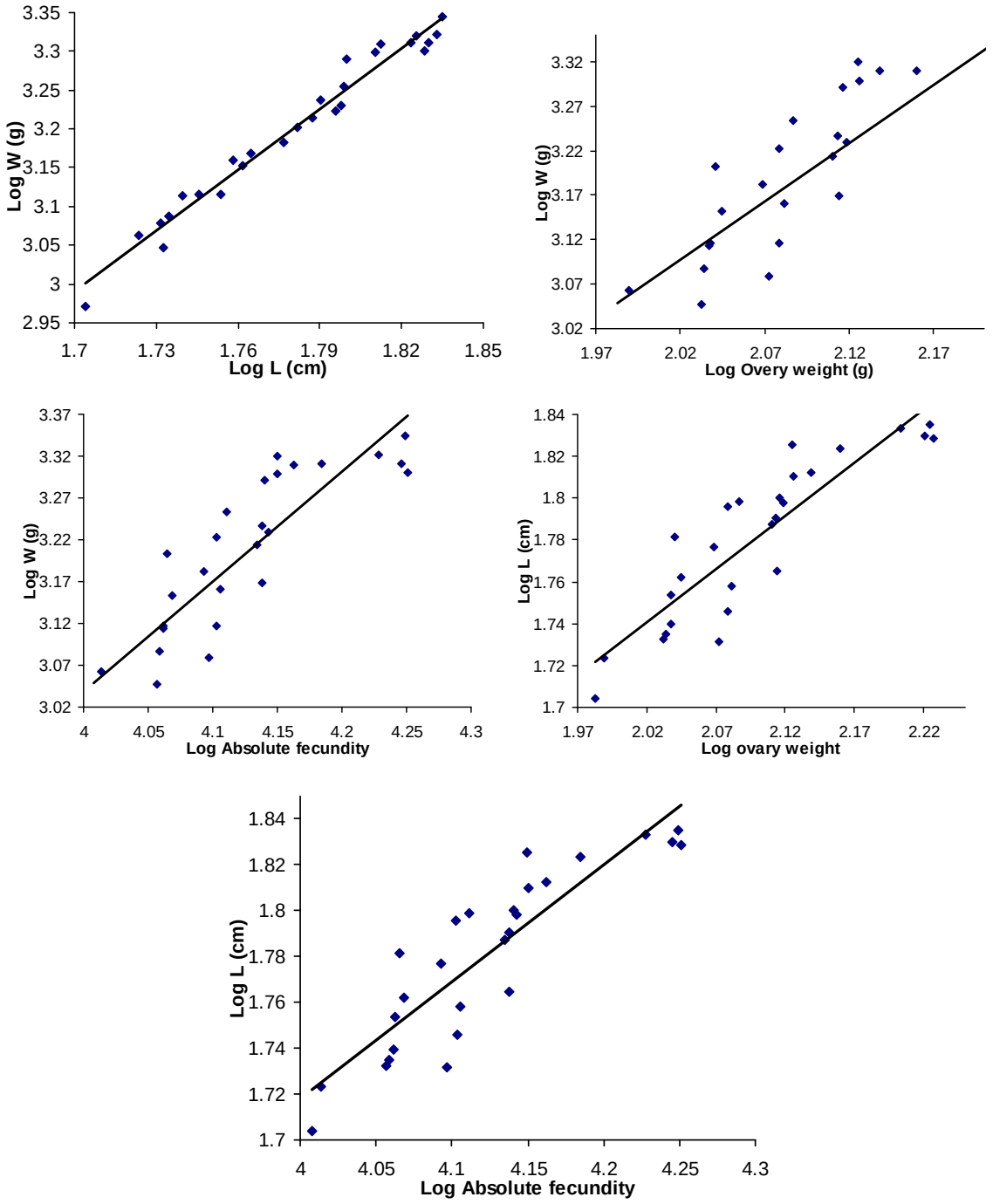

Fig 1 Biometric relationships in *Chitala chitala* from the river Ravi, Pakistan.

Table 1 Biometric characters of *Chitala chitala* from the river Ravi, Pakistan.

Sr. No.	Index	Range	Mean±SD
1.	Total body weight (g)	937-2208	1629±364
2.	Total length (cm)	50.6-68.4	60.6±5.29
3.	Condition factor (g/cm^3)	0.65-0.78	0.72±0.038
4.	Ovary weight (g)	96.17-168.60	127±20
5.	Gonado-Somatic Index (%)	6.38-9.85	7.96±1.03
6.	Absolute fecundity	10171-17833	13431±2144
7.	Relative fecundity	6.75-10.42	8.42±1.09

Table 2 Statistical analyses of total length and wet body weight of *Chitala chitala.*

Sr. No.	Parameters	Regression equation	Regression coefficient	Exponential equation
1.	Wet body weight (W) vs total length (L)	Log W = - 1.4522 +2.6133 Log L	0.9715	$W = 0.0353(L)^{2.61}$
2.	Wet body weight (W) vs ovary weight (OW)	Log W = 0.446 + 1.3127 Log OW	0.7485	$W = 2.7925(L)^{1.31}$
3.	Wet body weight (W) vs absolute fecundity (AF)	Log W = -2.204 + 1.3109 Log AF	0.7481	$W = 0.0063(L)^{1.31}$
4.	Total length (L) vs ovary weight (OW)	Log L = -0.6678 + 1.5536 Log OW	0.7905	$W = 0.2149(L)^{1.55}$
5.	Total length (L) vs absolute fecundity (AF)	Log L = -0.3145 + 0.5082 Log AF	0.7902	$W = 0.4847(L)^{0.51}$

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