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LENGTH- WEIGHT RELATIONSHIP AND CONDITION FACTOR OF THREE SMALL INDIGENOUS FISH SPECIES (*CHANNA PUNCTATUS*, *PETHIA TICTO*, AND *TRICHOGASTER FASCIATA)* FROM THE TURAG RIVER, BANGLADESH

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ABSTRACT: Length-weight relationship (LWR) and condition factor (K) are fundamental tools to evaluate the growth of a fish population and the health of the aquatic habitat. The present study was undertaken to investigate the length-weight relationship and condition factor of three small indigenous fish species namely, *Channa punctatus*, *Pethia ticto*, and *Trichogaster fasciata* from the Turag River, Bangladesh. The fish samples were collected from three different sites (Aichi, Arichpur and Rajabari) during the month of December 2022 to February 2023. A total of 63 fish samples of different sizes were collected for analysis. The total length of these fishes ranged between 6.0 to 18.2 mm, 4.1 to 8.0 mm, 6.8 to 9.5 mm with mean length of 10.62 mm, 6.42 mm, 8.12 mm and their weight ranged from 4 to 171g, 5 to 36g, 31 to 69g with mean weight of 41.48g,17.45g, and 52.8g for *Channa*, *Pethia* and *Colisa* spp. respectively. The study found that the values of the growth coefficient (b) for the 3 species varied greatly ($P < 0.005$) from 3 and ranged from 2.19 *(Channa punctatus*) to 2.82 (*Pethia ticto*) indicating negative allometric growth pattern in all species under this natural habitat. R^2 value was calculated as 0.392, 0.852 and 0.944 for *C. punctatus, P. ticto and Trichogaster fasciata*respectively. The value of Fulton's condition factor (K) was lower than 1.0 reflecting the poor condition of the aquatic habitat to maintain the well-being of the fish species. This finding will provide insights towards sustainable stock management of the studied fish species in the Turag River, Bangladesh.

Key words: Length-weight relationship, condition factor, fish growth pattern.

INTRODUCTION

A comprehensive understanding of the aquatic environment of water bodies is essential for the effective and efficient development of fisheries (Vishal Rajput 2019). Bangladesh is blessed with an enormous area of inland open

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waters including rivers, canals, man-made and natural lakes, freshwater marshes, estuaries, brackish water impoundments, and floodplains and these have the potential to provide among of the world's richest fish resources; in terms of output, Bangladesh is surpassed only by China and India (Hossain 2015). The Turag River is one the important rivers which is an upper tributary river of the Buriganga River and flows beside the Dhaka. Being originated from the Bangshi River, it passes through Gazipur and merges with the Buriganga at Mirpur in Dhaka District (Choudhury and Choudhury 2004). One of the most contaminated river systems in the world is the Turag-Tongi-Balu system (Whitehead *et al.* 2018). Severe river water pollution surrounding Dhaka city is caused by toxic wastewater from thousands of factories, including tanneries and metal plants (Asaduzzaman *et al.* 2016; Tamim *et al.* 2016). Rapid and unplanned industrialization, ignorance about the harmful impact of water pollution, lack of proper river management practice and effective regulations against water pollution are some of the most notable factors that contribute significantly to the degraded water quality of these rivers including the Turag. Pollution of rivers might affect the metabolism of fish population and ultimately their growth.

The *Channa* belongs to the family Channidae of the order Anabantiformes, the *Pethia* belongs to the family Cyprinidae of the order Cypriniformes and the *Colisa* belongs to the family Osphronemidae of the order Perciformes are some of the highly demanded and consumed fish species available in the Turag River. Extensive research on growth and length is crucial for the maintenance of a healthy commercial stock (Vishal Rajput 2019). Fish length and weight data are typically analyzed to provide biological information, and this type of study has become one of the standard practices in fishery biology (Kumary *et al.* 2016). The condition factor of a fish reflects its physical and biological environment, as well as variations caused by interactions among its physiological and dietary conditions (Le Cren 1951).

In fishery biology, the length-weight relationship (LWR) and condition factor are very highly effective measures for enforcing fruitful guidelines for sustainable fishery management in natural water sources (Vishal Rajput 2019). The significance of figuring out length-weight relationships (LWRs) in fish has been emphasized by many studies (Jisr *et at.* 2018) as it offers details on the growth pattern, overall health, life history, habitat circumstances, along with morphological characteristics of the fish (Schneider *et al.* 2000; Froese 2006). Keeping this in view, the present study was conducted to investigate the length-weight relation and condition factor of the selected fish species of the Turag River, Dhaka. This study might reflect the growth pattern and wellbeing of the fish species and health condition of the habitat.

MATERIAL AND METHODS

Collection of samples: The fishes to be analyzed were collected from three different sites of the Turag River namely Aichi (23°88'18.17"N, 90°40'43.91"E),

Fig.1 Map of sampling sites of the Turag River, Bangladesh

Arichpur (23°89'0660"N, 90°40'61.02"E) and Rajabari (23°53'07.5"N, 90°24'54.0"E). A total of 63 specimens of three different species (*Channa punctatus*, *Pethia ticto* and *Trichogaster fasciata*) were collected for the study from December 2022 to February 2023. The samples were collected from each site with the assistance of locally hired fisherman and boatmen very early in the morning. Cast net and Chinese net (Cheena vala) were used to collect fish samples. After collection, the fish samples were kept in Ziploc bag and labelled using marker. The samples within Ziploc bag were kept in an insulated icebox and then taken to the fisheries laboratory, Department of Zoology, Jagannath University for further analysis. The fish species were identified based on morphometric characteristics according to the taxonomic key from Encyclopedia of Flora and Fauna of Bangladesh (Freshwater Fishes), Vol-23. The fish samples were measured for total weight using a 30 cm ruler which was then converted into mm unit and total body weight was determined using an electrical balance machine.

Length-weight relationship (LWR): The length-weight relationship of the fish species under study was determined following log transformation formula of Le Cren (Le Cren, 1951). The length-weight relationship formula $W = aL^b$ was used to determine the relationship between the weight (g) of the fish and its total length (cm). Where,

W= total body weight(g),

L= total body length(cm),

'a' is the rate of change of weight with length (regression Intercept)

'b' is the weight at unit length (regression slope/growth coefficient).

This length-weight relationship was also expressed using the linear regression of the log-transformed equation: $\log (W) = \log (a) + b \log (L)$. According to Ricker and Carter (1958), when this formula is applied on sampled fish, the value of 'b' may deviate from the 'ideal value' 3, which represents an isometric growth due to specific environmental conditions or the circumstance of fish themselves. On the other hand, fish have negatively allometric growth when b is less than 3, and they become slimmer with increasing length while fish become heavier when b is more than 3.0, indicating positive allometric growth and ideal growing conditions (Jisr et at. 2018).

Condition factor (K): To determine the condition factor, which is a measurement of fish's wellbeing of plumpness, the following equation suggested by Fulton (1904) was used and the equation is based on the assumption that a fish's weight is directly proportional to its length cube.

$K=100 \text{ X } (W/L^3)$. Where,

W = body weight of the fish (gm) and L= total length of the fish (mm).

In case of the non-isometric value of b (<3), the equation can be modified as-

$$K=100 \text{ X } (W/L^b)$$

Where, L=Total length of the fish (cm)

The relative Condition factor Kn was calculated by the following formula-

$$Kn= W/aL^b$$

Where 'a' and 'b' are the exponential form of the intercept and slope respectively, of the logarithmic length-weight equation by Le Cren (1951). Regression analysis was used to determine the 95% confidence intervals for 'a' and 'b'. $\mathbf{R^2}$ value around 1 implies a more efficient model.

All the statistical analysis and graphical representations were done using the data analysis package in Microsoft Excel.

RESULT AND DISCUSSION

The total length and weight of *C. punctatus*, *P. ticto* and *T. fasciata* used in the present study varied from 60 to 182 mm, 41 to 80 mm, 68 to 95 mm and 4

to 171g,5 to 36g and 31 to 69g respectively. Table 1. shows the data on length and weight of those fish collected for the study and Table 2. represents the size related variations in the length-weight relationship, condition factor, modified factor and relative factor of the fishes.

Table 1: Data on length and weight of *Channa punctatus*, *Pethia ticto* and *Trichogaster fasciata*

Species	n	TL (mm)		Mean length (mm)	SD of length (mm)	BW(g)		Mean Weight (g)	SD of weight (g)
		Min	Max			Min	Max		
1. *Channa punctatus*	25	6.0	18.2	10.62	3.34	4	171	41.48	44.91
2. *Pethia ticto*	33	4.1	8.0	6.42	0.96	5	36	17.45	7.63
3. *Trichogaster fasciata*	5	6.8	9.5	8.12	1.42	31	69	52.8	14.21

Table 2: Regression parameters and Condition factor of *Channa punctatus*, *Pethia ticto* and *Trichogaster fasciata*

Species	a	b	R^2	Fulton CF	Modified CF	Relative CF
1. *Channa punctatus*	0.001	2.19	0.392	0.0008-0.0060	0.0371-0.4298	0.3734-0.4322
2. *Pethia ticto*	0.0001	2.82	0.852	0.0032-0.0087	0.0660-0.1671	5.2557-13.2898
3. *Trichogaster fasciata*	0.0013	2.41	0.944	0.0087-0.0111	0.0101-0.1309	0.8892-1.0703

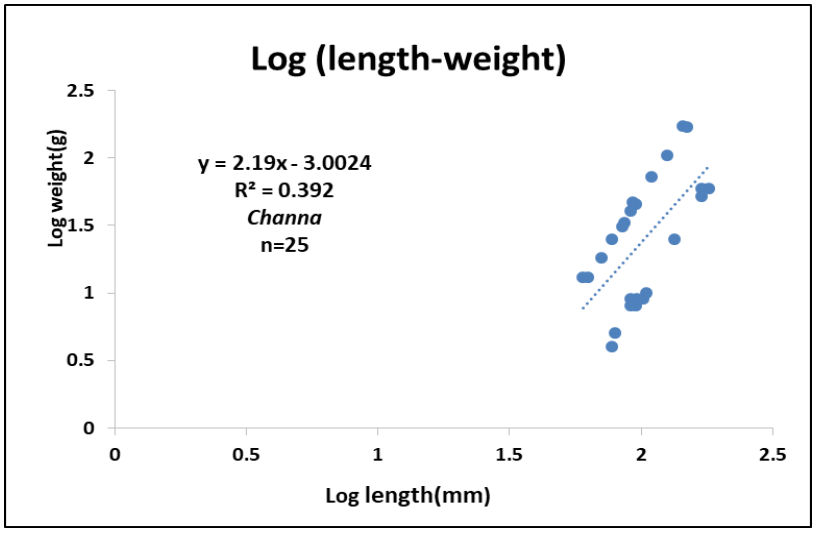

Fig. 2 Length-Weight relationship of *Channa punctatus*.

The value of 'b' remains constant at '3' in an ideal fish (Allen,1938), but under natural condition the value of 'b' usually ranges 2.5 and 4 (Hile,1936; Martin,1949). As stated by Tesch (1971), the exponent b often has a value close to 3 but it fluctuates between 2 and 4. In the present study, the value of b was

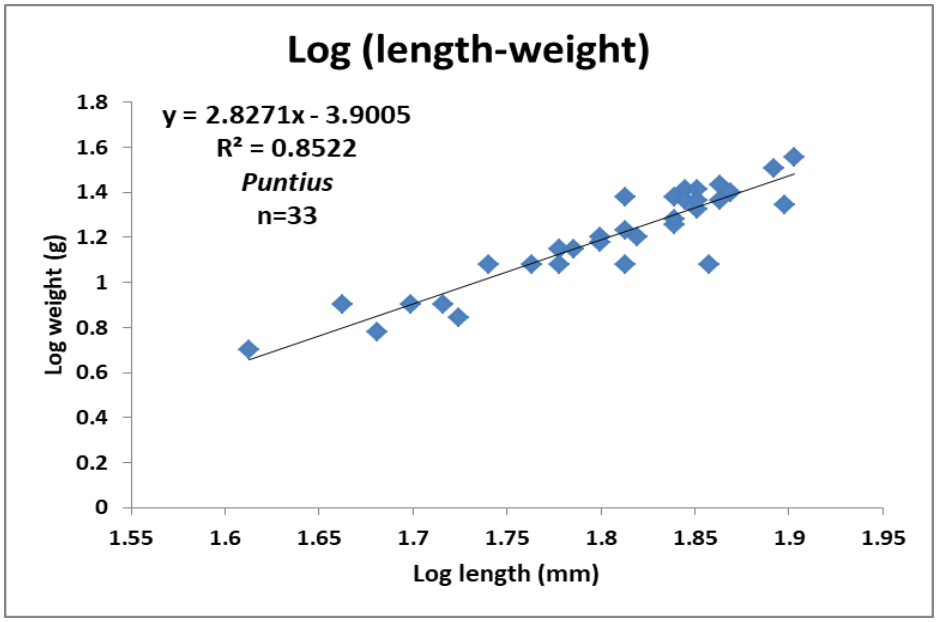

Fig. 3. Length-Weight relationship of *Pethia ticto*.

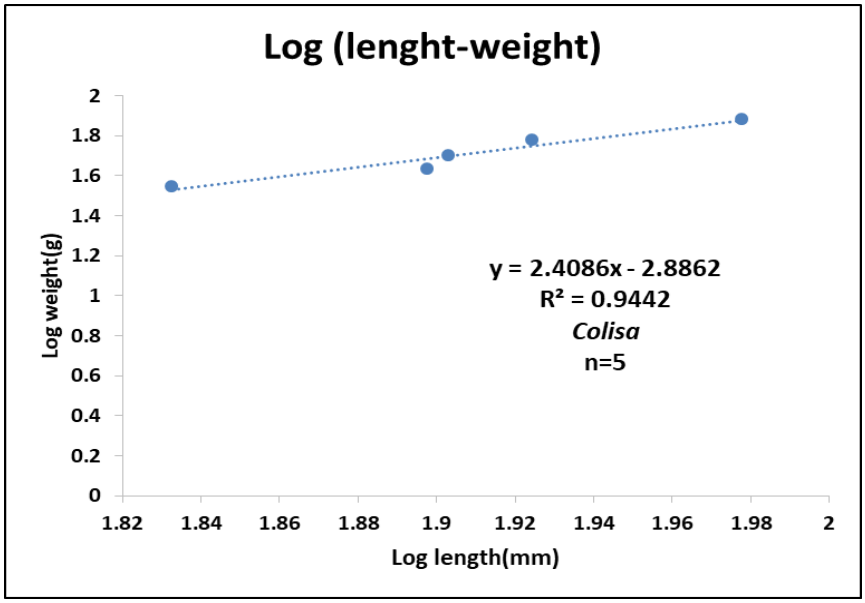

Fig. 4. Length-weight relationship of *Trichogaster fasciata*.

recorded 2.19 for *Channa punctatus*, 2.82 for *Pethia ticto* and 2.40 for *Trichogaster fasciata*, which indicates negative allometric growth (b<3) pattern that is the fishes are not growing at a rate, proportional to their length. Many factors, such as climate, habitat, reproductive maturity, food availability, hunger pattern, and general health, as well as yearly environmental changes can influence the length-weight relationship growth coefficient in freshwater fish (Bagenal and Tesch, 1978). Mortuza and Rahman (2006) reported the 'b' values for *R. corsula* 2.941, 3.008 and 2.984 from Padma River in Rajshahi, Bangladesh. This indicates that the Padma River is a healthier habitat for fish than the Turag River. The estimated growth coefficients were 2.97, 2.95 & 2.93 for *Labeo calbasu* of Kaptai Lake, Rangamati, Bangladesh (Basak & Hadiuzzaman, (2019). In this case too, Kaptai Lake offers a better environment for fish than the Turag River.

Singh and Serajuddin (2017) reported a positive allometric growth (b> 3) for male, female and combined (male & female) of *C. punctatus* from three rivers (Gomti, Ganga, Ken), except in the females of Gomti River. Md. Yeamin Hossain (2010) reported that the value of b for *P. ticto* was close to isometric value (2.976–3.213) from the Padma River, northwestern Bangladesh and this value is higher than the findings of current study. Akter *et al.* (2016) reported negative allometric growth of the species *Trichogaster fasciata* collected from different fish markets in Jessore and Jhenaidah districts as 'b' value ranged between (1.290-1.962), which is lower than the findings of current study.

The quality of fish is essentially represented by the condition factor, which is the outcome of the interactions between biotic and abiotic elements and their impact on the fish's state of physiological condition (Kumary et al. 2016). Hence, higher condition factor means that the fish population has attained better condition. The condition factor for the fish species under this study were calculated as 0.0008-0.0060 for *Channa punctatus*, 0.0032-0.0087 for *Pethia ticto* and 0.0101-0.1309 for *Trichogaster fasciata*.

Singh and Serajuddin (2017) estimated condition factor to be more than 1 for male, female and combined (male & female) of *C. punctatus* from three rivers (Gomti, Ganga, Ken). Hossain et al. (2012) reported the value of condition factor ranged between 1.72–1.84 for *P. ticto* in the Ganges River, Northwestern Bangladesh.

Based on the findings of current study of length-weight relationship and condition factor, the fish species are not in a good condition in terms of health and growth pattern. Turag River with an exposure to extreme level of pollution due to various anthropogenic activities along with various other factors- is not in a state of maintaining the overall well-being of the studied fish species. To protect the fish diversity in the Turag River, necessary steps should be taken to

protect the river from pollution. Strict and effective regulations should be enforced against pollution. Efficient river management practice and sustainable use of the river should also be ensured. This study also recommends undertaking broad scale study of length-weight relationship and condition factor on seasonal basis that might yield helpful information useful to fishery managers, strategists, and scientists, as well as those who conduct further research in this area.

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