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TEMPORAL VARIATIONS OF LENGTH, WEIGHT AND CONDITION OF THE ASIAN STINGING CATFISH *Heteropneustes fossilis* (Bloch, 1794) IN THE GANGES RIVER (NW BANGLADESH)

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A B S T R A C T

The present study revealed on temporal variations of length, weight and condition of *Heteropneustes fossilis* (Bloch, 1794) in the Ganges River, Northwestern Bangladesh. Total 1161 individuals of *H. fossilis* were caught by various habitual fishing gears such as seine net, cast net and gill net during January to December 2019. For every specimen, body weight (BW) was taken by digital balance to the accuracy of 0.01 g and total length (TL) was taken using a measuring board. Relative condition factor (K_R) was assessed by $K_R = W/(a \times L^b)$, where W is the BW in g, L is the TL in cm and a and b are length-weight relationships parameters. The value of K_R ~ 1 specifies good health, >1 specifies over bodyweight as compared to length, whereas <1 suggests a fish in poor condition. The TL varied from 8.5-28.7 cm whereas the BW was 37.17–2250 g. The overall K_R for *H. fossilis* was 0.99-1.06 in the Ganges River. The highest K_R was observed in May while the lowest was in January. The K_R was significantly correlated with BW in the Ganges River. The outcomes of the study will be helpful for future management of this fish in the Ganges river ecosystem as well as adjacent water bodies.

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INTRODUCTION

Catfish, a common name for a large group of Siluriformes ray-finned bony fish, lived in inland-brackish-coastal waters, but most of them live in shallow and flowing waters and are found in Asia, North and South America and Africa (Bruton, 1996). It has considerable significance in different regions because of its immense commercial significance and the intent of the aquarium (Sarkar *et al.,* 2017). In spite of the presence of such nonviolent parasites on their bodies, catfish are not only ideal for high production rates but also preferable to culture in warm climate and have great disease resistance (Elenien *et al.,* 2009). There are the growing concern about farming of this fish, along with its high rate of growth, persistence with the changed environmental situation, and the attractiveness of consumers because fresh fish is often taken (Sarkar *et al.,* 2017).

The *Heteropneustes fossilis* (Bloch, 1794) (Siluriformes) is a valuable catfish species (locally known as *shinghi* or *shinghee*), primarily a fish of pond, *beels*, ditches, swamp and marshes but occasionally present in muddy rivers (Froese and Pauly 2021). With admirable taste, high medicinal value of good protein, calcium and iron, this catfish has high commercial value (Ahmed *et al.,* 2012, Jayalal and Ramachandran, 2012). Distribution of this species is widely in Bangladesh, Pakistan, India, Mayanmar, Nepal, Sri Lanka Laos and Thailand (Talwar and Jhingran, 1991). It is classified as least concern species both in Bangladesh (IUCN Bangladesh, 2015) and worldwide (IUCN, 2021).

Condition factor is the most significant factor for determining the well being of fish species and its natural ecosystems, and also act as functional tools for management and conserving wild stock (Bagenal and Tesch, 1978; Rahman *et al.*, 2012). Additionally, it measures fish well-being quantitatively and forecasts population success in the future (Richter, 2007; Hossain *et al.*, 2013; 2016). Moreover, the relative condition factor (K_R) can be used to examine fish health (Rypel and Richter, 2008; Hossain *et al.*, 2009; 2013) as well as very important to estimate the environmental condition of fishes (Hossen *et al.*, 2019).

A sum of studies including length-length relationship (LLR) (Ferdaushy and Alam, 2015) and length-weight relationships (LWRs) (Khan *et al.,* 2012; Ferdaushy and Alam, 2015; Das *et al.,* 2015; Muhammad *et al.,* 2017; Hossain *et al.,* 2017; Islam *et al.,* 2021), condition factors (Muhammad *et al.,* 2012; Das *et al.,* 2015; Ferdaushy and Alam, 2015; Hasan *et al.,* 2020) of this fish species have been carried out, but to the best of our knowledge, there is none of this studies cover the condition of fishes covering year round data in the Ganges River of Bangladesh and elsewhere. Therefore, the present study was aimed to describe the temporal variations of length, weight and relative condition factor of *H. fossilis* in the Ganges River, NW Bangladesh using a number of specimens with various sizes over the study period of one year.

MATERIALS AND METHODS

Study Site and Sampling

The present study was conducted out in the Ganges River (Charghat: 24°15' N, 88°44' E; and Shaheb Bazaar: 24°20' N, 88°34'), NW Bangladesh. A number of 1161 samples of *H. fossilis* were collected from the fishers' catch during January to December 2019. Individuals were collected from the fishers' catch. Seine net, gill net and cast net were used to catch the fishes. Fishes were immediately kept in ice on the spot and on the arrival to the laboratory fixed them with a 10% buffered solution. Total length (TL) was measured by using a measurement board and body weight (BW) were taken with electronic balance.

Data analyses

According to Le Cren (1951), the LWR was estimated by: $W = a \times L^b$. The parameters of regression *a* and *b* were obtained by *ln (W) = ln (*a) + *b ln (L).* The equation was being used for calculating the LWR, where the weight of the body (g) is *W*, and length in cm is *L*. Normal logarithm-based linear regression analysis have been used to derive regression parameters *a* and *b*. Furthermore, the 95% confidence limit (CL) of *a* and *b* and the determination coefficient (r^2) were determined. According to Froese (2006), unexpected outliers were removed. To approve the *b* values, a t-test was performed that varied significantly from the isometric value (*b* = 3) (Sokal and Rohlf, 1987).

Relative condition factor (K_R) was assessed with the equation: $K_R = W/(a \times Lb)$ (Le Cren, 1951), where *W* is the BW in g, *L* is the TL in cm and *a* and *b* are LWRs parameters. According to Le-Cren (1951), if the value of K_R is 1 which indicates good health, however and if it is less or higher than 1 indicates relatively poor or imbalance condition of the fish.

Statistical analyses

GraphPad Prism 6.5 software was used for statistical analyses with considered at 5% level of significance ($p< 0.05$) in this study.

RESULTS

Length-weight

Total of 1161 individuals were collected through January to December 2019 from the Ganges River. The lowest and highest TL was 8.5 cm and 28.7 cm, respectively. The BW of *H. fossilis* ranged 3.12-146.55g. Monthly variations of TL and BW were shown in Figure 1 and Figure 2, respectively.

Relative condition factor

The lowest value of K_R was 0.99 in January and the highest value was 1.06 in May. Monthly variations of K_R were shown in Figure 3 and Table 1. Additionally, Table 2 showed the correlation between TL *vs.* K_R and BW *vs.* K_R. Furthermore, variations of K_R with TL were shown in Figure 4.

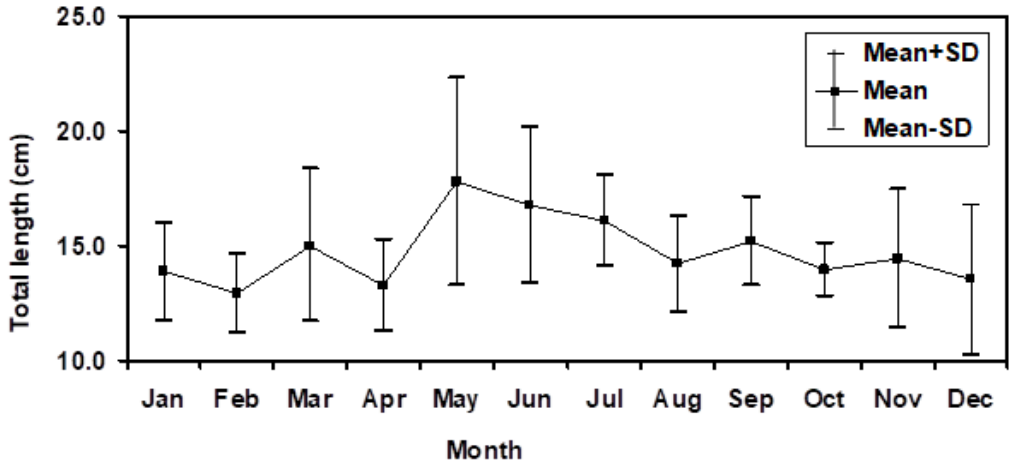

Figure 1. Monthly variations of total length for *Heteropneustes fossilis* (Bloch, 1794) from the Ganges River, northwestern Bangladesh.

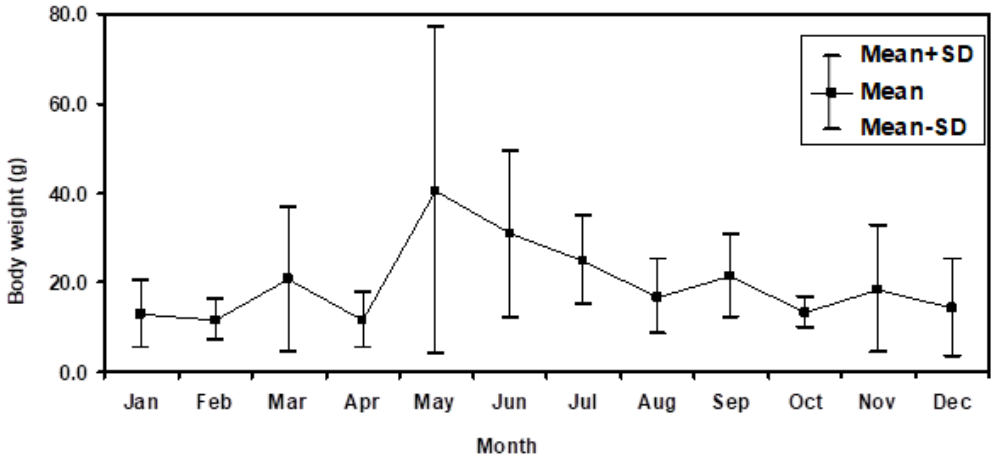

Figure 2. Monthly variations of total length for *Heteropneustes fossilis* (Bloch, 1794) from the Ganges River, northwestern Bangladesh

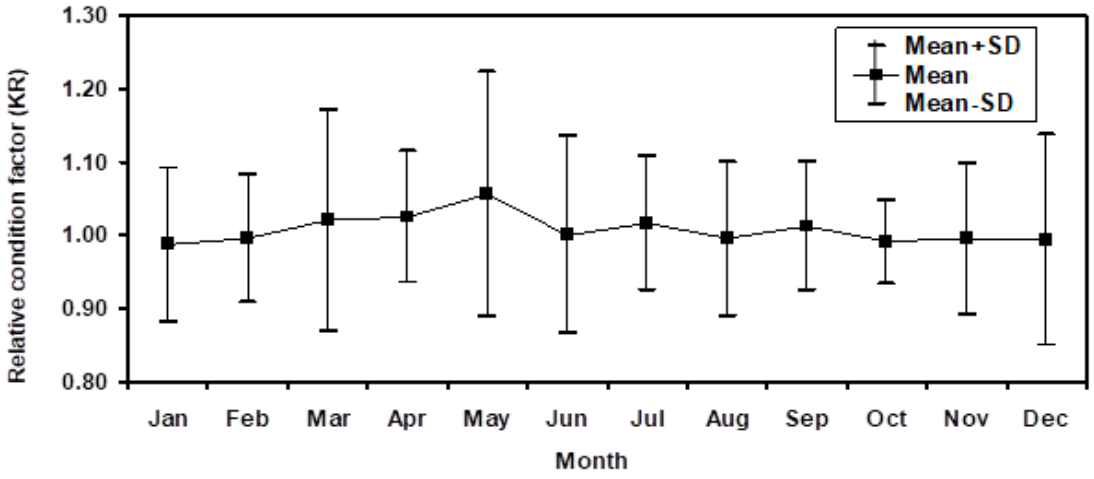

Figure 3. Monthly variations of relative condition factor (K_R) for *Heteropneustes fossilis* (Bloch, 1794) from the Ganges River, northwestern Bangladesh

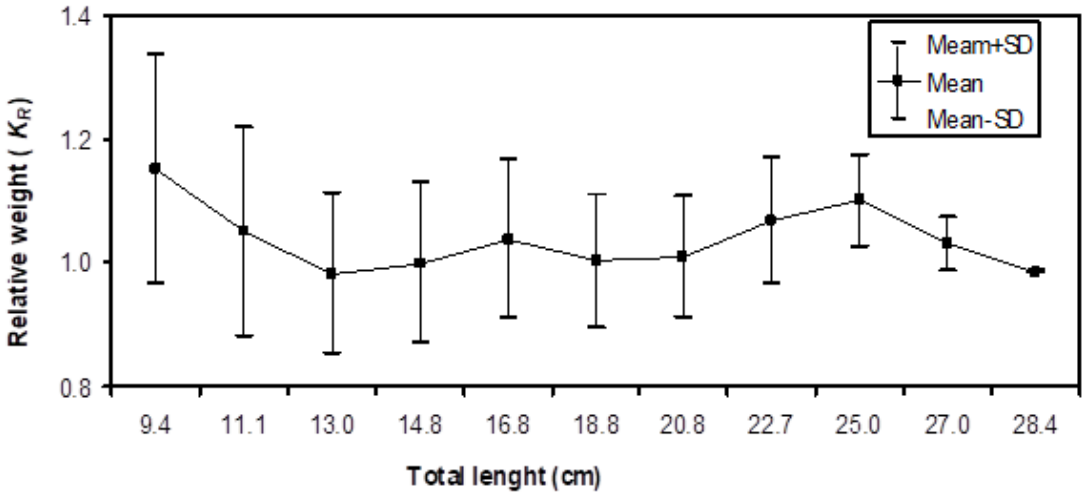

Figure 4. Variation of Relative condition factor (K_R) with total length (TL) of *Heteropneustes fossilis* from the Ganges River, northwestern Bangladesh

Table 1. Descriptive statistics on relative condition factor (K_R) measurements and their 95% confidence limits of *Heteropneustes fossilis* (Bloch, 1794) from the Ganges River, northwestern Bangladesh

Month	n	Relative condition factor (K_R)			
		Min	Max	Mean ± SD	95% CL
Jan	90	0.70	1.23	0.99± 0.11	0.96-1.01
Feb	102	0.82	1.20	1.00 ± 0.09	0.98-1.01
Mar	81	0.77	1.67	1.02± 0.15	0.99-1.05
Apr	95	0.83	1.28	1.03 ± 0.09	1.01-1.04
May	82	0.75	1.45	1.06 ± 0.17	1.02-1.09
Jun	92	0.75	1.32	1.00 ± 0.13	0.97-1.03
Jul	104	0.83	1.34	1.02 ± 0.09	1.00-1.03
Aug	112	0.73	1.30	1.00 ± 0.11	0.98-1.02
Sep	86	0.82	1.24	1.01± 0.09	0.99-1.03
Oct	118	0.87	1.11	0.99± 0.06	0.98-1.00
Nov	112	0.77	1.41	0.99 ± 0.10	0.98-1.01
Dec	88	0.68	1.37	0.99 ± 0.14	0.96-1.02
Overall	1161	0.63	1.74	1.00±0.14	1.00-1.02

n, Sample Size; Min, Minimum; Max, Maximum; SD, Standard Deviation; CL, Confidence Limit

Table 2. Relationships of relative condition factor (K_R) with total length (TL) and body weight (BW) of *Heteropneustes fossilis* from the Ganges River, northwestern Bangladesh

Relationships	r_s values	95% CL of r_s	*P* values	Significance
TL *vs.* K_R	0.0401	-0.0192 to 0.0991	*P* = 0.172	ns
BW *vs.* K_R	0.2377	0.1810 to 0.2928	*P* = <0.001	****

r_s, Spearman rank-correlation values; CL, confidence limit; *p*, shows the level of significance; *ns*, not significant; **** very highly significant

DISCUSSION

Information about body condition of *H. fossilis* in the Ganges River is scare, excluding Nageshwari River in Bangladesh (Ferdaushy and Alam, 2015). During this study, a large number of individuals of different body size were collected from the study site through habitual fishing gears around the year. However, absence of smaller than 8.5 cm TL during the study may be attributed to the selectivity of fishing gear (Azad *et al.*, 2018; Rahman *et al*., 2021).

The maximum length of *H. fossilis* recorded as 28.7 cm TL in our study, which is lower than the maximum known TL of 31.0 cm, in the Ganga River, India (Khan *et al.*, 2012) but higher than the maximum TL of 26.8 cm found in Gajner *beel*, a wetland ecosystem of Bangladesh (Rahman *et al.,* 2019). Maximum length information is required to assess population parameters, in addition to asymptotic length (L_∞) and fish growth consonant, which is crucial for the strategic planning of fisheries resources (Hossain *et al.,* 2012). The data of *H. fossilis* have been recorded over a prolonged period of time and are not reflective of any single season, so they should be considered for comparative purposes only as mean-annual values.

Average TL and BW were comparatively smaller in February and April, respectively. June – July were the peak spawning season of *H. fossilis* (Thakur and Nasar, 1977) and in August off-springs were recruited in the adult stock. In May, maximum mean length and weight found as presence of much more food in the River.

In this study, relative condition factor (K_R) was calculated to assess the overall well being and productivity of *H. fossilis* in the Ganges River. Average K_R values over the year signified a balance habitat for the stock. During this study, the lowest and highest K_R values were found in January and May, respectively. During the peak spawning season, the K_R value may be higher (Khan *et al.*, 2001). The dissimilarity may take place due to gonad maturity, the quantity of undigested food in the digestive tract and reduction in the composition of fat deposited in bodily tissue (Hossain *et al.*, 2017).

Smaller individuals showed a higher K_R value due to their high feeding intensity. The value reduces gradually with escalating the length while gonadal maturity occurs. However, according to Welcome (1979), the condition factor in fish decreases with decreasing in size and is also affected by the reproductive cycle. We found no reference about the relative condition factor (K_R) of *H. fossilis* elsewhere. Therefore, it is not easy to compare with other findings.

CONCLUSION

The relative condition factor was highly correlated with body weight for *H. fossilis* in the Ganges River. Temporal variations of the relative condition factor were found with the highest in May and lowest in January. The findings of this study will help to develop sustainable management of *H. fossilis* in the Ganges River and other aquatic ecosystems.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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