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# Length-weight Relationship and Condition Factor of Two Gangetic Mystus species, Mystus *tengra* (Hamilton, 1822) and *Mystus cavasius* (Hamilton, 1822)

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### Abstract
The present study deals with length-weight relationship of two Gangetic Mystus, *Mystus tengra* (Hamilton, 1822) and *Mystus cavasius* (Hamilton, 1822) collected from local fish market of Rajshahi City Corporation from September 2010 to February 2011. Considering the size of frequency, the total length ranged from 65mm to 97mm in *M. tengra* and 102 mm to 148 mm in *M. cavasius*. The total mean weight ranged from 2.2g to 7.4g in *M. tengra* and 10.6g to 20.2g in *M. cavasius*. The condition factor ($K_o$) was $0.873 \pm 0.036$ and $0.678 \pm 0.067$ in *M. tengra* and *M. cavasius* respectively. However, the calculated relative condition factor ($K_n$) was $0.972 \pm 0.045$ and $1.030 \pm 0.107$ were in *M. tengra* and *M. cavasius* respectively.

**Keywords:** Gangetic *Mystus*, fish biology, length-weight relationship, condition factor, Rajshahi University

## 1. Introduction
Bangladesh is a riverine country with vast water resources. The country is fortunate with large numbers of rivers and their tributaries, canals, haors, baors, estuaries, lakes and vast fishing ground the Bay of Bengal [20]. Total water resources of the country is 21,182,306 ha including 4,575,706 ha of inland and 16,606,600 ha of marine water [1]. Fish is an important source of protein, which provides 63% animal protein to human [2] where approximately 80% of animal protein get from anole fish flesh because of poor production of eggs and meet in our country [3]. In many fishes changes in the relative growth of various body proportions are known to occur at different stages of development and particularly at sexual maturity [4]. Studies on relative growth and morphometric characters of fishes are important in the study of biology of the fishes. All living animal has tendency to maintain symmetrical growth of its different body parts in relation to one another. It is generally known that growth of all the body parts is dependent on the total length of the body, but the total length of the body is not dependent on all other body parts.

Gangetic Mystus is a species of catfish of the family Bagridae. In the wild it is found in Indian Subcontinent countries [19]. *Mystus* species used as food in Bangladesh and it has good demand in fish market due to its taste [21]. The population is known to be decreasing in recent past, due to catching, pet trading and habitat destruction [5]. The exact relationship between length and weight differs among species of fish according to their inherited body, shape, and within a species according to the condition of robustness of individual fish. Condition sometimes reflects food availability and growth within the weeks prior to sampling. But, average condition of each population varies seasonally and yearly. Sex and gonad development are other important variables in some species, especially percids. Bangladesh has diverse array of water resources including 260 freshwater fish species, 24 freshwater prawn, 475 marine fish, 36 marine or brackish water shrimp and 12 exotic fish species [1]. Among the freshwater fishes catfish is a rich and exceptionally diverse group of fishes constituting the order Siluriformes. Study of the body measurement has been extensively used in the identification of the species of fishes. Studies on relative growth and morphometric of perciformes have been described by several researchers such as *Anabas testudineus* [6] and *Tilapia mossabica* [7]. Also relationship of length-weight of *Lepidocephalus guntea* was described [15].

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Recently, various aspects of indigenous species of small fishes were described in Bangladesh [8]. The biology, population and length-weight relationship of *Puntius stigama* was discussed [9]. However, only few works have been reported of catfish's research in Bangladesh [10, 11]. Thus the aim of this study was to estimate the parameters of the length-weight relationship and condition factor of the very common two Gangetic Mystus species, *Mystus tengra* and *Mystus cavasius*.

## 2. Materials and Methods

A total 300 specimens (110 male and 190 female) of each of different sized *Mystus tengra* and *Mystus cavasius* were collected from local market, Shaheb Baza, Rajshahi New Market and Binodpur Bazar of Rajshahi City Corporation areas during September 2010 to February 2011 (Table 1). Sexes were separated on the basis of body shape, genital papilla and coloration. Females were identified by visually the base of the round genital structure which had a round protrusion; the abdominal region was always broader and longer and darkens color than the male. However, the male, genital papilla was a soft, elongated structure, broad at the base and gradually tapering towards the end. The tip of the papilla was beyond the base of the first anal fin, the body was elongated, and the color was light in comparison with that of the female [22]. Finally, a semi-circle incision was used to open the body cavity and sex was assessed. All the specimens were carried in the laboratory of Fisheries, Department of Zoology, University of Rajshahi for further study. In the laboratory, the total length and standard length of the fish were measured in the nearest mm by means of a measuring board and their weights were recorded in the nearest grams by a sensitive pan balance (Model No. CT, 1200-S, USA). The collected specimen were washed under tap water and preserved in 5% formalin in individual plastic jars for morphometric and meristic study. Some amount of 5% formalin was also injected into the gut to prevent further digestion. A magnifying glass was used to count the fin rays and dorsal spines. Total length (TL), Standard length (SL), $1^{st}$ dorsal length ($DL_1$), $2^{nd}$ dorsal length ($DL_2$), pectoral length (PL), pectoral length (PL), pelvic length (PVL), anus length (ANL), anal length (AL), and total weight (TW) were recorded shown in Table 2 accordingly [12]. Co-efficient of condition factor (K) was also calculated according to the researcher [13, 14] in this study was presented in the Table 3, 4 and 5. The length-weight relationships of the two species were calculated from the logarithmic formula described [14] and other statistical analyses were calculated by SPSS (statistical packages for social science). Length-weight relationship was calculates by following formula, W= $aL^n$ [where, W, weight; L, length; a, constant equivalent; n, another constant to be calculated empirically]. The value of 'a' and 'n' was calculated in log form as, Log a = ∑Log TW

×∑logTL²—∑logTL × ∑(logTL×logTW) / N×∑logTL²—(∑logTL)². n = ∑logTW—N×loga / ∑logTL [where n, indicates the number of specimens]. Condition factor was calculated as; here we used observed value ($K_0$) and calculated value (Kc). Formulae, $TW=KTL^3$ which was written as, K= $TW/TL^3$ [where TW total weight in grams and TL is the total length in mm and K factor was written as, $K=TW×10^5/TL^3$. Relative condition factor was determined by using the following formula, Kn=TW/aLn or, Kn= $TW/\overline{TW}$ [where TW, observed total weight, $\overline{TW}$, calculated total weight].

## 3. Results and Discussion

During the present study a total 300 individuals of were analyzed in different age group of fishes (Table 1). All the length-weight regression were significant (p<0.01), with the coefficient of determination (r) ranging from 0.872 to 0.999 in case of *M. tengra* and 0.940 to 0.994 in *M. cavasius*. In our study, b values ranged from 2.36 to 3.07 showed significant differences between *M. tengra* and *M. cavasius* respectively (Table 3). The slope b provides valuable information on fish growth, being isometric when b=3, positive allometric when b>3 and negative allometry when b<3 [16]. This study indicates isometric growth for both of the species (Table 2, 3 and 4) which are related to other researchers [17, 9]. Generally, isometric growth indicates that the body increases in all dimension in the same proportion of growth whereas the negative allometry indicates that the body become more rotund as it increases in length and a slimmer body [17]. The change in weight in relation to length generally not on basis of specific gravity but due to change in the farm of volume, because usually equilibrium is maintained between the density of organism that of surrounding water. Since Fulton's condition factor (K) is a measurement involving the length and weight for a particular fish species; therefore it could be influenced by the same factors as length weight relationship. The condition factor determined by Ponderal index [13] observed mean value ($K_o$) as 0.873±0.036 and 0.678±0.067 in *M. tengra* and *M. cavasius* respectively (Table 4). However, the calculated relative condition factor ($K_n$) was 0.972±0.045 and 1.030±0.107 were in *M. tengra* and *M. cavasius* respectively shown in Table 5. These condition factors values and Ponderal index values are the information regarding the development of reproductive systems, robustness, fatness, and plumpness of these species. The variation of the above observations describes the seasonal variation in feeding and gonadal condition the fishes. Similar fluctuations of $K_n$ values were observed several researcher in many fish species [7, 18]. Thus, our results of this study could contribute to the culture and management of these fish species and also awaken an interest in the study of native species that play an important role in the Ganges river ecosystem and fish production.

**Table1:** Estimated parameters of length–weight relationships for Gangetic Mystus species of Bangladesh (N=100).

| Class interval | TL | TW | SL | DL1 | DL2 | PL | PVL | AL | ANSL |
|---|---|---|---|---|---|---|---|---|---|
| 65-69 | 66.33 | 2.63 | 53 | 21.8 | 30.5 | 13.4 | 26.5 | 37.3 | 28.87 |
| 70-74 | 71.96 | 3.38 | 56.87 | 22.87 | 31.86 | 13.62 | 29.67 | 39.92 | 32.8 |
| 75-79 | 76.95 | 4.08 | 59.36 | 22.72 | 31.13 | 15.5 | 30.05 | 40.47 | 33.02 |
| 80-84 | 81.4 | 4.82 | 64.3 | 22.95 | 32.75 | 16.25 | 31.65 | 42.21 | 35.47 |
| 85-89 | 86.87 | 5.82 | 69.12 | 25.5 | 36.95 | 17.62 | 35 | 47.25 | 95.5 |
| 90-94 | 91.5 | 6.35 | 72.5 | 27.87 | 39.5 | 19.12 | 38.67 | 51.12 | 42.37 |
| 95-99 | 96.08 | 7.06 | 75.17 | 29.3 | 41.65 | 20.5 | 40.62 | 52.5 | 43.72 |
| Mean | 81.58 | 4.88 | 64.34 | 24.72 | 34.90 | 16.71 | 33.16 | 44.40 | 36.54 |
| SD | ±9.87 | ±1.50 | ±7.70 | ±.68 | ±4.11 | ±2.33 | ±4.74 | ±5.08 | ±5.47 |

TL, Total length; SL, Standard length; DL, Dorsal length; PL, Pectoral length; PLV, Pelvic length; ANSL, Anus length; AL, Anal length; TL, Total weight(in Gramm).

**Table 2:** Relationship of total length with other different body length of *M. tengra* and *M. cavasius.*

| Relation between (X) | (Y) | Species | Mean ±SD of 'X' | Mean ±SD of 'Y' | Value of 'a' | Value of 'b' | r-value |
|---|---|---|---|---|---|---|---|
| TL | SL | *M. tengra* | 81.58±9.87 | 64.34±7.07 | 0.914 | 0.777 | 0.992 |
| | | *M. cavasius* | 124.33±14.24 | 99.87±12.94 | -9.691 | 0.881 | 0.940 |
| TL | DL1 | *M. tengra* | 81.58±9.87 | 24.72±2.68 | 3.975 | 0.254 | 0.872 |
| | | *M. cavasius* | 124.33±14.24 | 40.26±7.77 | -27.306 | 0.543 | 0.992 |
| TL | DL2 | *M. tengra* | 81.58±9.87 | 34.90±4.11 | 2.839 | 0.393 | 0.891 |
| | | *M. cavasius* | 124.33±14.24 | 48.70±7.57 | -16.805 | 0.526 | 0.982 |
| TL | PL | *M. tengra* | 81.58±9.87 | 16.71±2.33 | -2.391 | 0.234 | 0.985 |
| | | *M. cavasius* | 124.33±14.24 | 25.37±6.04 | -27.283 | 0.423 | 0.994 |
| TL | PVL | *M. tengra* | 81.58±9.87 | 33.16±4.74 | -5.329 | 0.471 | 0.963 |
| | | *M. cavasius* | 124.33±14.24 | 46.05±6.88 | -13.577 | 0.479 | 0.983 |
| TL | AL | *M. tengra* | 81.58±9.87 | 44.84±4.81 | 0.314 | 0.540 | 0.990 |
| | | *M. cavasius* | 124.33±14.24 | 66.77±7.07 | -0.200 | 0.538 | 0.993 |
| TL | ANSL | *M. tengra* | 81.58±9.87 | 42.13±4.84 | -4.904 | 0.507 | 0.999 |
| | | *M. cavasius* | 124.33±14.24 | 63.16±7.57 | -2.718 | 0.529 | 0.993 |

[a, value of interprets; b, regression co-efficient; and r, Co-efficient correlation. TL, Total length; SL, Standard length; DL1, 1st Dorasl length; DL2, 2nd Dorsal length; PL, Pectoral length; PVL, Pelvic length; ANL, Anus length; AL, Anal length].

**Table 3:** Length-weight relationship of *M. tengra* and *M. cavasius*

| Species | n | Value of 'a' | Value of 'b' | r-value |
|---|---|---|---|---|
| *M. tengra* | 100(7) | -3.83 | 2.36 | 0.994 |
| *M. cavasius* | 100(10) | -5.33 | 3.07 | 0.989 |

**Table 4:** The value of condition factor ($K_0$) of *M. tengra* and *M. cavasius.*

| Species | Mean value of obs. $K_o$ | Mean value of $K_c$ |
|---|---|---|
| *M. tengra* | 0.873±0.039 | 0.900±0.070 |
| *M. cavasius* | 0.678±0.067 | 0.658±0.005 |

**Table 5:** The value of relative condition factor ($K_n$) of *M. tengra* and *M. cavasius.*

| Species | Range of $K_n$(mm) | Mean value of $K_n$ |
|---|---|---|
| *M. tengra* | 0.883-1.034 | 0.972±0.045 |
| *M. cavasius* | 0.940-1.309 | 1.030±0.107 |

## 4. Conclusion

This study provides valuable information on length weight relationship and condition factor of two Mystus species from Bangladesh. The findings of this study could be effective information for fishery biologists, fish farm managers and conservationists to initiate the stock assessments of these Mystus species in the Ganges, Bangladesh and in neighboring countries. In conclusion, the differences in length weight relationship and condition factor of two Gangetic Mystus species in this study could be due to the factors listed earlier or a combination of factors which require further investigation.

## 5. Acknowledgements

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