Length-weight relationships of *Mystus cavasius* with special reference to body morphometric characters from river Chenab, Punjab, Pakistan

Maria Latif, Muhammad Zafar Ullah, Imtiaz Begum Minhas and Samavia Latif

Abstract

The present study focused on the length-weight relationships of freshwater catfish, *Mystus cavasius* in relation to their different morphometric characters. 100 specimens of *M. cavasius* were collected from downstream of Qadirabad barrage, Chenab river, Pakistan. The total length ranged from 5.90-17.80cm with mean 12.13±0.22 and body weight ranged from 2.00-42.0g with mean 17.75±0.70. The regression coefficient (b) was 2.71 indicating negative allometric growth of this fish. Standard, fork length; head length, width; body depth, girth; pre, post-dorsal lengths and length of caudal peduncle were found to be highly correlated with increasing total length and body weight (r= 0.866; p<0.01). This small sized catfish is heavily targeted by local fisher community and fishermen. To the author’s best knowledge, the results of this study will provide baseline information on this potentially important small indigenous catfish.

Keywords: *Mystus cavasius*, Chenab river, allometric growth, length-weight relationships, morphometry

1. Introduction

*Mystus cavasius* (Hamilton, 1822) is a small sized freshwater catfish locally known as Kanghat/ Tenga in Pakistan. It belongs to the order Siluriformes and family Bagridae. It is reported from rivers, streams, lakes, dams and barrages of Pakistan by various workers [1-6]. Among small indigenous species, it gives significant size catch at Thatta fish markets and Kotri barrage fish landing sites of Pakistan [7]. It is a hardy fish tolerating wide ranges of environmental factors such as temperature and low oxygen level [8]. It is eury-omnivorous fish having more inclination towards the carnivorous feeding habits [9]. Female dominance over males is reported in the populations of this species [7, 10].

Among small sized catfishes, it has relatively high market price due to good protein contents in its flesh [11-12]. It is also being exported as an ornamental fish from India [13]. Small indigenous fish species are valuable source of protein and minerals in the diet of developing countries peoples, such as the proximate composition of *M. cavasius* showed muscle protein contents to be 16.16% on fresh matter basis and Calcium to Phosphorous ratio 1.44% on dry matter basis [14]. High levels of vitamin A, Fe and Zn are reported from locally available small fish species and thus are potential sources of micronutrients in the diets of developing countries peoples [15].

Knowledge of Length-weight relationships (LWRs) and condition factor (K) are extensively used in fish biology for assessing population sizes, growth patterns, physiological states and for comparing life histories of different populations of same species in response to varying food availability, climatic conditions and other environmental factors [16-17]. Most of the data available on LWRs of *M. cavasius* populations is from Bangladesh and Indian water bodies, [18-22] only fewer studies reported LWRs of this species from Pakistan [5, 7]. The population of *M. cavasius* is reported to gradually declining from Bangladeshi water bodies [23]. As data about biological aspects of catfish species such as morphometric measurements involving LWRs is scarce from Pakistan. Therefore, present study was aimed to investigate LWRs of *M. cavasius* with special reference to their morphological characters. To the best knowledge of authors, this is the first report on the LWRs of this species from Qadirabad barrage, river Chenab and will be useful for the proper management and conservation of this species in its natural habitat.
2. Materials and Methods

Punjab is the land of five rivers, among these Chenab River is a life line for Pakistan, Qadirabad barrage is situated at Chenab river, about 45 Km away from district Gujranwala. The total wetland area is 2816 ha supporting diversified fauna and flora of both aquatic and terrestrial ecosystems. Fish sampling was mainly done from downstream of the Qadirabad barrage (32°19'33 N, 70°34'05'7 E, 200 M) by using cast nets of varying mesh sizes from January to June 2017. Collected samples were immediately preserved in 10% formaldehyde solution to prevent any deterioration and then were brought to the laboratory at Fisheries Research and Training Institute, Manawan, Lahore for their further study. After tagging, each fish was weighed nearest to 0.1 g by using digital weighing balance and total length was noted by using scale nearest to 0.01 cm. For each individual other morphometric characters such as standard length, fork length, head length, head width, body depth, body girth, pre-dorsal length, post-dorsal length and length of caudal peduncle were also measured.

2.1 Statistical analysis

The LWRs were estimated by using the equation $W = aL^{b}$. (Where $W= $ Body weight; $a= $ Constant; $L= $ Total length and $b= $ Regression coefficient). Collected data was tested for normality by using Kolmogorov-Smirnov test. Additionally, data was subjected to regression analysis for estimating 95% Confidence Interval (CI) of a and b, and the coefficient of determination ($r^2$). All statistical analyses were considered significant at $p<0.01$.

3. Results

In the present study, a total of 100 fish samples were collected from downstream of Qadirabad barrage, river Chenab. The data for all the studied morphometric characters includes their minimum and maximum values, mean, standard error and standard deviation (Table 1). The total length ranged from 5.90 to 17.80 cm with mean 12.13±0.22 and body weight ranged from 2.00 to 42.0 g with mean value of 17.75±0.70. The other morphometric characters such as standard, fork length, head length, width; body depth, girth; pre and post dorals lengths and length of caudal peduncle mean (±SE) values were 9.55±0.17, 9.74±0.18, 2.36±0.03, 1.50±0.02, 2.43±0.04, 2.59±0.04, 3.62±0.06, 4.99±0.11 and 1.77±0.04 respectively.

When total length of *M. cavavisus* was taken on x-axis and other morphometric measurements were taken on y-axis then LWRs was found highly significant ($r=0.866$; $p<0.01$) with slope value 2.718 (2.41±0.02). The regression analysis was also found significant for other morphometric characters such as; standard length-total length, fork length-total length, head-length-total length, head width-total length, body depth-total length, body girth-total length, pre-dorsal length-total length, post-dorsal length-total length and length of caudal peduncle-total length (Table 2). Among these studied characters maximum correlation was observed for standard length-total length and fork length-total length ($r=0.973$).

### Table 1: Central tendency values including Mean, standard error and standard deviation of different body morphometric measurements of *M. cavavisus*.

<table>
<thead>
<tr>
<th>Body Measurement</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean± S.E</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Length (TL)</td>
<td>5.90</td>
<td>17.80</td>
<td>12.13±0.22</td>
<td>2.303</td>
</tr>
<tr>
<td>Body Weight (BW)</td>
<td>2.00</td>
<td>42.00</td>
<td>17.75±0.70</td>
<td>7.233</td>
</tr>
<tr>
<td>Standard Length (SL)</td>
<td>4.50</td>
<td>13.70</td>
<td>9.55±0.17</td>
<td>1.799</td>
</tr>
<tr>
<td>Fork Length (FL)</td>
<td>4.60</td>
<td>14.00</td>
<td>9.74±0.18</td>
<td>1.829</td>
</tr>
<tr>
<td>Head Length (HL)</td>
<td>1.30</td>
<td>3.30</td>
<td>2.36±0.03</td>
<td>0.391</td>
</tr>
<tr>
<td>Head Width (HW)</td>
<td>0.70</td>
<td>2.20</td>
<td>1.50±0.02</td>
<td>0.285</td>
</tr>
<tr>
<td>Body Depth (BD)</td>
<td>1.40</td>
<td>3.50</td>
<td>2.43±0.04</td>
<td>0.441</td>
</tr>
<tr>
<td>Body Girth (BG)</td>
<td>1.60</td>
<td>3.70</td>
<td>2.59±0.04</td>
<td>0.451</td>
</tr>
<tr>
<td>Pre-Dorsal Length (Pr. L)</td>
<td>1.70</td>
<td>5.00</td>
<td>3.62±0.06</td>
<td>0.627</td>
</tr>
<tr>
<td>Post-Dorsal Length (Ps. L)</td>
<td>2.00</td>
<td>7.20</td>
<td>4.99±0.11</td>
<td>1.094</td>
</tr>
<tr>
<td>Length of Caudal Peduncle (L.C.P)</td>
<td>0.50</td>
<td>3.00</td>
<td>1.77±0.04</td>
<td>0.465</td>
</tr>
</tbody>
</table>

Length in (cm), Weight in (g), S.E= Standard Error, S.D= Standard Deviation

### Table 2: Descriptive statistics and regression parameters of total length (cm) with different morphometric characters of *M. cavavisus*.

<table>
<thead>
<tr>
<th>Equation</th>
<th>a</th>
<th>b</th>
<th>95% CI of a</th>
<th>95% CI of b</th>
<th>$r$</th>
<th>$r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW = a + b TL</td>
<td>-15.21</td>
<td>2.718</td>
<td>-18.98 to -11.43</td>
<td>2.412 to 3.024</td>
<td>0.866**</td>
<td>0.749</td>
</tr>
<tr>
<td>SL = a + b TL</td>
<td>0.390</td>
<td>0.756</td>
<td>-0.09 to 0.820</td>
<td>0.721 to 0.790</td>
<td>0.973**</td>
<td>0.947</td>
</tr>
<tr>
<td>FL = a + b TL</td>
<td>0.375</td>
<td>0.773</td>
<td>-0.062 to 0.811</td>
<td>0.738 to 0.808</td>
<td>0.973**</td>
<td>0.948</td>
</tr>
<tr>
<td>HL = a + b TL</td>
<td>0.724</td>
<td>0.135</td>
<td>0.278 to 0.970</td>
<td>0.115 to 0.155</td>
<td>0.978**</td>
<td>0.946</td>
</tr>
<tr>
<td>HW = a + b TL</td>
<td>0.447</td>
<td>0.087</td>
<td>0.235 to 0.639</td>
<td>0.070 to 0.104</td>
<td>0.701**</td>
<td>0.492</td>
</tr>
<tr>
<td>BD = a + b TL</td>
<td>0.574</td>
<td>0.153</td>
<td>0.297 to 0.851</td>
<td>0.131 to 0.176</td>
<td>0.798**</td>
<td>0.638</td>
</tr>
<tr>
<td>BG = a + b TL</td>
<td>0.684</td>
<td>0.158</td>
<td>0.406 to 0.962</td>
<td>0.135 to 0.180</td>
<td>0.806**</td>
<td>0.649</td>
</tr>
<tr>
<td>Pr. L = a + b TL</td>
<td>0.623</td>
<td>0.248</td>
<td>0.354 to 0.892</td>
<td>0.226 to 0.270</td>
<td>0.911**</td>
<td>0.830</td>
</tr>
<tr>
<td>Ps. L = a + b TL</td>
<td>-0.413</td>
<td>0.446</td>
<td>-0.808 to -0.818</td>
<td>0.414 to 0.478</td>
<td>0.938**</td>
<td>0.880</td>
</tr>
<tr>
<td>L.C.P = a + b TL</td>
<td>-0.340</td>
<td>0.174</td>
<td>-0.584 to -0.097</td>
<td>0.155 to 0.194</td>
<td>0.864**</td>
<td>0.747</td>
</tr>
</tbody>
</table>

$a= $ intercept; $b= $ regression coefficient; CI= confidence interval; $r= $ coefficient correlation. **Correlation is significant at the 0.01 level (2-tailed).

A significant correlation was observed, when body weight was taken on x-axis and all other morphometric characters on y-axis (Table 3). The maximum observed value of correlation was for standard length-body weight ($r = 0.879$; 95% CI of 0.194 to 0.240) and minimum for head width-body weight ($r = 0.638$ 95% CI of 0.019 to 0.031).
The maximum value of coefficient of determination was found for fork length-total length ($r^2 = 0.948$) and minimum for head width-body weight ($r^2 = 0.407$). The $b$ values for all the studied morphometric characters was below 3, indicating negative allometric growth of different body parts of this fish in relation to its total length and body weight. The $b$ value does not wholly depends on length-weight of a fish but also on other factors such as salinity, temperature, sex, stage of maturity, food availability, feeding habits and seasonal changes.

4. Discussion

Information on length-weight in reference to body morphometric characteristics of *M. cavasius* is quite insufficient. The present study recorded the maximum size of *M. cavasius* in the river Chenab as 17.80 cm TL which was lower than the maximum recorded value 23.5 cm TL in Pakistan [7]. Several authors reported different maximum recorded values of total length of *M. cavasius* collected from different water bodies such as 14.8 cm, 15.0 cm and 22.6 cm from Pakistani, Bangladesh and Indian water bodies respectively [5, 21, 18]. The size differences observed for *M. cavasius* might have some biological reasons but mainly are due to some technical reasons such as different gears selectivity, sample sizes and shrinkage in body sizes of formalin preserved specimens.

In the present study, $b$ value was 2.63 indicating negative allometric growth of *M. cavasius*. Similar growth pattern was reported for this species from Indus river, Pakistan [7]. In their study the $b$ values for male, female and combined sexes were 2.51, 2.57 and 2.54 respectively supporting the results of the present study. *M. cavasius* specimens collected from Bhadra reservoir, India indicated negative allometric growth [18]. The result of their study also supports the present findings. The isometric growth of *M. cavasius* from Taunsa barrage, Pakistan was reported [5]. The results of their study contradicted with present findings.

The length-weight relationship of *M. cavasius* was found highly significant supporting the results of our study [21]. However, the length and weight of *M. cavasius* (5.0-15.0 cm, 1.3-30.4 g) recorded in their study were smaller than present study. The length-weight relationship of *M. cavasius* collected from fish markets of Bangladesh reported positive allomorphic growth of this fish [25]. In another study, *M. cavasius* specimens collected from Jamuna river, Bangladesh indicated positive allometric growth for this species [20]. The results of these studies are contradicting to our findings. Various factors such as population sizes, food and feeding habits, sex differences, maturational stages, seasons and sampling procedures could be reasons for such observed differences [24]. The allometric growth pattern of Mystus species were reported from different water bodies [20, 22, 25-27]. The specimens of *M. bleecki* were collected from Chenab river, Pakistan for estimating their length-weight relationships [25]. The value of $b$ was 2.62 indicating negative allometric growth of this species. The result of their study also supports present findings. The values of regression slope ($b$) for different Mystus species are presented in Table 4.

### Table 3: Descriptive statistics and regression parameters of body weight (g) with different morphometric characters of *M. cavasius*.

<table>
<thead>
<tr>
<th>Equation</th>
<th>a</th>
<th>B</th>
<th>95% CI of a</th>
<th>95% CI of b</th>
<th>r</th>
<th>r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL = a + b BW</td>
<td>0.596</td>
<td>0.217</td>
<td>5.257 to 6.136</td>
<td>0.194 to 0.240</td>
<td>0.879**</td>
<td>0.772</td>
</tr>
<tr>
<td>FL = a + b BW</td>
<td>5.808</td>
<td>0.222</td>
<td>3.357 to 6.259</td>
<td>0.198 to 0.246</td>
<td>0.878**</td>
<td>0.771</td>
</tr>
<tr>
<td>HL = a + b BW</td>
<td>1.644</td>
<td>0.041</td>
<td>1.511 to 1.777</td>
<td>0.034 to 0.048</td>
<td>0.752**</td>
<td>0.566</td>
</tr>
<tr>
<td>HW = a + b BW</td>
<td>1.053</td>
<td>0.025</td>
<td>0.940 to 1.166</td>
<td>0.019 to 0.031</td>
<td>0.638**</td>
<td>0.407</td>
</tr>
<tr>
<td>BD = a + b BW</td>
<td>1.582</td>
<td>0.048</td>
<td>1.440 to 1.723</td>
<td>0.040 to 0.055</td>
<td>0.783**</td>
<td>0.614</td>
</tr>
<tr>
<td>BG = a + b BW</td>
<td>1.697</td>
<td>0.051</td>
<td>1.562 to 1.832</td>
<td>0.044 to 0.058</td>
<td>0.813**</td>
<td>0.661</td>
</tr>
<tr>
<td>Pr L = a + b BW</td>
<td>2.294</td>
<td>0.075</td>
<td>2.134 to 2.455</td>
<td>0.067 to 0.084</td>
<td>0.868**</td>
<td>0.753</td>
</tr>
<tr>
<td>Ps L = a + b BW</td>
<td>2.754</td>
<td>0.126</td>
<td>2.443 to 3.006</td>
<td>0.110 to 0.142</td>
<td>0.833**</td>
<td>0.694</td>
</tr>
<tr>
<td>LCP = a + b BW</td>
<td>0.937</td>
<td>0.047</td>
<td>0.775 to 1.099</td>
<td>0.039 to 0.056</td>
<td>0.735**</td>
<td>0.540</td>
</tr>
</tbody>
</table>

$a =$ intercept; $b =$ regression coefficient; CI= confidence interval; $r =$ coefficient correlation. **Correlation is significant at the 0.01 level (2-tailed).

5. Conclusion

The results of the present study provide baseline information’s regarding length-weight relationships with reference to different morphometric characters of *M. cavasius*. This data will be useful for fishery researchers, conservationist and policy makers for proper management and exploitation of this species from river Chenab, Pakistan.

6. Acknowledgement

The authors are grateful to the field officer and officials of Qadirabad barrage, Department of Fisheries, Punjab, for their assistance during field work. We also wish to acknowledge private fishermen for their cooperation in collecting specimens.

7. References

5. Muhammad H, Iqbal Z, Bashir Q, Hanif MA. Length-
weight relationship and condition factor of catfish species
from Indus River, Pakistan. Punjab University Journal of

Aliens; a catastrophe for native freshwater fish diversity

7. Soomro AN, Baloch WA, Laghari ZA, Palh ZA, Lashari
KH, Mastoi GM et al. Length-weight relationship and
condition of Mystus cavasius (Hamilton) from lower
Indus River at Thatta District, Sindh, Southern Pakistan.
International Journal of Emerging Trends in Science and

8. Akhteruzzaman M, Kohinoor AHM, Shah MS, Hussain
MG. Observations on the induce breeding of Mystus
cavasius (Hamilton). Bangladesh Journal of Fisheries.

intensity, gastroscopic index and hepatosomatic index
of a catfish Mystus cavasius from Chambal river (near
Rajghat) Madhya Pradesh. International Journal of

10. Bhatt VS. Studies on the biology of some freshwater
fishes part VI. Mystus cavasius (Ham.). Hydrobiologia.

11. Ashashree HM, Venkateshwarlu M, Sayeswara HA.
Seasonal changes of protein in the tissues of male catfish
Mystus cavasius (Ham.) in Bhadra reservoir, Karnataka,
India. International Journal of Applied Biology and

12. Gupta S. A review on Mystus cavasius, a popular food
fish of Indian subcontinent. International Journal of

13. Gupta S, Banerjee S. Indigenous ornamental fish trade of
West Bengal. Narendra Publishing House, New Delhi,
2014, 63.

of some small indigenous fish species (SIS) of
Bangladesh. Bangladesh Journal of Fisheries Research.

15. Kawarazuka N, Bene C. The potential role of small fish
species in improving micronutrient deficiencies in
developing countries: building evidence. Public Health

16. Froese R. Cube law, condition factor and weight-length

17. Latif M, Ullah MZ, Minhas IB, Latif S. Morphometric
study of Puntius sophore (Hamilton, 1822) with special
reference to body length-weight from Chenab River,
Punjab, Pakistan. Journal of Entomology and Zoology

18. Venkateshwarlu M, Srigowri J, Somashekar DS,
Ashashree HM. Length-weight relationship and condition
factor of freshwater catfish Mystus cavasius (Hamilton-
Buchanan) from Bhadra reservoir, Karnataka.

19. Muralidharan M, Arunachalam M, Raja M. Length-
weight relationships for fish species from Cauvery River
at Hogenakkal in South India. Journal of Applied
Ichthyology. 2011; 27(3):968-969.

20. Hossain MY, Rahman MM, Fulanda B, Jewel MAS,
Ahamed F, Ohtomi J. Length-weight and length-length
relationship of five threatened fish species from the
Jamuna (Brahmaputra river tributary) river, northern

SMA, Bahkali AH et al. Length-weight and length-length
relationship of five Mystus species from the Ganges and
Rupsha rivers, Bangladesh. Journal of Applied

22. Akther S, Akhter M, Hossain M. Length-weight
relationship and condition factor of two Gangetic Mystus
species, Mystus tengra (Hamilton, 1822) and Mystus
cavasius (Hamilton, 1822). Journal of Entomology and

23. Hussain MG, Azadi MA. Brood stock management status
and some suggestions to control negative selection
inbreeding in hatchery stocks Bangladesh. Naga. The

24. Bagenal TB, Tesch FW. Age and growth. Methods of
assessment of fish production in freshwaters. In: T.B.
Bagenal (Ed.), Oxford Blackwell Scientific Publication,
101-136.

Length-weight and length-length relationships of
freshwater wild catfish Mystus bleekeri from nala Daik,
2012; 11(50):11168-11172.

26. Hossain MY, Ahmed ZF, Leunda PM, Jasmine S, Oscoz
J, Miranda R et al. Condition, length–weight and
length–length relationships of the Asian striped catfish
Mystus vittatus (Bloch, 1794) (Siluriformes: Bagridae) in
the Mathabhanga River, southwestern Bangladesh. Journal of

27. Gupta S, Banerjee S. Length-weight relationship of
Mystus tengra (Ham.- Buch., 1822), a freshwater catfish
of Indian subcontinent. International Journal of Aquatic