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Length-Weight Relationships of Juvenile *Pangasius* with Special Reference to Body Size and Condition Factor

M. NAEEM[++], N. T. NAREJO*, A. SALAM, S. A. RASOOL, M. KHALID, A. ISHTIAQ

Institute of Pure and Applied Biology, Bahauddin Zakariya University, Multan 60800, Pakistan.

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Abstract: 110 juvenile samples of introduced *Pangasius*, 0.64 g in mean body weight and 5.03 cm in mean total length (TL), were analyzed for length-weight relationships (LWR). Strong correlation ($P < 0.001$) with r-value 0.940 exited in LWR, and calculated slope value (b) 3.05, specified isometric growth pattern in studied *Pangasius*. Various studied morphometric parameters were also strongly correlated ($P < 0.001$) with total length (TL) and body weight of *Pangasius*. TL of the fish indicated strongest correlation (r = 0.982) with standard length, while it was weakest with head length (r = 0.349). However, condition factor remained constant in the present work. To the best of our knowledge, no research work is carried out on LWR of *Pangasius* up till from Pakistan. This study will supply first reference from Pakistan in literature, which will be very valuable for management and development of *Pangasius* in Pakistan.

Keywords: *Pangasius*, Length – Weight Relationships, Condition factor

1. INTRODUCTION

To identify and classify fishes, taxonomists and ichthyologists use various morphometric characteristics and measurements, including body length, head length, depth and fin lengths. These morphometrics are frequently provided as a proportion of total, standard and fork length of the fish (Howe, 2002). Information on the relationships among body weight and several body measurements is necessary in fisheries biology. However, length-weight relationships (LWR) is one of the most widely used method. It offer fundamental information, being useful to compare between-region comparisons growth, to estimate the length of an individual fish of known weight or vice versa (Forese, 1998), to evaluate the isometric and allometric growth pattern in fish (Naeem *et al.*, 2012) and also for early selection of the fish for breeding (Eyduran *et al.*, 2010). Thus, LWR has both applied and basic uses (Picter and Hart, 1982). Moreover, length relationship among different measurement parameters is also significant tool in fisheries for comparative growth and management (Moutopoulos and Stergiou, 2002).

Condition factor (K) is also greatly assessed in fish biology and fisheries management. The well-being state of the fish can be inferred with a condition factor (LeCren, 1950). It is calculated from the relationship between the weight of a fish and its length, with the intention of describing the "condition" of that individual fish (Froese 2006). Furthermore, it can also be used in assessing the well-being of fish (Zamani-Faradonbe *et al.*, 2015). Several factors, like age, food availability and its source, physiochemical parameters of water for fish growth and sexual maturity of fish, may influence on K-value (Gomiero, 2005; Alam *et al.*, 2014).

Pangasius (Family: Pangasiidae), has grown to be a profitable Asian catfish that was expanded to be cultured in different vicinities of Thailand. It is extensively preferred for human consumption for its sweet taste and tender flesh. *Pangasius* has also introduced and cultured in many countries and still its demand has been rising (FAO-GLOBEFISH, 2014) due to its striking characters such as low-fat content and white flesh (Orban *et al.*, 2008).

Thus, the current work aims at to estimate the relation of body length and weight of *Pangasius* with different morphometric measurements and condition factor. The finding of this research work will be supportive to ichthyologists and taxonomists for further studies from various regions of the world.

2. MATERIALS AND METHODS

One hundred and ten, randomly selected fish specimens were used in the present study, which were brought from Thailand to Pakistan. After arrival the laboratory, the fish were weighted (g) on an electric balance and different length measurements (cm) **(Table 1)** were taken. Data was transformed into logarithm by using MS-Excel 2007 for Windows 2007.This logarithm- transformed data was then used for further analysis of length-weight (LWR) and length-length relationships (LLR) by:

$$Log\ Y = a + b\ Log\ X$$

[++]Corresponding author: Muhammad Naeem , Email:dr_naeembzu@yahoo.com ,Tell.No.+92 3337378881

*Department of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro 67080, Sindh, Pakistan.

where '*a*' and '*b*' are constants of the relationship, representing the intersect part of the "*Y*" axis and slope of the equation, respectively.

Condition factor (K), the degree of wellbeing, was calculated by:

$$K = W/(TL)^3 \times 1OO$$

Statistical analysis have been considered highly significant at $P<0.001$ (***), significant $P<0.05$ (**), and least significant $P<0.01$(*).

3. RESULTS AND DISCUSSION

Table 1 represents the mean (± Standard Deviation) alongwith their respective range values for various body length measurements (cm), weight (g) and condition factor (K) of *Pangasius*. **(Table 2 and 3**) represent different statistical parameters of regression analysis and 95% of confidence level (Cl), when different length parameters and K-value were analyzed with 'TL' and 'W' of *Pangasius*, respectively for log-transformed data. The relation between TL with all studied length parameters was strong at $P<0.001$, with maximum r-value 0.964 in TL-SL, and it was significant at $P<0.01$ for HL , HW and AFB. Slope value (b) remained very close to 1.00 in case of SL, FL, PtFL, PvFL, AFL with TL, representing isometric growth, i.e. these parameters increase in same proportion as total length of the fish **(Table 2)**. Weight of *Pangasius* was also found correlated with all studied length parameters and condition factor value. Isometric growth pattern was indicated by TL-W relation, being close to 0.33. Many studies have reported on relationship between weight and length of fish in national and international research publication (Yousaf *et al.*, 2009; Naeem *et al.*, 2010a; 2010b; 2011a; Mokhtar *et al*., 2014; Gupta and Banerjee, 2015). But, as till now, LWR, LLR and K for *Pangasius* has not been presented in research publications from Pakistan. Results of the present study were compared to other species from previously published work, in the same aspect. Calculated *b* value (3.05) remained extremely close to 3.00 in LWR, pointed to isometric growth in *Pangasius*. Earlier, several studies indicate isometric growth in fish. However, some recent examples includes, (Hossain *et al*. 2006) Karna and Panda (2012) who have also documented "b" values 3.02 and 3.05 in their studied catfishes *Mystus vittatus* and *M. gulio* respectively, for combined sexes. However, this b-value may range from (Bayhan *et al.*, 2008). Length-weight Relationships of Seven Flatfishes

Table 1: Central tendency values of various measurement parameters for *Pangasius*.

Parameters	Mean ± S.D	Range
Total length(TL)	5.03 ± 0.71	3.6 - 7.1
Wet weight(W)	0.64 ± 0.31	0.22 - 1.84
Condition Factor(K)	0.47 ± 0.16	0.31 - 0.7
Standard length(SL)	4.16 ± 0.58	3.0 - 5.9
Fork length(FL)	4.46 ± 0.61	3.3 - 6.3
Head length(HL)	1.03 ±0.06	0.4 - 1.5
Body depth(BD)	0.7±0.09	0.4 - 1.1
Head width(HW)	0.63 ±0.20	0.3 - 1.1
Body girth(BG)	1.43 ±0.10	0.8 - 2.2
Dorsal fin length(DFL)	0.65 ± 0.09	0.3 - 1.1
Pectoral fin length(PtFL)	0.57 ± 0.10	0.4 - 0.9
Pelvic fin length(PvFL)	0.47 ± 0.08	0.2 - 0.7
Anal fin length(AFL)	0.50 ± 0.10	0.2 - 0.8
Anal fin base(AFB)	1.03 ± 0.11	0.5 - 1.7
Tail width(Ta.W)	1.01 ± 0.13	0.6 - 1.9
Tail length(Ta.L)	0.90 ±0.10	0.3 - 1.9

Table 2: Summary of LWR and LLR for *Pangasius*.

Equation	Relationship Parameters		95% CI of a		95% CI Of b	r
	a	b	Min	Max		
W=a+bTL	-2.36	3.05	-2.51	-2.22	2.83-3.26	0.940 ***
K=a+bTL	-0.363	0.05	-0.51	-0.22	-0.17-0.26	0.042 ^{ns}
SL=a+bTL	-0.03	0.92	-0.06	0.01	0.87- 0.87	0.964 ***
FL=a +bTL	0.01	0.91	-0.03	0.05	0.85- 0.97	0.948 ***
HL=a+bTL	-0.42	0.61	-0.59	-0.25	0.36-0.86	0.426 **
HW=a+bTL	-0.72	0.72	-0.98	-0.46	0.35- 1.09	0.349 **
BG=a+bTL	-0.74	1.27	-0.84	-0.65	1.14– 1.41	0.876 ***
BD=a+bTL	-1.17	1.45	-1.27	-1.07	1.30-1.60	0.881 ***
DFL=a+bTL	-1.04	1.22	-1.19	-0.90	1.00 –1.43	0.738 ***
PtFL=a+bTL	-0.95	1.00	-1.09	-0.81	0.81– 1.20	0.703 ***
PvFL=a+bTL	-1.14	1.15	-1.30	-0.98	0.92– 1.38	0.687 ***
AFL=a+bTL	-1.08	1.1	-1.25	-0.90	0.85– 1.35	0.638 ***
AFB=a+bTL	-0.91	1.30	-1.09	-0.73	1.05-1.56	0.699 **
Ta.W=a+bTL	-0.67	1.96	-0.84	-0.51	0.72– 1.19	0.613 ***
Ta.L =a+bTL	-1.06	1.43	-1.23	-0.89	1.20-1.67	0.754 ***

r: correlation coefficient, ns: not significant

Table 3: Regression analyses results when external body parameters studied in relation to wet body weight of *Pangasius*.

Equation	Relationship Parameters		95% CI of a		95% CI Of b		r
	a	b	Min	Max	Min	Max	
K=a+bW	-0.30	0.13	-0.32	-0.28	0.07	0.19	0.381 **
TL=a+bW	0.77	0.29	0.76	0.77	0.27	0.31	0.940 ***
SL=a +bW	0.68	0.28	0.68	0.69	0.26	0.30	0.945 ***
FL=a+bW	0.71	0.27	0.70	0.72	0.25	0.30	0.922 ***
HL=a+bW	0.06	0.22	0.04	0.08	0.15	0.29	0.498 ***
HW=a+bW	-0.18	0.18	-0.21	-0.14	0.07	0.30	0.288 *
BG =a+bW	0.24	0.39	0.23	0.25	0.35	0.43	0.874 ***
BD=a+bW	-0.05	0.45	-0.07	-0.04	0.40	0.49	0.879 ***
DFL=a+bW	-0.11	0.37	-0.13	-0.09	0.30	0.44	0.726 ***
PtFL=a+bW	-0.18	0.31	-0.19	-0.16	0.26	0.37	0.714 ***
PvFL=a +bW	-0.25	0.36	-0.27	-0.23	0.29	0.43	0.695 ***
AFL=a+bW	-0.23	0.33	-0.25	-0.20	0.25	0.41	0.626 ***
AFB=a+bW	-0.09	0.39	0.07	0.12	0.31	0.47	0.678 ***
Ta.W=a+bW	-0.07	0.30	0.05	0.09	0.23	0.37	0.624 ***
Ta.L=a+bW	0.03	0.38	0.01	0.06	0.30	0.47	0.651 ***

2.5 to 3.5 in fishes. Thus, many studies also reflects a deviation from 3.00, with negative and positive allometric growth, e.g. Chu *et al*. (2012), that may be due to difference in various factors i.e. environmental conditions (pH, temperature), health, gonads maturity and habitat (Muchlisin *et al*., 2010); none of these have been considered in the current work. Condition factor (K) calculated for *Pangasius*, in the present work, varied from 0.31 to 0.70, which is lower than that of *Capoeta gibelio* (1.021±0.143), but highest value of K was similar to that of mean value for *C. capoeta* (0.075±0.244) (Radkhah, and Eagderi, 2015). The recorded lower K-value for *Pangasius* might be due to less feeding intensity. On the other hand, several studies (Naeem *et al.*, 2010b; 2011b) reported a non-significant correlation between TL and K-value. The results for this relationship were also found insignificant at $P < 0.05$.

The present work supplies first ever baseline information on the LWR, LLR and condition factor of *Pangasius* which will cooperate in the management and taxonomy of this fish species.

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