Length–Weight Relationships of Twelve Fishes from the Padma River near Rajshahi City, Bangladesh

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Abstract: The present observations are significant for conservation and management of freshwater economic important fishes of the Padma River. The objective was to evaluate the length-weight relationships (LWRs) of freshwater fish species, which serves as a baseline for comparison to other relatively altered tropical Bangladeshi rivers. The length–weight relationships (LWRs) were studied of 12 species belonging four classes, seven families and 11 genera (*Gagata youssoufi, Cirrhinus reba, Clupisoma garua, Ompok bimaculatus, Pangasius pangsius, Securicula gora, Ailia coila, Chanda nama, Parambassis ranga, Botia lohachata, Rhinomugil corsula* and *Labeo boga*) are captured from the River Padma near Rajshahi City, Bangladesh. The length (L) - weight (W) relationships were estimated using the logarithmic form of the equation $W = aL^b$. The exponent b varied from 2.813 to 3.173. This study describes the length–weight relationships (LWRs) of 12 species of fishes from the Padma River, near Rajshahi city, Bangladesh.

Key Word: Length-weight relationship, allometric growth, isometric growth

1. Introduction

Length–weight relationships have been used extensively for the conversion of growth-in-length equations to growth-in-weight for use in stock assessment models to estimate the stock assessment biomass from a limited sample size as indicators of fish condition, to compare the life histories of certain species among regions and other aspects of fish population dynamics (Binohlan and Pauly, 1998; Moutopoulos and Stergiou, 2002; Sani *et al*., 2012; Mortuza *et al*., 2013; Nie et al., 2013). It also allows for the study of the ontogenetic allometric changes in fish growth (Teixeira-de Mello et al., 2006) and possible effects from parasites (Teixeira-de Mello and Eguren, 2008).

This study describes the length–weight relationships (LWRs) of 12 least concern and near threaten species according to IUCN read list from the Padma River, near Rajshahi city, Bangladesh (IUCN Bangladesh, 2000). These fishes species once abundant in rivers, streams, canals, reservoirs, lakes, ponds and beel, haor and baor swamplands of Bangladesh, India, Nepal and Sri-Lanka (Froese and Pauly, 2011), the populations are in serious decline due to over-exploitation augmented by various ecological changes and degradation of their natural habitats. The length–weight relationships (LWRs) of threatened fishes are the most important biological parameters to provide information on the growth and condition of fish species and the entire fish community, and are highly significant for management and conservation of natural populations (Sarkar et al., 2009; Muchlisin et al., 2010). Length–weight relationships have been reported for some commercially important fishes from the River Padma, but data for most of the endemic freshwater fish species are still missing. In this study, the parameters of the length–weight relationships are presented for 12 such fish species collected from The River Padma near Rajshahi, Bangladesh.

2. Material and Methods

The Padma is one of the largest river of Bangladesh. It is the main distributaries of the Ganges which originates in the Gangotri glacier of the Himalayan. The part of the Ganga in Bangladesh is known as the Padma which enters Bangladesh from India (Murshidabad district) at Shibganj Upazila (Manakosha and Durlavpur unions) of Chapai Nawabganj district. Its length in Bangladesh is 366 kilometers.

This study was conducted on the Padma River near Rajshahi City, ($24^0 21'$ N and $88^0 36'$E) Bangladesh (Fig. 1). Monthly samples were collected from different fishing spots and fish markets of Rajshahi City, June 2012 to May 2013. The main gear used by

commercial fishers included cast nets, gill nets, drag nets, mosquito nets, hand nets as well as traditional fishing traps. The fresh samples were immediately chilled in ice on site and fixed with 0% buffered formalin upon arrival at the laboratory then identified according to Jayaram, 1981; Rahman, 1989 and Talwar and Jhingran, 1991. All morphometric measurements were taken according to Froese and Pauly, 2011. All fishes were individually measured to the nearest 0.01 mm and weighed on a digital electronic balance (bosch EP 628) to the nearest 0.01 g. The LWR was estimated using the expression W =

a L^b (Ricker, 1973), where W = total weight (g) and L = total length (mm). The parameters 'a' and 'b' were estimated by linear regression after logarithmic transformation of weight and length data (logW = log a + b log L), Where,

W = Weight of fish (g)
L = Length of fish (cm)
a = y Intercept or the initial growth coefficient
b = Slope or the growth coefficient

The statistical significance level of r^2 and SE for standard error of b (P < 0.001) were calculated for all 12 species.
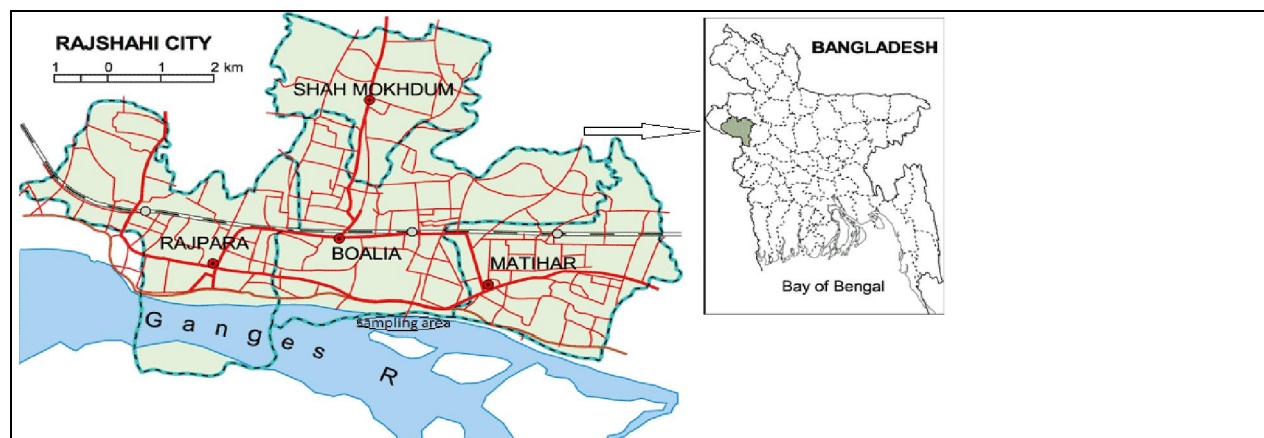

Fig. 1. Location of sampling area of Padma River near Rajshahi City.

3.   Results

A total of 2015 specimens from 12 fish species belonging to seven families and 11 genera were used for the LWR calculations (Table 1). The observed maximum total length among all individuals sampled during the study was 1177 mm, which was a specimen of *P. pangasius* having total weight 16 kg and minimum total length 17 mm with total weight 0.13g of specimen *G. Youssoufi*. The regression coefficients (b) values ranged from 2.813 for *G. youssoufi* to 3.178

for *C. reba*, whereas the 'a' values ranged from 0.01242 to 0.8315 for *L. boga* and *A. coila* respectively.

The calculated 'b' value of the LWR indicated positive allometric growth in *P pangasius, A. coila, C. nama B. lohachata* (b > 3.00), but rest of the species shown negative allometric growth (b < 3.00). All LWRs were highly significant (P < 0.001), with coefficient of determination (r^2) ranged from 0.838 for *G. youssoufi* to 0.976 for *C. garua*.

Table -1. Parameters of the length-weight relationships for 12 fish species from the River Padma, near Rajshahi City, Bangladesh.

Class: Family	Species	No. of species (n)	Length (mm)		Weight (g)		a	b	SE (b)	r2
			mini	max	mini	max				
Siluriformes: Sisoridae	Gagata youssoufi	130	17	45	0.13	1.22	0.7683	2.838	0.0778	0.9515
Siluriformes: Schilbeidae	Clupisoma garua	160	80	305	2.8	301	0.6908	2.813	0.0121	0.9761
Siluriformes: Schilbeidae	Ompok bimaculatus	185	55	225	1.56	95	0.6153	2.849	0.0085	0.9644
Siluriformes: Pangasidae	Pangasius pangsius	120	77	1177	3.40	16000	0.3047	3.000	0.0817	0.9511
Siluriformes: Schilbeidae	Ailia coila	210	51	170	0.31	23	0.8315	3.065	0.0079	0.9179
Cypriniformes: Cyprinidae	Cirrhinus reba	155	73	245	3.49	58.57	0.4601	3.178	0.0312	0.9741
Cypriniformes: Cyprinidae	Securicula gora	170	71	224	2.58	70.00	0.7071	2.942	0.0104	0.9623
Cypriniformes: Cobitidae	Botia lohachata	150	44	91	0.81	6.54	0.7136	3.073	0.0154	0.9126
Cypriniformes: Cyprinidae	Labeo boga	150	80	290	8	360.1	0.1242	2.843	0.0149	0.853
Perciformes: Ambassidae	Chanda nama	200	21	90	0.12	8.7	0.6989	3.010	0.0082	0.8649
Perciformes: Ambassidae	Parambassis ranga	190	21	89	0.13	10.5	0.6669	2.920	0.0101	0.9216
Mugiliformes: Mugilidae	Rhinomugil corsula	195	9	261	6.5	198.31	0.6987	2.984	0.0068	0.8779

4.   Discussion

In the present study, value of 'b' (slope) close to 3 shows that the fish grow isometrically and other values show allometric growth (Andreu-Soler et al., 2005). Most of the estimates for 'b' values obtained in the present work show a similar trend with those of Sani et al. (2010) in tributaries of the Yamuna and Ganga, by Sarkar et al. (2009) in Ganga basin, Pet et al. (1996) in Sri Lankan reservoirs, Ahmed and Saha (1996) in Kapati Lake, Bangladesh, and by Sivakami (1987) and Ramakrishniah (1988) in the Nagarjunasagar reservoirs. However, in the present study, the higher value of b (>3) for some species may be due to the dominance of juveniles and an incomplete coverage of the known size range. Differences in the slopes of the length-weight estimates for the same species in different regions can be affected by environmental conditions or developmental state of the fish (Le Cren, 1951) or, according to Froese (2006), by the range lengths used in the length-weight relationships.

The coefficient of determination (r^2) ranged from 0.853 (*L. boga*) to 0.9741 (*C. reba*), nine of 12 regressions presented r^2 values higher than 0.90. All linear regressions were statistically significant (P < 0.001). The calculated standard error of b (SE) ranged from 0.0068 to 0.0817, thus indicating a tendency towards positive allometry, which is in accordance with the majority of fish species (Froese, 2006).

In conclusion, this study provides an important baseline study on the LWRs of 12 least concern and near threatened fish species from the River Padma near Rajshahi City, Bangladesh. These results can be an effective tool for fisheries management and conservation to initiate early management strategies and regulations for conservation of the remaining stocks of the endangered species in the Padma River. This study also provides valuable information for the online database, as well as providing an important baseline for future studies within the Ganga-Brahmaputra basin have almost all been subjected to perturbations of various origins.

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