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Original Article

Length-weight relationship and condition factor of cat fish species from Indus River, Pakistan

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Abstract
This study was aimed to describe length-weight relationship and condition factor of 18 cat fish species belonging to five families of Indus River in Taunsa barrage from Punjab, Pakistan. The value of length weight relationship (LWR) equation and condition factor (K) ranged $W= -0.249\ TL^{0.79}$ – $W= -2.803\ TL^{3.55}$ and 0.07 – 1.69 respectively. The objective of this study was to determine LWR and condition factor of cat fish species of Indus River that could help in conservation and management of ichthyofauna in the Indus Rivers, Pakistan.
Key Words: Indus River, Taunsa Barrage, Cat fish, management, conservation.

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INTRODUCTION

Catfishes are one of the diverse group belonging to order siluriformes. The name catfishes is given to this group due to the presence of prominent tactile slenderical barbells (whiskers) near the mouth that resembles with whiskers of cat. The skin of catfishes is scaleless and have fleshy adipose fin without fin rays, have sharp spines in dorsal and pectoral fins used for defense mechanism (Wang *et al.,* 2016). They have well developed hearing apparatus formed of complex set of bones and use swim bladder for production of sound. They have wide range in their size, smallest are some members of madtom species less than 5cm in their length. While the largest is Danube catfish *(Silurus glanis)* reached 13ft (4m) in length with 180kg weight (Owen, 2005). Most catfish are bottom feeders, generally they are omnivorous feeders and valuable scavengers (Bashir *et al*. 2015). Catfish are important food throughout the world due to their tasty spineless flesh. They are widely cultivated in North America, Asia and Africa (Sabet *et al.,* 2016). There are 2855 catfish species reported in Catalog of Fishes database list (Eschmeyer, 1998). Nelson (1994) reported 2405 species belonging to 412 genera and 34 families of catfish in the world. Wildly used in fish biology are application of length-weight relationship (LWR) to get knowledge about adaptation of fish species to environmental conditions (Froese, 2006). Also, fish condition and species life histories can be compared using LWR values (Moutopoulos and Stergiou, 2002). Condition factor (K) can be applied to asses seasonal changes in fish growth which may fluctuate with stock reproductive stage and abundance of food (Datta *et al.,* 2013). The information about welfare of fish due to its physiological state can be assessed with K. Moreover, the values of K can be used to make comparisons between two populations living in specific food resources available in particular climatic conditions and other conditions (Froese, 2006). Thus the maintenance of ecosystem equilibrium that depends upon adequate management of life cycle of fish species can be improved by condition factor (Imam *et al*., 2010).

The data about morphometric measurements regarding to cat fish species is very poor and scares in Pakistan particularly in natural water resources. Therefore, this study was aimed to describe the length-weight relationship and condition factor of cat fish species inhabiting in Taunsa barrage of the Indus River, Punjab, Pakistan. The finding of this

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study will provide important information for successful conservation and management of cat fish species in their natural environment.

MATERIALS AND METHODS

A total of 370 fish specimens of 18 species belonging to 5 families of freshwater cat fish were collected from Indus River at Taunsa barrage from August 2013 to July 2014. The specimens were tagged, measured to the nearest 1mm (total length) and weighted to the nearest 0.01g by digital balance with calculating capacity upto 0.01g after collection at study sites. The length parameters including total length, standard length and fork length were calculated on measuring board capacity upto 0.1cm. The process of tagging, weighting and length parameter measurements were carried out at Fish lab of Govt. of the Punjab Fisheries office Taunsa Barrage. Afterwards fishes were preserved in 10% formalin and transported to Department of Zoology, University of the Punjab, Lahore and identified upto species level using taxonomic key by Mirza and Sharif (1996). The relationship between total body length and total body weight were calculated with the help of linear regression equation $W=aL^b$. This equation was transformed into logarithmic expression Log W = log a + b log TL, where W is total body weight, TL is total body length and a and b are constant (Sarkar *et al.,* 2013; Bashir *et al.,* 2015). The condition factor K was calculated by the equation $K= 100\ W/L^3$ (Datta *et al.,* 2013). Where K is condition factor, W is total weight of fish and L is total length of fish. All the statistical analysis was made by using software SPSS 21.

RESULTS AND DISCUSSIONS

The catfish specimens collected from the Taunsa Barrage on the Indus River belongs to 5 families (Siluridae, Scilbeadae, Bagridae, Sisoridae and Heteropneustidae) and 18 species. The values of range of body weight (g) and total length (cm) of each species with regression equation and condition factor K is given in Table 1. The lowest value of total body weight (1g) was calculated in *Mystus vittatus* (Blotch, 1794) and highest value (257g) was calculated in *Bagarius bagarius*. Total body length ranged 2.4 – 42.2cm in *Mystus vittatus* and *Bagarius bagarius* also (Table I). The lowest value of b (0.79) of regression equation and condition factor K (0.068) was recorded in *Sissor rhabdophorus*. The highest values of b (3.55) of regression equation and K (1.69) was recorded in *Clupisoma garua* and *Rita rita* respectively (Table I). The value of slope b was within the expected range 2.5-3.5 as suggested by Froese (2006) in most fish species in this study except *Ompok pabda* (2.22), *Eutropiicthys vacha* (2.33), *Pseudeutropius atherinoids* (2.43), *Mystus tengara* (2.41), *Glyptothorax cavia* (2.12), *Sisor rabdophorus* (0.79) and *Heteropneustes fossilis* (2.13). Moreover the value of b parameter of length-weight relationship was used to determine isometric or allometric growth pattern of 18 catfish species of 5 families in this study. The value of regression equation slope b was 3.00 in *Mystus horai* represents isometric growth type (Table I). The value of b parameter was higher than 3 in *Wallago attu* (3.462), *C. garua* (3.55), *B. bagarius* (3.24) and *G. stocki Mirza & Nijssen* (3.28). These catfish species shows positive allometric growth pattern. While value of b parameter was less than 3 in *Ompok bimacultus* (2.87), *O. pabda* (2.22), *E. vacha* (2.33), *P. atherinoids* (2.43), *Sperata seenghala* (2.80), *Mystus bleekeri* (2.49), *M. cavasius* (2.92), *M. vittatus* (2.69), *M. tengara* (2.41), *R. rita* (2.92), *G. cavia* (2.12), *S. rhabdophorus* (0.79) and *H. fossilus* (2.13). These species shows negative allometric growth pattern.

The value of b parameter of regression equation was calculated less than one in *S. rhabdophorus* (0.794). This unusual value can be related due to very large length of upper lobe of caudal fin of this species. The result of this study are comparable with the results of Bashir *et al*. (2015), Muhammad *et al*. (2016), Liang *et al*. (2016), Sabet *et al*. (2016), Kamikawa *et al*. (2015), Sarkar *et al*. (2013) and Soomoro *et al*. (2007). The value of K factor in most of the fish cat fish species of the Indus river were calculated below 1 except *M. bleekri, M. vittatus, M. tengara, M. vittatus* and *R. rita*. These results of K factors suggested that most of the catfish species of Indus River at Taunsa Barrage are not in very good condition. This may be due to overfishing, deficiency of food as most of the catfish species in this study are carnivores, use of poisonous chemicals and electric current for harvesting of fish from the Indus River because many fisherman do this practice to economize the fish harvesting expenditures. The lowest value of K factor (0.07) in *S. rhabdophorus* may also be attributed due to exceptionally extended upper tip of its caudal fin. The b parameter depends upon genetically determined effects of a species and determine growth rate either

isometric or alometric. If the values of b parameter were close to 3 and stay constant its mean that there is no change in the form of individual along ontogenetic growth (Froese, 2006).

Table I: Length–weight relationship and condition factor of cat fish species of the Indus River from Taunsa Barrage.

Family / Species	Weight range (g)	Length range (cm)	N	a	b	95% cl of a		95% cl of b		r^2	K	G.T
						Lower limit	Upper Limit	Lower limit	Upper limit			
I. Siluridae												
Wallago attu	28 – 256	25 – 38.3	12	-2.87	3.34	-3.159	-1.400	2.43	3.93	0.96	0.51	A^+
Ompok bimaculatus	89 – 146	26.6 – 31.5	15	-2.97	2.87	-2.321	-1.429	1.93	3.23	0.96	0.48	A^-
Ompok pabda	10 – 37	11 – 18.1	26	-1.26	2.22	-1.750	-0.786	1.81	2.64	0.89	0.71	A^-
II. Schilbeadae												
Eutropiicthys vacha	4 – 40	7.3 – 18.9	15	-1.37	2.33	-1.863	-0.877	1.90	2.76	0.91	0.85	A^-
Clupisoma garua	10 – 70	11 – 20.9	10	-2.80	3.55	-3.615	-0.991	2.01	4.09	0.89	0.86	A^+
Pseudeutropius atherinoids	6 – 16	10.1 – 13.1	16	-1.55	2.43	-2.929	-0.187	1.14	3.72	0.96	0.72	A^-
III. Bagridae												
Sperata seenghala	59 – 191	23.7 – 31.9	10	-2.06	2.80	-3.438	-0.697	1.86	3.74	0.87	0.47	I
Mystus bleekeri	1.5 – 21	2.9 – 14.1	66	-1.54	2.49	-1.649	-1.444	2.37	2.60	0.96	1.35	A^-
Mystus cavasius	2 – 28	7.4 – 14.8	71	-2.00	2.92	-2.216	-1.790	2.69	3.15	0.90	0.95	A^+
Mystus vittatus	1 – 11	2.4 – 10.3	26	-1.76	2.69	-2.030	-1.496	2.32	3.07	0.90	1.34	A^-
Mystus horai	3 – 15	7.6 – 12.6	13	-2.13	3.00	-2.993	-1.280	2.13	3.87	0.95	0.79	I
Mystus tengara	1.5 – 14	3.7 – 16.2	27	-1.62	2.41	-1.910	-1.333	2.04	2.78	0.98	1.11	A^-
Rita rita	12 – 211	9.7 – 25.2	16	-1.80	2.92	-2.129	-1.471	2.62	3.22	0.97	1.69	A^-
IV. Sisoridae												
Bagarius bagarius	70 – 257	28.1 – 42.2	13	-2.82	3.24	-2.230	-1.583	3.10	3.785	0.94	0.38	A^+
Glyptothorax cavia	21 – 24	13.9 – 14.8	12	-1.11	2.12	-2.123	-1.00	2.01	2.488	0.99	0.76	A^-
Glyptothorax stocki Mirza & Nijssen	11 – 21	11.5 – 14	12	-2.44	3.28	-2.785	-1.976	3.12	3.654	0.99	0.78	A^+
Sisor rabdophorus	4.2 – 8.8	16.5 – 26.1	14	-0.24	0.79	-1.520	1.021	-0.165	1.753	0.23	0.07	A^-
V. Heteropneustidae												
Heteropneustes fossilis	3 – 9	8.7 – 13	08	-1.45	2.13	-3.323	0.419	2.00	3.983	0.92	0.48	A^-

N=Number of specimens, a= intercept, b= slope, cl= confidence interval, r^2= coefficient of determination, K= condition factor, G.T= growth type, I= isometric growth, A^+ = positive allometric growth and A^- = negative isometric growth

There is an inverse relation between the constant of regression and coefficient of regression (da Costa and Araújo, 2003). The value of b parameter may change between habitats, seasonally and even on daily basis (Goncalves *et al*., 1997; Ozaydin and Taskavah, 2007).The difference in value of b also can be attributed due to many factors like; preservation techniques, health condition of fish, maturity of gonads, degree digestive tract fullness, effects of area and seasons and difference in ranges of observed length (Sarkar *et al*., 2013).

Conclusion and recommendation

It is concluded from this study that cat fishes that were evaluated in this study at the Taunsa Barrage of Indus River are in stress situation due to continuously worse situation of their natural habitat. It is recommended that malpractices like over and illegal hunting, water pollution, habitat degradation should be strictly handled with proper management at Govt. level.

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