International Journal of Research
Available at https://edupediapublications.org/journals
p-ISSN: 2348-6848
e-ISSN: 2348-795X
Volume 03 Issue 13
September 2016

Length-weight relationship of Fresh water Cyprinid fishes of the Genus *Salmostoma* and *Chela* in India: A Review

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Abstract

Length-weight relationship of cyprinid fishes of the genus *Salmostoma* and *Chela* are reviewed based on published data. Fishes are the natural source of protein and provide certain other useful products as well as economic substance to many countries. It is known that the knowledge on fish biology especially on morphology and length-weight relationship of fishes is importance in increasing the technology for evolving judicious fisheries management. A general 'allometric' and 'isometric' growth pattern was observed in these two fish species.

Key Words: Length-weight relationship, *Salmostoma* & *Chela* fishes, Allometric and isometric growth.

Introduction

The length-weight relationship gives an idea about the mathematical relationship between length and weight. It also depicts variation in the observed weight of individual fish from the expected weight. This variation indicates the fatness, general well being or gonadal development of the fish (Le Cren, 1951). The length-weight relationship of a fish can be described by the hypothetical cube law, $W = CL^3$ (Where in W = weight of fish, L = length of fish and C = a constant), as length is a linear measure and weight a measure volume. But Le Cren (1951) has suggested the use of the parabolic equation $W = aL^n$ (Where W = weight of fish, L = length of fish and a = constant equivalent to 'C' of cube law and 'n' a constant to be determined empirically). The cube law represents a condition in an ideal fish, where in the fish maintain a constant shape, Where n = 3 (Allen, 1938). If there is a change in density and form as a results of growth, there will be

significant departure from the isometric growth. Hence, the formula $W = aL^n$ will be more useful in describing the length-weight relationship. The value of the exponent 'n' in the parabolic equation usually lies between 2.5 and 4.0 (Hile, 1936; Martin, 1949).

There are mainly two objectives in studying the length-weight relationship of fishes: (1) to determine the type of mathematical relationship between the two variables, so that if one is known the other could be computed and (2) to calculate the relative condition factor.

Standard weight in fish is the typical or expected weight at a given total length for a specific species of fish. Most standard weight equations are for freshwater fish species.

Weight-length curves are developed by weighing and measuring samples of fish from the population. Methods of obtaining such samples include surveys, or measurements of fish caught by fishermen, recreational fishermen and/or by the researchers themselves. Some scientists use cast nets, trotlines, or other means to catch many individual fish at once for measurement. To determine a standard weight equation, several data sets or weight-length relationships representing a species across its range are used.

As fish grow in length, they increase in weight. The relationship between length and weight is not linear. The relationship between length (*L*) and weight (*W*) can be expressed as:

$W = aL^b$

The exponent *b* is close to 3.0 for most of the fish species. The coefficient *a* varies between species. If the exponent *b* is greater than 3 for a certain fish species, that species tends to become relatively fatter or have more girth as it grows longer (https://en.wikipedia.org).

Length-weight relationship of *Salmostoma* fishes

Piska (1990) studied the length-weight relationship of *Salmostoma clupeoides* from two reservoirs namely Osman sagar and Himayath sagar and found the negative allometric growth pattern for the fishes (Table 2). The differences between morphometric, meristic and

length-weight characters in two water bodies indicated that they are drawn from a common stock and no remarkable differentiation has occurred for placing them under separate natural populations.

Sandeep P. Jadhav et al (2012) reported the length-weight relationships of four species of cyprininid fishes - *Salmostoma bacaila, Salmostoma novacula, Salmostoma cluepoides* and *Chela laubuca* from Dimbe reservoir of Pune (Maharashtra) India. The length-weight relationships obtained for the fishes *Salmostoma bacaila*: Male W= 0.055 $L^{2.912}$ Female, W= 0.057 $L^{2.665}$, *Salmostoma novacula*: Male W= 0.298 $L^{1.742}$ and Female, W= 0.285 $L^{1.832}$ *Salmostoma clupeoides:* Male W= 0.101$L^{2.62}$ and Female, W= 0.09 $L^{2.591}$ and *Chela laubuca*: Male W= 0.215 $L^{2.243}$ and Female, W= 0.318 $L^{2.341}$. Their results revealed that all the four species and both the sexes of fishes showed allometric growth except male *Salmostoma bacaila* which showed isometric growth pattern.

Length-weight relationship of *Chela* fishes

The data on length, weight of *Chela phulo* from Indian waters was reported by Alikunhi and Chaudhuri (1954). While,Wagh and Bapat (1984) studied the length-weight relationship in *Chela clupeoides.*

Table 1 shows the comparative study on length –weight relationship coefficients (a and b) for different species of *Chela* and *Salmostoma* male and female fishes by several researchers in India. While, Table 2 depicts length–weight relationship coefficients (a and b) for combined sexes of *Salmostoma* and *Chela* fishes in India by various authors.

Nagar and Sharma (2016) were selected two fish species namely *Chela bacaila* and *Puntius sophore* for length-weight relationship. The sexes were differentiated by surgical observation of the gonads. The observed lengths and weights were transformed into logarithmic values and equations were calculated by least square method. The values of regression coefficient (b) computed were 2.743 (female), 2.950 (male), and 2.887 (sexes combined) for *Chela bacaila*. During their study the b‟ values were found to

be lower than the isometric value 3 which indicates that the *Chela bacaila* becomes more slender as the length increases. The b‟ value of males was slightly higher than females in this case.

The length-weight relationship of *Chela bacaila* (Gunther) was studied by Dahare Rajesh (2011) from Wainganga river of Maharashtra .The length-weight relationship of *Chela bacaila* in relation to their corresponding parabolic representations are Male *C. bacaila* $W = 0.006634\ L^{2.9086}$, female $W = 0.012325\ L^{2.6478}$. The value of 'b' is found to be 2.9086 for males and 2.6478 in females. The males are heavier than females at equal length. Based on 'b' value, it indicates the river condition was not found good for healthy development of *Chela bacaila.*

Anna Mercy et al (2008) worked on length- weight relationship (LWR) for 16 species of indigenous ornamental fishes of the Western Ghats of India. The fish samples used for this study were collected by operating cast net from different rivers of Kerala, south-west part of the Western Ghat region.The 'b' values of 10 species out of 16 were found very close to the isometric value of 3.0. Their study revealed that 10 species showed no significant difference at 5% level from the expected value of '3', while the remaining six showed differences. Hence, they can be concluded that the growth is isometric for 10 species among them *Chela fasciata* is one of the species whereas, growth is allometric in other species viz., *P. amphibius, P. melanampyx, Salmostoma boopis, Esomus danricus, Parambassis thomassi* and *Nemacheilus triangularis* .

Conclusion

The Length-weight relationship of fishes intends to find out baseline information regarding these two fish species i.e., *Salmostoma* and *Chela* from the different regions of India and will able to understand their growth, well being and stock assessments for the betterment of fisheries management.

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Figure 1:*Salmostoma* fish specimens showing different lengths

Table 1: Comparative study on length –weight relationship coefficients (a and b) for different species of *Salmostoma* and *Chela* fishes in India by various researchers

Sl. No	*Species*	*Male*		*Female*		*Reference/Source*
		a	*b*	*a*	*b*	
1	*Salmostoma bacaila*	0.055	2.912	0.057	2.665	Sandeep P.Jadhav et al.,2012
2	*Salmostoma navacula*	0.298	1.742	0.285	1.832	Sandeep P.Jadhav et al.,2012
3	*Salmostoma clupeoides*	0.101	2.62	0.090	2.591	Sandeep P.Jadhav et al.,2012
4	*Salmostoma untrahi*	0.00004	3.0938	0.00001474	2.8178	Kiran and Puttaiah, 2006
5	*Chela laubuca*	0.215	2.243	0.318	2.341	Sandeep P.Jadhav et al.,2012
6	*Chela bacaila*	-2.079	2.950	-1.858	2.743	Nagar & Sharma, 2016
7	*Chela bacaila*	-2.1782	2.9086	-1.9092	2.6478	Dahare Rajesh,2011

Table 2: Comparative study on length –weight relationship coefficients (a and b) for combined sexes of *Salmostoma* and *Chela* specimens in India by various authors

Sl. No	*Species*	*a*	*b*	*Reference/Source*
1	*Salmostoma boopis*	0.067499	2.1817	Anna Mercy et al.,2008
2	*Chela fasciata*	0.01709	3.0051	Anna Mercy et al.,2008
3	*Salmostoma clupeoides*	0.03943	2.6108 (Osmanasagar)	Piska ,1990
4	*Salmostoma clupeoides*	0.03676	2.6089 (Himayath sagar)	Piska, 1990