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Full Length Research Paper

Length-weight relationship and relative condition factor in *Xenentodon cancila* of River Mat in Mizoram

Satyajit Das, Biplab Kumar Das* and Devashish Kar

Department of Life Science and Bioinformatics, School of Life Sciences, Assam University, Silchar- 788011, Assam, India.

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The present study attempts to develop a comprehensive length-weight relationship and relative condition factor (K_n) of *Xenentodon cancila* collected from River Mat in Mizoram. The value of exponent ‘n’ in the equation $W = cL^n$ was 1.185 for the species *X. cancila.* The computed ‘t’ value indicated that the ‘n’ value of the species is significantly different from the expected value ‘3’ and hence the Cube Law $W = cL^n$ did not hold good in the case of *X. cancila* found in Mat in Mizoram. The correlation co-efficient (r) in *X. cancila* was found to be 1 indicating that there is high positive correlation between length and weight in the species. The relative condition factor (Kn) remained greater than 1 for the species indicating their general well being to be good in Mat River in Mizoram.

Key words: Length-weight relationship (LWR), relative condition factor, *Xenentodon cancila*, Mat River, Mizoram.

INTRODUCTION

The fish production plays a significant role in the human economy. India has vast potential for development of inland fisheries (Das and Kar, 2011). According to Le Cren (1951), knowledge of the length-weight relationship of a fish is essential, since various important biological aspects, namely, general well being of fish, appearance of first maturity, onset of spawning, etc., can be assessed with the help of condition factor, a derivative of this relationship; moreover, the length-weight relationship (LWR) of fish is an important fishery management tool because they allow the estimation of the average weight of the fish of a given length group by establishing a mathematical relationship (Das et al., 2013, 2014a). As length and weight of fish are among the morphometric characters, they can be used for the purpose of taxonomy and ultimately in fish stock assessment (Shadi et al., 2011). In fisheries science, the condition factor is used in order to compare the ‘condition’, ‘fatness’ or well being of fish and it is based on the hypothesis that heavier fish of a given length are in better condition. Condition factor has also been used as an index of growth and feeding intensity (Kar, 2007, 2013; Oribhabor et al., 2011). An extensive research on length-weight relationship of commercial freshwater fishes from different water bodies in India is already reported. The length-weight relationships are useful in the standardization of length type when data are summarized (Froese, 1998). This study reports the LWR of *Xenentodon cancila* of Mat River in Mizoram, India.

MATERIALS AND METHODS

In fishes, generally the growth pattern follows the

*Corresponding author. E-mail: biplabkumar1987@gmail.com.

cube law. Such relationship for the fishes will be valid when the fish grows isometrically. In such cases, the experimental value must be exactly 3. But, in reality, the actual relationship between length and weight may depart from the ideal value due to environmental conditions or condition of fish. This relationship is expressed by the equation $W = aL^n$.

The b value for each form was significantly different from the isometric growth (b=3) (Sokal and Rohlf, 1981). The data were transformed into log-log transformation. The transformed data of length-weight and length-length relationship was estimated by the method of least squares as used by Ricker (1973). For practical purpose, this relationship is usually expressed in its logarithmic form (Le Cren, 1951).

In this study, a total of 35 fish specimens comprising *Xenentodon cancila* ranging from 85-180 mm in length and 7-45 gm in weight were studied for the length weight relationship. The species were identified by using the key provided by Jayaram (2010) and Talwar and Jhingran (1991). Individual measurements of fish species pertaining to total length (TL cm) and total weight (g) were done with the help of precision of Vernier Calliper and Digital Sartorious Electronic Balance respectively. The total length (TL) of each fish species were taken from the tip of snout to the longest ray of caudal fin. Fish weight was measured after blot drying. The LWR was established by fitting equation of the form:

$$W = cL^n \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where W is the weight of the fish, ‘L’ its length and ‘c’ and ‘n’ are constants. Equation 1 could be expressed in the linear form by using logarithms, as given below:

$$\text{Log } W = \text{Log } c + n \text{ Log } L$$

The estimates of the constants c and n were obtained empirically by using the formulae, as given below:

$$Log\ C = \frac{\sum Log\ W \times (\sum\ LogL^2) - \sum Log\ L \times \sum(LogL \times LogW)}{N(\sum LogL^2) - (\ \sum (LogL)^2)}$$

$$n = \frac{\sum Log\ W - NLogC}{\sum og\ L}$$

Significance of the variation in estimates of n is from the expected value ‘3’ (cube law). Weights were estimated for different lengths using relationship equation (Das et al., 2015). The relation between length and weight for each fish was computed with the help of statistics. The Fulton’s Condition Factor (K) was computed by using the formula, as given below:

$$Condition\ Factor\ (K) = \frac{Weight\ (g)}{(Length)^3\ (cm)} \times 100$$

RESULTS

The formula correlating L-W of *X. cancila* is given below:

$$\text{Log } W = -1.334 + 1.185 \text{ Log } L$$

The exponent ‘n’ in L-W relationship for *X. cancila* was 1.185, whereas the computed ‘t’ values indicated that ‘n’ value of the species was significantly different from the expected value ‘3’. Hence, the Cube Law $W = cL^n$ did not hold good for the species.

The computed correlation co-efficient (r) value in *X. cancila* was found to be 1 which indicates there is high positive correlation between the length and weight in the species.

The condition factor (K_n) is an indication of general well being of fishes. The Le Cren’s condition factor (K_n) of *X. cancila* was found to be 1.25 which is greater than 1, thus indicating their general well being to be good. Therefore, all these observations appear to indicate that single value of ‘c’ and ‘n’ may not be responsible for the entire size range of the fish (Table 1).

DISCUSSION

The relationship between length and weight in the fish of *X. cancila* follows the cube law strictly and the weight increase observed was a rate of the cube’s length in all the samples collected from spatially and geographically different places characterized by different environmental conditions (Prasad and Ali, 2007). The rate of increase in weight in relation to length was slightly higher in the fish collected from river (b= 3.00); it may be due to ecological factors, particularly high dissolved oxygen concentration, circulation of water and forage organisms to the fish. The length-weight relationship was also in a

Table 1. Length-weight relationship of *Xenentodon cancila*.

S/N	Length (mm)	Weight (gm)	Log L	Log W	Log L^2	Log L × Log W	Fultons Condition Factor (K)	LaCrens Condition Factor (Kn)
1	140	39.1	2.146128	1.592177	4.605866	3.417015177	1.424927114	27.38912323
2	130	33.2	2.113943	1.521138	4.468756	3.21559974	1.51115157	23.56996756
3	124	24.12	2.093422	1.382377	4.382414	2.893898624	1.265063274	17.27229299
4	126	26.1	2.100371	1.416641	4.411556	2.975469995	1.304754706	18.63541935
5	112	14	2.049218	1.146128	4.199295	2.348666227	0.996492347	10.21630605
6	125	26	2.09691	1.414973	4.397032	2.967071781	1.3312	18.59113954
7	129	30	2.11059	1.477121	4.454589	3.117596921	1.397500989	21.32814383
8	104	20	2.017033	1.30103	4.068423	2.624220877	1.777992717	14.79994379
9	120	25.1	2.079181	1.399674	4.322995	2.910175352	1.452546296	18.08294022
10	130	37	2.113943	1.568202	4.468756	3.31508961	1.684114702	26.26773493
11	130	36	2.113943	1.556303	4.468756	3.289935326	1.638598088	25.55779615
12	110	33	2.041393	1.518514	4.167284	3.099883249	2.479338843	24.16275608
13	150	59	2.176091	1.770852	4.735373	3.853535584	1.748148148	40.82298362
14	105	7	2.021189	0.845098	4.085206	1.708103115	0.604686319	5.170592004
15	120	27	2.079181	1.431364	4.322995	2.976064695	1.5625	19.45176837
16	105	17	2.021189	1.230449	4.085206	2.486970193	1.468523918	12.55715201
17	180	36	2.255273	1.556303	5.086254	3.50988624	0.617283951	24.12847792
18	110	17	2.041393	1.230449	4.167284	2.511829428	1.277235162	12.44748041
19	100	17	2	1.230449	4	2.460897843	1.7	12.67427123
20	120	25	2.079181	1.39794	4.322995	2.906570649	1.446759259	18.01089664
21	155	45	2.190332	1.653213	4.797553	3.621083773	1.20841865	30.95609265
22	130	33	2.113943	1.518514	4.468756	3.210052449	1.502048248	23.4279798
23	125	34	2.09691	1.531479	4.397032	3.211373476	1.7408	24.31149017
24	130	32	2.113943	1.50515	4.468756	3.181801791	1.456531634	22.71804102
25	125	33	2.09691	1.518514	4.397032	3.184187085	1.6896	23.59644634
26	120	30	2.079181	1.477121	4.322995	3.071202811	1.736111111	21.61307596
27	111	29	2.045323	1.462398	4.183346	2.991076229	2.120455006	21.19792103
28	112	28	2.049218	1.447158	4.199295	2.965542319	1.992984694	20.4326121
29	115	26	2.060698	1.414973	4.246476	2.915832522	1.709542204	18.87976199
30	95	17	1.977724	1.230449	3.911391	2.433487877	1.982796326	12.79977818
31	101	13	2.004321	1.113943	4.017304	2.23270047	1.261767192	9.673689062
32	114	23	2.056905	1.361728	4.230858	2.800944592	1.552434487	16.72853042
33	110	13	2.041393	1.113943	4.167284	2.273995811	0.976709241	9.518661488
34	85	7	1.929419	0.845098	3.722657	1.630548152	1.139833096	5.386152784
35	85	7	1.929419	0.845098	3.722657	1.630548152	1.139833096	5.386152784

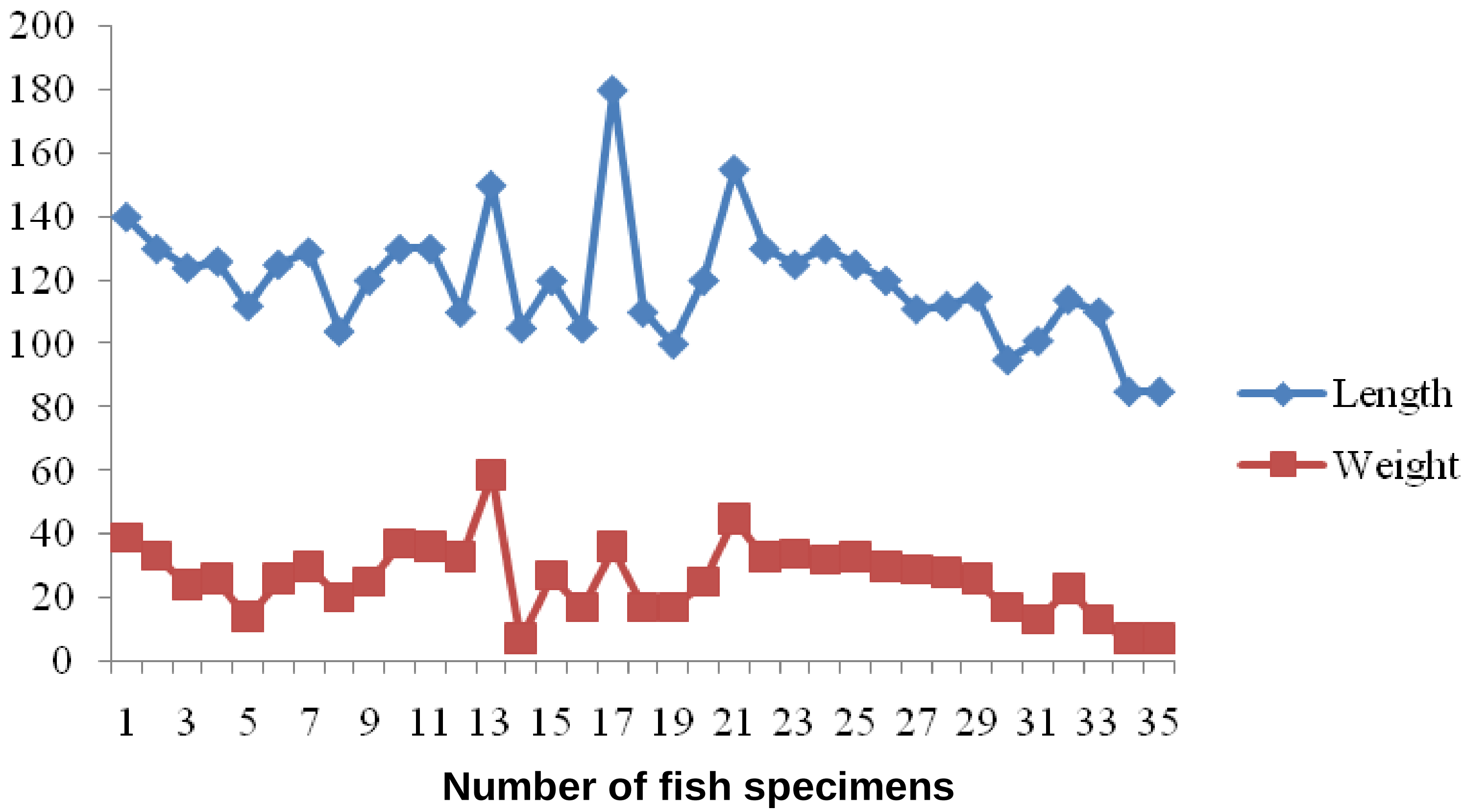

Figure 1. The relationship between total length and total body weight (gm) of *X. cancila*.

dynamic pattern with highly significant coefficient of determination. The current interpretation of the parameters resulting from the LWR of the species could disclose information which may be useful to the study of fishery biology and management of fishes (Das et al., 2014b). According to Tesch (1971), the length-weight relationship in fishes can be affected by habitat and area besides other factors such as seasonal effect, degree of stomach fullness, gonad maturity, sex, health, preservation techniques and differences in the observed length ranges of the specimens (Figure 1).

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