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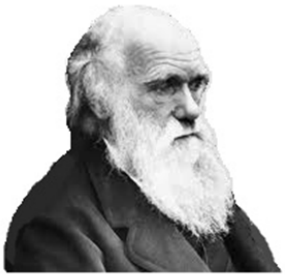

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Length-Weight Relationship and Condition Factor of *Garra mcclenlandi, Danio aequipinnatus* and *Crossocheilius latis* at the Drainage system of Mon, Nagaland, India

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ABSTRACT

This study describes the length-weight relationship (LWR) and condition factor for three important freshwater fish species (*Garra mcclenlandi, Danio aequipinnatus* and *Crossochelius latis*) collected from drainage system of Mon, Nagaland, India from 2022 to 2023. During survey a total of 278 specimens of mixed population were examined. 95% confidence level of *b* values (regression coefficient) of Length-Weight Relationship (LWR) ranged from 2.3616 - 3.1485 indicating positive allometric pattern of growth for *D. aequipnnatus*, while *G. mcclenlandi* and *C. latis* showed negative allometric growth. The highest condition factor (k) 1.0993 was observed in *D. aequipnnatus*, lowest in *G. mcclenlandi* with 0.8126 while $r^2 > 0.90$ for all the three species.

***Keywords*:** Length-weight relationship, Condition Factor, *Crossocheilius latis, Danio aequipinnatus, Garra mcclenlandi*

1. INTRODUCTION

The Length-Weight relationship (LWR) is one of the conventional techniques that produce reliable biological information for the management of fisheries. Its significance is particularly felt when determining the average weight at a specific length group and evaluating

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the overall health of a fish population (Bolger and Connoly, 1989). Growth of the fish is usually indicated by its increase in length and the corresponding weight (Jobling, 2022). Length-weight relationship (LWR) can also be used to compare fish populations from different areas or habitat groupings, as well as between different life cycle stages (Petrakis and Stergiou, 1995; Gonçalves *et al.,* 1997) and tracking seasonal variations in fish growth (Richter *et al.,* 2000). Similar to other morphometric measurements, the relationships between length and weight may change during the events of life cycle such as growth, metamorphosis, and reaching adulthood (Le Cren, 1951).

Length is easier to measure than weight and weight can be estimated later using the length-Weight relationship which helps among other fish given its definite length (Arsalan *et al.*, 2004). According to (Bashir *et al*. 1993) the length-weight relationship of fish varies depending upon the condition of life in aquatic environment. The relationship is expressed by the equation W = cLn, where W = weight in gm L = length in cm and c and n are two exponents. The values of **c** and the exponent **n** are determinable empirically (Lagler 1952). This equation was used by several workers for different species from different habitats. Some of the recent works in this aspect are those by (Patgiri *et al*., 2003; Oscoz *et al.,* 2005; Serajuddin, 2005; kar and Barbhuiya, 2005). However, informations on the Length-weight relationship of hill stream fishes from north-eastern regions are scarce.

The length-weight relationship also provides means for finding out the "condition factor" and the seasonal changes. The condition factor of fishes is the most important biological parameter which provides information on condition of fish species and the entire community and is of high significance for management and conservation of natural populations (Muchlisin *et al.*, 2010).

Following a research of the literature, it was discovered that these important fish species from the drainage system of Mon, specifically, and Nagaland in general, do not have any Length Weight Relationship (LWR) data. In light of such aspects, the purpose of this study has been undertaken to evaluate their LWR and condition factors, by which their sustainable use could be implemented.

2. MATERIAL AND METHODS

2. 1. Description of study site

The Dikhu River is one of the most prominent river which traverses the district of Mokokchung, Longleng and Mon districts and passes through Naganimora before its confluence with the mighty Brahmaputra River in Assam. Almost all the minor rivers originate in Mon are tributary of Dikhu river. The important minor river included Yengmon, Yityong, Kaimang, Tesang, Maksha, Tapi, Tizit, Teyap, Tekang, Jein, Teggie, Telem, Pongma and Tehok, which provide good fishing grounds and has a number of fish species. There are also several minor streams, rivulets and rills all over the district and many of them dry up during lean season but roar in monsoon (Figure 1).

2. 2. Data collection and sample size

Fish samples were collected on monthly basis from 2022-2023 in drainage system of Mon, Nagaland with the help of local fishers having over a decades of experiences in fishing technique. During the survey a total number of 278 specimens consisting of *Garra mcclenlandi*

78, *Danio aequipinnatus* 127 *and Crossocheilius latis* 73 were collected in order to calculate the length-weight relationship and condition factor while taxonomic identification were done after Jhingran and (Talwar, 1991) and (Jayaram, 2013). Measurements were taken for each individual the total length (TL) in centimeter and total weight (TW) in gram were measured with digital caliper and electronic weighing machine respectively. Some collected sample were stored in 10% formalin and transported to laboratory department of zoology, Kohima Science College, Jotsoma.

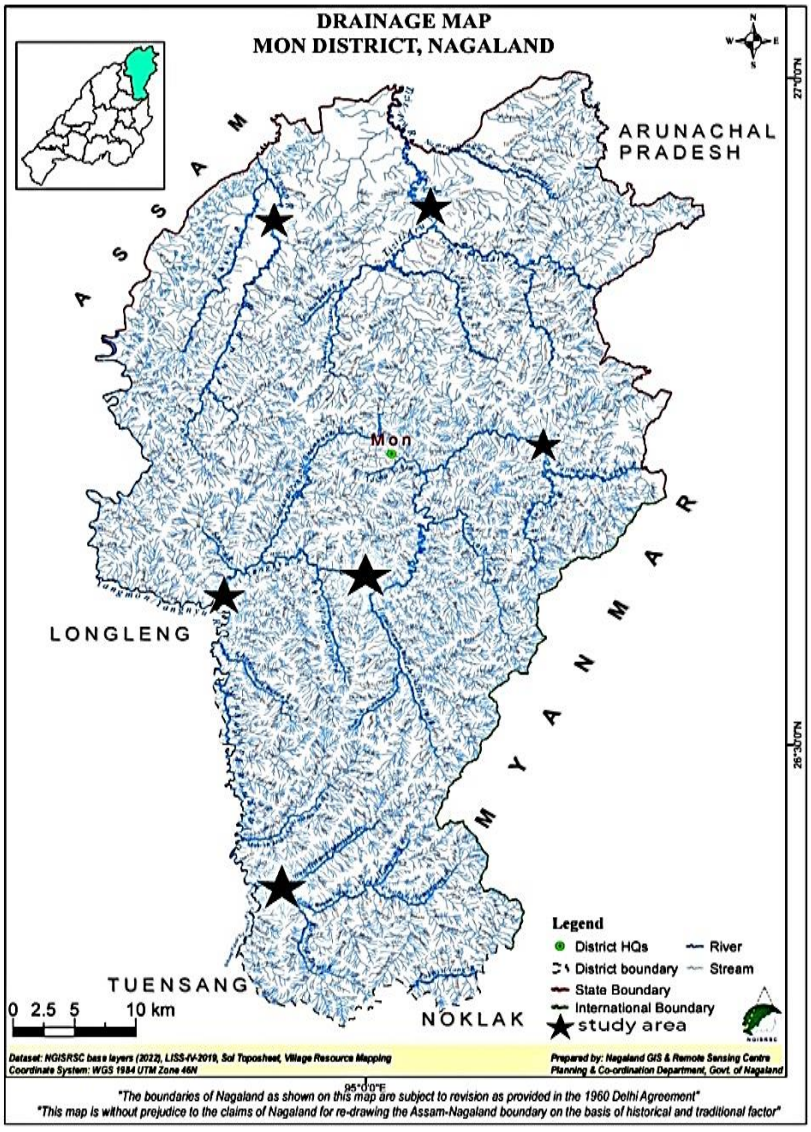

Figure 1. Location map of sampling sites in the drainage system of Mon.

2. 3. Statistical analysis

The relationship between length (TL) and total weight (TW) of fish was analysed by measuring length and weight of fish specimens collected from study area. The statistical

relationship between these parameters of fishes was established by using the parabolic equation: $W = a L^b$ where W = weight of fish in (g), L = length of fish in (cm), a = proportionality constant (intercept) and b = regression coefficient (slope). The association degree between length and weight was calculated by the determination coefficient (r^2). Value of the exponent **b** provides information on fish growth. When b = 3, the increase in weight is isometric, otherwise it is allometric (positive allometric if b > 3, negative allometric if b < 3). Condition factor is used for comparing the condition, fatness, or well-being of fish, based on the assumption that heavier fish of a given length are in better condition. Therefore, fishes with condition factor values greater than one (≥ 1) were considered as high while those less than one (< 1) were low. The coefficient of condition K was calculated using the relationship: K = (TW / TL3) * 100 where K = condition factor, TW = total weight of fish (g), TL = total length of fish (mm) and 100 is a factor to bring the value of K near unity.

3. RESULT AND DISCUSSION

Length-Weight relationships (LWR) were calculated for a total of 278 individuals of three species (*G. mcclenlandi, D. aequipinnatus* and *C. latis*). The parameters of the length- weight relationships for each species are given in Table 1, together with the regression coefficient (R^2) the number of specimens measured (n), slop **b**, the intercept of **a** and the total size and weight of the smallest (min) and largest (max) specimens measured. Linear regression graph on total length (TL) and total weight (TW) were shown in Figure 2. The graph plotted between the observed length and expected weight gives a straight line of regression, which shows that increase in weight is an exponent function of its length. On the other hand the weight of the fish is considered as function of its growth (Gulland JA, 1977). When the specific gravity of a fish remains unchanged and retains the same shape during its life time. It is growing isometrically and the value of length exponent **b** would be exactly 3.0 (Wootton, 1990). In the present study calculated allometric coefficient **b** ranged from minimum of 2.36161 for the species *Crossocheilius latis* to Maximum of 3.14854 for *Danio aequipinnatus.* (Froese, 1998) recommended that the exponent **b** of length- weight relationships (LWR) should fall within the expected range of 2.5-3.5. The present study result indicated positive allometric pattern of growth for *D. aequipinnatus* while *G. mcclenlandi* and *C. latis* showed negative allometric growth that adequately adjusted within the range and very closed to 3. Hence, all three species do follow the cube law. The degree of stomach fullness, gonad development, habitat, diet, growth phase, season, sex, size range, general health, overall fish condition, and preservation methods are some of the aspects that determine a fish's Length-weight Relationship (Tesch, 1971). These factors, however, were not taken into consideration in the current investigation.

Table 1. Length-Weight parameters and measurements of *D. aequipinnatus, G. mcclellandi* and *C. latis.*

Fish species	**N**	Length range (cm)	Weight range (g)	A	b	r^2	k
Danio aequipinnatus	127	4.9 -11.1 cm	1.2 - 15.0 g	-2.9526	3.1485	0.8847	1.0993

Garra mcclenlandi	78	6.1 - 12.4 cm	2.1 – 14.2 g	-1.7042	2.6026	0.9479	0.8964
Crossocheilius latis	73	12.1 - 19.8 cm	13.1 – 75.0 g	-1.3137	2.3616	0.7402	0.8126

Abbreviations; N = number of specimens, A = proportionality constant (intercept), b = regression coefficient (slope) and r^2 = correlation coefficient, K = condition factor.

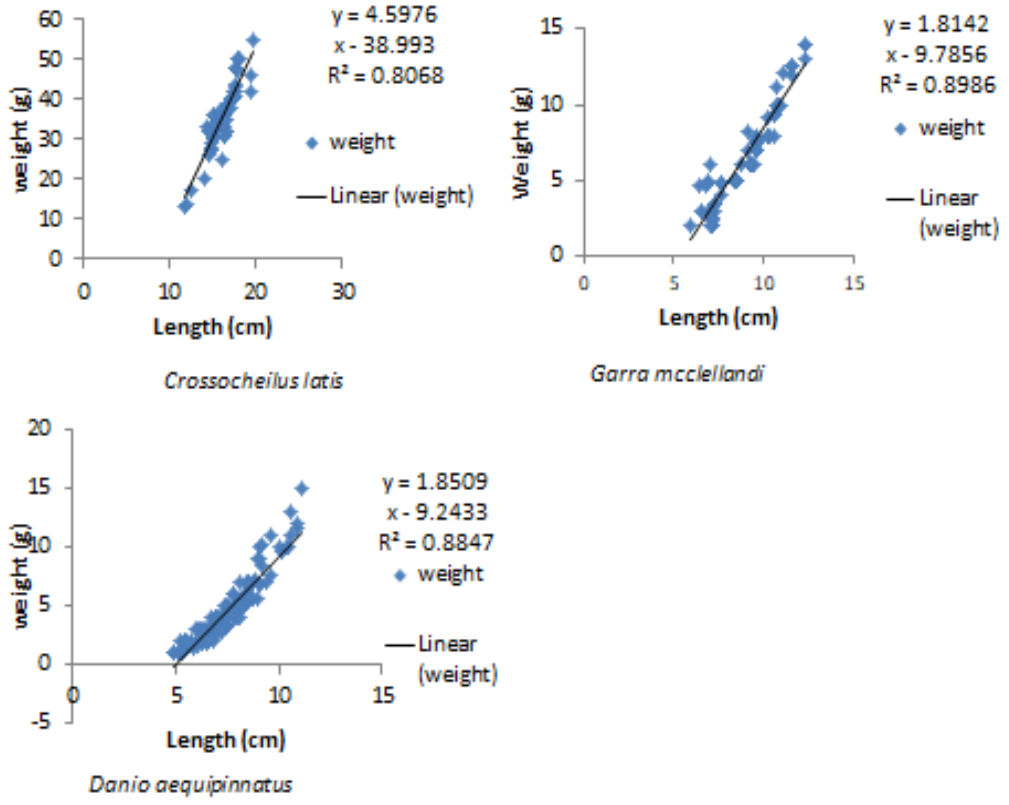

Figure 2. Scatter diagram showing Length-Weight relationship of *D. aequipinnatus*, *G. mcclellandi* and *C. latis.*

4. CONCLUSIONS

In present survey a total of 278 specimens of mixed population were examined and calculated allometric coefficient b ranged from minimum of 2.36161 for the species *Crossocheilius latis* to Maximum *of* 3.14854 for *Danio aequipinnatus*. 95% confidence level of *b* values (regression coefficient) of Weight-Length Relationship (WLR) ranged from 2.3616 - 3.1485 indicating positive allometric pattern of growth for *D. aequipnnatus*, while *G. mcclenlandi* and *C. latis* showed negative allometric growth. The highest condition factor (k) 1.0993 was observed in *D. aequipnnatus*, lowest in *G. mcclenlandi* with 0.8126 while $r^2 > 0.90$ for all the three species.

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