ISBN: 978-93-48091-58-1

19. Length-Weight Relationship and Relative Condition Factor of *Ompok pabda* (Hamilton, 1822) And *Barilius barila* (Hamilton, 1822) Collected from Hel River, Kokrajhar, Assam, India

Fariha Jabeen, Subungsha Basumatary

Department of Zoology,
Science College, Kokrajhar, Assam.

Abstract:

Length-Weight Relationships (LWR) and Relative condition factors (Kn) of two fish species, collected from the Hel River, Kokrajhar, Assam, India were studied in the present investigation. Altogether 171 specimens (Ompok pabda = 75 and Barilius barila = 96) were taken for study. Fishes were collected from fishermen and nearby markets along the river using gill nets, drag nets, and cast nets of varying mesh sizes from September 2021 to August 2022. The slope (b) value calculated for Ompok pabda was 3.59 which slightly differed from the ideal fish range (2.5 to 3.5) suggested by Froese (2006) indicating positive allometric growth. However, the b value for B. barila was computed to be 3.008, which was consistent with the range of Cube Law 2.5 to 3.5 (Froese, 2006) indicating isometric growth. Shape of Ompok pabda was found out to be eel-like and Barilius barila to be fusiform which was interpreted from the mean "a" value of 0.001 and 0.011 respectively. The Relative condition factors (Kn) of the fish species were computed to be 1.26 ± 0.06(>1) in Ompok pabda and 1.003 ± 0.08(>1) in Barilius barila indicating that the Hel River has favourable aquatic environment for fish growth and propagation.

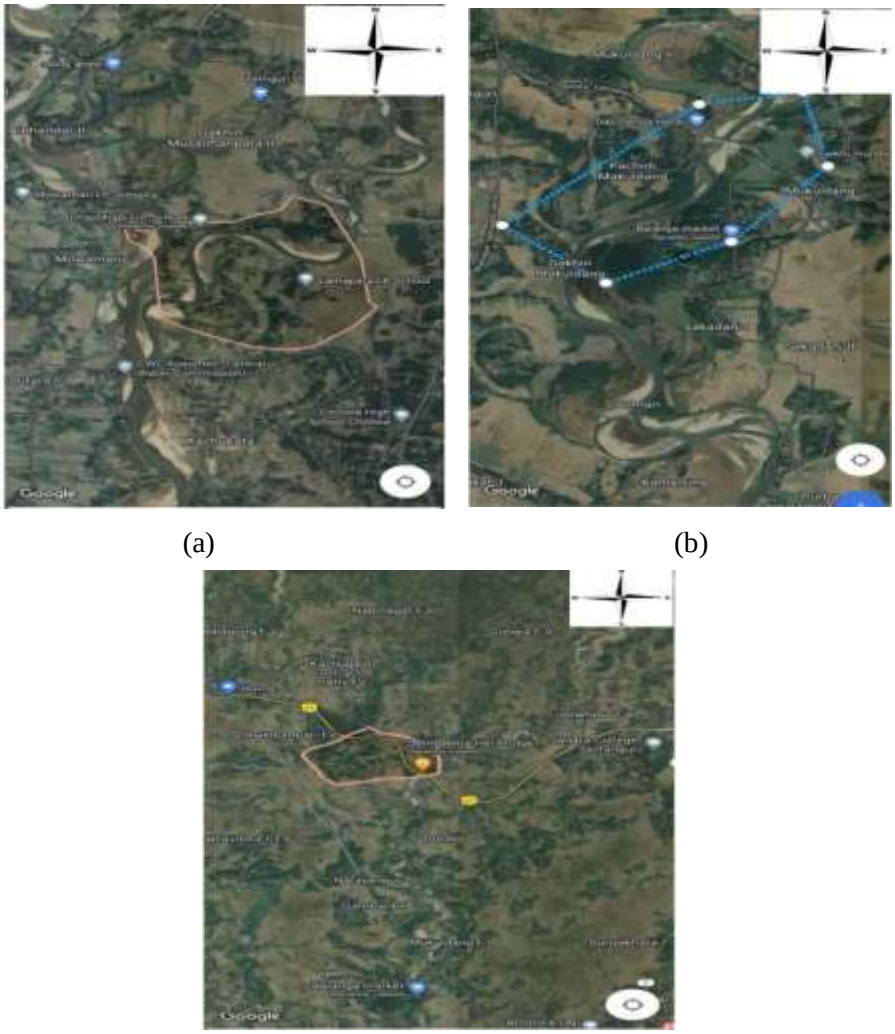
Keywords:

Length-weight relationships, Relative condition factor, Allometric growth, Isometric growth, Hel River

19.1 Introduction:

Fishes exhibit growth in length and an increment in weight throughout their lifetime. The length-weight relationship (LWR) and condition factor (K) are essential parameters used in fisheries biology to assess the overall health and well-being of fish populations. The length-weight relationship establishes a correlation between the length and weight of a fish species, aiding in estimating the biomass and growth patterns. Whereas, the Condition factor measures the overall health and well-being of a fish based on its weight and length and is indicative of its overall fitness and nutritional status. Another parameter viz. Relative condition factor (Kn), on the other hand, adjusts this measurement by comparing the fish's condition to a standard condition for its species, accounting for natural variations. Understanding these metrics is crucial for fisheries management and conservation efforts, enabling scientists and policy makers to make informed decisions to sustainably manage fish

populations and their habitats. In order to monitor the feeding intensity, age and growth rates in fish (Oni *et al.*, 1983), condition factor and relative condition factor play very crucial roles. The K and Kn factors can also be used as indices in assessing the status of the aquatic ecosystem in which the fish live (Anene, 2005). The primary objectives of LWR studies are to establish a mathematical correlation between length and weight variables and investigate variations in actual weight from the expected weight among different length groups. This study aimed to furnish baseline data on the length-weight relationship and relative condition factor for *Ompok pabda* and *Barilius barila*, sampled from Hel River, Kokrajhar, Assam, India. As far as we know, this is the inaugural report of LWRs for both species in this study area, making it a valuable addition to the comprehensive baseline data of freshwater fishes in the region.



(a) (b)

(c)

Figure 19.1: Map showing study area, Source-Google maps (Accessed June 26, 2022). Assam map, (a) Musalmanpara (East Bhowraguri), (b) Balanga (West Dotma), and (c) Hel Bridge (East Kachugaon).

19.2 Materials and Methods:

The present investigation was carried out in Hel River, Kokrajhar, Assam. The river originates in Bhutan and flows through Kokrajhar district in the west. The three sampling sites undertaken for fish collection were- Balanga, West Dotma (located at 26.48456°N latitude and 90.10881°E), Hel Bridge, East Kachugaon (located at 26.56802°N latitude and 90.06782°E) and Musalmanpara, East Bhowraguri (located at 26.44825°N latitude and 90.10524°E longitude). Sampling was done during the months of September 2021 and August 2022 from fishermen and fish markets near the three sampling sites of the river.

The fishing gears used by the fishermen were mainly gill nets (mesh size = 10-15 mm), drag nets (mesh size = 1-10 mm) and cast nets (mesh size = 10-15 mm). After collection, fish species were identified following Talwar & Jhingran (1991), Jayaram (1999), and Vishwanath, Lokeswar, Nebeshwar, Rameshori, and Shangningam (2014). A weighing scale (SF-400) with a capacity of 10000g×1g×353oz×0.1oz, the lowest mark of 0.0 g, and a ruler with millimetre and centimetre scales are used for the measurements of Total Weight and Total Length. Individual fish were measured for total length with a precision of 0.1 cm and weighed with an accuracy of 1g. The calculation of length-weight relationships (LWRs) was performed using the linear regression equation log TW = log a + b log TL, where TW represents the fish's weight and TL represents its total length.

19.2.1 Length Weight Relationship (LWR):

The length-weight relationship was established using the allometric growth formula as proposed by Huxley (1924), given by $\boldsymbol{W = aL^b}$, where W is the weight of the fish in grams, L is the length of the fish in centimeters, 'a' is the intercept (constant), and 'b' is the slope or growth coefficient of the regression line.

To linearize the equation, as suggested by Le Cren (1951), it was transformed into logarithmic form: log W = log a + b log L. Outliers were removed from the log-log plots of length and weight using recommendations from Froese (2006). The regression of log-weight on log-length was calculated using the "least squares" method, and the sample data were grouped for analysis.

Comparison between the estimated values of 'b' and respective critical values allow the determination of statistical significance of 'b' values and their inclusion in the isometric range (b=3) or allometric ranges, i.e., positive allometric (b>3) or negative allometric (b<3) (Froese, 2006).

sThe calculations required to estimate the coefficient of correlation ($\boldsymbol{r^2}$) for length and weight was done using the formula:

$$r = \frac{\sum xy - n\,\bar{x}\,\bar{y}}{\sqrt{\left\{\sum x^2 - n(\bar{x})^2\right\}\left\{\sum y^2 - n(\bar{y})^2\right\}}}$$

19.2.2 Relative Condition Factor (Kn):

The relative condition factor (Kn) is a metric used to assess the health and well-being of an individual fish in relation to its expected condition based on its length. It helps compare the actual condition of a fish to the typical condition of others of the same species and size. The formula to calculate the relative condition factor (Kn) is as follows:

$$Kn = \frac{W}{w}$$

where, W = Observed body weight; w = Calculated body weight, Kn = Relative condition factor. The equation of Length-Weight Relationship, $W = aL^b$ was used to determine the calculated weight 'w' of fish specimen.

19.2.3 Data Analysis:

The collected data of *O. pabda* and *B. barila* was tabulated and analyzed based on their length and weight measurements. The data was processed with the help of Microsoft Word and Microsoft Excel.

19.3 Result:

In this particular study, altogether 171 individual fish were collected throughout the entire research period. Among these, 75 were *Ompok pabda* species, and 96 were *Barilius barila* species. Estimated parameters and descriptive statistics of the LWRs of *Ompok pabda*, and *Barilius barila* are given in Table 19.1, Fig. 19.2 and Fig. 19.3, showing length-weight relationships, and Fig. 19.4 and Fig. 19.5 indicating the 'Mean Kn' value of the respective fish species.

Table 19.1 Descriptive statistics and parameters of LWRs for two fish *Ompok pabda* and *Barilius barila* from the Hel River in Kokrajhar, Assam, India collected during the months of September 2021 to August 2022.

Species	N	TL (cm)		TW (cm)		Regression Parameters		95% CL of a	95% CL of b	r^2	Mean Kn
		Min	Max	Min	Max	a	b				
Ompok pabda	75	15.2	19.8	18.5	50	0.001	3.59	0.0005-0.0018	3.27-3.85	0.946	1.26±0.06
Barilius barila	96	6.3	10.6	3.01	12.99	0.011	3.008	0.008 – 0.014	2.87-3.14	0.952	1.003±0.08

[N, number of individuals; TL, total length; TW, body weight; Min, minimum; Max, maximum; a, intercept; b, slope, CL, confidence limits; r^2, coefficient of determination. Kn, relative condition factor.]

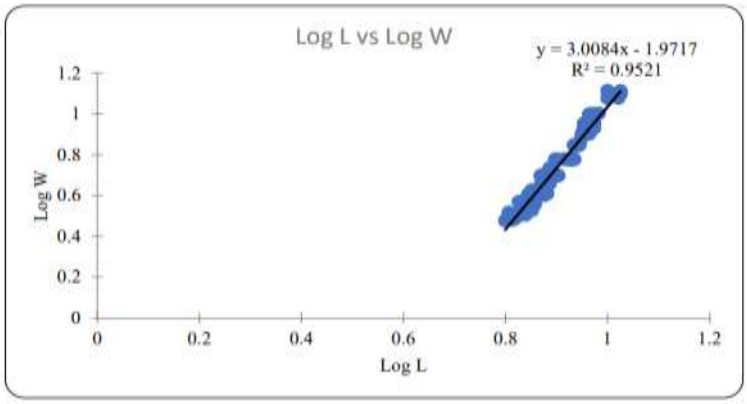


Figure 19.2: LWR graph of *Barilius baria*

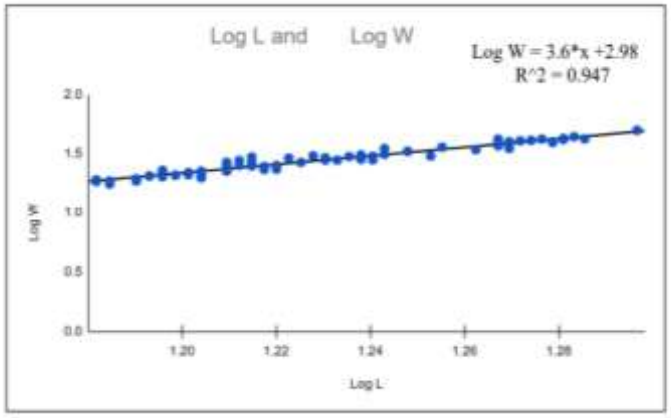


Figure 19.3: LWR graph of *Ompok pabda*

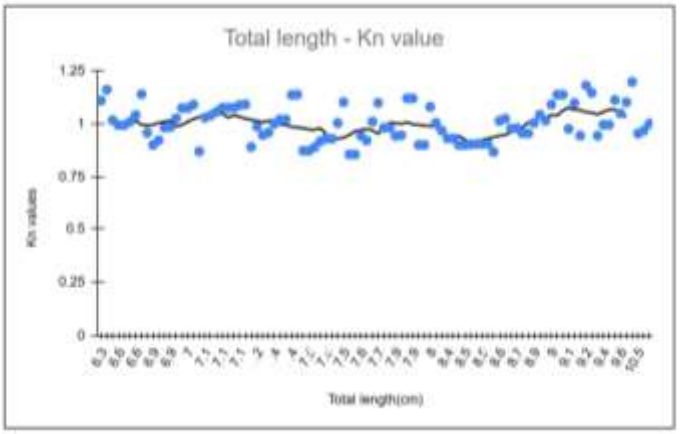


Figure 19.4L LWR graph of *Barilius baria*

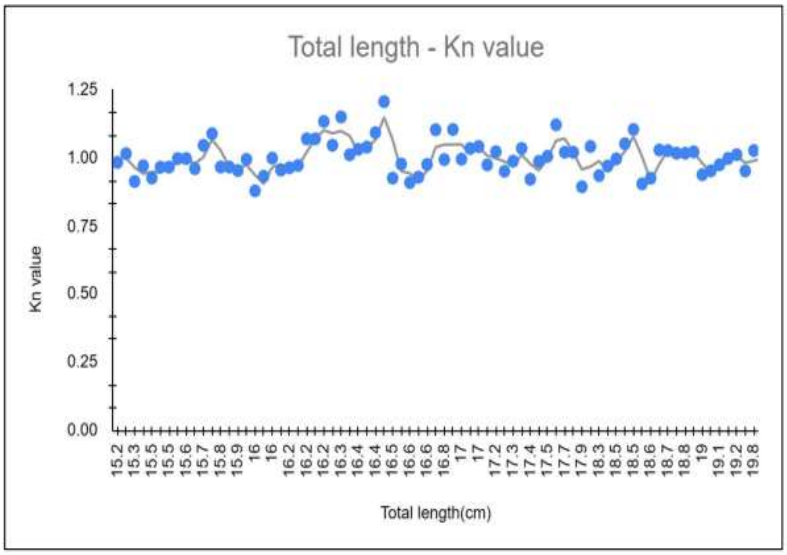


Figure 19.5: LWR graph of *Ompok pabda*Discussion

LWR studies are crucial to the field of fisheries science. It assists in estimating the weight of fish from the available data recorded by Mir *et al.,* (2012) and demonstrates a critical function in calculating population increase, biomass, gonadal maturity, and productivity (Le Cren, 1951; Pauly, 1983; Rahman & Hafzath, 2012). In the current study, the co-efficient of regression parameters ‘a’ and ‘b’ of *O. pabda* were calculated to be 0.001 and 3.59, respectively, whereas according to Froese (2006), the range of ‘b’ is slightly higher than the ideal fish range i.e., from 2.5 to 3.5. Positive allometric growth was indicated by the high b value (b>3), which showed that large-sized specimens grew more in height or broadness than in length. Gupta *et al.,* (2010) reported on a similar investigation on *O. pabda* from the Gomti River. According to their findings, during the pre-monsoon, the coefficient 'b' of the LWRs was close to the isometric (b = 3.08) and allometric (b = 2.87), although it showed negative growth during the period of monsoon and positive growth after the monsoon, respectively. The relative condition factor (Kn) for *O. pabda* in the current study was discovered to be 1.260.06(>1), which differed slightly from the outcomes of Bhattacharjee *et al.,* (2020), who determined the Kn value of O. *pabda* to be 0.9140964 (<1) collected in the Gomati River and Rudrasagar lake of Tripura, India.

For *B. barila*, the 'b' value was computed to be 3.008 which is well within the range of 2.5 to 3.5 (Froese, 2006) of Cube Law. The estimated ‘b’ value which is equivalent to three (≈3) indicated an isometric growth *for* which the fish has proportional length and weight. The LWRs of *B. barila* from the Torsa River, West Bengal, were the subject of research by Koushlesh *et al.,* (2017). They discovered that the 'b' value (2.686) (<3) showed negative allometric growth, in contrast to the 'b' value (3.008) (≈3) obtained in the current study, which indicated isometric growth. According to Le Cren (1951), *B. barila*'s mean Kn value, which assessed relative condition, was estimated as 1.003 ± 0.08(> 1), which suggested that the fish were in good overall health.

Ompok pabda and *Barilius barila* were determined to have eel-like and fusiform shape respectively, when both species were analyzed using the Bayesian technique at 95% CL of 'a' (Froese *et al.*, 2014). The outcomes of Jabeen & Barbhuiya (2018), who evaluated at the length-weight relationships of *Barilius barila*, *Opsarius tileo*, and *Cyprinion semiplotum* recorded on the Manas River, located in Assam, India, supported the fusiform shape of *Barilius barila* estimated from our study.

In general, small variations in the parameters b and Kn values in our study compared to similar studies discovered in different study areas may be caused by varying climatic conditions, excessive fishing, and pesticide usage by the inhabitants in their crops that directly flow through the Hel River, which is actually fatal to the aquatic ecosystem but has fortunately yet to have created a major threat to the growth and overall health of the fish.

19.4 Conclusion:

The current survey will contribute to the knowledge of sustainable fishery resources in Hel River, Kokrajhar, Assam, India. It will also be beneficial in determining the ecological, biological, and physiological state, well-being, condition, and morphology of fish, and will help to properly plan management strategies for the sustenance of the two distinct fish species studied. The parameters shown in this study could be employed to study the growth and dynamics of population expansion of these two fish species exploited from this region.

19.5 Acknowledgements:

The Science College in Kokrajhar provided the physical resources needed to complete this work, which the authors are grateful for. The authors are also obligated to the section heads and fisher folks at the study locations who made it possible to get access to the rivers and fish samples.

19.6 References:

1. Anene, A. (2005): Condition factors of four cichlid species of a man-made lake in Imo state, Southwest, Nigeria. *Turkish Journal of Fisheries and Aquat. Sciences.* 5:43-47pp.
2. Bhattacharjee, P., Pal P. (2020). Study on length weight relationship and feeding habits of a threaten fish *Ompok pabda* from Tripura, India. *Journal of Entomology and Zoology Studies*. Vol 8(6): 1971-1975.
3. Froese, R. (2006). Cube law, condition factor and weight-length relationships: history, meta-analysis and recommendations *Journal of Applied Ichthyology* Vol 22(4): 241-253.
4. Froese, R., Thorson, J.T., Reyes, R.B., (2014). A Bayesian approach for estimating length-weight relationships in fishes. *Journal of Applied Ichthyology.*
5. Vol 30(1): 78- 85.
6. Gupta, B.K., Sarkar, U.K., Bhardwaj, S.K., Pal, A. (2010). Condition factor, length–weight and length–length relationships of an endangered fish *Ompok pabda* (Hamilton 1822) (Siluriformes: Siluridae) from the river Gomti, a tributary of the River Ganga, India. *Journal of Applied Ichthyology.* Vol 27(3): 962–964.

7. Huxley, J.S. (1924). Constant differential growth-ratios and their significance. *Nature*, 14: 896-897.
8. Jabeen, F., Barbhuiya, A.H. (2018). Length-weight relationships of *Barilius barila* (Hamilton, 1822), Opsarius tileo (Hamilton, 1822) and Cyprinion semiplotum (McClelland, 1839) collected from Manas River in Assam, India. Journal of Applied Ichthyology. Vol 34(5): 1210–1211.
9. Jayaram, K.C. (1999). *The freshwater fishes of the Indian region*. Narendra Publishing House, Delhi, 551 pp.
10. Koushlesh, S.K., Sinha, A., Kumari, K., Borah, S. (2017). Length-weight relationship and relative condition factor of five indigenous fish species from Torsa River, West Bengal, India. *Journal of Applied Ichthyology*. 34(1): 169-171pp.
11. Le Cren, E. D. (1951). The length–weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *Animal Ecology*. Vol 20, 201–219pp.
12. Mir, J.R., Shabir, R. & Mir, F.A. (2012). Length-Weight Relationship and Condition Factor of *Schizopyge curvifrons* (Heckel, 1838) from River Jhelum, Kashmir, India. *World Journal of Fish and Marine Sciences*, **4**: 325–329.
13. Oni, S.K., Olayemi, J.Y., Adegboye, J.D. (1983): Comparative physiology of three ecologically distinct fresh water fishes, *Alestes nurse* (Ruppell), *Synodontis schall* (Bloch), S. Schneider and *Tilapia zilli* (Gervais) *Journal of Fish Biology.*22:105–109.
14. Pauly, D. (1983). Some simple methods for the assessment of tropical fish stocks FAO Fisheries Technical Paper, 234: 1–52. http://www.fao.org/docrep/003/X6845E00.HTM.
15. Rahman, M.M. & Hafzath, A. (2012). Condition, length-weight relationship, sex ratio and gonado somatic index of Indian Mackeral (*Rastrelliger kanagurta*) captured from Kuantan coastal water. *Journal of Biological Sciences*, **12**: 426–432.
16. Talwar, P. K. & Jhingran, A. G., (1991). *Inland fishes of India and Adjacent Countries*. Oxford and IBH publishing Co., New Delhi.
17. Vishwanath, W., Nebeshwar, K., Lokeswar, Y., Shangningam, B. D. & Rameshori, Y. (2014). Freshwater Fish Taxonomy and a Manual for Identification of Fishes of Northeast India. Manipur University and National Bureau of Fish Genetic Resources, Lucknow, India. 1–116.