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LENGTH-WEIGHT RELATIONSHIP OF *TRICHOGASTER LALIUS* (HAMILTON, 1822) FROM MANIKA MAUN AND BURHI GANDAK RIVER OF BIHAR, INDIA

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ABSTRACT

Length-weight relationship of *Trichogaster lalius* (Hamilton, 1822) was studied first time from the Burhi Gandak river and Manika maun in the districts of Bihar, India. A total of 278 fish specimens were sampled by the help of different gears and traps on fortnightly basis from June, 2019 to May, 2020. The present study shows the allometric coefficient b= 2.54, negative allometric growth of fish and highly significant (p<0.001). The present observation will serve as the baseline for the sustainable utilization and conservation of wetlands and rivers of Bihar.

***Key word*:** Burhi Gandak, *Trichogaster lalius*, sustainable, growth, wetlands.

Introduction

Burhi Gandak is a tributary of the river Ganga which flows in left bank that rises in the West Champaran district of Bihar's Chautarwa Chaur terai area, close to Bhishambharpur. In its upper stages, it is referred to as Sikrana and gets water from the Masan and Ramrekha rivers. Burhi Gandak is the name given to Sikrana following the Dhanauti River's confluence close to Motihari. It's one of India's most winding rivers. Point bars, an oxbow lake, a natural levee, meander scars, and abandoned channels are all visible. It is distinguished by a tiny waterway enclosed in a large valley. The river basin of Burhi Gandak is prone to flooding on a regular basis. It passes through West Champaran, East Champaran, Mehsi, Muzaffarpur, Samastipur, and Khagaria before joining the Ganga River close to Gogri, having travelled roughly 400 kilometres in total (Singh *et al*., 2018). The Burhi Gandak basin is endowed with abundant fishery resources in addition to naturally occurring wetlands, such as land depressions and oxbow lakes (mauns and chaurs), which are essential to the region's survival. An area which got flooded during high discharge of river situated at the banks of the channels of rivers or streams that enclosed within valley walls are termed as floodplain (Goudie, 2004). These rivers tributaries form a land structure known as oxbow lakes; locally termed as maun and has immensely rich biodiversity, serve as a breeding and foraging grounds for fish species (Raut *et al*., 2020). About 70 species of fishes are recorded from the Burhi Gandak river (Raut

et al., 2020) and fishes like *Botia dario, Botia lohachata, Channa orientalis, Esomus danricus, Heteropneustes fossilis, Macrognathus pancalus, Nandus nandus, Ompok pabda, Pethia phutunio, P. ticto, Trichogaster fasciata* and *T. lalius* are considered as the potential ornamental and cultured species for the livelihood of the small-scale fishermen (Craig *et al*., 2004). *Trichogaster lalius* (Hamilton, 1822), is a dwarf gaurami having orange-coloured oblique stripes descends backwards and downwards from a back to the abdominal region and serve as an ornamental value amongst the eight native species of the genera (Sahu *et al*., 2018). The species is native to the Asian countries like India, Bangladesh and Pakistan (Awasthi *et al*., 2015; Jayaram, 1981). Organism growth is dependent on the length and biomass of the fish with age (Mendes *et al*., 2004). Le Cren, 1951 proposed a practical index for better apprehension of growth and maturity of fish, its survival, reproduction and well-beingness by framing a mathematical relationship between the length and weight of the fish. It turns out to be very important parameter for determining the biomass of the standing stock, age based-weight estimation, stock assessment and life history analysis among the same species of different regions (Pauly, 1993; Petrakis and Stergiou, 1995; Anderson and Neumann, 1996; Gayanilo and Pauly, 1997; Goncalves *et al*., 1997; Haimovici and Velasco, 2000; Moutopoulos and Stergiou, 2002; Santos *et al*., 2002). Whereas condition factor also serves as a pivotal part in estimating the fish growth in a particular habitat (Awasthi *et al*., 2015).

Although, several scientists have worked on the LWR of *Trichogaster lalius* (Sandhya *et al*. 2016; Sangma *et al*., 2019; Rahman *et al*., 2021; Mahapatra *et al*., 2019; Islam *et al*., 2016 & 2017; Awasthi *et al*., 2015; Borah *et al*., 2016; Hossain *et al*., 2015 and Baitha *et al*., 2017) but there is paucity of information of LWR on the fishes of Burhi Gandak river. Currently there is no information available of the LWR of *T.lalius* of Burhi Gandak river, Bihar. Hence, the present study aimed to provide the first published reference to estimate the LWR and condition factor of the *T.lalius*.

Materials and Methods

Study area

The present study was conducted on *T. lalius* at two sampling sites namely Burhi Gandak river and Manika maun of Bihar. Burhi Gandak river is a left bank tributary of the Ganga River and originates from Chautarwachaur near Bishambharpur in West Champaran district of Bihar. It covers a total length of 580 km. Manika maun is an oxbow lake, forms by a meandering of river Burhi Gandak. The sampling station was located on the stretch of Burhi Gandak river (25°59'48"N & 85°39'39"E) at Samastipur and Manika maun (26°5'36"N & 85°27'47"E) at Muzzaffarpur.

On field sampling

A total 278 specimens were collected from Manika maun (oxbow lake formed by Burhi Gandak river) and stretch of Burhi Gandak river by using different gears like gill net and box trap of different mesh size from June 2019 to May 2020 on fortnightly basis. Specimens was brought to laboratory and identified by following Talwar and Jhingran, (1991) and Jayaram, (1999). Total length and fish weight were measured using vernier calliper and digital weighing balance nearest to the 0.1cm and 0.01g respectively. the obtained data was log transformed and relationship were calculated by using cube law given by

Fig. 1: Satellite image showing location of sampling site 1 (Manika maun) and sampling site 2 (stretch of river Burhi Gandak).

Table 1: Descriptive statistics of LWR parameters of *Trichogaster lalius.*

Species	n	Total length (cm)		Total weight (g)		Parameters		95% CL of *a*	95% CL of *b*	r^2	K value
		Min	Max	Min	Max	*a*	*b*				
Trichogaster lalius (Hamilton,1822)	278	2.2	5.6	0.56	4.96	0.07	2.54	1.44-1.59	3.95-3.35	0.85	1.01

n-number of samples, *a*- intercept, *b*- slope, r^2- regression coefficient, K- condition factor, CL- confidence level

Le Cren (1951) *i.e.* $W= aL^b$. The equation was log transformed into Log W = Log a+b Log L where L is the total length of fish, W is weight of fish, intercept and slope of fish of regression equation is given by a and b. Regression coefficient were estimated to determine the linear regression equation quality. Outliers were selected and removed by following the Froese, (2006). The condition factor for estimating the wellness of the fish were estimated by using $K= W \times 100/L^3$, where K is the Fulton's condition factor. Statistical analyses were done using MS Excel 2013.

Results

The descriptive statistics of estimated parameters of LWR of *T. lalius* are showed in Table 1. Total length and weight ranges from 5.6cm to 2.2cm and 4.96g to 0.56g respectively. The relationship shows a straight line with the slope b and intercept a. The value of regression coefficient r^2, b and a along with their 95% confidence limits are given in Table 1.

Fig. 2 shows the graph plot of relation between log L and log W. The condition factor of *T. lalius* was estimated 1.01 (Table 1).

Discussion

The present study was conducted on 278 samples and the data were found highly significant ($p<0.01$) when subjected to ANNOVA on LWR. 85% of variations in weight in an association with variations in length were reported in pooled samples of *T. lalius* as depicted by correlation coefficient (r^2) (Table 1). The regression parameter *b* value was found to be consistent in range with the expected value suggested by (Froese, 2006). The evaluated *b* value for *T. lalius* was found comparatively lower to the *b* value reported by (Rahman *et al.*, 2021; Sangma *et al.*, 2019; Islam *et al.*, 2017; Sandhya *et al.*, 2016; Borah *et al.*, 2016; Hossain *et al.*, 2015; Baitha *et al.*, 2017) whereas found in consistent with the results of Awasthi *et al.*, (2015) in the samples of Ponds of Barabanki while in rivers it was higher. Such deviation in the *b* value may be due to ecological factors acted either singly or in amalgamation such as presence of forage organism in abundance in relation to fish (Serajuddin, 2005), number of specimens studied, habitat, gastro-somatic index, maturity of fish and sex (Froese, 2006), season (Srivastava *et al.*, 2003; Ricker, 1973; Hossain *et al.*, 2006). The value estimated in this study was found to be 2.54 for pooled samples and the values were accepted with both of the ranges either within 2.5-3.5 (Froese, 2006) and 2.0-4.0 (Hile, 1936; Martin, 1949; Begenal and Tesch, 1978). The study reveals $b < 3$ which indicates that the fish grows in negative allometric manner as it shared more energy to the length than weight that aids them to escape the predators and more food search (Liu *et al.*, 2016; Vicentin *et al.*, 2012). The "K" condition factor is an index to measure the physiological condition that depicts the wellness of the fish during its life cycle (Angelescu *et al.*, 1958). The fishes which show the K value higher than 1 are in healthy condition than those fishes that have lower than 1 (Nash *et al.*, 2006). The value of K was estimated to be 1.01 which indicates the

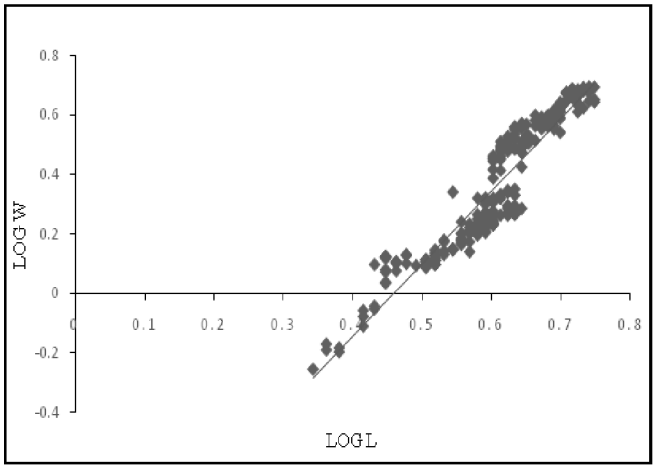

Fig. 2: Length-weight relationship of *Trichogaster lalius* of Burhi Gandak river.

Fig. 3: Freshly collected specimen of *T. lalius.*

stable health of the fish species that might be due to the pollution in river, environmental factors, stress, maturity stages that influenced the condition factor of fish (Lambert and Dutil, 1997; Zargar *et al*., 2012; Ahmad, 2013; Ali *et al*., 2014).

Conclusion

Considering the anthropogenic activities causing the risk to the ecosystems of rivers and wetlands; its sapping biodiversity due to the invasion, overfishing, pollution by nearby industries like sugar mill, impact of alien species and various reasons; its conservation and sustainable utilization of resources should be encouraged. In the present study are, majority of fishes have high ornamental value in the Indian market and caters to the food value in the state. This study provides the first attempt to the pivotal information of LWR of *T.lalius* from the Burhi Gandak that can be use in the development of management rules and regulations of the mauns as well as for river for the sustainable utilization and conservation of the ecosystem.

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Reference

Ahmad, F.M.Y. (2013). Length-weigh relationships, relative condition factor, and relative weight of Characidae fish in Jebel Aulia Dam, Sudan. *Int. J. Mar. Atmos. Earth Sci*., 1-7.

Anderson, R.O. and Neumann (1996). Length, weight, and associated structural indices. *Fisheries techniques*.

Angelescu, V., Gneri F.S. and Nani A. (1958). La del Mar Argentine hake (biology and taxonomy). *Hydrobiologia. Navada Publication*, **1004**, 1-224.

Awasthi, M., Kashyap A. and Serajuddin M. (2015). Length-weight relationship and condition factor of five sub-populations of *Trichogaster lalius* (Osphronemidae) of central and eastern regions of India. *Journal of Ichthyology*, **55**, 849-853.

Baitha, R., Sinha A., Koushlesh S.K., Chanu T.N., Kumari K., Gogoi P. and Das, B.K. (2018). Length weight relationship of ten indigenous freshwater fish species from Gandak River, Bihar, India. *Journal of Applied Ichthyology*, **34(1)**, 233-236.

Begenal, T. and Tesch F.W. (1978). Age and Growth. Method for assessment of fish production in freshwater. (ed. Bagenal T.), IBP Hand book.

Borah, S., Bhattacharjya B.K., Saud B.J., Yadav A.K., Debnath D., Yengkokpam S. and Sarma K.K. (2017). Length–weight relationship of six indigenous fish species from Deeporbeel, a Ramsar site in Assam, India. *Journal of Applied Ichthyology*, **33(3)**, 655-657.

Craig, J.F., Halls A.S., Barr J.J.F. and Bean C.W. (2004). The Bangladesh floodplain fisheries. *Fisheries Research*, **66(2-3)**, 271-286.

Froese, R. (2006). Cube law, condition factor and weight–length relationships: history, meta analysis and recommendations. *Journal of applied ichthyology*, **22(4)**, 241-253.

Gayanilo, F.C. and Pauly (1997). *FAO-ICLARM stock assessment tools: reference manual* (No. 8). Food & Agriculture Org.

Gonçalves, J.M.S., Bentes L., Lino P.G., Ribeiro J., Canário A. V. and Erzini K. (1997). Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. *Fisheries research*, **30(3)**, 253-256.

Goudie, A. (Ed.). (2004). *Encyclopedia of geomorphology* (Vol. 2). Psychology Press.

Haimovici, M. and Velasco G. (2000). Length-weight relationship of marine fishes from Southern Brazil. *Naga*, **23(1)**, 19-23.

Hile, R. (1938). Morphometry of the cisco, Leucichthys artedi (*Le Sueur*), in the lakes of the Northeastern Highlands, Wisconsin. *Internationale Revue der Gesamten Hydrobiologie and Hydrographie*, **36(1)**, 57-130.

Hossain, M.Y., Hossen M.A., Ahmed Z.F., Hossain M.A., Pramanik M.N.U., Nawer F. and Islam M.A. (2017). Length–weight relationships of 12 indigenous fish species in the Gajner Beel floodplain (NW Bangladesh). *Journal of Applied Ichthyology*, **33(4)**, 842-845.

Islam, M. A., Siddik M.A.B., Hanif M.A., Chaklader M.R., Nahar A. and Ilham I. (2017). Length–weight relationships of four small indigenous fish species from an inland artisanal fishery, Bangladesh. *Journal of Applied Ichthyology*, **33(4)**, 851-852.

Jayaram, K.C. (1981). Freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.

Jayaram, K.C. (1999). *The freshwater fishes of the Indian region*.

Lambert, Y. and Dutil J.D. (1997). Can simple condition indices be used to monitor and quantify seasonal changes in the energy reserves of cod (*Gadus morhua*). *Canadian Journal of Fisheries and Aquatic Sci.*, **54(S1)**, 104-112.

Liu, H.P., Ye, S.W. and Li, Z.J. (2016). Length–weight relationships of three schizothoracinae fish species from the Niyang River, a branch of the Yarlung Zangbo River, Tibet, China. *J. of Applied Ichthyology*, **32(5)**, 982-985.

Mahapatra, B.K., Pradhan A. and Kumar S. (2019). Length-weight relationship of three indigenous ornamental fishes from North Eastern hilly region, Assam, India.

Martin, W.R. (1949). The Mechanism of Environmental Control of Body m Fishes. *University of Toronto studies. Biological series*, **70**, 1-91.

Mendes, B., Fonseca P. and Campos A. (2004). Weight–length relationships for 46 fish species of the Portuguese west coast. *Journal of Applied Ichthyology*, **20(5)**, 355-361.

Moutopoulos, D.K. and Stergiou K.I. (2002). Length–weight and length–length relationships of fish species from the Aegean Sea (Greece). *Journal of Applied Ichthyology*, **18(3)**, 200-203.

Nash, R.D., Valencia A.H. and Geffen A.J. (2006). The origin of Fulton's condition factor—setting the record straight. *Fisheries*, **31(5)**, 236-238.

Pauly, D. (1993). Fishbyte section editorial. *Naga, the ICLARM quarterly*, **16(2-3)**, 26.

Petrakis, G. and Stergiou K.I. (1995). Weight-length relationships for 33 fish species in Greek waters. *Fisheries research*, **21(3-4)**, 465-469. Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and south-west coast of Portugal. *Fisheries research*, **30(3)**, 253-256.

Rahman, S. and Dutta A. (2021). Length-Weight Relationship and the condition factor of *Trichogaster lalius* (Hamilton, 1822), a freshwater fish· from Golaghat district of Assam.

Raut, S.M., Kumar M., Bhatt B.P., Singh J. and Kumar T. (2020). Potential and Opportunity for Or-namental Fishes in North Bihar. *Biotica Research Today*, **2(7)**, 677-679.

Ricker, W.E. (1973). Linear regressions in fishery research. *Journal of the fisheries board of Canada*, **30(3)**, 409-434.

Sahu, S., Sahu S. and Sahu P. (2018). A note on the biology of Dwarf Gourami, *Trichogaster lalius* (Hamilton, 1822). *International Journal of Fisheries and Aquatic Studies*, **6(5)**, 169-171.

Sandhya, K.M., Hassan M.A., Kumari S., Mishal P., Lianthuamluaia L., Kumar V. and Meena D.K. (2016). Length–weight relationships of four indigenous freshwater fish species from Khalsi wetland in lower Ganga basin, West Bengal, India. *Journal of Applied Ichthyology*, **32(3)**, 505-506.

Sangma, S.K., Bhattacharjee P. and Pal P. (2019). Length-weight relationship, Relative length of gut and Gastro-somatic index of *Chanda nama* (Hamilton, 1822) and *Trichogaster lalius* (Hamilton, 1822) from Tripura, India. *J. Entomol. Zool. Stud*, **7(3)**, 737-742.

Santos, M.N., Gaspar M.B., Vasconcelos P. and Monteiro C.C. (2002). Weight–length relationships for 50 selected fish species of the Algarve coast (southern Portugal). *Fisheries research*, **59(1-2)**, 289-295.

Serajuddin, M. (2005). Length-weight relationship of freshwater spiny eel, *Mastacembelus armatus* (Lacepede) from Aligarh region, Uttar Pradesh, India.

Singh, D.S., Tiwari A.K. and Gautam P.K. (2018). The Burhi Gandak: Moÿþst Sinuous River. *The Indian Rivers: Scientific and Socio-economic Aspects*, 209-219.

Srivastava, R.S. and Singh H.R. (2003). Length-weight relationship of *Puntius sophore* (*Ham*.) from Allahabad region. *Proceedings of the National Academy of, Sciences, India Section B: Biological Sciences*, **73**, 53-58.

Talwar, P.K. and Jhingran A.G. (1991). *Inland fishes of India and adjacent countries* (Vol. 2). CRC press.

Vicentin, W., dos S. Costa F.E. and Suarez Y.R. (2012). Length–weight relationships and length at first maturity for fish species in the upper Miranda River, southern Pantanal wetland, Brazil. *Journal of Applied Ichthyology*, **28(1)**, 143-145.

Zargar, U.R., Yousuf A.R., Mushtaq B. and Dilafroza J.A.N. (2012). Length-weight relationship of the crucian carp, Carassius carassius in relation to water quality, sex and season in some lentic water bodies of Kashmir Himalayas. *Turkish Journal of Fisheries and Aquatic Sciences*, **12(3)**.