Original Research Article

Length- weight relationships of four indigenous freshwater fishes of longshen stream, Indo -Myanmar borderline of North-East of India

ABSTRACT

Length-weight relationships (LWR) are reported for four indigenous fish species of longshen stream, Indo-Myanmar boundary line North-Eastern of Indian region, for the period of June 2020 to September 2022. Specimen species were collected during different exploratory surveys, using through traditional bamboo made fishing gears. The b value for LWRs varied from 2.09(*Bariliusvagra)* to 2.63(*Garralissorhynchus*). R^2 values varied from 0.85 to 0.95, indicating unique values. The results providing baseline information for the need of sustainable ecological as well as economical management and conservation of indigenous fish species in Indo-Myanmar borderlines.

Keywords: L-W relationship, Indigenous fish, Langshen stream, Indo-Myanmar, Northeast India

INTRODUCTION

The Myanmar international borderlines are sharing with four Indian states, those are Nagaland, Manipur, Arunachal Pradesh and Mizoram. These North-Eastern states are totally engulfed with high altitude hill ranges with dense forest cover where fish capturing, culturing and conservation is very difficult. Present investigations were conducted in the streams of Nagaland nearby longwa boundary line village of Indo-Myanmar. Length-weight relationships (LWRs) of the fishes are important tools in the fisheries science and can be effectively used for estimation of body weight based on the body length and furthermore for the assessment of growth patterns (Masram et al 2022; Mahadevan et al 2017; Sani et al 2010). Despite of extensive use of LWRs in fishery science, the gap in the data about LWRs of plain area fish species and hilly region fish species is astonishing. The streams originated North - Eastern India not only supports number of globally threatened and endemic freshwater fish species but also ensures the food and nutritional security of the local community (Viswanath 2017). There are many length-weight relationship studies conducted in different rivers around the world (Abowei et al. 2009) conducted study of the length-

weight relationship and condition factor of five fish species from Nkoro River, Niger Delta, Nigeria (Ahmed et al 2011) investigated similar study like Length-weight relationships and condition factors of six fish species in Atbara River and Khashmel-girba Reservoir, Sudan; (Naderi et al 2013) studied Length-weight relationships for five stingray species from the Persian Gulf. (Lim et al 2014) investigated Length-weight relationship of stingrays in Kuala Selangor, Malaysia. (Teixeira et al 2017) investigated on Length-weight relationships for four stingray species from the tropical Atlantic Ocean. (Reis et al 2019) examined Length-weight relationship of 13 fish species from the Lower Sakarya River of Turkey. However, no data are available on the LWRs of the species inhabiting in boundary line streams. Therefore, present investigation estimates the LWRs of four species of *Garralissorhynchus* (McClelland, 1842); *Opsariusbarna* (Hamilton, 1822); *Bariliusvagra* (Hamilton, 1822) and *Tor tor* (Hamilton, 1822) which have economic and conservation importance and focused on elucidating the length-weight relationship for traditional catch of small indigenous fish species having no or limited information.

MATERIALS AND METHODS

Specimens were collected by local tribal people for their livelihood purpose only and they didn't cross any ethical procedures and harm to stream and diversity. With the exception of an abrupt weather changes, the pre- and post-monsoon periods of June 2020 to September 2022 were the particular times for fish capture. The water flow is stable and fairly tranquil throughout these periods, making them ideal for fish capture from stream habitats.Fish species collected different sampling points of longshen stream (26.6730°N; 95.07154°E), (26.6726°N; 95.0703°E), (26.6732°N 95.0733°E) and (26.6728°N 95.0777°E) located nearby longwa village, Mon district, Nagaland, India. All the fish specimens used in present study were captured by the local fishermen from different parts and depths of the stream. The water depth usually varied average 20 to 40 cm. Fish species captured using by traditional bamboo gears those are

Basket bamboo trap

It resembles a fishing trap and is made entirely of bamboo. Bamboo pieces are cut into very thin sticks and tied together with nylon thread to form a fishing trap with a basket-like design. Fish can enter the apparatus through a hole at the front. 80-120 cm in length and 20 cm in width. These are used in moving, shallow water. Fish cannot escape the trap once they have entered it. Because it is placed horizontally on the bottom, this equipment successfully

catches the majority of little fish. This equipment is frequently used in the North East of India.

Bamboo chopper

It is a fishing device resembling a trap made of completely sliced bamboo. Fish can enter it through an opening at one end. Approximately 80 centimetres in length. The width is 30 cm. While its installation is in a shallower area than that of a basket bamboo trap, its mode of operation is identical. Small local fish are caught with the trap.

Polo

Bamboo has been chopped to make it. The absence of the neck region in comparison to other bamboo gears is the only distinction. With this equipment, small to medium-sized fish are captured. The method of catching catfish from a body of water's muddy bottom is unusual.

Jhuri

Bamboo and net are also components of it. A bamboo is split in half, with one half bent and the other half attached with a net. It is typically employed to catch local tiny fish and prawns. The length is 25 cm, and the radius is roughly 40 cm. This equipment is used by people to capture fish from rivulets with shallow water. The catch includes prawns and small fish.

Pouli

Its structure is comparable to Polo. However, in this instance, the bamboo splits separate and go straight to the ground. No convolution or neck. Small native fish will be captured in slow-moving streams.

very rarely through electro fishing depending on the station. Fishes were preserved in 7% formalin. Standard length (SL) and total length (TL) was measured for each specimen to the nearest 0.1 mm using a digital caliper. Weight (W) was determined to the closest 0.01 g using digital weighing balance. LWR parameters were estimated according to the equation given by (Froese 2006): $W = a\ SL^b$ Where, W is the body weight (g), SL is the standard length (cm), "*a*" is the intercept and "*b*" is the slope of log transformed linear regression. The coefficient of determination ($r2$) was estimated as the goodness of fit.

RESULTS AND DISSCUSION

The current investigation included 32 specimens of *G. lissorhynchus*, with minimum lengths of 5.9 cm and maximum lengths of 8.8, minimum weights of 9 g and maximum weights of 17 g, 27 specimens of *O. barna*, with minimum lengths of 6.4 cm and maximum length 8.2 cm, minimum weights of 9 g and maximum weights of 15 g, and 22 specimens of *B. vagra*minimum lengths of 6.7 cm and maximum length 7.9, minimum weights of 10 g and maximum weights of 17 g, 30 number specimens of *T. tor* with minimum length 6.5 cm and maximum length 8.2 and minimum weight 12 gm and maximum weight 20 gm were investigated. sampling information data, descriptive statistics of length and weight, and the parameters of descriptive statistics of the sample sizes (*n*), maximum and minimum value for SL, TL and W for each species, estimates of the LWRs parameters are presented in Table 1. The *b* value ranged from 2.09 (*Bariliusvagra*) to 2.63 (*Garralissorhynchus*). *R*2 values varied from 0.85 to 0.95, indicating a unique degree of positive relationship between length according to earlier studies based on fish base.

The small native fish species *G. lissorhynchus, O. barna, B. vagra,* and *T. tor* were the subject of the current length and weight association investigation. All except*T. tor* were small fish species. Therefore, there is no opportunity to address different size groups of fish in these current experiments, including *T. tor,* for which we only have nominal size data. The minimum and maximum lengths of *G. lissorhynchus* were 5.9 cm and 8.8, those of *O. barna* were 6.4 cm and 8.2, and those of *B. vagra* were 6.7 cm to 7.9 cm for 22 individuals. A total of 30 *T. tor* specimens, ranging in size from 6.5 cm to 8.2 cm, were examined. All of these fish are adults and mature, but their growth and maturity stages are due to the terrain they inhabit, as well as ecological and stream flow conditions. Eventually, all of these fish modified themselves to survive in the hill streamenvironment. In general, ideal fish value of *b* usually remains constant at 3.0 (Froese, 2006). However, (Beverton and Holt 1957) suggested that the parting of the *b* value from three is sporadic in adult fishes. Present study of four species showed noteworthy aberrations from the ideal value and incorporated a comparative table (Table 2) of four other researchers b values for easy understanding the range. Such variation in the *b* value could be attributed due to variant factors such as length range used, sampling site, season, stomach fullness, gonadal maturity, diet, sampling gear, mesh size, frequency of sampling, fishing and it was also proved in similar studies of (Piseet al 2018)

Moreover because of pressure, presence or absence of disease and parasite (Franklin et al 2009; Ogunola et al 2018). However, these factors were not considered in present study and thus the observed variations in LWRs parameters could be due to the effect of a single factor or synergistic effect of multiple factors. Additionally, due to small size range species. We are

unable to comment on the allometry of the species. Long-term studies are required to integrate inter-annual variability must be effectively covered to allow such estimates. Nevertheless, the value of the parameter *b* for all species from longshen stream is within the expected range of 2.5–3.5 (Froese, 2006). The coefficient of determination (*r*2) ranged from 0.85–0.95. According to (Hanif et al 2017) and fish with ideal growth shows the coefficient of determination (*r*2) between 0.90 and <1. The *r*2 value in the present study was found to be less than 0.90 for one species and all others in minimal range. So, the results indicate the proper fitness of the model for growth and good health status of the study species. We aimed to provide data in order to contribute to studies aiming at population dynamics.

The conclusions of these very first investigations in this Indo-Myanmar biodiversity hotspot area are helpful for future research on fisheries management, fish population dynamics, and conservation, as well as comparisons with earlier studies. Therefore, more frequent studies require immediate attention.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are completely incorporated in this manuscript.

REFERENCES

Abowei J F N, Davies O A, and Eli AA (2009). Study of the length-weight relationship and condition factor of five fish species from Nkoro River, Niger Delta, Nigeria. *Current Research Journal of Biological Sciences*, 1(3), 94-98.

Ahmed E O, Ali M E, and Aziz AA (2011). Length-weight relationships and condition factors of six fish species in Atbara River and Khashmel-girba Reservoir, Sudan. *International Journal of Agriculture Sciences,* 3(1), 65-70.

Beverton R J H and Holt S J (1957). On the dynamics of exploited fish population. *Fisheries Investigations, 11*, 1–533. https://doi.org/10.1007/978-94-011-2106-4_2

Franklin E C, Brong C V, Dow A R and Craig M T (2009). Length–weight and length–length relationships of three endemic butterflyfish species (Chaetodontidae) from coral reefs of the Northwestern Hawaiian Islands, USA. *Journal of Applied Ichthyology*, *25*, 616–617. https://doi.org/10.1111/j.1439-0426.2009.01281.x

Froese R (2006). Cube law, condition factor and weight–length relationships: History, meta-analysis and recommendations. *Journal of Applied Ichthyology*, *22*, 241–253. https://doi. org/10.1111/j.14390426.2006. 00805.x

Masram V, Singh P, Datta S N and Tewari G (2022). Length weight relationship and condition factor of Labeorohita (ham.) collected from domesticated and riverine habitats. Indian Journal of Ecology, 49(3), 869-872

Hanif M A, Siddik M A B, Chaklader M R, Pham H D & and Kleindienst R (2017). Length–weight relationships of three catfish species from a tributary of the Dhaleshwari River, Bangladesh. *Journal of AppliedIchthyology*, *33*, 1261–1262. https://doi.org/10.1111/jai.13448

Lim K C, Chong V C, Lim P E andYurimoto T (2014). Length-weight relationship of stingrays in Kuala Selangor, Malaysia. *Journal of Applied Ichthyology*, 30, 1096–1098.

Mahadevan G, Ravi V and Murugesan P (2017). Length-weight relationship of two mudskippers (Gobiidae: Oxudercinae) *Oxudercesdentatus* (Eydoux&Souleyet, 1850) and *Scartelaoshistophorus*(Valenciennes, 1837) from Dhamara estuary, Odhisa, India. *Journal of AppliedIchthyology*, *33*, 1258–1260. https://doi.org/10.1111/jai.13455

Naderi M, Zare P andAzvar E (2013). Length-weight relationships for five stingray species from the Persian Gulf. *Journal of Applied Ichthyology*, 29, 1177–1178.

Ogunola O S, Onada O A and Falaye A E (2018). Preliminary evaluation of some aspects of the ecology (growth pattern, condition factor and reproductive biology) of African pike, *Hepsetusodoe*(Bloch 1794), in Lake Eleiyele, Ibadan, Nigeria. *Fisheries and Aquatic Sciences*, *21*, 12. https://doi.org/10.1186/s41240-018-0087-y

Pise M, Gorule PA, Kharat S Length-weight relationships of four freshwater fishes from northern Western Ghats of India. *J Appl Ichthyol*. 2018; 34:1394–1396. https://doi.org/10.1111/jai.13820

Reis I, Cerim H and Ates C (2019). Length-weight relationship of 13 fish species from the Lower Sakarya River, Turkey. *Aquatic Sciences and Engineering*, 34(3), 86-89. https://doi.org/10.26650/ASE2019566636

Sani R, Gupta B K, Sarkar U K, Pandey A, Dubey V K, and Singh Lakra W (2010). Length–weight relationships of 14 Indian freshwater fish species from the Betwa (Yamuna River tributary) and Gomti (Ganga River tributary) rivers. *Journal of Applied Ichthyology*, 26(3), 456-459.

Teixeira E C, Silva V E L, Fabré N N and Batista V S (2017), Length–weight relationships for four stingray species from the tropical Atlantic Ocean. *Journal of Applied Ichthyology*, 00: 1–3. doi: 10.1111/jai.13255.

Vishwanath W (2017) Diversity and conservation status of freshwater fishes of the major rivers of northeast India, *Aquatic Ecosystem Health & Management*, 20:1-2, 86-101 http://dx.doi.org/10.1080/14634988.2017.1294947

Table: 1 Descriptive statistic, estimated parameters of LWRs ($W = a \times L^b$) for four species from Longshen stream of Indo-Myanmar hotspot of Northeast India sampled using traditional fishing gears during June 2020 to September 2022

Species	Sample size n	Total Length (cm)		Total weight (g)		Regression Parameters				
		Min	Max	Min	Max	A	b	R^2	95% CI a	95% CI b
Garralissorhynchus	32	5.90	8.80	9.00	17.00	0.51	2.63	0.95	0.341-0.771	2.25-3.01
Opsariusbarna	27	6.40	8.20	9.00	15.00	0.12	2.54	0.91	0.0113 - 0.224	2.21 - 2.86
Bariliusvagra	22	6.70	7.90	10.00	17.00	0.22	2.09	0.85	0.0065-0.711	1.48-2.69
Tor tor	30	6.50	8.20	12.00	20.00	0.25	2.10	0.93	0.161- 0.388	1.88 - 2.32

Table: 2 A comparative table of b values from different studies indicating the nominal range of b values

Source of the comparison	b values				
Teixeira et al. 2017	3.01	3.07	3.15	3.02	
Naderi et al, 2013	2.92	2.92	3.08	3.03	2.92
Lim et al, 2014))	3.37	3.39	3.34		
Present study	2.63	2.54	2.09	2.10	

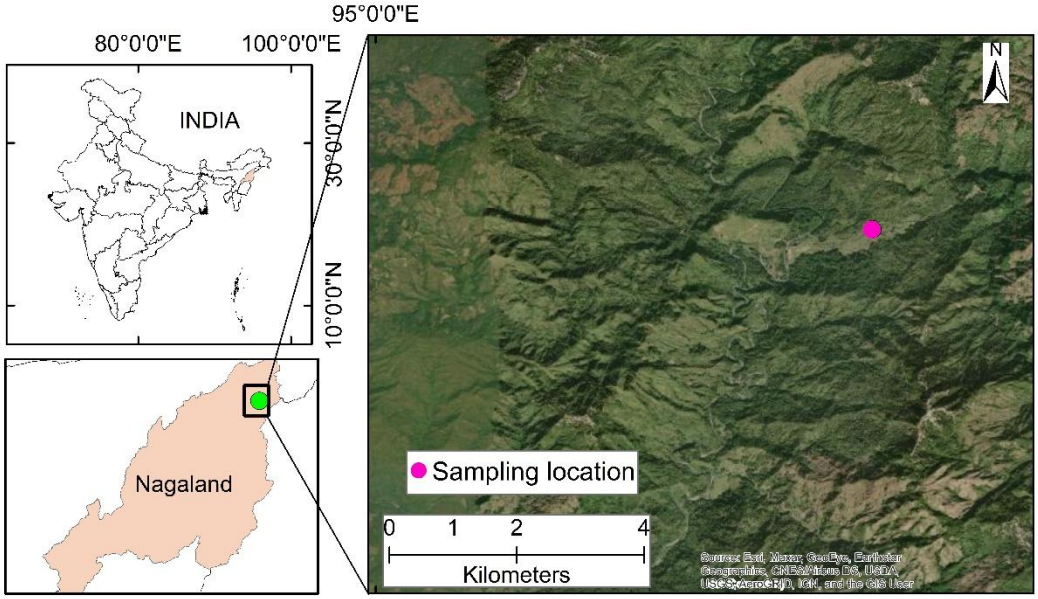

Fig 1. One of the sampling location Map.