

MORPHOMETRIC DIMENSIONS OF THREE *LEPIDOCEPHALICHTHYS* FISH SPECIES FROM ARUNACHAL PRADESH, INDIA

Ram Kumar¹, Santoshkumar Abujam^{1*}, Bari Dabi², Vivekanand Safi and D. N. Das¹

¹Department of Zoology, Rajiv Gandhi University, Rono Hills, Doimukh, India.

²Department of Zoology, D. N. Govt. College, Itanagar, India.

³Krishi Vigyan Kendra, Karsingsa, Papum Pare, India.

*e-mail: santosh.abujam@gmail.com

(Accepted 31 October 2018)

ABSTRACT : The morphometric of three species of *Lepidocephalichthys* i.e. *Lepidocephalichthys guntea*, *Lepidocephalichthys arunachalensis* and *Lepidocephalichthys annandalei* had been carried out from the three rivers of Arunachal Pradesh. Seven-morphometric parameter was used i.e. body weight, total length, standard length, dorsal fin height, caudal fin length, head length and body depth. Among the three species, certain morphometric parameters was found to be highest in *L. arunachalensis* with body weight 3.42gm, total length 78.11mm, standard length 67.74mm, head length 10.66mm while, certain parameters was recorded as highest in *L. guntea* with dorsal fin height 10.46mm, caudal fin length 12.38mm, and body depth 9.95mm. The lowest body parameters were recorded in *L. annandalei*. The correlation analysis among the parameters of *L. guntea* was found positive significant at 0.01 level; in *L. arunachalensis* certain parameters found positive significant at 0.01 and certain parameters at 0.05 level; in *L. annandalei* certain parameters was found positive and negative significant at 0.01 and 0.05 level. The value of regression coefficient (b) for *L. guntea*, *L. arunachalensis* and *L. annandalei* was 2.87, 3.13 and 2.42 respectively. It reveals that *L. arunachalensis* have slight better growth than other two species. However, all the species signify allometric growth pattern and didn't follow the cube law. The coefficient of correlation (r) showed more or less similar trend in *L. guntea* (r = 0.866), *L. arunachalensis* (r = 0.941) and *L. annandalei* (r = 0.816). It indicates that there was a good correlation between length and weight of all the fish.

Key words : Morphometric, *Lepidocephalichthys*, Arunachal Pradesh.

INTRODUCTION

The species of *Lepidocephalichthys* is found in the rivers and streams of Arunachal Pradesh. They are *Lepidocephalichthys guntea* (Hamilton, 1822), *Lepidocephalichthys arunachalensis* (Datta and Barman, 1984) and *Lepidocephalichthys annandalai* (Chaudhuri, 1912). They are commonly known as *Remum-poda* (in Nyishi and Galo tribes), *Ribii* (in Adi tribes) and *Bali Botia* in Assamese. Generally, they are one of the most delicious food fish as well as ornamental value. It is widely distributed in all over India, Pakistan and, Nepal, Bangladesh and also records from Thailand & Myanmar (Havird and Page, 2010). They are bottom dwelling fish and found in fresh water (12°C to 30°C), foot hill river, swamps and flooded fields where they probably feed mainly on benthic vertebrates. Habitat of the fish species is muddy localities and bottom feeder, and partially buried under sand or mud. The mouth of the species is sub-

terminal and they feed predominantly small crustaceans, algae and vegetable debris.

Loaches of the genus *Lepidocephalichthys* are belongs to the cobitidae family, the body is elongated with a laterally compressed. The colour of fish is charcoal light brown and small dark spot on the body. Their body is very slippery because the presence of slime secreted by the skin and covered with numerous microscopic scales. The fish species are of great potential in ornamental trade. Identification of these species is more controversial because of its great similarity. There is so many overlapping of meristic character in young stage. So far, no work has been done on the morphometric dimensions of *Lepidocephalichthys* species from the state of Arunachal Pradesh. However, Kumar *et al* (2017) partially studied the length-weight relationship of *Lepidocephalichthys guntea* from the Dikrong River, Arunachal Pradesh. With this milieu, the present research

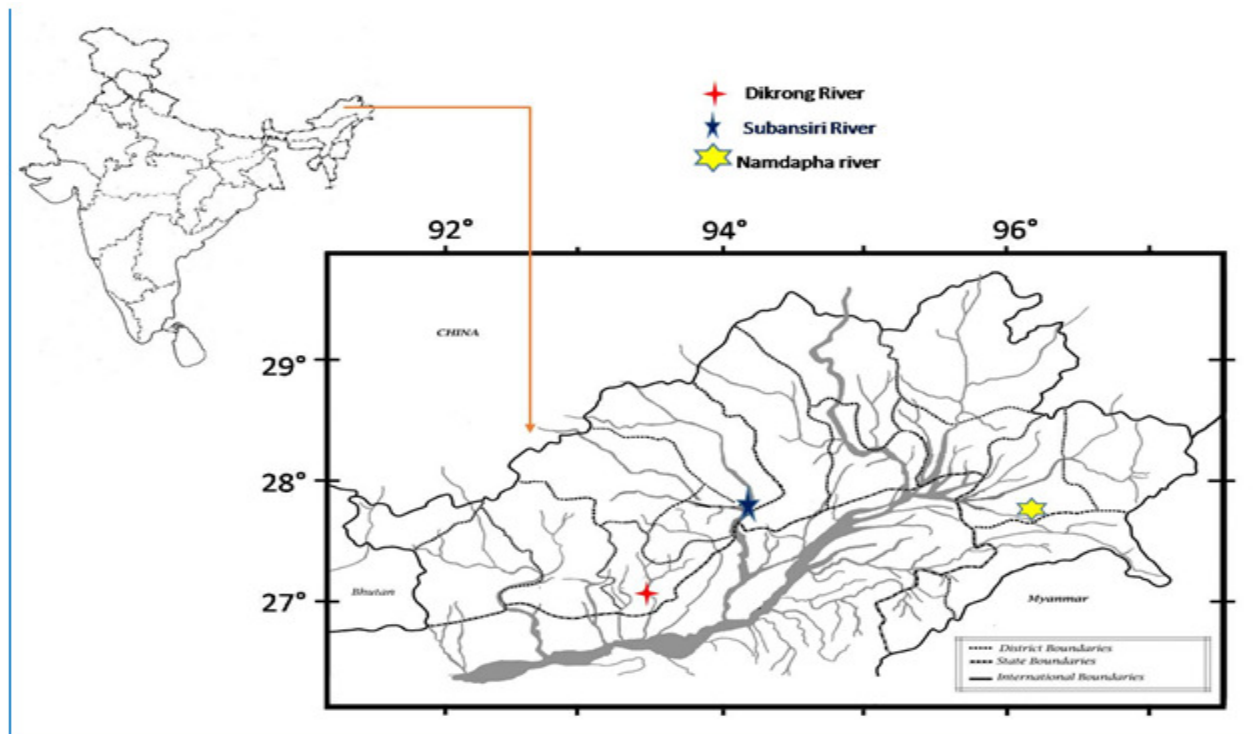


Fig. 1 : Study areas of sampling sites (three rivers), in Arunachal Pradesh.

aims to study the morphometric dimensions of *Lepidocephalichthys* species from the Namdapha, Subansiri and Dikrong rivers, Arunachal Pradesh, India.

MATERIALS AND METHODS

Lepidocephalichthys sp. was collected from the Namdapha River, Subansiri river and Dikrong river of Aunachal Pradesh during 2017 (Figs. 1 & 2). The target species were also collected from hill streams and foot hills of the Arunachal Pradesh by using mainly cast net and local traps. The identification and segregation of separate species were done based on colour pattern, dark spot variability on caudal peduncle, shape of caudal fin and lamina circularis of pectoral fin (Vishwanath *et al.*, 2007; Havird and Page, 2010).

Morphometric measurement

The morphometric measurement used were total length (TL), standard length (SL), body weight (BW), dorsal fin height (DH), caudal fin length (CL), head length (HL) and body depth (BD). The body weight (BW) was measured in gram (g) using weighing machine (name). Total length (TL) was taken from tip of snout to end of caudal fin. The standard length (SL) was taken from tip of mouth to base of caudal fin (coincided to distal tip of hypural plates). The Dorsal fin height (DL) was taken from the origin of dorsal fin to the highest point of the fin. The caudal fin length (CL) was taken from base of the origin to end of the fin. The Head length (HL) was taken from tip of the mouth to end of the occiput while



Fig. 2 : *Lepidocephalichthys* species: (a) *L. guntea* (b) *L. arunachalensis* & (c) *L. annandalei*.

body depth (BD) was taken from the origin of dorsal fin base to the ventral side.

The parameters of the length–weight relationship $W=aL^b$ were estimated by linear regression of the log-transformed weight and length (LeCren, 1951). The equation was transformed into a logarithmic and expressed as: $\text{Log } W = \text{Log } a + b \text{ Log } L$; where ‘a’ is a constant being initial growth and ‘b’ is the growth coefficient.

Data analysis

The descriptive statistical analysis and correlation

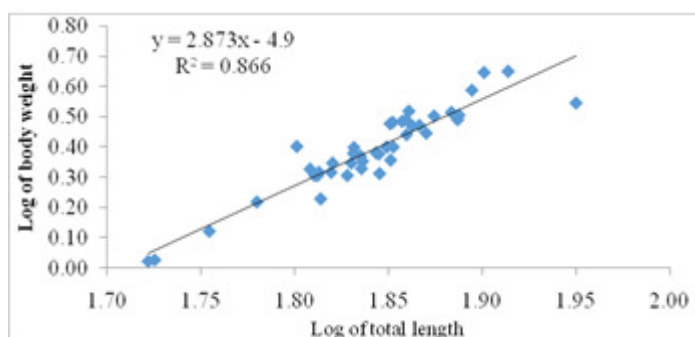


Fig. 3 :Log of length-weight relationship of *Lepidocephalichthys guntea*.

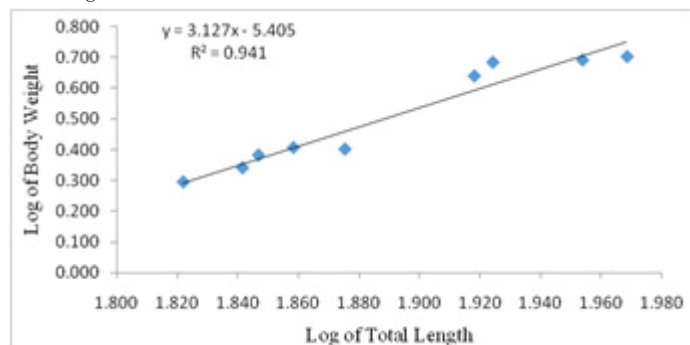


Fig. 4 :Log of length-weight relationship of *Lepidocephalichthys arunachalensis*.

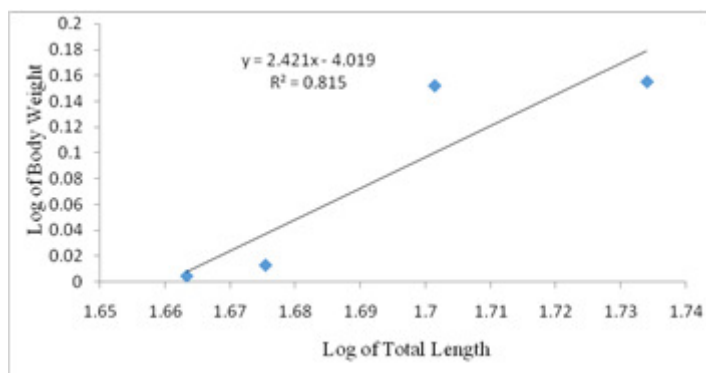


Fig. 5 :Log of length-weight relationship of *Lepidocephalichthys annandalei*.

Table 1 : Morphometric of *Lepidocephalichthys* species.

Parameters (Unit)	Mean ±		
	<i>L. guntea</i>	<i>L. arunachalensis</i>	<i>L. annandalei</i>
BW (gm)	2.62 ± 0.73	3.42 ± 1.32	1.22 ± 0.23
TL (mm)	70.23 ± 6.59	78.12 ± 9.59	49.47 ± 3.61
SL (mm)	57.62 ± 5.54	67.74 ± 8.44	40.60 ± 3.11
DH (mm)	10.46 ± 0.90	8.81 ± 1.87	7.11 ± 0.13
CL (mm)	12.38 ± 1.06	11.44 ± 1.00	7.91 ± 1.06
HL (mm)	10.35 ± 0.69	10.66 ± 1.05	8.40 ± 1.07
BD (mm)	9.95 ± 1.24	9.85 ± 1.49	7.50 ± 0.71

between the parameters were obtained from the IBM SPSS version 20. Length-weight relationship were transformed into log of base 10 to normalized and stabilize the variance and using Microsoft excel 10 for regression and plotting graph, similarly using them to determined R^2 .

RESULTS

The morphometric measurement of *L. guntea* specify that mean of body weight was 2.62mg, total length 70.23mm, standard length was 57.62 mm and head length was 10.35mm (Table 1). The correlation analysis among the parameters found to be positively significant at 0.01 level (Table 2). Body weight was positively significant with total length (0.898), standard length (0.895), dorsal fin height (0.838), caudal fin length (0.751), head length (0.805) and body depth (0.909). Total length was positively significant with standard length (0.930), dorsal fin height (0.778), caudal fin length (0.811), head length (0.774) and body depth (0.836). Standard length was positively significant with dorsal fin height (0.793), caudal fin length (0.837), head length (0.796) and body depth (0.795). Dorsal fin height was positively significant with caudal fin length (0.700), head length (0.685) and body depth (0.733). Caudal fin length was positively significant with head length (0.743) and body depth (0.691). Head length was also positively significant with body depth (0.7). The log weight-length relationship of *L. guntea* showed allometric growth ($b=2.873$) and strong relationship between the body weight and total length of the fish with R^2 value of 0.8661.

The morphometric measurement of *L. arunachalensis* revealed the average body weight was 3.42 gm, total length was 78.12 mm, standard length was 67.74 mm and the head length was 10.66 mm (Table 1). The correlation analysis among the parameters was found to be positively significant and also simply correlated (Table 3). Body weight was positively significant with total length (0.967), standard length (0.963), head length (0.917) and body depth (0.852) at 0.01 level; dorsal fin height (0.757) and caudal fin length (0.767) at 0.051 level. Total length was positively significant with standard length (0.992), head length (0.980), body depth (0.863) at 0.01 level; dorsal fin height (0.732) and caudal fin length (0.720) at 0.05 level, Standard length was positively significant with head length (0.983), body depth (0.833) at 0.01 level; dorsal fin height (0.715) and caudal fin length (0.695) at 0.05 level. Dorsal fin height was positively significant with caudal fin length (0.762), head length (0.667) at 0.05 level and simply correlated with body depth (0.522). Caudal fin length was positively significant with head length (0.679) at 0.05 level and simply positive correlated with body depth (0.419). Head length was also positively significant with body depth (0.790) at 0.05 level. The

Table 2 : Correlation analysis of morphometric measurements of *L. guntea*.

Parameters	BW	TL	SL	DH	CL	HL	BD
BW	1						
TL	0.898**	1					
SL	0.895**	0.930**	1				
DH	0.838**	0.778**	0.793**	1			
CL	0.751**	0.811**	0.837**	0.700**	1		
HL	0.805**	0.774**	0.796**	0.685**	0.743**	1	
BD	0.909**	0.836**	0.795**	0.733**	0.691**	0.755**	1

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 : Correlation analysis of morphometric measurements of *L. arunachalensis*.

Parameters	BW	TL	SL	DH	CL	HL	BD
BW	1						
TL	0.967**	1					
SL	0.963**	0.992**	1				
DH	0.757*	0.732*	0.715*	1			
CL	0.767*	0.720*	0.695*	0.762*	1		
HL	0.917**	0.980**	0.983**	0.667*	0.679*	1	
BD	0.852**	0.863**	0.833**	0.522	0.419	0.790*	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 4 : Correlation analysis of morphometric measurements of *L. annandalei*.

Parameters	BW	TL	SL	DH	CL	HL	BD
BW	1						
TL	0.896	1					
SL	0.852	0.994**	1				
DH	-0.995**	-0.874	-0.832	1			
CL	0.789	0.960*	0.954*	-0.741	1		
HL	0.615	0.203	0.112	-0.639	0.054	1	
BD	0.991**	0.857	0.801	-0.979*	0.768	0.673	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

log weight-length relationship of *L. arunachalensis* indicates allometric growth ($b=3.13$) and strong relationship between body weight and total length of the fish and the result of R^2 value is 0.9413.

The morphometric measurement of *Lepidocephalichthys annandalei* revealed the mean body weight was 1.225 gm, total length was 49.48mm, standard length was 40.61mm and head length was 8.4 mm (Table 1). The correlation analysis among the parameters was found to be positively significant at 0.01 and at 0.05 level and also simply correlated (Table 4). Body weight was positively correlated with total length (0.896), standard length (0.852), caudal fin length (0.789), head length (0.615) while negative significant with dorsal fin height (0.995) and positive significant with body depth (0.991) at 0.01 level. Total length was positively significant with standard length (0.994) at 0.01 level and caudal fin length (0.960) at 0.05 level; negative correlated with dorsal fin height (-0.874), positive correlated with head length

(0.203) and body depth (0.857). Standard length was negative correlated with dorsal fin height (-0.832); positively significant with caudal fin length (0.954) at 0.05 level; simply positive correlated with head length (0.112) and body depth (0.801). Dorsal fin height was negative correlated with caudal fin length (-0.741), head length (-0.639) and negative significant with body depth (0.979) at 0.05 level. Caudal fin length was positively correlated with head length (0.054) and body depth (0.768). Head length was also simply positively correlated with body depth (0.673). The log length-weight relationship of *L. annandalei* showed the allometric growth ($b=2.42$) and strong relationship between body weight and total length with R^2 value of 0.8159.

DISCUSSION

L. guntea was small, moderately elongated, slightly compressed anteriorly and much posteriorly. Dorsal and ventral body almost parallel, caudal fin rounded, a light band extends from snout to the base of caudal fin which

is flanked by a series of dark blotches running below and above the band. A black ocellus exists on the upper half of caudal fin base. Dorsal fin originated slightly behind to the corresponding position of pelvic fin origin. Body colour variable and ranges from ground to dirty yellowish. *L. Arunachalensis* possessed rounded or truncated caudal fin; side with 12–14 large, dark spots; dorsal-fin origin conspicuously posterior to pelvic-fin origin; caudal fin with numerous dark reticulations. *L. annandalei* was small body, elongated, sub-cylindrical, snout pointed and mouth inferior with 3 pairs of barbels. Body more compressed posterior than the anterior. Scales minute and anterior nostril surrounded by a flap. Body colour light brownish and 9-10 irregular brown blotches along lateral line. Head and snout stripped with black spots. Caudal fin consist of two distinct black spots, one at upper base of fin and one at centre of posterior edge of fin.

The measurement of three species of the cobitidae family was found to be varied in their morphometric parameters. In overall, the mean values of the morphometric parameter of *L. arunachalensis*, was highest in comparison of the other two species *L. guntea* and *L. annandalei* while, the lowest mean values of body parameters was recorded in *L. annandalei*. The present findings was similar with the observations made by Havird and Page (2010) and Arunkumar (2002) where the average values of all morphometry was higher in *L. Arunachalensis*. The variation of the morphometric data was probably due to genetic makeup and the environmental variables in the study area and may impact negatively on the fish species. Moreover, dissimilarity of the species is due to diverse ecosystem localities with their different environment potentials.

In overall, the correlation was found to be positively significant among the morphometric parameters of *L. guntea* and *L. arunachalensis*. But in *L. annandalei*, it was negatively significant in certain parameters. It may be attributed to hidden factors that a conclusive against the growth response pattern of the fish in river. The growth co-efficient showed the allometric growth and didn't follow the cube law ($b=3$) in all three fish species (Figs. 3-5). The present study also showed the strong relationship in length and weight in all three species. The similar result in b value was also observed in *L. goalparensis* (Das and Bordoloi, 2014) and in *L. guntea* (Kumar *et al*, 2017). In other freshwater fishes, the allometric growth was also reported by various workers (Froese, 2006; Abujam and Biswas, 2014; Abujam and Biswas, 2016; Dakua *et al*, 2016).

ACKNOWLEDGEMENTS

The first (RK), second (SKA) and fifth (DND) authors are thankful to Department of Biotechnology, New

Delhi, Govt. of India for financial help through DBT Project No. BT/382/ NE/TBP/2012 to carry out the work at the Department of Zoology, Rajiv Gandhi University, Rono Hill, Arunachal Pradesh, India. The first (RK) author also acknowledged to the authority of Rajiv Gandhi University for fellowship. Third (BD), fourth (SM) and fifth (VS) authors are thankful to the Department of Zoology, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh for providing necessary research facilities.

REFERENCES

- Abujam S K S and Biswas S P (2014) Length-weight relationship and condition factor of spiny eel *Macrogathus aral* from upper Assam, India. *Int. J. Curr. Life Sci.* **4**(3), 605-611.
- Abujam S K S and Biswas S P (2016) Length-weight relationship of spiny eel *Macrogathus pancalus* (Hamilton-Buchanan) from upper Assam, India. *J. Aqua. Engin. Fish. Res.* **2**(2), 50-60. doi: <https://doi.org/10.3153/JAEFR16007>.
- Arunkumar L (2000) Loaches of the genus *Lepidocephalichthys* (*Lepidocephalus*) from Manipur, with description of a new species. *J. Fish Biol.* **57**(5), 1093- 1104.
- Datta A K and Barman R P (1984) On a new species of *Noemacheilus* (Pisces: Cobitidae) from Arunachal Pradesh, India. *Bull. Zool. Survey of India* **6**, 275–277.
- Dakua S, Abujam S K, Islam M and Basumatary N (2016) Length-weight relationship and condition factor of *Parluciosoma daniconius* (Hamilton) from the upper Assam, India. *J. Fisheries Sciences.com* **10**(1), 53-56.
- Das M K and Bordoloi S (2014) Length–weight relationship and condition factor of *Lepidocephalichthys goalparensis* Pillai and Yazdani, 1976 in Assam, India. *J. Appl. Ichthyol.* **30**, 246-247.
- Chaudhuri B L (1912) Descriptions of some new species of freshwater fishes from north India. *Rec. Indian Mus. (Calcutta)* **7**(5), 437–444.
- Froese R (2006) Cube law, condition factor and weight–length relationships: history, meta-analysis and recommendations. *J. Applied Ichthyol.* **22**, 241–253.
- Hamilton F (1822) An account of the fishes found in the river Ganges and its branches. Edinburgh & London.
- Havird J C and Page L M (2010) A revision of *Lepidocephalichthys* (Teleostei: Cobitidae) with descriptions of two new species from Thailand, Laos, Vietnam, and Myanmar. *Copeia* **1**, 137–159. doi: <https://doi.org/10.1643/CI-08-240>.
- LeCren E D (1951) The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). *J. Anim. Ecol.* **20**, 201-221.
- Kumar R, Abujam S K, Darshan A, Kumari A and Das D N (2017) Length-Weight Relationship of *Lepidocephalichthys guntea* (Hamilton, 1822) from Dikrong River, Arunachal Pradesh. *World Wide J. Multidisciplinary Res. Develop.* **4**(2), 197-200.
- Vishwanath W, Lakra S and Sarkar U K (2007) *Fishes of Northeast India*, National Bureau of Fish Genetic Resources, Lucknow, U.P., India 264pp.