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Investigation Of Morphometric Features And Their Relationships In Clarias Batrachus From Selected Water Bodies In India

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ABSTRACT
The current study determines the morphometric features and correlations of Clarias batrachus (Linnaeus, 1758) collected from Ara and Jaunpur in India. The collection of some 150 fish specimens occurred between September 2024 and April 2025. Each fish specimen was measured for nineteen morphometric and relative metamorphic features. The descriptive statistical parameters and correlation coefficients compared to total length and other morphometric features. The correlation between most morphometric features and overall length was positive and significant ($p \leq 0.01$). Thus, there is a clear relationship between the total length of fish and all morphometric features that seem to be the best predictors of allometric pattern growth in fish. The study forms a strong foundation for its effective management and sustainable utilization.

Keywords: *Clarias batrachus, morphometric characters, water bodies.*

INTRODUCTION

Fish are sensitive to environmental changes and can quickly adjust (Hosssian et al., 2010). Morphometric features are effective and dependable methods for identifying fish specimens in their stocks (Costa et al., 2003). Morphometric character differences result from changes in environmental circumstances rather than genetic differentiation (Pinheiro et al., 2005). However, changes in fish morphology caused by genetic polymorphisms are the product of natural selection over a lengthy period of geographical isolation.

Clarias Scopoli, 1777, is the largest genus of air-breathing catfishes in the Old World catfish family and can be found in inland lakes throughout. Clarias batrachus is one of the 16 Asian species widely used in aquaculture and the aquarium trade, as well as the focus of numerous biochemical studies. Clarias batrachus (Linnaeus, 1758) known as the Asian walking catfish or magur, is a member of the order Siluriformes (fish having a suprabranchial chamber) and family Clariidae (catfish). It is endemic to Southeast Asia and found in ponds, swamps, rice fields, and slow-moving rivers in Pakistan, India, Bangladesh, Sri Lanka, Thailand, Myanmar, Malaysia, Singapore, Indonesia, and the Philippines. The body is brownish to greenish blue, with a black dorsal side. The dorsal and anal fins have distinctive crimson edges. They have extended bodies and lowered heads. They feature tiny eyes, a terminal mouth, and four sets of barbels. The dorsal fin is located anterior to the tip of the pectoral fins, and the pectoral spine is robust and serrated on both sides. Clarias batrachus is a dominant species in aquaculture due to its flexibility, high reproductive capacity, potamodromous behavior, and omnivorous bottom-feeding habits. The Invasive Species Specialist Group (ISSG) has nominated the species as one of the 100 "World's Worst Invaders" (Courtenay & Stauffer 1990).

Earlier researchers have studied various aspects of Clarias batrachus (Ihssen et al., 1981; Chakraborty et al., 1998; Tripathi & Verma, 2003; Ng & Kottelat, 2008; Więcaszek & Krzykawski, 2010; Parvez et al., 2022; Tiwari & Paul, 2023). The current study aims to collect data on the morphometric characteristics and correlations of Clarias batrachus (Linnaeus, 1758) from aquatic habitats in Arrah and Jaunpur, India.

Morphometric analysis of Clarias batrachus, a widely cultured and ecologically versatile species, is essential for understanding its biology, taxonomy, species identification, population structure, discrimination, selective breeding, monitoring, management, and conservation

MATERIAL AND METHODS

The work was conducted in the Department of Zoology of VKS University, Ara, from September 2024 to April 2025. For the study, four water bodies from Ara (Bhojpur) and Dhobi Pond, Jaunpur, were selected to procure 150 specimens of fish Clarias batrachus. At once, samples were instantly chilled in ice and stored in the laboratory with 10 % buffered formalin, where nineteen morphometric and relative morphometric characters were analyzed with standard procedures as previously followed by Dwivedi & Menezes (1974) and Prasad et al., (2020). Different linear dimensions were measured on a board with 0.01 cm accuracy.

1. Total length (TL): It is the distance between the anterior-most extremity of the body (tip of snout or the upper lip and the posterior-most boundary body).
2. Standard Length (SL): Length from the tip of the snout to the fork of the tail.
3. Depth of body (DB): Maximum vertical distance between dorsal and ventral margin of the fish body.
4. Diameter of Eye (DE): It is the distance between the front and rear margin of the eye.
5. Pre-dorsal Length (PrDL): It is the space between the anterior-most end of the body and the front end of the dorsal fin base.
6. Length of Dorsal fin (LDF): It is the length of the dorsal fin, measured from the front base to the posterior tip of the fin.
7. Length of anal fin length (LAF): It is the length of the anal fin, measured from the front base to the posterior tip of the fin.

The descriptive statistical parameters and correlation coefficients were analyzed alongside the total length and other morphometric characters. Linear regression relationship equation was applied to determine the relationships between total length versus morphometric parameters as $y = a + bx$, where x = total length. All the statistical analyses ($p<0.05$) were done by using the GraphPad Prism 8.0 software.

RESULTS AND DISCUSSION

Tables 1–4 show observations on morphometric characteristics. Table 1 summarizes the range and means values for morphometric features. Table 2 summarizes the correlation matrix for the various morphometric characteristics. Table 3 includes the regression equation, coefficients of determination, and correlation coefficients for morphometric features. Table 4 shows the relative morphometric characteristics of Clarias batrachus.

Nineteen morphometric measurements disclose that total length (TL) of Clarias batrachus were found in a range from 24.8 to 32.9cm, standard length (SL) between 21.6 to 27.8cm, length of head (HL) varies from 5.4 to 6.6cm, height of body (HB) ranged from 3.8 to 5.3cm, width of body (WB) from 4.2 to 5.8cm, height of head (HH) from 2.7 to 3.9cm, length of snout (LS) from 1.2 to 1.6cm, diameter of eye (DE) ranged from 0.6 to 1.0cm, interorbital width (IW) ranged from 2.5 to 3.0cm, gape of mouth (GM) ranged from 0.6 to 1.1cm, length of dorsal-fin (LDF) varies from 13.00 to 18.70cm, length of pectoral-fin (LPF) varies from 1.75 to 2.40cm, length of ventral-fin (LVF) varies from 1.30 to 2.00cm, length of anal-fin (LAF) varies from 210.00 to 12.80cm, length of caudal-fin (LCF) varies from 2.90 to 4.00cm, length of caudal peduncle (LCP) ranged from 0.8 to 1.30cm, height of caudal peduncle (HCP) ranged from 1.40to 2.00cm, pre-dorsal length (PrDL) ranged from 7.90 to 9.10cm and post-dorsal length (PoDL) ranged from 4.20 to 7.50cm (Table 1). The recorded maximum lengths for this species vary according to different sources from 23 cm (Bhuiyan 1964) to 46 cm (Huda et al., 2003). The present observation follows the range of observations of earlier works.

Serajuddin (2004), Kashyap et al., (2014), and Sardana et al., (2022) observed similar results in Labeo rohita, Labeo bata, Labeo calbasu, Mastacembelus armatus, Macrognathus pancalus and Channa punctatus respectively. The results resemble those previously described by Al-Faisal et al., (2015) and Roul et al., (2017) due to geographical location and ecological conditions noted by Fakunmoju et al., (2014). Variations in morphometric characters of fishes are dependent on their body size. Sharma et al., (2015) have recorded subtle variations in morphometric characters of Tor putitora for characterizing their stocks. Remarkably, Dean et al., (2002) reported the differences in morphometric parameters to separate physically similar species. Saini et al., (2008) reported the morphometric differentiation of the catfish Mystus seenghala. The variances in the morphology of many fish species were determined from different parts of Africa.

Fishes with the same morphometric characters are usually assumed to constitute a stock, and variations between the stocks help in stock structure analysis and also for any short-duration environmentally induced

variation (Cardin, 2000; Sardana et al., 2023). Freshwater fish diversity is rapidly declining around the world due to global warming and severe disruptions of climate change (Barbarossa et al., 2021). Many workers provided morphometric data on fish to highlight their usefulness in distinguishing fish stocks inhabiting similar or different environments (Doherty & McCarthy, 2004; Najero et al., 2008; Najero, 2010; Sardana et al., 2022). Dean et al., (2002) have reported the differences in morphometric parameters to separate physically similar species.

Morphometric analysis is considered to be very important in the identification of any stocks of a fish species. The current study on the morphometric characters of Clarias batrachus revealed that all nineteen morphometric measurements of the fish have a linear association with the total length (TL) as the value of the coefficient of correlation (r) was highly significant ($p<0.001$) which showed that with the increase in total length (TL) of fish, there was a corresponding increase in length of various body measurements (Table 2). However, comparatively low values of coefficient of correlation ($p<0.01$) were found between the diameter of the eye, gape of mouth, length of caudal peduncle, the height of caudal peduncle, and post dorsal length. Kashyap et al., (2015) also observed low values of the correlation coefficient (r) between total length and eye diameter (ED) in the River Gomti and Pond of Malihabad, Kolkata, indicating a weak relationship. Singh & Tandon (2009) related the decrease in the eye diameter of fish in River Gomti to the water turbidity of the River. The characteristics like the height of the head, length of the dorsal fin, length of the anal fin, length of the caudal fin, and pre-dorsal length about total length illustrate very high correlation coefficients. Similarly, Johal et al., (2003) reported that most of the characters display a high degree of correlation coefficients.

Fish morphometric characters usually refer to the measuring of the total length of fish with various other body parts. A study of linear regression relationships between the total length of fish and several morphometric characters by Marr (1955), Hoque (1984), and Chaklader et al., (2006) were found to be the best indicator for detecting the growth pattern of fish.

The values of the correlation coefficients are comparable to those reported by other researchers (Nahar et al., 2018). Pathak et al., (2013) described the significant correlation among morphometric parameters in S. richardsonii. Furthermore, the established correlations highlight the relationship between different traits as fish grow. These findings correlate with the outcomes of Soni & Ujjania (2017) determined the relationships between the morphology of fish specimens of rohu (Labeo rohita), mrigal (Cirrhinus mrigala), and catla (Catla catla).

The regression equation represents the relationships between the total length and the dependent variables. The regression equations estimate one morphometric measurement based on the knowledge of the total length. The positive correlations and linear relationships observed indicate that changes in total length reflect across the measured morphometric characters (Table 3). Comparison of regression analysis for each morphometric parameter also indicated differential growth rates as many parameters were significant at 0.1%, 1%, and 5% levels in the student t-test. The coefficient of variation of total length was very high with standard length (SL), Interorbital width (IW), gape of mouth (GM), length of dorsal fin (LDF), length of pectoral fin (LPF), length of ventral fin (LVF), length of anal fin (LAF), length of caudal fin (LCF), height of caudal peduncle (LCP), and predorsal length (PrDL). The notable differences in the slopes for the morphometric characters indicate that there are varying growth rates for these parameters between the compared populations. These variations suggest a connection between phenotypic diversity and geographical barriers, which in turn demonstrates limited intermingling among Clarias batrachus populations.

Nineteen relative morphometric measurements disclose that head in total length (HTL) of Clarias batrachus were found in a range from 4.18 to 4.98, head in standard length (HSL) between 3.44 to 4.21, height in total length (HtTL) varies from 5.81 to 6.54, height in standard length (HtSL) ranged from 4.98 to 5.68, height in length of head (HtLH) from 1.24 to 1.56, snout in length of head (SLH) from 4.13 to 4.69, diameter of eye in length of head (DELH) from 6.60 to 9.00, diameter of eye in snout (DES) ranged from 1.60 to 2.00, diameter of eye in interorbital width (DEIW) ranged from 3.00 to 4.17, predorsal length in standard length (PrLSL) ranged from 2.62 to 3.42, postdorsal length in standard length (PoLSL) ranged from 3.66 to 5.14, length of dorsal fin in standard length (LSFSL) varies from 1.56 to 1.86, length of pectoral fin in head (LPFH) varies from 2.67 to 3.59, length of ventral fin in head (LVFH) varies from 3.32 to 4.34, length of anal fin in standard length (LAFSL) varies from 2.18to 2.30 length of caudal fin in head (LCFH) varies from 1.65 to 2.07, height of caudal fin in total length (HCFTL) ranged from 7.97 to 8.93, length of caudal peduncle in standard length

(LCPSL) ranged from 21.70 to 27.00, length of caudal peduncle in height (LCPHt) ranged from 3.67 to 6.78 (Table 4).

The diameter of the eye in (a) length of head, (b) snot, and (c) interorbital width showed a decreasing trend with their corresponding increase. Less average values of relative morphometric characters except for height in the length of the head, the diameter of the eye in the length of the head, the diameter of the eye in the snout, length of anal fin in standard length, length of caudal fin in head and length of caudal fin total length indicate a relative reduction in the body parts of fish due to spatial climate change. The maximum differences appear to be based on variations in feeding regimes and the sensitivity of fish in the eastern and northern regions of the country (Sardana et al., 2022). The variations based on the head region are the result of differences in the feeding regimes, or they may be due to the availability of food in the area (Rao, 2001).

As a result, morphometric investigations of Clarias batrachus demonstrate that body measures are not only biologically informative but also helpful in aquaculture, biodiversity monitoring, and species conservation. These investigations update our understanding of species adaption, growth dynamics, and ecological reactions, laying a solid foundation for its successful management and sustainable exploitation.

CONCLUSION

Morphometric investigations reveal significant variations among populations from different geographic regions influenced by environmental conditions or aquaculture practices. These variances may help identify stocks and analyze population structure. The study is vital for species management as it can assess individual well-being and uncover potential disparities between different populations of the same species. The investigation of nineteen morphometric features in Clarias batrachus demonstrated an effect from its surroundings. High correlation coefficient findings mark a strong positive association between the morphometric parameters and total length, implying that these parameters grow proportionally with total length.

Table 1: The morphometric characters of Clarias batrachus.

Sl. No.	Character (cm)	Range of Number of Individuals in Each set (n = 25 - 30)					Average
		1st Set	2nd Set	3rd Set	4th Set	5th Set	
1.	Total Length (TL)	24.8±2.5	25.5±2.7	26.8±2.8	27.9±2.6	32.9±2.7	27.58±3.20
2.	Standard Length (cm)	21.6±2.0	22.0±2.3	23.0±2.1	23.9±2.2	27.8±2.5	23.62±2.52
3.	Length of Head (LH)	5.4±0.6	6.1±0.5	6.2±0.4	6.3±0.5	6.6±0.7	6.12±0.44
4.	Height of Body (HB)	3.8±0.5	3.9±0.4	4.1±0.6	4.8±0.5	5.3±0.5	4.38±0.65
5.	Width of Body (WB)	4.2±0.6	4.6±0.6	4.8±0.7	5.3±0.5	5.8±0.8	4.94±3.20
6.	Height of Head (HH)	2.7±0.4	3.1±0.5	3.2±0.4	3.6±0.4	3.9±0.5	3.3±0.62
7.	Length of Snout (LS)	1.2±0.2	1.3±0.3	1.4±0.3	1.5±0.2	1.6±0.2	1.4±0.46
8.	Diameter of Eye (DE)	0.6±0.1	0.7±0.1	0.8±0.1	0.9±0.1	1.0±0.1	0.8±0.16
9.	Interorbital Width (IW)	2.5±0.2	2.6±0.3	2.7±0.2	2.8±0.2	3.0±0.2	2.72±0.16
10.	Gape of Mouth (GP)	0.6±0.1	0.7±0.1	0.8±0.1	0.9±0.1	1.1±0.1	0.82±0.19
11.	Length of Dorsal Fin (LDF)	13.00±1.4	14.00±1.5	14.50±1.7	14.80±1.9	17.60±2.4	14.78±1.72
12.	Length of Pectoral Fin (LPF)	1.75±0.2	1.80±0.3	1.83±0.4	1.90±0.3	2.40±0.3	1.94±0.26
13.	Length of Ventral Fin (LVF)	1.30±0.2	1.40±0.3	1.50±0.3	1.60±0.2	2.00±0.4	1.56±0.27
14.	Length of Anal Fin (LAF)	9.80±1.0	10.00±1.2	10.30±1.4	10.40±1.3	12.80±1.5	10.66±1.22
15.	Length of Caudal Fin (LCF)	2.9±0.2	3.2±0.2	3.30±0.3	3.40±0.3	4.00±0.4	3.36±0.40
16.	Length of Caudal Peduncle (LCP)	0.8±0.1	0.9±0.1	1.06±0.1	1.09±0.1	1.30±0.2	1.01±0.16
17.	Height of Caudal Peduncle (HCP)	1.4±0.3	1.4±0.3	1.55±0.2	1.57±0.2	2.00±0.3	1.60±0.23
18.	Pre Dorsal Length (PrDL)	7.9±0.9	8.00±1.0	8.50±1.1	8.58±1.2	9.10±1.0	8.42±0.49
19.	Post Dorsal Length (PoDL)	4.2±0.6	4.80±0.7	5.00±0.7	5.13±1.1	7.50±0.9	5.33±1.27

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Table 2: The correlation matrix amongst the different morrphometirc characters of Clarias batrachus

	TL	SL	LH	HB	WB	HH	LS	DE	IW	GM	LDF	LPF	LVF	LAF	LCF	LCP	HCP	PrDL	PoDL
TL	1.000	0.999***	0.807*	0.949**	0.947**	0.917**	0.918**	0.918**	0.970***	0.970***	0.990***	0.983***	0.998***	0.982***	0.981***	0.888**	0.987***	0.953**	0.984***
SL		1.000	0.783NS	0.951**	0.940**	0.906**	0.911**	0.911**	0.965***	0.965***	0.982***	0.982***	0.994***	0.980***	0.970***	0.881**	0.981**	0.953**	0.978***
LH			1.000	0.804NS	0.910**	0.935**	0.926**	0.926**	0.902**	0.902**	03863*	0.732NS	0.842*	0.732NS	0.898**	0.931**	0.801NS	0.864*	0.802NS
HB				1.000	0.978***	0.961***	0.955**	0.955**	0.970***	0.970***	0.921**	0.898**	0.954**	0.881**	0.926**	0.898**	0.894**	0.937**	0.891**
WB					1.000	0.955***	0.990***	0.990***	0.993***	0.993***	0.947**	0.886**	0.962***	0.874*	0.962***	0.954**	0.908**	0.959***	0.905**
HH						1.000	0.989***	0.989***	0.981***	0.981***	0.926**	0.848*	0.938**	0.833*	0.948**	0.952**	0.878**	0.938**	0.876**
LS							1.000	1.000***	0.986***	0.986***	0.920**	0.835*	0.936**	0.829*	0.940**	0.984***	0.869*	0.971***	0.865*
DE								1.000	0.986***	0.986***	0.920**	0.835*	0.936**	0.829*	0.940**	0.984***	0.869*	0.971***	0.865*
IW									1.000	1.000***	0.970***	0.914**	0.981***	0.910**	0.979***	0.964***	0.938**	0.982***	0.934**
GM										1.000	0.970***	0.914**	0.981***	0.910**	0.979***	0.964***	0.938**	0.982***	0.934**
LDF											1.000	0.974***	0.994***	0.975***	0.997***	0.899**	0.993***	0.945**	0.992***
LPF												1.000	0.975***	0.998***	0.956**	0.795NS	0.992***	0.885**	0.992***
LVF													1.000	0.972***	0.990***	0.907**	0.985***	0.960***	0.983***
LAF														1.000	.0955**	0.800NS	0.994***	0.891**	0.993***
LCF															1.000	0.919**	0.981***	0.949**	0.980***
LCP																1.000	0.845*	0.977**	0.838*
HCP																	1.000	0.913**	1.000***
PrDL																		1.000	0.906**
PoDL																			1.000

(TL = Total length, SL = Standard length, LH = Length of head, HB = Height of body, WB = Width of body, HH = Height of head, LS = Length of snout, DE = Diameter of eye. IW = Interorbital width, GM = Gape of mouth, LDF = Length of dorsal fin, LVF = Length of ventral fin, LAF = length of anal fin, LCF = Length of caudal fin, LCP = Length of caudal peduncle, HCP= height of caudal peduncle, PrDL = Predorsal length, PoDL = Postdorsal length, ***=p<0.0001, **=p<0.01 and *p<0.05).

Table 3: The regression equation, values of coefficient of determination and correlation coefficient of morphometric characters of Clarias batrachus.

Sl. No.	Character (cm)	Regression Equation	Coefficient of Determination (R^2)	Correlation Coefficient (r)	't' value
1.	Total Length (TL)				
2.	Standard Length (cm)	y=0.784x+1.987	0.997	0.998***	27.35***
3.	Length of Head (LH)	y=0.111x+3.036	0.651	0.807*	2.36*
4.	Height of Body (HB)	y=0.191x-0.897	0.901	0.949**	5.21**
5.	Width of Body (WB)	y=0.184x-0.139	0.897	0.947**	5.11**
6.	Height of Head (HH)	y=0.132x-0.360	0.841	0.917**	3.98*
7.	Length of Snout (LS)	y=0.045x+0.150	0.842	0.918**	4.01*
8.	Diameter of Eye (DE)	y=0.045x-0.449	0.842	0.918**	4.01*
9.	Interorbital Width (IW)	y=0.058x+1.113	0.941	0.970***	6.911**
10.	Gape of Mouth (GP)	y=0.058x-0.786	0.941	0.970***	6.11**
11.	Length of Dorsal Fin (LDF)	y=0.530x+0.141	0.979	0.989***	11.581***
12.	Length of Pectoral Fin (LPF)	y=0.081x-0.306	0.966	0.983***	9.27**
13.	Length of Ventral Fin (LVF)	y=0.084x-0.760	0.966	0.983***	9.27**
14.	Length of Anal Fin (LAF)	y=0.373x+0.354	0.963	0.981***	8.76**
15.	Length of Caudal Fin (LCF)	y=0.123x-0.048	0.962	0.981***	8.76**
16.	Length of Caudal Peduncle (LCP)	y=0.044x-0.205	0.788	0.888**	3.34*
17.	Height of Caudal Peduncle (HCP)	y=0.071x-0.357	0.974	0.987***	10.64***
18.	Pre Dorsal Length (PrDL)	y=0.144x+4.436	0.908	0.952**	5.39**
19	Post Dorsal Length (PoDL)	y=0.389x-5.406	0.969	0.984***	9.56**

Table 4 Relative Morphometric characters of Clarias batrachus

Sl. No.	Character	Range of number of individuals in each set (n= 25-30)					Average
		1st Set	2nd Set	3rd Set	4th Set	5th Set	
1.	Head in total length (HTL)	4.59±0.4	4.18±0.3	4.32±0.4	4.43±0.4	4.98±0.5	4.50±0.31
2.	Head in standard length (HSL)	4.00±0.4	3.44±0.3	3.71±0.4	3.79±0.4	4.21±0.4	3.83±0.29
3.	Height in total length (HtTL)	6.52±0.9	6.54±0.8	6.54±0.7	5.81±0.6	6.20±0.6	6.32±0.32
4.	Height in standard length (HtSL)	5.68±0.7	5.59±0.7	5.61±0.6	4.98±0.5	5.24±0.5	5.42±0.30
5.	Height in length of head (HtLH)	1.42±0.2	1.56±0.2	1.51±0.2	1.31±0.2	1.24±0.1	1.41±0.13
6.	Snout in length of head (SLH)	4.56±0.4	4.69±0.3	4.43±0.4	4.20±0.4	4.13±0.4	4.39±0.23
7.	Diameter of eye in length of head (DELH)	9.00±0.9	8.71±0.8	7.75±0.7	7.70±0.8	6.60±0.7	7.95±0.95
8.	Diameter of eye in snout (DES)	2.00±0.2	1.86±0.2	1.75±0.2	1.67±0.2	1.60±0.2	1.78±0.16
9.	Diameter of eye in interorbital width (DEIW)	4.17±0.4	3.71±0.3	3.38±0.3	3.11±0.3	3.00±0.3	3.47±0.48
10.	Predorsal length in standard length (PrLSL)	2.73±0.3	2.62±0.3	2.71±0.2	3.42±0.3	3.05±0.3	2.91±0.33
11.	Postdorsal length in standard length (PoLSL)	5.14±0.5	4.54±0.5	4.60±0.5	4.66±0.5	3.66±0.4	4.52±0.54
12.	Length of dorsal fin in standard length (LSFSL)	1.86±0.3	1.56±0.2	1.59±0.2	1.61±0.2	1.58 ±0.2	1.64±0.12
13.	Length of pectoral fin in head (LPFH)	3.42±0.3	3.59±0.3	3.54±0.4	3.08±0.3	2.67±0.3	3.26±0.39
14.	Length of ventral fin in head (LVFH)	4.15±0.4	4.34±0.4	4.13±0.4	3.94±0.4	3.32±0.3	3.98±0.37
15.	Length of anal fin in standard length (LAFSL)	2.20±0.3	2. 81±0.3	2.23±0.2	2. 03±0.2	2.30±0.2	2.24±0.40
16.	Length of caudal fin in head (LCFH)	1.86±0.2	1.90±0.3	2.07±0.2	1.97±0.2	1.65±0.2	1.89±0.16
17.	Length of caudal fin in total length (LCFTL)	8.55±0.6	7.97±0.8	8.93±0.9	8.72±0.9	8.23±0.8	8.49±0.40
18.	Length of caudal peduncle in standard length (LCPSL)	27.0±1.5	24.2±1.0	21.70±1.7	21.93±1.3	23.17±1.9	23.6±2.15
19.	Length of caudal peduncle in height (LCPHt)	6.75±0.86	6.78±0.81	5.85±0.62	5.78±0.8	3.67±0.5	5.77±1.28

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