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Morphometric and Meristic characteristics description of stripped catfish (*Pangasianodon hypophthalmus*, Sauvage 1878) culture in south Gujarat, India

***Niharika P. Shah[1], N.C. Ujjania[2] and Aakash B. Pardeshi[3]**

Department of Aquatic Biology, Veer Narmad South Gujarat University, Surat 395 007, India

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ABSTRACT

The present study was conducted to understand the morphometric and Meristic characteristics of stripped catfish (*Pangasianodon hypophthalmus*, Sauvage 1878) culture in south Gujarat. For the morphometric measurement and Meristic count total 815 fish specimens were randomly collected from the described culture systems. For the morphometric measurements of the fish, total length (TL), standard length (SL) and body weight were taken. Meristic counts were included to count number of spine and rays for dorsal fin, pectoral fin, pelvic fin, anal fin and caudal fin. In present study, morphometric observation including total length (TL) 18.500-48.00 cm with mean 34.760±0.185, standard length (SL) 16.500-39.000 cm with mean 28.791±0.154 and weight (WT) 100.00-930.00 g with mean 376.720±5.615 was observed in studied fish. The morphometric relationship of the variables (TL vs WT, SL vs WT and TL vs SL) shows the linear relationship among the variables respectively. The values of intercept (a = -1.882, -1.546 & -0.024), correlation coefficient (r = 0.820, 0.816 & 0.910) and growth constant (b = 2.832, 2.802 & 0.962) were noted respectively. The Meristic characteristics of the studied fish were counted as dorsal fin spine and rays (1/6), Pectoral fin spine and rays (1/9), Pelvic fin spine and rays (1/7) and anal fin rays (29-30). It is very much essential to record the morphological and meristic characters of the studied fish for identification. All such information can also be considered an initial step for studying evolutionary relationships of fish species.

Key words: *Morphometric, Meristic, Length, weight, Pangasianodon, Stripped catfish and Growth*

Introduction

Striped catfish (*Pangasius hypophthalmus*, Sauvage, 1878) is the important fish species for aquaculture and primarily produced in Southeast Asia including India, Bangladesh, Thailand, Vietnam, Indonesia, Malaysia, and Philippines. It has high production and great demand in several countries around the world. The global production of pangasius is about 2.8 million tones (2018) by Vietnam, India, Bangladesh and Indonesia which valued about US$ 3.6 billion (FAO, 2020). In India, it was introduced in West Bengal and Andhra Pradesh during 1990 for aquaculture purposes (Singh and Lakra, 2012 and Seshagiri *et al*., 2021) and is an economically important catfish species spreading fast culture (Singh *et al*., 2012 and Mugaonkar *et al.*, 2019) due to fast growth, easy culture, good acceptability of feed, and survival in adverse conditions like high salinity and low oxygen level (Ali *et al*., 2013 and Kinare and Harkulkar, 2022). The 'morphometric' is mainly used for the external body measurement while 'meristic' is mostly used for counting the morphological characters of any organism (Dars *et al.*, 2012 and

([1]Assistant Professor (Adhoc), [2]Professor, [3]M.Sc. Student)

Hassan *et al.,* 2020). These are the traditional methods to study the fish biology, fish development pattern, habitat conditions, overall health, early life, feeding, fish condition, sexual category, size range, physical condition and geographically variant populations (Jisr et al., 2018; Hassan *et al.*, 2020, Sabbir *et al*., 2020; Islam *et al*., 2020; Khatun *et al*., 2022). The relationship among the morphological variables including total length, slandered length and weight can be categorized into three main categories, i.e. positive allometry, when the proportional morphological variable increases with increment of total length (TL), negative allometry, when the proportional morphological variables decreases with increase in total length (TL) and isometry, when morphological variables indicating direct relationship with total body length (TL); therefore, if the length is increased than the other body part also increase in equal rate accordingly (Ambily, 2017; Kamboj and Kamboj, 2019). The study of length-weight relationships (LWRs) is widely applied approach in fisheries management as it provides information on stock density, biomass, breeding grounds, seasons, health status and availability of the fish (Froese, 2006; Sharma *et al*., 2016). It is very much essential to record the morphological and meristic characters of the studied fish to solving the race problem and identification. All such information can also be considered an initial step for studying evolutionary relationships of fish species (Langer *et al*., 2013; Prasad *et al*., 2020). Morphological variations in fish have been cited by various authors for different species but no report is available on the morphometric and meristic analysis of stripped catfish in south Gujarat region. With this aim the present work on the morphometric and meristic characters of stripped catfish has been undertaken from the culture ecosystems of south Gujarat.

Materials and Methods

Study area

The proposed study was conducted during the December 2022 to March 2023 from the cage and pond culture system at the Selud village which was situated near the bank of Ukai reservoir in Uchchhal Taluka of Tapi district, Gujarat (Fig. 1).

Sample collection

For the morphometric measurement and meristic count 815 fish specimens were randomly collected from the described culture systems. These fish specimens were safely transported to the Research laboratory of Department of Aquatic Biology (VNSGU, Surat) and used for the further analysis.

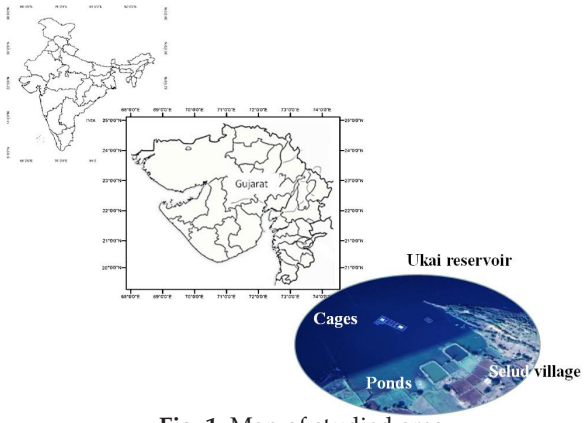

Fig. 1. Map of studied area

Morphometric Measurements

For the morphometric measurements of the fish, total length (TL) was measured from tip of snout to the end of caudal fin and standard length (SL) was taken from tip of snout to caudal peduncle corrected up to 0.5 cm with help of measuring tape and body weight was taken with the help of digital balance corrected up to 1.0 g.

Analysis of data

Morphometric relationship

The morphometric data including total length, standard length and weight were used to establish the mathematical relationship among the total length-weight, standard length-weight and total length-standard length to follow the equation of Froese (2006).Whereas, the variables relationship from log transformed data were also established to follow the method of Pauly (1983).

$W = aL^b$

$\log W = \log a + b \log L$

(W = Weight of fish (g) L = Length of fish (cm) a = Intercept b = Exponent)

Meristic counts

Meristic counts (four characters) were included to count number of spine and rays for dorsal fin, pectoral fin, pelvic fin, anal fin and caudal fin. Each character was counted three times independently with the help of magnifying glass to follow the method of Fitri (2019).

Results and Discussion

Morphometric observation and relationship

In the present study, morphometric observation including total length (TL) 18.500-48.00 cm with mean 34.760±0.185, standard length (SL) 16.500-39.000 cm with mean 28.791±0.154 and weight (WT) 100.00-930.00 g with mean 376.720±5.615 was observed in studied fish (Table 1). The morphometric relationship of the variables (TL vs WT, SL vs WT and TL vs SL) shows the linear relationship among the variables (Fig. 3A, 3B & 3C) respectively. The values of intercept (a=-1.882, -1.546 & -0.024), correlation coefficient (r=0.820, 0.816 & 0.910) and growth constant (b=2.832, 2.802 & 0.962) were noted respectively (Table 2). The correlation coefficient depicted positive strong correlation among the variables and growth constant is (b<3.0) which shows that total length and weight variables of the studied fish did not fulfill the 'cube law' and depicted negative allometric growth in the culture system. The negative allometric growth pattern reflects that length growth of fish occurs faster than weight growth that may occur due to variations in various environmental factors, habitat changes, i.e. water temperature, food availability, stress and water productivity (Naminata *et al*., 2014 and Segun *et al*., 2022). Although, values of "a" and exponent "b" for the fish in this study were within the limits Froese (2006) and Pervin and Mortuza (2008). The growth pattern reported in this study (b values) were mostly in agreement with the value reported by Shahriar Nazrul *et al.* (2011) for GIFT (2.69), Okomoda *et al*. (2018) for Pangapinus (2.844) and for *P.hypophthalmus* (2.931). Hossain *at al*. (2009) recorded negative allometric growth in *E. vacha* from the lower Ganges, which is in accordance with the present study.

Meristic characteristics

The body of studied fish is described as elongated, mouth position is terminal. The body surface is dark grey to black color which become silvery-grey on the flank and belly with dark strips along the lateral line. moreover, dorsal, adipose, pectoral and caudal fins were observed dark grey color while pelvic and anal fins light grey to white with grey membrane (Fig. 2). During the study, two pairs of the barbells at the corner of the mouth were also observed. The meristic characteristics of the studied fish was described in Table 3 which were counted asdorsal fin spine and rays (1/6), Pectoral fin spine and rays (1/9), Pelvic fin spine and rays (1/7) and anal fin rays (29-30). On the basis of these findings, fin formula of fish was developed (D 1/6, P_1 1/9, P_2 1/7, A 29-30) and identified as *Pangasianodon hypophthalamus*. The body color pattern and mristic characteristic of *P.hypophthalamus* were reported by so many researchers, Froese and Pauly (2017**)** was reported that fins dark grey or black, 6 branched dorsal-fin rays,

Fig. 2. Studied fish

Table 1. Morphometric parameters (total length, standard length and weight) of fish

Morphometric parameters	Minimum	Maximum	Mean	SE
Total Length (cm)	18.500	48.000	34.760	0.185
Standard Length (cm)	16.500	39.000	28.791	0.154
Weight (g)	100.000	930.000	376.720	5.615

n=815, SE = standard error

Table 2. Morphometric relationship (total length, standard length and weight) of fish

Morphometric relationship	a	B	R^2
Total Length vs Weight	- 1.822	2.832	0.820
Standard Length vs Weight	- 1.546	2.802	0.816
Total Length vs Standard Length	- 0.024	0.962	0.910

n=815

black stripe above and below the lateral line. Similarly, Neilson *et al.* (2018) reported the similar in body shape of other catfishes but can be distinguished by the number of pairs of barbels around the mouth, *P. hypophthalmus* has only two pairs of maxillary barbells.Dark stripe on the middle of anal fin and each caudal lobe reported by Kottelat (2001). Shafi and Quddus (2001) were also reported dorsal fin rays (7), pelvic fin rays (7), ventral fin rays (6) which were quite similar while reported anal fin rays (60-79) was more than the findings.Samples of *P. hypopthalmus* from Bangladesh showed a fixed number of six pelvic fin rays (Hossain *et al.,* 2010). Small adipose fin, similar pattern of pectoral fin and dorsal fin, with the first ray being ossified and segmented rays, anal fin with 31 rays and pelvic fin with 8 rays of striped catfish was reported by Snovsky and Golani (2012). The findings of present study are evident by Mahalder and Mustafa (2013) and Khamees *et al.* (2013) for fin formulae of the striped catfish *P. hypophthalmus.*

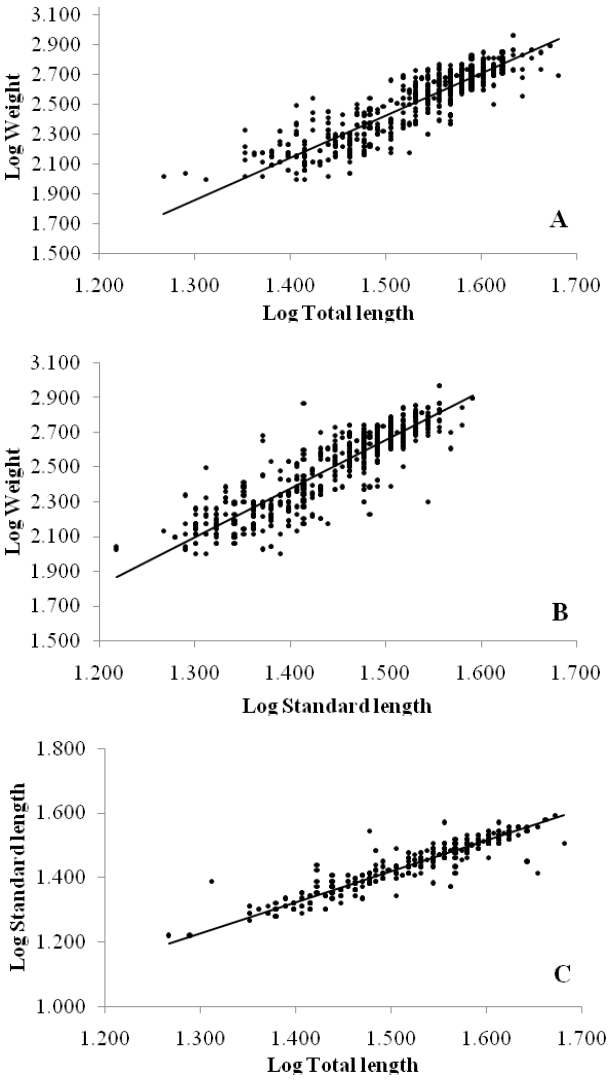

Fig. 3. Morphometric relationship (A) Total length vs Weight,(B) Standard length vs Weight and (C) Total length vs Standard length

Conclusion

On the basis of counting of meristic characteristics, fin formula of fish was developed (D 1/6, P_1 1/9, P_2 1/7, A 29-30) and identified as *Pangasianodon hypophthalamus.* Simultaneously the correlation coefficient (r) depicted positive strong correlation among the variables while growth constant is (b<3.0) which showed that total length and weight variables of the studied fish did not fulfill the 'cube law' and depicted negative allometric growth in the culture system.The negative allometric growth pattern reflects that length growth of fish occurs faster than weight growth that may occur due to variations in various environmental factors. The study recommended that farmers must follow better management practices including quality seed stocking, feed management, disease management etc. to enhance the fish production.

Table 3. Meristic characteristics of fish

Range	Dorsal fin		Pectoral fin		Pelvic fin		Anal fin
	Spine	Rays	Spine	Rays	Spine	Rays	
Minimum	1.0	5.0	1.0	7.0	1.0	6.0	27.0
Maximum	1.0	7.0	1.0	9.0	1.0	7.0	30.0
Mean	1.0	6.0	1.0	8.8	1.0	6.5	28.8
SE	0.0	0.0	0.0	0.1	0.0	0.1	0.1

Fin formulae = D 1/6, P_1 1/9, P_2 1/7, A 29-30
n=815, SE = standard error

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Disclosure of conflict of interest

The authors are declaring that they have no conflicts of interest.

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