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Original Research

Assessment of Growth Pattern in Relation to Certain Morphometric Parameters of *Catla catla* (Ham. 1822) in Vallabhsagar Reservoir (Gujarat)

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Abstract

The relationship of morphometric parameters with total length of Indian major carp (Catla catla Ham. 1822) was revealed in present study. The total length, standard length weight and other morphometric features were measured in between of different 10 landmark points. The correlations coefficient (r) was 0.713 to 0.988 that shows significant positive correlation between independent variable (total length) and dependent variable (other morphometric parameter). The morphometric length mouth tip to premaxilla (1-10) contributed 6.842 % of total length whereas length of dorsal fin front to anal fin origin (3-7) contributing about 27.326 % of the total length. Current study shows that majority of morphometric parameters with total length shows negative allometric (0.338-2.417), caudal fin top to caudal fin bottom (5-6) with total length (TL) shows positive allometric growth (4.046) whereas weight with total length (WT-TL) shows isometric (3.009) growth for the studied species. The finding of growth constant for catla depicts that in the Vallabhsagar reservoir growth of fish is normal and the aquatic environment of water body is conducive for the fish.

Keywords: Growth, Indian Major Carps, Morphometric, Catla, Vallabhsagar Reservoir

Introduction

Among the Indian major crap catla (*Catla catla* Ham. 1822) is commercially important cultivable fish species of Indian subcontinent and cultured in lentic and lotic habitat (Jhingran, 1968) that is contributes major portion to the fresh water fish production of the country and market demand. In fishes, morphometric characters or growth of the body parts shows proportional positive increments with length. Therefore, morphometric measurement of fishes and the study of statistical relationship among body parts are essential for taxonomic study (Tandon *et al.,* 1993), systematics and growth variability (Joseph and Jayasankar, 2001 and Ujjania *et al.,* 2013) and stock discreteness (Zafar *et al., 2002*; Doherty and McCarty, 2004 and Barriga-Sosa *et al.,* 2004). This method is the simplest, most direct amongst the methods of species identification and growth estimation which does not sacrifice the fish (Samaradivakara *et al.,* 2012). Therefore, these are generally being used in many fish species (Anyanwu and Ugwumba, 2003; Eyo, 2002 and 2003 and Kosai *et al.,* 2014) and especially in carps (Ujjania, 2003; Naeem *et al.,* 2012; Tripathy *et al.,* 2013; Pandey, 2017, Balai *et al.,* 2017 and Sharma *et al.,* 2018) for growth variability and stock discrimination analysis. The present study was taken up to describe the growth variability and relationship of different morphometric parameters of catla in Vallabhsagar reservoir of Gujarat, India and it is helpful to manage the fish stock and estimate the growth of the fish during the culture.

Materials and Methods

Study Area

Vallabhsagar reservoir is situated on river Tapi at 21° 15'N Latitude and 73° 35'E Longitude geographical location (Fig. 1) and was constructed in 1971 for multiple uses for domestic, irrigation, industries etc. This reservoir having catchment area of 62 255 km^2, water spread area of 52 000 ha at FRL of 105.10 m above MSL and mean depth 11.8 m. For the fulfillment of study objectives, the morphometric measurement of fish specimens were taken from the pre-selected commercial fish landing center of Vallabhsagar reservoir.

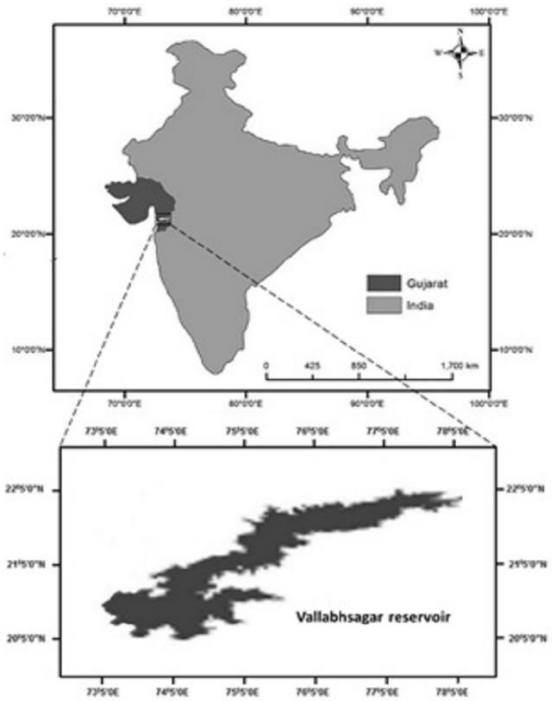

Figure 1: Location of study area (Vallabhsagar reservoir)

Morphometric Measurements

The morphometric measurements are the distances of different landmark point (Table 1 and Fig. 2) and were measured from 200 specimens during September to December 2009. These morphometric measurements of fish specimens were taken in centimeter with the help of metallic divider, measuring board, measuring tape whereas

body weight of fish specimens were taken in grams with the help of single pan balance to follow the method of Hockaday *et al.* (2000).

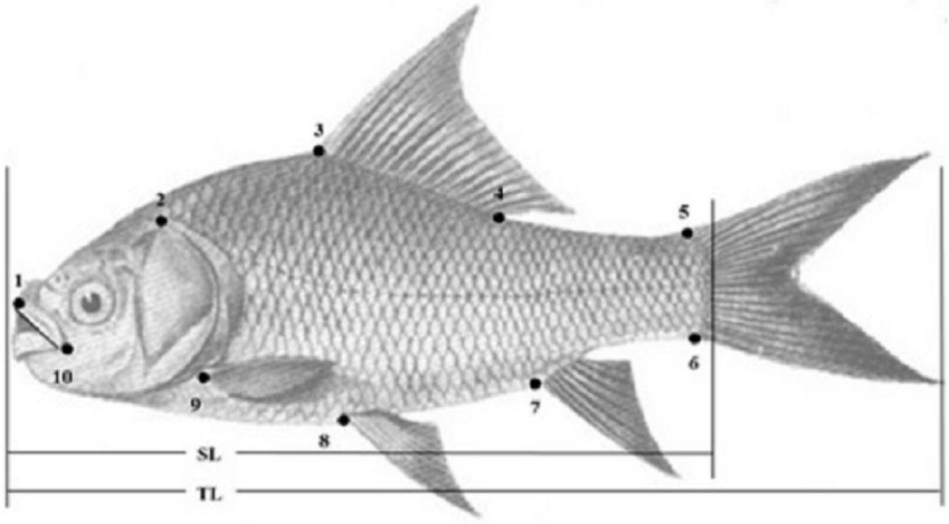

Figure 2: Different landmarks for morphometric measurements (Landmark are 1. Snout; 2. Operculum top; 3. Dorsal fin front; 4. Dorsal fin back; 5. Caudal top; 6. Caudal bottom; 7. Origin of anal fin; 8. Origin of pelvic fin; 9. Origin of pectoral fin; 10. Pre-maxilla; SL. Standard length and TL. Total length)

Table 1: Morphometric measurements of catla from Vallabhsagar reservoir

S. No.	Distances of landmarks	Morphometric measurements
1	1-2	Mouth tip to operculum top
2	1-3	Mouth tip to dorsal fin front
3	1-10	Mouth tip to pre maxilla
4	2-3	Operculum top to dorsal fin front
5	2-9	Operculum top to pectoral fin
6	2-10	Operculum top to pre maxilla
7	3-4	Dorsal fin front to back)
8	3-7	Dorsal fin front to anal fin
9	3-8	Dorsal fin front to pelvic fin
10	3-10	Pre maxilla to dorsal fin front
11	4-5	Dorsal fin back to caudal top
12	4-6	Dorsal fin back to caudal bottom
13	4-7	Dorsal fin back to anal fin
14	4-8	Dorsal fin back to pelvic fin
15	5-6	Caudal top to caudal bottom
16	5-7	Anal fin to caudal top
17	6-7	Anal fin to caudal bottom
18	7-8	Pelvic fin to anal fin
19	8-9	Pectoral fin to pelvic fin
20	8-10	Pre maxilla to pelvic fin
21	9-10	Pre maxilla to pectoral fin
22	SL	Standard length
23	TL	Total length
24	WT	Weight

Statistical Analysis

The relationship of various morphometric parameters on total length which were simple variables, calculated by $Y=aX^b$ whereas Y=a+bX for logarithmic transformed variables (LeCren, 1951) and in these equations 'Y' is the dependent variable (other than total length morphometric parameters), X is the independent variable (total length), 'a' is the intercept value and 'b' is the regression coefficient or growth constant. Microsoft Excel 2010 was used for the graphical preparation and statistical analysis of the data.

Result and Discussion

Morphometric parameters of the of the fish shows that standard length was ranged 18.800-24.500 (22.718±0.128) cm, total length was ranged 23.100 to 30.100 (28.391±0.162) cm while weight was ranged 1225.00-6350.00 (4450.00±118.00) gm (Table 2).

Table 2: Statistical analysis of different morphometric parameters of catla

S. No.	Parameters	Min	Max	Mean	SE	a	b	r	% of TL
1	1-2	3	5	4.162	0.047	-1.622	1.54	0.812	14.658
2	1-3	8.8	11.3	10.647	0.051	-0.136	0.8	0.959	37.5
3	1-10	1.2	2.1	1.943	0.012	-0.939	0.844	0.713	6.842
4	2-3	2.2	5.8	4.639	0.094	-2.244	2.055	0.972	16.34
5	2-9	4.2	5.5	4.997	0.03	-0.601	0.894	0.883	17.601
6	2-10	3.4	5.7	4.879	0.059	-2.367	2.1	0.959	17.185
7	3-4	8.1	11.9	10.463	0.082	-0.848	1.284	0.933	36.853
8	3-7	5.4	8.5	7.758	0.079	-1.797	1.847	0.988	27.326
9	3-8	3.4	6.5	5.64	0.073	-2.629	2.323	0.972	19.867
10	3-10	3.9	10.6	9.625	0.125	-2.538	2.417	0.764	33.902
11	4-5	5.2	6.9	6.58	0.041	-0.752	1.08	0.968	23.175
12	4-6	3.4	6	5.401	0.069	-2.721	2.373	0.979	19.022
13	4-7	2.5	5.2	4.573	0.055	-2.669	2.288	0.948	16.105
14	4-8	4.7	7.1	6.725	0.048	-0.744	1.081	0.799	23.689
15	5-6	2.2	5.5	4.382	0.093	-5.256	4.046	0.959	15.434
16	5-7	2.9	4.5	3.903	0.039	-1.707	1.58	0.9	13.747
17	6-7	1.9	3.2	3.043	0.026	-1.507	1.368	0.793	10.718
18	7-8	5.2	6.8	6.192	0.046	-0.83	1.116	0.877	21.808
19	8-9	5.9	9.3	8.131	0.089	-1.655	1.763	0.874	28.638
20	8-10	5.2	6.5	6.037	0.033	0.143	0.338	0.768	21.264
21	9-10	3.1	5.5	4.584	0.06	-2.583	2.229	0.951	16.148
22	SL	18.8	24.5	22.718	0.128	-0.029	0.953	0.977	80.018
23	TL	23.1	30.1	28.391	0.162				
24	WT	1.225	6.35	4.45	0.118	-1.662	3.009	0.934	

The correlations coefficient (r) ranged between 0.713 and 0.988 which indicating that the relationship between the independent variable (total length) and dependent variable (other morphometric parameters) were significant positive. The correlation coefficient (r) was minimum 0.733 for morphometric length of mouth tip to premaxilla (1-10) on total length (TL) which was contributing about 6.842% of total length while it was maximum 0.988 for morphometric length of dorsal fin front to anal fin origin (3-7) on total length (TL) that was contributing about 27.326% of the total length (Table 2). Such kind of positive significant correlation of total length and morphometric measures reported in major carp from different water bodies of southern Rajasthan (Ujjania, 2003), Calbasu from Chenab River, Pakistan (Naeem *et al.*, 2012), Carps from Shahdol region of Madhya Pradesh (Pandey, 2017) and catla from Jaisamand Lake, Rajasthan (Balai *et al.*, 2017). Whereas similar findings were also reported in *S. richardsonii* from Uttarkashi district of Uttrakhand (Negi and Negi, 2010), in mahseer from Rajasthan (Ujjania *et al.*, 2012), in tilapia from two ponds of Vadodara, Gujarat (Pathak *et al.*, 2013) and in *Tor putitora* from Himachal Pradesh (Arora and Julka, 2013).

The growth constant or regression coefficient (b) was analyzed to determine the growth status of the fish in the water body. In the equation if $b<3.0$, $b>3.0$ and $b=3.0$ shows that growth of the fish is negative allometric, positive

allometric and isometric respectively hence, current study shows that majority of morphometric parameters with total length shows negative allometric (0.338-2.417), caudal fin top to caudal fin bottom (5-6) with total length (TL) shows positive allometric (4.046) whereas weight with total length (WT-TL) shows isometric (3.009) growth for the studied fish species (Table 2). The findings of growth constant for studied fish depicts that the growth of fish is normal in the water body and the aquatic environment is conducive for the fish. The relationship between morphometric features and total length was reported negative allometric in *Labeo calbasu* (Naeem *et al.*, 2012), in *Tor putitora* (Arora and Julka, 2013) and in *Tor putitora* (Naeem *et al.*, 2011). Ujjania *et al.* (2013) also reported isometric and positive allometric growth for rohu in large water body and small water body of southern Rajasthan whereas Balai *et al.* (2017) and Ujjania and Soni (2017) was reported negative allometric growth in catla from Jaisamand Lake and Vallabhsagar Reservoir respectively.

Conclusion

The present study described that morphometric parameters and total length of catla was significantly correlated and positive correlation coefficient shows the proportional positive increase in morphometric features compare to total length. The values of growth constant or regression coefficient (b) of weight and total length indicate the isometric growth of catla in Vallabhsagar reservoir (Gujarat). It is also concluded that aquatic environment of Vallabhsagar reservoir is conducive and it is suitable for the growth of Indian major carp (*Catla catla*).

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Conflict of Interests

There is no conflict of interest.

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