



# **Biometric Assessment of *Cyprinus carpio* var. *Communis* from Anchar Lake of Kashmir Valley**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Morphometric analysis have proven to be a useful tool for studying fish species, population and races. It is a basic fundamental tool for attaining information on development of organisms, systematics, growth, variation and morphology. The present study was carried out in Anchar lake of Srinagar Kashmir to analyze morphometric measurements of *Cyprinus carpio* var. *communis*. About 120 specimens of *Cyprinus carpio* var. *communis* was collected randomly from different zones of the water body. The morphometric characters were classified into genetically controlled (narrow range), intermediate (moderate range) and environmentally (vast range) controlled characters. In percentage of total length out of fourteen 14 morphometric characters 5 were genetically controlled, 2 characters were intermediate and 7 characters were environmentally controlled. The relationship between the different morphometric characters was found to be linear with most of them being highly significant ( $p < 0.01$ ). The study concluded that the environmentally controlled characters were maximum, which indicates that these characters are less stable in nature.

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**Keywords:** Biometric assessment; common carp; morphometry; Anchar lake; Kashmir valley.

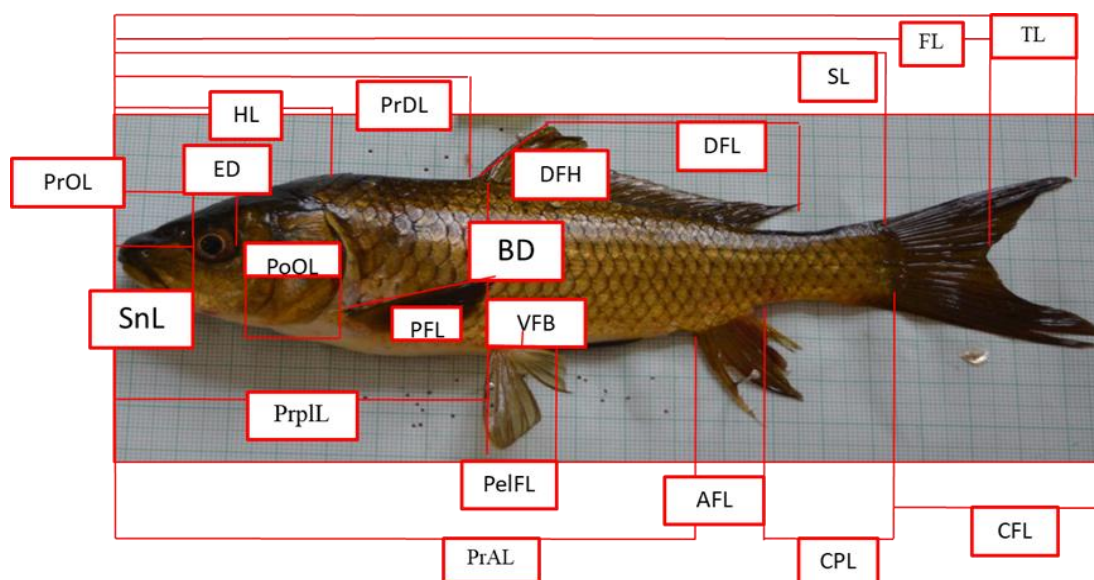
## 1. INTRODUCTION

“The environmental changes in the habitats of the fish due to anthropogenic activities result in pollution of the aquatic environment which causes morphometric characters to adapt to the changing environmental conditions” [1]. “Basic fundamental tool for knowing about development of organisms, growth, systematic, variations and structure of population characteristics of fish is morphometric study” [2]. “It plays an important role for estimating relationship between various parts of body” [3]. “Thus, studying morphometric characters form a useful tool to study morphometric measurement and identify fish stock” [4]. “However, fish vary greatly in morphological traits in between the populations and within species than any other vertebrates” [5]. “Morphometric analysis provides an important tool to make sure of genetic and environmental stock identification of different fish population; the differences in populations arise due to changes in the environment factors or through genetic variations, which results from nature during long periods of geographical isolation” [6]. So due to increased anthropogenic activities resulting in pollution of the aquatic

environment by fertilizers and pesticides cause environmental changes in the habitats in turn results in morphological changes within species. Thus, morphometric characters respond to changes in environmental factors and these responses differ from species to species.

## 2. MATERIALS AND METHODS

A total number of 120 specimens of *C. carpio* var. *communis* were collected from Anchar lake of Kashmir Valley. The samples were collected between November 2021 to March 2022. The samples were collected using cast net with the help of a professional licenced fisherman. The samples were brought to the laboratory in live condition for further analysis. In the laboratory, fishes were washed under tap water in order to remove mucus and other particulates and then dabbed with clean cloth. Total 20 morphometric characters (Fig. 1) were taken for the present investigation by using digital vernier calliper (True size) to the nearest 0.01 mm. The readings were always taken on the left side of body. All the characters were calculated in the percentage of total length. The morphometric characters were recorded following [7], [8].



**Fig. 1. Morphometric characters of *C. Carpio* var. *communis*:** 1. Total length (TL) 2. Fork Length (FL) 3. Standard Length (SL) 4. Pre Anal Length (PrAL) 5. Pre Dorsal Length (PrDL) 6. Pre Pelvic length (PrPIL) 7. Pectoral fin length (PFL) 8. Pelvic fin length 9. Anal fin length (AFL) 10. Dorsal fin length (DFL) 11. Caudal fin length (CFL) 12. Caudal peduncle length (CPL) 13. Ventral fin base (VFB) 14. Dorsal fin height (DFH) 15. Body depth (BD) 16. Head length (HL) 17. Pre orbital length (PrOL) 18. Post orbital length (PoOL) 19. Snout length (SnL) 20. Eye diameter (ED)

These measurements were subjected to both inferential and descriptive statistics using SPSS version 16 and Microsoft excel. The coefficient of correlation (r) and regression (b) were tested for significance. The data were then used to compute the regression equation for each dependent variable to fit the straight-line equation ( $Y=a+bX$ ), where Y is the dependent variable, 'a' is intercept, b the slope of the regression line and X the independent variable [9]. The various morphometric characters were then classified on the basis of range into genetically (<10%), intermediate (10-14%) and environmentally (>15%) controlled characters [10].

### 3. RESULTS

The mean, SD, Range, Range difference and correlation coefficient ( $R^2$ ) of the different morphometric measurements is presented in Table 1. Most of the morphometric characters of the sampled fish showed positive correlations between the studied characters; however, the value of the correlation coefficient varied. In percentage of total length out of 14 characters, 10 characters showed high correlation values (0.75-0.95), 2 were moderately correlated (0.50-0.75) and 2 were poorly correlated (0.25-0.50). While in case of head length three were moderately correlated and one poorly correlated. However, linear relationships have been observed between all the independent and dependent characters (Figs. 2-3). The present study revealed that out of the total characters that have been studied in percentage of total length, 5 were genetically controlled, 2 were intermediate, and 7 were environmentally controlled. In the percentage of head length all the characters were environmentally controlled.

### 4. DISCUSSION

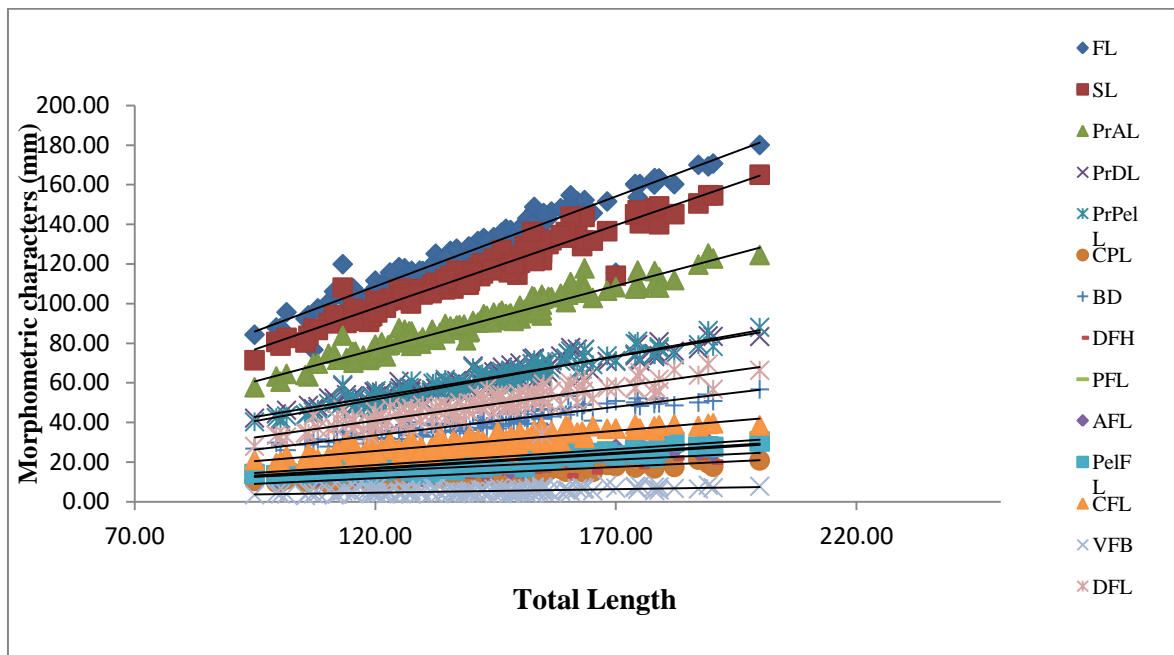
Morphometric characters on the basis of range difference can be categorised into genetically controlled, intermediate, and environmentally controlled characters. The characters which belonged to genetically controlled show minimum range of variations, intermediate characters show moderate range while environmentally controlled show maximum range of variation. In the present study, 5 (CPL, AFL, PFL, PeFL & VFB) of the morphometric characters were genetically controlled, 2 (CFL & DFH) were intermediate, and 7 (FL, SL, PrAL, PrDL, PrPeL, BD & DFL) were environmentally controlled in percentage of total length. While in the percentage of head

length all the characters were environmentally controlled (SnL, ED, PrOL & PoOL). These results are in conformation with Tandon et al. [11] reported 14 out of 19 and 13 out of 18 characters from the respective samples were exhibiting wide range differences hence were environmentally controlled in *Cirrhinus. reba* and *Gudusia chapra*. Similarly, Negi and Tarana [12] recorded in their study on *Schizothorax richardsoni* that out of 21 characters, 19 (genetically controlled) 1 character (intermediate) and 1 character (environmentally controlled). Siraj et al. [13] reported that in percent of total length out of 18 characters, 4 were genetically controlled, 12 characters were intermediate and 2 characters were environmentally controlled. Bhat et al. [14] reported that 3 characters were genetically controlled, 13 were intermediate and 2 were environmentally controlled. Similar other studies have been conducted such as Bhat et al. [15] conducted a study on *Tor putitora* and revealed that 12 characters were genetically controlled, two were intermediate and one was environmentally controlled with respect to body length. However, in case of head length three characters were intermediate and two were environmentally controlled. In present study maximum characters in percentage of total length and head length were environmentally controlled, which could be ascertained due to their unrestricted distribution and wide range of zoogeographical distribution. Same is supported by Khin et al. [16] who stated that fish species which have a wide range of zoogeographical distribution, maximum characters of fish species possess wide range in morphometric characters and are hence strongly influenced by the environment.

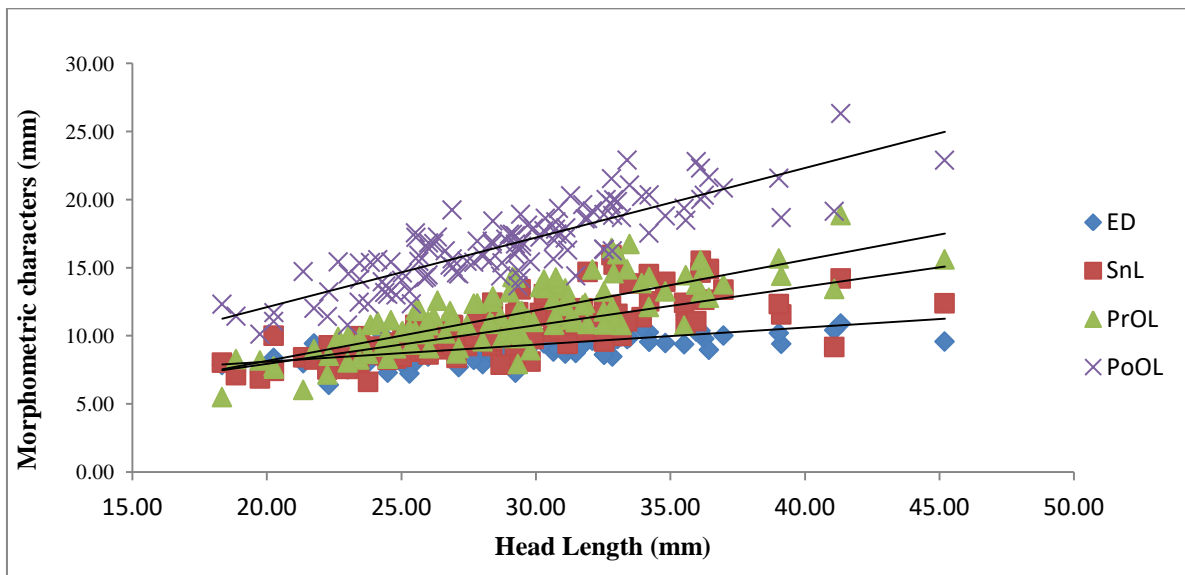
In the present study, all the morphometric traits showed highly significant ( $p<0.01$ ), positive relationship with total length. The characters like standard length, fork length, pre pelvic length showed high correlation coefficient while minimum correlation coefficient was achieved for dorsal fin height, ventral fin base and pre-orbital length. It may be due to the fact that all morphometric characters change proportionally with the increase in total length of fish and the higher level of correlations of morphometric traits indicate that whole body of the fish grows in a proportionate manner [17]. Our results are in line with Sharma et al. [18] who studied the relationship of total length and external body parts while analysing the morphometric and meristic characteristics of *Botia birdi* in Indus basin, Jammu & Kashmir and found a positive

**Table 1. Morphometric characters of *C. carpio* var. *communis* from Anchar Lake**

S.No.	In% age of total length	Mean (mm)	S.D.	Range (mm)		Range difference (%)	R	Regression equation
				Min	Max			
1	Fork Length (FL)	128.11	21.95	84.26	180.00	47.89	0.944	-0.198+0.907x
2	Standard Length (SL)	115.66	20.62	71.38	165.00	24.77	0.912	-2.616+0.836x
3	Pre-Anal Length (PraL)	90.60	18.90	57.72	125.21	33.76	0.879	-0.527+0.644 x
4	Pre-Dorsal Length (PrDL)	61.60	14.81	40.47	83.73	21.64	0.910	4.126+0.406x
5	Pre ventral Length (PrVL)	61.03	9.51	40.30	88.00	23.86	0.744	-0.747+0.436x
6	Caudal Peduncle Length (CPL)	14.36	10.05	8.37	21.96	6.79	0.861	-1.714+0.113x
7	Body Depth (BD)	39.61	2.89	25.98	56.67	15.35	0.792	-1.050+0.287x
8	Dorsal Fin Length (DFL)	48.18	6.80	27.95	69.52	20.79	0.733	0.476+0.337x
9	Anal Fin Length (AFL)	19.82	8.32	11.66	29.43	8.88	0.806	-1.904+0.153x
10	Pectoral Fin Length (PFL)	21.94	3.93	13.88	30.82	8.47	0.767	-0.817+0.161x
11	Pelvic Fin Length (PelFL)	20.37	3.93	12.70	30.37	8.83	0.792	-1.504+0.154x
12	Caudal fin Length (CFL)	30.02	3.87	19.46	39.54	10.04	0.427	0.985+0.205x
13	Dorsal Fin Height (DFH)	17.95	5.06	9.40	31.03	10.82	0.441	1.475+0.116X
14	Ventral Fin Base (VFB)	5.41	3.90	1.37	8.45	3.54	0.766	0.396+0.035x
In the % of Head Length								
16	Snout Length (SnL)	10.51	4.87	12.15	15.94	26.88	0.50	0.906+0.067x
17	Eye Diameter (ED)	9.24	1.94	10.55	11.52	23.34	0.38	1.574+0.194x
18	Pre-Orbital Length (PrOL)	11.52	0.98	13.52	18.87	29.91	0.60	1.045+0.074x
19	Post Orbital Length (PoOL)	16.73	2.31	17.71	26.33	39.18	0.72	1.195+0.109x



**Fig. 2. Relationship of different morphometric characters with total length in *C. carpio* var. *communis* (Anchar Lake)**



**Fig. 3. Relationship of different morphometric characters with head length in *C. carpio* var. *communis* (Anchar Lake)**

correlation in all parameters with respect to total length. The highest correlation was observed with fork length ( $R^2=0.99$ ) and least correlation with post orbital length ( $R^2=0.77$ ). Bhat et al. [14] documented similar results in *Cyprinus* spp. and observed that out of eighteen characters in relation to total length of fish, ten characters showed high values of correlation coefficient and rest parameters showed moderate correlation

coefficient. Qadri et al. [19] reported high correlation ( $r$ ) values for various morphometric characters with total length. Highest value was ascertained for standard length ( $R^2=0.88$ ). Similarly, Shah et al. [20] studied morphometry of farmed rainbow trout in Kashmir and reported high level of interdependence between the fourteen morphometric characters studied. Johal et al. [10] found standard length as most

correlated body part in *Tor putitora* from Gobindsagar [21,22].

## 5. CONCLUSION

Fourteen morphometric characters were studied in percentage of total length, of which 5 were genetically controlled, 2 were intermediate, and 7 were environmentally controlled. While in percentage of head length all characters were recorded to be environmentally controlled. Surprisingly, the environmentally controlled characters were observed highest which indicated that these characters are less stable in nature from this place. So, there is a great impact on these characters to be controlled environmentally, which is because no proper conservation strategies have been planned for the fish within Anchar lake. Also, it was revealed from correlation coefficient that all the characters were having positive and linear relationship.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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