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Morphometric and Meristic Analysis of Mirror Carp (*Cyprinus carpio* var. s*pecularis)* Collected from Dal Lake, Kashmir

S. Majeed, F.A. Bhat* and I. Mohd

Faculty of Fisheries, Rangil, Ganderbal, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Jammu and Kashmir-190 006, India
**E-mail: fabhat_fb@yahoo.com*

***Abstract*:** One hundred twenty-nine (129) fish samples of mirror carp, *Cyprinus carpio* var. s*pecularis of* variable sizes were collected for demonstrating the morphometric and meristic characteristics of this specie in the Dal Lake, Kashmir during January-August 2022. Morphometric characters (seventeen) and meristic counts (six characters) for each specimen were examined. The morphometric characters showed gradual increase as the body length and weight increases. The meristic count of anal fin rays was constant in all groups, while other parameters of meristic count varied.

Keywords: Mirror carp, Morphometric, Meristic, Dal Lake

The mirror carp, *Cyprinus carpio* var. *specularis*, is an exotic fish and a member of the Cyprinidae family, one of the largest families of freshwater fish. Europe is the home of the mirror carp. In 1955-1966, mirror carp of the German genotype were introduced into Dal Lake from Himachal Pradesh (Jhingran and Sehgal 1978). Dal Lake, a Himalayan urban lake, is situated in Srinagar, Jammu and Kashmir (J&K), at an elevation of 1,775 m with a mean latitude and longitude of 74°52ˈE and 34°07ˈN, respectively. Dal lake has been home to 17 species of fish (Das and Subla 1963, Jayaram 1974), 106 species of macrophytes from 30 families (Kaul and Zutshi 1967), 72 species of zooplankton (Yousuf and Parveen 1989), and 139 taxa of phytoplankters (Kundangar 1994). Main aim of the present study was to provide detailed, baseline information about the morphometric characters and meristic counts of this fish species.

MATERIAL AND METHODS

Collection of Specimens: A total of One hundred twenty-nine (129) specimens were collected from Dal Lake (34°07ˈN 74° 52ˈE) during January-August 2022. The collected samples were transported to Fishery Resource Management Laboratory at Faculty of Fisheries, Rangil for biological analysis.

Morphometry: All morphometric characters were measured to the nearest millimetres (mm) with digital calliper following the method described by Lowe-McConnel (1971) and Dwivedi and Menezes (1974). Weight of samples was recorded to nearest grams (g). The seventeen morphometric parameters were measured (Fig. 1). Based on their range, several morphometric characters were then divided into genetically (Narrow range, 10%), intermediately (Moderate range, 10-15%), and environmentally (Vast range, >15%) controlled characters (Johal et al 1994). The total length was considered as an independent variable while as other characters were considered as dependent variables. The equation Y = a + bX, was used to identify relationships where Y and X are the dependent and independent variables, respectively, a is the constant (intercept), and b is the regression coefficient.

Meristic: Meristic approaches entail counting the structures of fishes such as lateral line scales, fin spines and rays, gill rackers and branchiostegal rays to determine the species and class of fish. Counts were made on the left side of the body of samples. Fin formula represents the meristic count of a fish. The six meristic characters were counted: dorsal fin ray and spines, anal fin rays and spines, pectoral fin ray and spines, pelvic fin rays and spines, caudal fin rays and spines and lateral line scale count.

Statistical analyses: All statistical analyses were performed using MS-Excel 2007 and IBM SPSS Statistics 21.0 package.

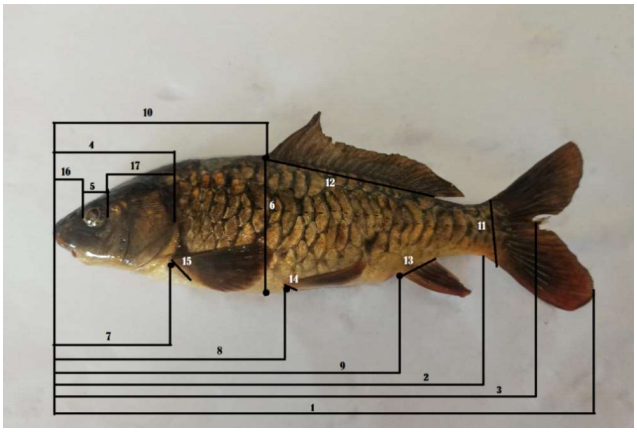
RESULTS AND DISCUSSION

Morphometry: The various morphometric characters of *C. carpio* var. s*pecularis* and their relationship are shown in Table 1-3 and Figure 1- 2. The mean total length and the standard length was 185.63 and 151.39 cm respectively. The total weight ranged from 37.83 to 602.01 g. Correlation

coefficient (r) was highest between total length and standard length (0.989) followed by total length and forked length (0.985) indicating high degree of correlation between the characters compared while the least degree of correlation was between total length and eye diameter (0.737). However with respect to head length (HL), highest correlation coefficient was of post-orbital length (0.957). Linear relationships were observed between all the independent and dependent characters (Fig. 1). Bhat et al (2010) while studying the morphometric characteristics of *Schizothorax*

Table 1. Various morphometric characters of *C. carpio* var. *specularis*

Statistical estimates	Min (mm)	Max (mm)	Mean (mm)
Total length	137.51	318.06	185.63
Standard length	112.19	290.48	151.39
Forked length	113.6	264.47	164.73
Head length	34.25	70.53	45.336
Eye diameter	5.71	11.66	8.53
Body depth	39.65	102.73	51.35
Pre-pectoral length	34.55	70.01	45.69
Pre-pelvic length	60.05	123.23	76.97
Pre-anal length	74.71	192.24	112.76
Pre-dorsal length	45.7	136.12	75.95
Caudal peduncle depth	13.23	43.48	20.28
Dorsal-fin base length	38.06	98.37	53.57
Anal-fin base length	9.61	27.72	13.25
Pelvic-fin base length	4.17	11.48	6.77
Pectoral-fin base length	4.14	13.37	7.84
Pre-orbital length	11.14	29.3	16.10
Post-orbital length	15.41	32.73	21.05
Weight	37.83	602.01	106.39



1. Total length (TL)
2. Standard length (SL)
3. Forked length (FL)
4. Head length (HL)
5. Eye diameter (ED)
6. Body depth (BD)
7. Pre-pectoral length (PPL)
8. Pre-pelvic length (PVL)
9. Pre-anal length (PAL)
10. Pre-dorsal length (PDL)
11. Caudal peduncle depth
12. Dorsal-fin base length (DFBL)
13. Anal-fin base length (AFBL)
14. Pelvic-fin base length (PFBL)
15. Pectoral-fin base length (PFBL)
16. Pre-orbital length (PrOL)
17. Post-orbital length (PoOL)

Fig. 1. Schematic illustration of measurements taken on the body of (*Cyprinus carpio* var.s*pecularis)* from the Dal Lake

Table 2. Relationship between total length and various morphometric characters of *C. carpio* var. *specularis*

Statistical estimates	Standard deviation	Correlation coefficient (r)	Regression equation
Standard length (SL)	35.27583	0.989	y = 0.948x - 24.71
Forked length (FL)	31.435619	0.985	y = 0.842x + 8.380
Body depth (BD)	12.58996	0.923	y = 0.316x - 7.311
Head length (HL)	8.04453	0.96	y = 0.21x + 6.344
Eye diameter (ED)	1.35957	0.737	y = 0.0272x + 3.4812
Pre-Pectoral length (PPCL)	8.36400	0.877	y = 0.199x + 8.68
Pre-Pelvic length (PPVL)	14.44091	0.907	y = 0.356x + 10.8
Pre-anal length (PAL)	23.63612	0.921	y = 0.591x + 2.895
Pre-dorsal length (PDL)	17.39363	0.855	y = 0.406x + 0.432
Caudal peduncle depth (CPD)	5.76005	0.949	y = 0.148x - 7.300
Dorsal-fin base length (DFBL)	11.33109	0.964	y = 0.297x - 1.565
Anal-fin base length (AFBL)	3.44915	0.928	y = 0.087x - 2.914
Pelvic-fin base length (PVFBL)	1.90767	0.745	y = 0.038x - 0.404
Pectoral-fin base length (PFBL)	1.77705	0.879	y = 0.042x - 0.043
Pre-orbital length	3.94399	0.89	y = 0.0955x - 1.6209
Post-orbital length	4.36857	0.923	y = 0.1096x + 0.7115

Table 3. Relationship between head length and various morphometric characters of *C. carpio* var. *specularis*

Statistical estimates	Standard deviation	Correlation coefficient (r)	Regression equation
Eye diameter (ED)	1.35957	0.789	y = 0.1334x + 2.4895
Pre-orbital length (PrO)	3.94399	0.909	y = 0.4456x - 4.0968
Post-orbital length (PoO)	4.36857	0.957	y = 0.5194x - 2.4942

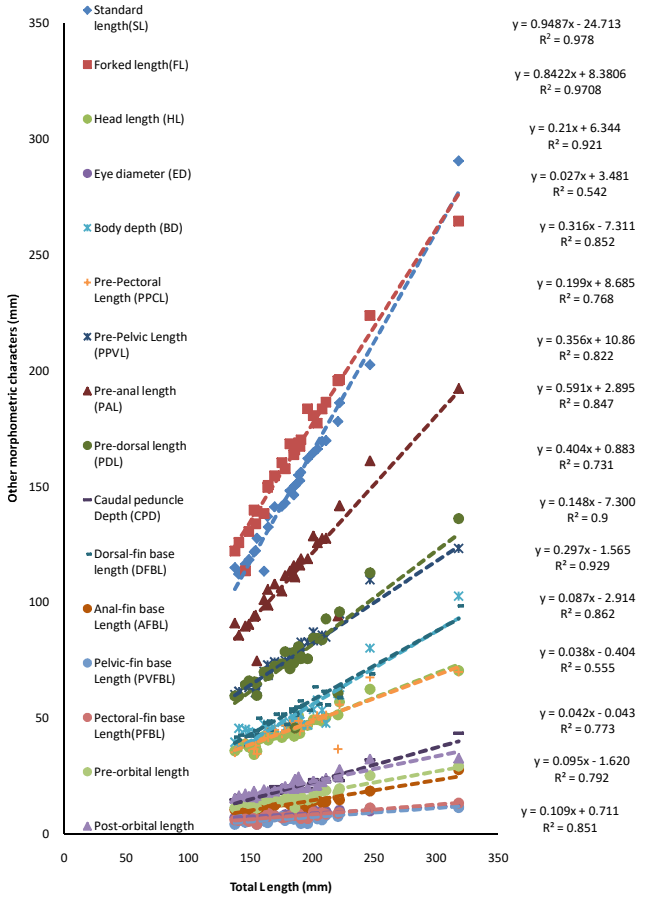


Fig. 1. Relationship between total length and other morphometric characters in *C. carpio* var. *specularis*

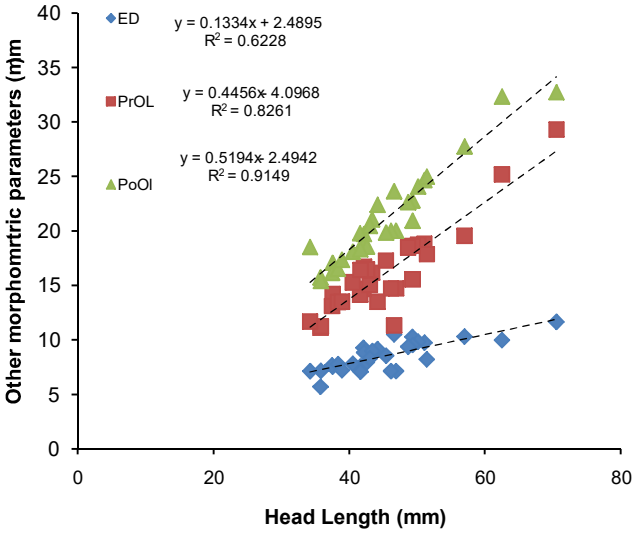


Fig. 2. Relationship between head length, pre-orbital length, post-orbital length v/s head length

sp. in the River Lidder of Kashmir reported least growth in body depth (0.1730) and maximum growth in standard length (0.9080) with respect to the total length of the fish. Shah et al (2011) investigated the morphometry of farmed rainbow trout in Kashmir and reported very high degree of relationship among the characters compared, with the highest degree of correlation (0.99) between total length and fork length and lowest value (0.82) between total length and body depth.

The morphometric characters have been categorized on the basis of range difference as mentioned above. The 13 characters such as SL, FL, HL, BD, PPVL, PPCL, PDL, PAL, CPD, DFBL, AFBL, PrO and PoO in percentage of total length were environmentally controlled while characters such as ED, PVFBL, and PFBL were genetically controlled characters. However, with respect to head length, ED is included in genetically controlled while PrO and PoO in environmentally controlled characters. Negi and Negi (2010) analysed the morphometric characters of *Schizothorax richardsonii* and reported that out of 21 characters studied, 19 were genetically controlled, 1 intermediate and 1 character environmentally controlled.

Meristic: Six meristic characteristics, including the number of lateral line scales, dorsal fin rays, pectoral fin rays, pelvic or ventral fin rays, caudal fin rays, and anal fin rays, have been counted and have a definite number, but they can vary and fall within a range (Table 3). The lateral line count ranged from 19-35, dorsal fin 19-23, pectoral fin 11-16, pelvic fin 6-9 and caudal fin 19-22. Anal fin rays count (6) was constant in all samples. These findings show that meristic counts of *Cyprinus carpio* var. s*pecularis showed variation while anal fin count showed similarities.* Meristic characters are genetically controlled but their expression may be modified by the environment. Singh *et al* (2018) reported caudal fin rays and anal fin rays ranging between 19-21 and 8-9 whereas dorsal fin rays, pectoral fin rays and ventral fin rays to be 7, 9 and 5, respectively in *Aorichthys seenghala*. Fin formula calculated for *Cyprinus carpio* var. *specularis* for the

present study was: D: 1/19-23, P: 11-16, V: 6-9, A: 6, C: 19-22, L1: 19-35. Talwar and Jhingran (2001) reported the fin formula of *Cyprinus carpio* var. c*ommunis* as D. 3-4/18-20, P1: 1/15, P2: 1/8, A. 3-5, L1: 30-40. This study focus on morphometric and meristic count of mirror carp as there was no previous work done on this aspect from Dal Lake.

CONCLUSION

Various morphometric characters studied showed a high degree of correlation(r) with each other. The coefficient of correlation (r^2) was maximum between total length and standard length and least between total length and pelvic- fin base length Further, meristic counts continuously change when the fish's body weight and length increase or decrease. The information generated serves as a foundation for the growth and effective management of Kashmir Valley's carp fishery as well as for a deeper comprehension of its biology and growth.

REFERENCES

Bhat FA, Yousuf AR, Balkhi MH, Mahdi MD and Shah FA 2010. Length-weight relationship and morphometric characteristics of *Schizothorax* spp. in the river Lidder of Kashmir. *Indian Journal of Fisheries* **57**(2): 73-76.

Das SM and Subla BA 1963. The ichthyofauna of Kashmir- History, topography, origin, ecology and general distribution. *Ichthyologica* **1**: 68-106.

Dwivedi SN and Menezes MR 1974. A note on the morphometry and ecology of *Brachiurus orientalis* (Bloch and Schneider) in the estuaries of Goa. *Geobios* **1**: 80-83.

Hazarika A, Borah U and Bordoloi L 2011. Studies on morphometric measurements and meristic counts of hill trout (*Barilius bendelisis*, Hamilton) from the river Buroi at the boundary areas of Assam and Arunachal Pradesh, India. *Indian Journal of Fundamental and Applied Life Sciences* **1**(3): 194-198.

Jayaram KC 1974. Ecology and distribution of fresh-water fishes, amphibia and reptiles, pp 517-584. In: Mani S (eds.). *Ecology and Biogeography in India*. Dr. W. Junk b.v. Publishers the Hague.

Jhingran VG and Sehgal KL 1978. *Coldwater fisheries of India*. Inland Fisheries Society of India. Barrackpore, pp 239.

Johal MS, Tandon KK and Sandhu GS 1994. Mahseer in Lacustrine Waters, Gobindsagar Reservoir. 1994. Morphometry of *Tor putitora,* pp 67-85. In: P. Nautiyal (eds.). *Mahseer the Game Fish*., Jagdamba, Prakashan Publisher, Srinagar, Garhwal.

Kaul V and Zutshi DP 1967. A study of aquatic and marshland of Srinagar. *Proceedings of the Natural Institute of Science, India* **33**-B: 113-123.

Kundangar MRD 1994. Impact of waste waters on the vegetational pattern of Dal Lake, pp 41-49. In: *National Symposium on Current Research in Plant Sciences*, Department of Botany, Punjab University, Chandigarh.

Lowe-McConnel RH 1971. Identification of freshwater fishes, pp 45-81. In: Ricker WE (eds.). *Methods of assessment of fish production in freshwaters.* Blackwell scientific, Oxford and Edinburg, UK.

Negi RK and Negi T 2010. Analysis of morphometric characters of *Schizothorax richardsonii* (Gray 1832) from the Uttarkashi District of Uttarakhand State, India. *Journal of Biological Sciences* **10**(6): 536-540.

Ryman N, Lagercrantz U, Andersson L, Chakraborty R and Rosenberg R 1984. Lack of correspondence between genetic and morphologic variability patterns in Atlantic herring (*Clupea harengus*). *Heredity* **53**(3): 687-704.

Shah TH, Balkhi MH, Najar AM and Asimi OA 2011. Morphometry, Length-weight relationship and condition factor of farmed female rainbow trout (*Oncorhynchus mykiss* Walbaum) in Kashmir. *Indian Journal of Fisheries* **58**(3): 51-56.

Singh A, Datta SN and Singh A 2018. Study of Biometric Characteristics of Giant River- Catfish *Aorichthys seenghala (*Sykes 1839) from Harike Wetland- A Ramsar site. *Indian Journal of Ecology* **45**(3): 627-631.

Snedecor GW and Cochran WG 1967. *Statistical Methods*. 6th Edition, The Iowa State University, Press, Ames, USA, p 168-181.

Talwar PK and Jhingran AG 2001. *Inland Fishes of India and Adjacent countries*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, p 18.

Yousuf AR and Parveen M 1989. Ecology of polluted waters of Kashmir, Barinambal basin of Dal Lake, pp 255-258. In: Yousuf AR, Raina MK and Qadiri MY (eds.). *Current Trends in Fish and Fishery Biology and Aquatic Ecology*, Department of Zoology, University of Kashmir, Srinagar.

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