



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2021; 9(5): 288-292

© 2021 JEZS

Received: 07-07-2021

Accepted: 09-08-2021

Sanjay Paunikar

Zoological Survey of India,
Northern Regional Centre, 218,
Kaulagarh Road, Dehradun-248
195, Uttarakhand, India

Shital Panwar

Department of Zoology, Shri
Guru Ram Rai University²,
Dehradun, Uttarakhand, India

Morphometric and meristic study of five freshwater fish species of Song River, Dehradun, Uttarakhand

Sanjay Paunikar and Shital Panwar

Abstract

The present study focuses on the identification of 25 fish specimens collected from one of the tributaries of river Ganga i.e., Song river in Dehradun, Uttarakhand during 2020. The 20 specimens of each fish were collected in different localities of Song river and twenty four morphometric measurements and eight meristic count parameter for each species. The five fishes were *Rasbora daniconius*, *Devario devario*, *Nemacheilus botia*, *Pethia conchonius* and *Channa gachua*. The total length and weight of *Rasbora daniconius* ranged from 7.6-5.5 cm and 5.1-1.8g; *Devario devario* fish species ranged from 7.6-5.5 cm and 6.9-1.9g; 6.9-5.1 cm and 4.4-1.2g (*Nemacheilus botia*), 5.4-4.4 cm and 3.6-1.5g (*Pethia conchonius*) and 9.1-7.5 cm and 8.1-4.8g (*Channa gachua*) respectively were recorded during the study period. 22/23 Morphometric characters were studied and their analysis of regression and correlation shows highly significant positive value ($r > 0.90$) in all parameters with respect to total length and head length. The meristic characters were counted to draw fin formula. The study of morphometric relationships and meristic characters are required for the taxonomic and phylogenetic studies.

Keywords: morphometric, meristic, fish species, Song River, regression, correlation

1. Introduction

Uttarakhand is rich in terms of fish diversity due to the two important perennial rivers of India i.e. River Ganga and Yamuna supported by many other tributaries. Dehradun district, lying between 29°58' and 31°02'N Latitude and 77°35' and 78°20' E Longitude, is one of the districts under Uttarakhand state, located in Himalayan region and nestled mainly between rivers. Dehradun can be divided into Eastern and Western Doon Valley. The eastern part, with Ganga River and its tributaries viz. Song, Suswa and Rawasan forming rich network. The western part is drained by Yamuna river system and its tributaries viz. Tons, Amlawa (originated from hilly area) and Asan River (originate from Shiwalik hills) with many seasonal nallas, Rao, Oggal, which form rich network of water in Western Doon Valley. Song River has its origin from the adjoining Tehri district. The Song River, one of the tributaries of Ganga river system is considered to be the principle drainage system of the study area Initially it runs parallel to the Mussoorie Mountain chain in North-West direction for few kilometers and then takes a sudden turn in South-East direction and joins Suswa River south of Doiwala.

Rasbora daniconius (Hamilton, 1822) is freshwater fishes and distributed ditches, ponds, canals, haors, streams, rivers and inundated fields. It inhabits mainly sandy streams and rivers. The Slender Rasboras are omnivores. In the wild, they feed on small aquatic insects and detritus. *Devario devario*, fishes have short barbels and many species having vertical or horizontal stripes. These species consume various small, aquatic insects, crustaceans and worms, as well as, in the case of fry, plankton. It is found in rivers, ponds, and fields in a subtropical climate, aquarium fish. *Nemacheilus botia*, a preference for stretches of streams and small rivers where leaf litter and other debris collects, areas of open sand or mixed cobbles, rocks, and boulders. It is aquarium fish.

Pethia conchonius occurs in numerous habitat-types, from flowing hill streams and tributaries of rivers to stiller waters such as lakes, ponds, and swamps. Studies have shown it to be a generalized omnivore feeding on worms, insects and other small invertebrates, as well as plant material and organic detritus. It is also aquarium fish. *Channa gachua* is a common fish found in most any type of wetland. It can live in large rivers or small brooks and creeks, in fast currents or stagnant waters, and in altered waterways such as canals [2].

Corresponding Author:**Sanjay Paunikar**

Zoological Survey of India,
Northern Regional Centre, 218,
Kaulagarh Road, Dehradun-248
195, Uttarakhand, India

It also lives in rice paddies. This fish is caught for food in many parts of Asia. This is one of several *Channa* known as dwarf snakeheads, smaller species kept in aquaria. It is also valued for its attractive coloration. This species has been studied for use in aquaculture operations

Identification of species is a primary step towards any research work and plays a key role for the behavioral study. Taxonomic identification is the initial step in the study of a species [1, 2]. In addition to the species identification, morphology is considered as a valuable source for fish population studies [3]. Morphometric is the quantitative criteria, while meristic are serial body counts. Complex variation associated with body form is one of the most difficult types of variation to quantify and the methods used to access it are collectively referred to as morphometrics [4]. Morphometric characters have been commonly used in fisheries biology as powerful tools for exact identification, of species, measuring discreteness and relationships among various taxonomic categories [5, 6]. Meristic character is also useful for describing or identifying the species [7].

Very few workers studied on fish diversity of Song River, but not much work on morphometric and meristic characters of fishes of the river. In this paper, we carried out study on morphometry and meristic characters of some local freshwater fishes found in the Song river of Dehradun district of Uttarakhand.

2. Material and Methods

2.1. Study Area: This study was carried out in one of the tributaries of river Ganga i.e., river Song flowing in different regions of Dehradun, Uttarakhand. 25 specimens were collected from three different zones: Maldevta near Shripur (30.3199° N, 78.1039° E), Gularghati near Balawala (30.2448° N, 78.1279° E) and Lacchiwala near Doiwala (30.2230° N, 78.0766° E).

2.2. Sample collection: 25 specimens of 5 species (*Rasbora daniconius*, *Devario devario*, *Nemacheilus botia*, *Pethia (Puntius) conchoni* and *Channa gachua*) were collected from the Song River at 3 different sampling zones. The fishes were collected with the help of net. The specimens were brought in the Ichthyology laboratory of Zoological Survey of India, Northern Regional Centre, Dehradun. The specimens were preserved in 10% formalin. Then fishes were used for the Morphometric measurements and Meristic counts. Morphometric characters were measured using a digital caliper. 22/23 Morphometric characters were obtained for each fish. The rate of growth of different morphological body parts of fish in relation to its total length and head length was studied. For meristic characters magnifying lens was used to count fin rays.

2.3. Statistical Analysis: Statistical calculation such as Mean, Standard deviation, regression equation and correlation coefficient have been calculated for all the 5 fish species. The regression method has been employed for morphometric measurement with the formula:

$$Y = a + bX$$

Where Y is the dependent variable such as fork length, standard length, body depth etc., 'a' is a constant value to be determined, 'b' is the regression coefficient and 'X' is the independent variable such as total length and head length. The

computer software Micro Soft EXCEL was used for all the statistical analysis of the data.

All the measurements and counts of each species were taken in the laboratory as per given by Day [8-10]. The weight unit of all fish samples in gram (g) and morphometric parameters measure in Centimeter (cm) of all fish samples.

3. Result and Discussion

In this investigation, five species were identified i.e., *Rasbora daniconius* (Hamilton 1822) under order Cypriniformes family Cyprinidae, *Devario devario* (Hamilton 1822) under order Cypriniformes family Cyprinidae, *Nemacheilus botia* (Hamilton 1822) under order Cypriniformes family Nemacheilidae, *Pethia conchoni* (Hamilton 1822) under order Cypriniformes family Cyprinidae and *Channa gachua* (Hamilton 1822) under order Perciformes family Channidae. The given table 1 depicts the Morphometric characters, table 2 depicts the meristic characters and table 3 depicts the regression and correlation coefficient of the identified species. Total length (TL), Standard length (SL), Fork length (FL), Body depth (BD), Pre-dorsal length (PDL), Pre-pectoral length (PPL), Pre-pelvic length (PVL), Pre-anal length (PAL), Base of dorsal fin (BDF), Base of pectoral fin (BPF), Base of pelvic fin (BVF), Base of anal fin (BAF), Base of caudal fin (BCF), Dorsal fin length (DFL), Pectoral fin length (PFL), Pelvic fin length (VFL), Anal fin length (AFL), Caudal fin length (CFL), Caudal peduncle length (CPL), Head length (HL), Eye-diameter (ED), Pre-orbital length (PRO), Post-orbital length (PRO) and Body weight (BW) are taken as Morphometric characters and Dorsal fin rays, Pectoral fin rays, Pelvic fin rays, Anal fin rays and Caudal fin rays are taken as meristic characters.

Based on the analysis of regression and correlation it has been observed that almost all the characters follows straight line relationship and show high degree of correlation coefficient indicating that all the morphometric characters increase as with increase in the proportion of total length and head length. The values of coefficient of correlation have been found to be highly significant at $p < 0.01$ and $p < 0.05$ for all the morphometric characters. Higher correlation coefficient 'r' indicated positive correlation in case of various Morphometric characters with the total length and head length. For *Rasbora daniconius*, correlation coefficient 'r' was maximum between total length and fork length and Pre-pelvic length ($r=0.983$) and lowest between total length and base pelvic fin length and base anal fin length ($r=0.900$) showing the positive correlation with total length. For *Devario devario*, correlation coefficient 'r' was maximum between total length and fork length ($r=0.996$) and lowest between total length and base caudal fin length ($r=0.900$) showing the positive correlation with total length. For *Nemacheilus botia*, correlation coefficient 'r' was maximum between total length and pre-dorsal fin length ($r=0.996$) and lowest between total length and pectoral fin length ($r=0.911$) showing the positive correlation with total length. For *Pethia conchoni*, correlation coefficient 'r' was maximum between total length and pre-dorsal length ($r=0.997$) and lowest between total length and base dorsal fin length. ($r=0.904$) showing the positive correlation with total length and for *Channa gachua*, correlation coefficient 'r' was maximum between total length and standard length ($r=0.996$) and lowest between total length and base pectoral fin length, base pelvic fin length and base caudal fin length ($r=0.913$). The Morphometric parameters showed proportional positive increase with increase in the length of fish.

The positive growth was recorded in morphometric parameters with increase in fish length [11, 12]. The meristic counts were almost constant in all the length groups of fish with different body length, so it concludes that the meristic counts were independent of body length [13]. The study on morphometric and meristic characters of fishes of different rivers of Dehradun along with Song River is very limited. The studied on the length-weight relationship of *Rasbora daniconius* from Saravathi reservoir of Karnataka [14] while the studied on the length-Weight relationship and condition factor of *Parluciosoma daniconius* (Ham.) from the upper Assam, India [15]. The finding showed that in *Schizothorax richardsonii* all morphometric characters show high degree of correlation coefficient from Uttarakashi district of Uttarakhand [16]. After investigation they observed that almost all the Morphometric characters show high degree of coefficient of correlation ($r > 0.90$) and correlation coefficient was significant at $p < 0.01$ in all the variables except in the depth of anal fin, which was significant at $p < 0.05$. Out of 21 characters studied, 19 characters were found to be genetically controlled, 1 character intermediate and 1 character as environmentally controlled. In *Tor putitora* positive correlation was observed between total length and external body parts by Langer *et al.* (2013). Some studied on *Garra gotyla gotyla* (Sucker head). The regression equation for LWR was estimated as $\text{Log Wt} = 2.869\text{Log L} - 1.878$. The results indicated that populations of *G. gotyla gotyla* in hill streams of Kashmir followed an isometric like growth pattern with 'b' values close to cubic law [17]. Some worker observed the linear relationship of *Garra gotyla gotyla*. Some variation in the count of branched and unbranched fin rays have been observed. Eighteen characters have been studied in percentage of total fish length from which three characters were genetically controlled, thirteen characters were intermediate and two characters were environmentally controlled [18]. Out of eighteen characters, ten characters show high values of correlation coefficient indicating that these characters are directly proportional to each other and eight characters show moderate correlation coefficient. In percentage of head length five were genetically controlled and two are intermediate. Three characters show least correlation coefficient and four shows moderate correlation. Morphometric analyses in his study only contribute to variations in body shape among the populations of *C. gachua* [19].

Some elucidated environmental impact on morphometry of *Garra lamta* (Hamilton-Buchanan) of Kumaun Himalaya shows most of the characters observed as genetically

controlled in respect to TL and SL while environmentally controlled (ecological) in respect to HL [20]. The studied on morphometric characters of freshwater fish *Cyprinus sp* collected from river Jhelum, Kashmir analysed and observed that all the morphometric characters were positively correlated with the total length [21]. Morpho-meristic characteristics of moustached Danio, *Danio dangila* from North-East hilly region of India found that all the morphometric parameters were positively correlated with total length [22]. The comparative studied of morphometric characteristics of Rohu and Jayanti Rohu under Captive Conditions in Tarai Region of Uttarakhand. The results reveal that morphometric parameters are significantly correlated to total length except caudal length in Jayanti rohu and body depth in rohu, respectively which signifies more body convexity of Jayanti rohu in comparison to Rohu [23]. The analyzed and interdependence of morphometric characters in the Hill stream fish *Mastacembelus armatus* (Lacepede) from Garhwal Himalaya. Analysis of variance (ANOVA) was which showed that all the relationships were significant at the level of 5% significance [24].

Studied on the four species of fishes Morphometric measurements and eight meristic count parameters for each fish species from Ganga river in Haridwar district, Uttarakhand. They found that the total length and weight of *Cyprinus carpio* ranged from 14–18 cm and 60–78 g; Mahseer fish species ranged from 21–28 cm and 120–185 g; 20–26 cm and 100–160 g (*Labeo rohita*) and 17–25 cm and 20–34 g (*Xenontodon cancila*) respectively were recorded during the study period. The regression coefficient 'b' show higher growth rate with respect to Total length was maximum in case of standard length ($b = 1.115$) and lowest in pelvic fin length ($b = 0.146$) for *Cyprinus carpio*, maximum in case of standard length ($b = 1.132$) and lowest in pectoral fin length ($b = 0.126$) for Mahseer, maximum in case of Fork and standard length ($b = 0.995$) and lowest in length of caudal peduncle ($b = 0.135$) for *Labeo rohita* and maximum in case of standard length ($b = 1.020$) and lowest in case of pelvic fin length ($b = 0.018$) for *Xenontodon canceilia* respectively [12]. Morphological account of *Schizothorax richardsonii* population of river kosi and river Alaknanda the study showed significant correlations exist in all the morphometric characters with total length except dorsal fin length in river Alaknanda. Twenty one characters have been studied in percentage of total length from which twelve characters were intermediate controlled in both the selected ecosystems which showed little bit disturbance in environmental conditions [25].

Table 1: Morphometric measurements of Identified fish species (Range, Mean and Standard deviation)

Characters studied	<i>Rasbora daniconius</i>		<i>Devario devario</i>		<i>Nemacheilus botia</i>		<i>Pethia conchonius</i>		<i>Channa gachua</i>	
	Range	Mean \pm SD	Range	Mean \pm SD	Range	Mean \pm SD	Range	Mean \pm SD	Range	Mean \pm SD
Total Length	7.6-5.5	6.48 \pm 0.861	7.6-5.5	6.34 \pm 0.832	6.9-5.1	5.72 \pm 0.746	5.4-4.4	4.92 \pm 0.383	9.1-7.5	8.22 \pm 0.661
Standard Length	6.4-4.2	5.5 \pm 1.105	6.3-4	4.94 \pm 0.882	5.6-4.2	4.8 \pm 0.561	4.6-3.7	4.08 \pm 0.327	7.4-6.2	6.76 \pm 0.517
Fork Length	7.3-4.9	6.04 \pm 1.043	7.5-4.9	5.84 \pm 1.052	6.8-5	5.54 \pm 0.730	5.1-4.2	4.56 \pm 0.336	-	-
Body Depth	1.7-1	1.28 \pm 0.277	2.4-1	1.64 \pm 0.594	1.4-0.8	0.98 \pm 0.285	1.9-1.2	1.58 \pm 0.286	1.5-1.2	1.34 \pm 0.114
Pre-dorsal Length	3.5-2.4	2.92 \pm 0.432	3.1-2.2	2.62 \pm 0.349	3.1-1.9	2.34 \pm 0.485	2.4-1.5	1.96 \pm 0.336	2.9-1.9	2.4 \pm 0.38
Pre-pectoral Length	1.6-1.1	1.3 \pm 0.2	1.2-0.7	0.96 \pm 0.207	1.7-1.1	1.36 \pm 0.240	1.3-0.8	1.08 \pm 0.192	2.5-1.7	2.08 \pm 0.319
Pre-pelvic Length	3.1-2.2	2.66 \pm 0.364	2.7-1.9	2.3 \pm 0.339	3.3-2.3	2.7 \pm 0.406	2.4-1.7	2.02 \pm 0.258	3.5-2.7	3.06 \pm 0.336
Pre-anal Length	4.7-3.3	4.04 \pm 0.646	4-2.8	3.28 \pm 0.46	4.7-3.1	3.66 \pm 0.642	3.2-2.2	2.74 \pm 0.371	4.7-3.8	4.26 \pm 0.384
Base Dorsal Length	1.2-0.4	0.82 \pm 0.349	2.2-1.2	1.66 \pm 0.397	1.5-1	1.24 \pm 0.207	1-0.7	0.88 \pm 0.109	4.3-3.3	3.8 \pm 0.412
Base Pectoral Length	0.9-0.7	0.76 \pm 0.089	0.4-0.1	0.18 \pm 0.13	0.5-0.3	0.36 \pm 0.089	0.4-0.2	0.36 \pm 0.151	0.5-0.3	0.38 \pm 0.083
Base Pelvic Length	0.9-0.7	0.8 \pm 0.1	0.6-0.1	0.22 \pm 0.216	0.4-0.2	0.28 \pm 0.083	0.3-0.1	0.18 \pm 0.083	0.4-0.2	0.28 \pm 0.083
Base Anal Length	0.9-0.7	0.8 \pm 0.1	2-0.9	1.26 \pm 0.439	0.9-0.5	0.7 \pm 0.158	0.6-0.2	0.4 \pm 0.158	2.5-1.7	2.1 \pm 0.316
Base Caudal Length	1.3-0.9	1.12 \pm 0.148	0.8-0.3	0.58 \pm 0.228	0.8-0.6	0.68 \pm 0.083	0.8-0.5	0.66 \pm 0.114	0.9-0.7	0.78 \pm 0.083
Dorsal Fin Length	1.3-1	1.14 \pm 0.134	1.2-0.9	1.04 \pm 0.151	1.1-0.9	1.02 \pm 0.089	1.5-0.5	1.1 \pm 0.367	4.8-3.9	4.32 \pm 0.364

Pectoral Fin Length	1.1-0.7	0.92±0.148	1.1-0.9	0.98±0.083	1.1-0.8	0.92±0.109	1-0.7	0.82±0.130	1.2-0.7	0.88±0.216
Pelvic Fin Length	1-0.5	0.72±0.178	0.9-0.5	0.7±0.187	0.8-0.5	0.66±0.130	0.9-0.2	0.6±0.228	1-0.5	0.68±0.216
Anal Fin Length	1-0.5	0.72±0.178	1.1-0.9	0.98±0.083	0.9-0.7	0.78±0.083	0.9-0.1	0.62±0.278	3.1-2.3	2.72±0.319
Caudal Fin Length	1.5-1.2	1.36±0.114	1.2-0.3	0.62±0.356	1.2-0.7	0.96±0.194	1.2-0.9	1.04±0.114	1.2-0.8	0.98±0.178
Caudal Peduncle Length	1-0.5	0.76±0.207	0.7-0.3	0.52±0.164	0.8-0.5	0.64±0.114	0.8-0.5	0.64±0.114	0.8-0.5	0.62±0.130
Body Weight	5.1-1.8g		6.9-1.9g		4.4-1.2g		3.6-1.5g		8.1-4.8g	
Head Region										
Head Length	1.3-1	1.2±0.122	1.3-0.9	1.12±0.164	1.3-0.8	1.04±0.207	1.2-0.9	1±0.109	2.2-1.6	1.88±0.238
Eye Diameter	0.4-0.3	0.38±0.044	0.5-0.3	0.38±0.083	0.4-0.2	0.32±0.083	0.4-0.3	0.32±0.044	0.5-0.3	0.38±0.836
Pre-Orbital Length	0.3-0.1	0.24±0.089	0.4-0.2	0.28±0.083	0.5-0.3	0.42±0.083	0.3-0.2	0.22±0.044	0.5-0.3	0.38±0.836
Post-Orbital Length	0.3-0.1	0.24±0.089	0.4-0.2	0.28±0.083	0.5-0.3	0.42±0.083	0.3-0.2	0.22±0.044	1.1-0.9	0.98±0.836

Table 2: Meristic characters of Identified fish species

S. No.	Meristic Characters	<i>Rasbora daniconius</i>	<i>Devario devario</i>	<i>Nemacheilus botia</i>	<i>Pethia conchonius</i>	<i>Channa gachua</i>
1.	Dorsal fin rays	8-9(2/6-7)	16-18(2/14-16)	13-14(2/11-12)	10-11(3/7-8)	35-36
2.	Pectoral fin rays	14-15	13-14	11	13-15	15-16
3.	Pelvic fin rays	8-9	7-8	7-8	9	5-6
4.	Anal fin rays	7(2/7)	17-19(3/14-16)	7(2/5)	7-8(2-3/5)	21-22
5.	Caudal fin rays	17-19	19	15-17	17-19	12

Table 3: Regression Equation and Correlation coefficient (r) in relation to total length and head length of Identified fish species

Characters studied	<i>Rasbora daniconius</i>		<i>Devario devario</i>		<i>Nemacheilus botia</i>		<i>Pethia conchonius</i>		<i>Channa gachua</i>	
	Regression Equation	r	Regression Equation	r	Regression Equation	r	Regression Equation	r	Regression Equation	r
Standard Length	1.041X-1.246	0.910	0.054X-1.743	0.994	0.736X+0.59	0.978	0.786X+0.214	0.920	0.78X+0.346	0.996
Fork Length	1.191X-1.676	0.983	1.26X-2.147	0.996	0.95X+0.108	0.970	0.823X+0.51	0.938	-	-
Body Depth	0.316X-0.768	0.981	0.697X-2.779	0.976	0.316X-0.747	0.979	0.735-2.035	0.983	0.169X-0.052	0.981
Pre-dorsal Length	0.486X-0.228	0.967	0.413X-0.001	0.985	0.645X-1.347	0.996	0.874X-2.341	0.997	0.561X-2.208	0.973
Pre-pectoral Length	0.226X-0.163	0.972	0.234X-0.522	0.938	0.316X-0.447	0.979	0.487X-1.363	0.989	0.482X-1.88	0.997
Pre-pelvic Length	0.416X-0.039	0.983	0.379X-0.102	0.929	0.539X-0.381	0.989	0.66X-1.227	0.977	0.506X-1.097	0.994
Pre-anal Length	0.699X-0.488	0.931	0.55X-0.206	0.994	0.855X-1.228	0.992	0.963X-1.996	0.993	0.574X-0.461	0.987
Base Dorsal Length	0.371X-1.586	0.915	0.472X-1.332	0.988	0.263X-0.264	0.946	0.259X-0.392	0.904	0.612X-1.232	0.981
Base Pectoral Length	0.104X+0.101	0.967	0.149X-0.767	0.953	0.118X-0.318	0.988	0.207X-0.741	0.950	0.116X-0.57	0.913
Base Pelvic Length	0.108X+0.114	0.900	0.24X-1.303	0.922	0.104X-0.316	0.928	0.207X-0.841	0.950	0.116X-0.67	0.913
Base Anal Length	0.108X+0.114	0.900	0.515X-2.006	0.976	0.197X-0.43	0.932	0.401X-1.63	0.919	0.469X-1.756	0.980
Base Caudal Length	0.165X+0.077	0.923	0.247X-0.984	0.900	0.104X+0.084	0.928	0.296X-0.796	0.995	0.116X-0.17	0.913
Dorsal Fin Length	0.143X+0.214	0.917	0.167X-0.017	0.914	0.118X+0.282	0.988	0.901X-3.335	0.940	0.534X-0.032	0.968
Pectoral Fin Length	0.165X-0.123	0.923	0.095X+0.376	0.947	0.134X+0.155	0.911	0.32X-0.753	0.940	0.322X-1.763	0.980
Pelvic Fin Length	0.197X-0.524	0.916	0.126X-0.036	0.916	0.17X-0.35	0.971	0.629X-2.496	0.946	0.322X-1.963	0.980
Anal Fin Length	0.197X-0.524	0.916	0.095X+0.376	0.947	0.104X+0.184	0.928	0.762X-3.129	0.937	0.457X-1.033	0.944
Caudal Fin Length	0.126X+0.564	0.916	0.424X-2.07	0.991	0.24X-0.411	0.917	0.282X-0.349	0.949	0.259X-1.146	0.955
Caudal Peduncle Length	0.234X-0.722	0.938	0.126X-0.236	0.916	0.146X-0.197	0.957	0.282X-0.749	0.949	0.193X-0.969	0.980
Head Region										
Eye Diameter	0.333X-0.02	0.912	0.481X-0.159	0.946	0.384X-0.079	0.951	0.324X+0.003	0.943	0.342X-0.263	0.976
Pre-Orbital Length	0.667X-0.56	0.912	0.481X-0.259	0.946	0.384X+0.021	0.951	0.324X-0.097	0.943	0.342X-0.263	0.976
Post-Orbital Length	0.667X-0.56	0.912	0.481X-0.259	0.946	0.384X+0.021	0.951	0.324X-0.097	0.943	0.342X+0.337	0.976

4. Conclusion

The present study revealed that Morphometric and meristic counts of freshwater fish of different regions of Dehradun showed proportional growth rate of fish species increasing with increase in fish length and show the higher positive correlation with the total length. Meristic counts were found to be constant.

5. Acknowledgement

The authors are highly grateful to the Director, Zoological Survey of India, Kolkata and Officer-In-Charge, Northern Regional Centre, Zoological Survey of India, Dehradun for constant encouragement and providing necessary the facilities.

6. References

1. Nayman. Growth and Ecology of Fish Population. Journal of Animal Ecology 1965;20:201-219.

- Langer S, Tripathi NK, Khajuria B. Morphometric and Meristic Study of Golden Mahseer (*Tor Putitora*) from Jhajjar Stream (JandK), India. Research Journal Animal, Veterinary and Fishery Sciences 2013;1(7):1-4.
- Deesri U, Cavin L, Claude J, Suteethorn V, Yuangdetkla P. Morphometric and taphonomic study of a ray-finned fish assemblage (*Lepidotes buddhabutrensis*, Semionotidae) from the Late Jurassic –earliest Cretaceous of NE Thailand. Geological Society, London, Special Publications 2009;315:115-124.
- Parsons KJ, Robinson BW, Hrbek T. Getting into shape: an empirical comparison of traditional truss-based morphometric methods with a newer geometric method applied to New World cichlids. Environmental Biology Fish 2003;67(4):417-431.
- Cavalcanti MJ, Monteiro LR, Lopes PRD. Landmark-based morphometric analysis in selected species of serranid fishes (Perciformes: Teleostei). Zoological

- Studies 1999;38:287-294.
6. Quilang JP, Basiao ZU, Pagulayan RC, Roderos RR, Barrios EB. Meristic and morphometric variation in the silver perch, *Leiopotherapon plumbeus* (Kner, 1864), from three lakes in the Philippines. *Journal of Applied Ichthyology* 2007;23:561-567.
 7. Gogoi R, Goswami UC. Length-Weight Relationship and Sex Ratio of Fresh Water Fish *Amblypharyngodon mola* (Ham-Buch) from Assam. *International Journal of Fisheries and Aquatic Studies* 2015;1(4):68-71.
 8. Day F. The Fauna of British India including Ceylon and Burma. Fishes Taylor and Francis, London. 1889, I(II).
 9. Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries. Oxford & IBH Publication, New Delhi. 1991;1(2):1158.
 10. Jayaram KC. The fresh water fishes of the Indian region. Narendra Publishing House, Delhi 2010.
 11. Ujjania NC, Kumar G, Langar RK, Krishna G. Biometric studies of Mahseer (*Tor tor* Ham. 1822) from Bari Talab (Udaipur), India. *International Research Journal of Biological Sciences* 2012;2(3):138-41.
 12. Kamboj N, Kamboj V. Morphometric and meristic study of four freshwater fish species of river Ganga. *Indian Journal of Animal Sciences* 2019;89(4):120-123.
 13. Zafar M, Nazir A, Akhtar N, Mehdi Naqvi SMH, Zia-ur-Rehman M. Studies on meristic counts and Morphometric measurements of Mahseer (*Tor putitora*) from a spawning ground of Himalayan foot-hill River Korang Islamabad, Pakistan. *Pakistan Journal of Biological Science* 2002;5(6):733-35.
 14. Kumar KH, Kiran BR, Purushothom R, Puttaiah ET, Manjappa S. Length-Weight Relationship of Cyprinid Fish, *Rasbora daniconius* (Hamilton-Buchanon) from Sharavathi Reservoir, Karnataka. *Zoos' Print Journal* 2005;21(1):2140-2141.
 15. Dakua SK, Islam M, Nilam B. Length-Weight relationship and Condition factor of *Parluciosoma daniconius* (Hamilton) from the upper Assam, India. *Journal of Fisheries Science* 2016;10(1):53-56.
 16. Negi RK, Negi T. Assemblage structure of stream fishes in the Kumaon Himalaya of Uttarakhand State, India. *Life Science Journal* 2010;7(1):9-13.
 17. Qayoom U, Syed N, Mushtaq ST. Morphometry and length-weight relationship of sucker head, *Garra gotyla gotyla* (Gray, 1830) in hill streams of Kashmir. *International Journal of Fisheries and Aquatic Studies*. 2015;3(2):437-439.
 18. Brraich, OS, Akhter S. Morphometric characters and meristic counts of a Fish, *Crossocheilus latius latius* (Hamilton- Buchanan) from Ranjit Sagar Wetland, India. *International Journal of Fisheries and Aquatic Studies* 2015;2(5):260-265.
 19. Jearranaiprepame P. Morphological differentiation among isolated populations of dwarf snakehead fish, *Channa gachua* (Hamilton, 1822) using truss network analysis. *Acta Biologica Szegediensis* 2017;61(2):119-128,
 20. Kanwal BPS. Environmental impact on morphometry of *Garra lamta* (Hamilton-Buchanan) of Kumaun. *International Journal of Fisheries and Aquatic Studies*. 2017;5(3):45-48 2017.
 21. Bhat MA, Mohammad N, Masarat S. Morphometric characters of freshwater fish *Cyprinus sp* collected from river Jhelum, Kashmir. *International Journal of Innovative Research and Advanced Studies* 2016;3(4):117-120.
 22. Banerjee T, Mahapatra BK, Patra BC. Morpho-meristic characteristics of moustached Danio, *Danio dangila* (Hamilton, 1822) from North-East hilly region of India. *International Journal of Fisheries and Aquatic Studies*. 2017;5(2):389-393.
 23. Sharma L, Pant B, Tamta E, Ram RN. Original Research Comparative Study of Morphometric Characteristics of Rohu and Jayanti Rohu under Captive Conditions in Tarai Region of Uttarakhand. *International Journal of Livestock Research* 2018;8(11):239.
 24. Rashid M, Sagir M, Dobriyal AK. Analysis and interdependence of morphometric characters in the Hill stream fish *Mastacembelus armatus* (Lacepede) from Garhwal Himalaya. *Journal of Applied and Natural Science*. 2019;11(1):107-115.
 25. Lohani V, Pant B, Pandey NN, Ram N. Morphological account of *Schizothorax richardsonii* population of river kosi and river Alaknanda *International Journal of Marine Sciences* 2020;8(2):12-24.