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Morphometric and meristic characters of *Schizothorax esocinus* (Heckel, 1838) from dal lake, Kashmir, India

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Abstract

Schizothorax esocinus, locally known as “Chirruh” is an indigenous cyprinid fish of Dal Lake Kashmir. The fish is commercially important and well adapted along with other cyprinids inhabiting the lake. The present study was aimed to describe morphometric and meristic characters of *S. esocinus* from Dal Lake, Kashmir. 30 specimen of *S. esocinus* were collected from Dal Lake, for which fourteen morphometric measurements and five meristic count parameters were studied. The fin formula of *S. esocinus* was devised as D, I+5-10, P, I +7-11, C, I +15-23, A, I+3-7. The total length of the specimen ranged from 136.30 mm to 297 mm with the corresponding weight being 18.17 gms and 159.51 gms respectively. The various morphological characters compared showed high co-efficient of correlation (r) values, indicating that the characters were highly correlated to each other with highest correlation coefficient value found between total length and standard length (r= 0.7829).

Keywords: Dal Lake, morphometrics, Meristics, *Schizothorax esocinus*

Introduction

The Union Territory of Jammu and Kashmir is rich in aquatic resources ranging from ponds, pools, steams, wetlands, springs and rivers to the voluminous lakes in the plains and in high altitudes. The water bodies of Kashmir valley support a wide variety of indigenous and exotic fish species with the major ichthyofauna represented by the Central Asiatic fishes in which Schizothoracids are predominant (Sunder *et al.*, 1979) [13]. Fishes belonging to families Cyprinidae, Cobitidae, Siluridae, Poecilidae, Sisoridae and Salmonidae are also found in the valley. Yousuf (1996) [15] reported 42 species of fishes from Kashmir while Balkhi (2007) [1] reported 40 species. However due to pollution and encroachment of water bodies, not more than 22 species are existing at present (Kullander *et al.*, 1999; Bhat *et al.*, 2010) [6, 2]. Most fish species inhabiting the waters of Kashmir are small in size. Their size, growth and distribution depends on environmental conditions such as water temperature, velocity of water current, nature of substratum, availability of food and their feeding habits (Yousuf *et al.*, 2003; Bhat *et al.*, 2010) [16, 2].

Schizothoracids, the indigenous cyprinids are prominent in foothill streams of the Himalaya and Central Asia and dwell in both lotic as well as lentic water bodies of Kashmir. These fish are usually called snow trouts and are restricted to cold regions and to the habitats owing snow fed rivers. *Schizothorax ecosinus*, locally known as ‘chirruh’ is the most valuable species of the Kashmir valley, forms an important delicacy of local population and is well suited to crystal clear and oxygenated waters of the valley. They are moderately sized, native, benthopelagic fishes found in mountain streams, rivers and gravel bottomed lakes. Body of the fish is elongated with minute scales and numerous black spots. Mouth is slightly ascending forward, the upper jaw being little longer than lower. However, indiscriminate fishing pressure, introduction of exotic species such as carps and other human made activities such as pollution, urbanization, overfishing will ultimately lead the status of this species make more vulnerable for their living. They are designed as prized fishes, and are believed to have migrated into lakes and streams of Kashmir from Central Asian watersheds bordered by inner and Southern slopes of Hindu Kush, Karakoram and inner ends of north western Himalayan and Suleiman Ranges.

Morphometric and meristic characters of fish are the ones which are assessable or countable. Morphological measurements, meristic counts, shape and size offer data beneficial for taxonomic position. Fish have greater variance in morphological traits both within and

amongst population than other vertebrates and are more susceptible to environmentally induced morphological variations. Morphometric and meristic studies can thus be a primary step in investigating the stock structure of species with a large sized population.

Materials and Methods

A total of 30 specimen of *S. esocinus* were collected from commercial catches of Dal Lake. Simple random sampling, representative of all length groups, was carried out. The samples collected were transported in ice boxes to the laboratory for further analysis.

Morphometric characters were measured by using fish measuring board and Vernier Calliper for accuracy to the nearest millimetre as described by Lagler *et al.* (1962) [8], Laevastu (1965) [7], Lowe-McConnel (1971) [9], Dwivedi and Menezes (1974) [4] and Grant and Spain (1977). About 14 morphometric and 5 meristic characters were studied for each fish sample. The morphometric characters measured were total length (TL), standard length (SL), forked length (FL), pre dorsal length(PDI), pre anal length (PAL), pre pelvic length (PPvL), pre pectoral length (PPcL), eye diameter (ED), body depth (BD), head length (HL), post orbital length (Pool), pre orbital length (PrOL), snout length (SnL) and caudal fin length (CFL). Total length (TL) and all other measurements were taken in millimeters. Meristic counts were analyzed by conventional method. All the meristic counts were set up against incoming light in the laboratory room using a needle and small pins for easy counting.

Results

Dal Lake is the main water body of Kashmir valley with immense socio economic significance. The lake is greatly utilized for its water and food resources in the form of fish

and Nelumbo (lotus stem). The lake is being polluted with sewage from settlements, agricultural runoff and effluents from various small and large scale domestic and commercial sources. Measurements of numerous morphometric traits of *S. esocinus*, their mean, median, standard error, standard deviation, coefficient of determination, coefficient of correlation are given in Table 1 and 2. The correspondence amongst several characters i.e., total length vs standard length, total length vs forked length, total length vs pre anal length total length vs pre pelvic, total length vs pre pectoral length, total length vs head length, head length vs eye diameter, head length vs snout length are described in Table 2. Coefficient of determination (R^2) values fluctuated from 0.90 to 0.54 indicating that the morphometric characters are highly correlated.

For meristics, the range of fin rays in dorsal fin came out to be 9-12 with a mean of 10.3, in pectoral fin the range of fin rays came out to be 10-15 with a mean of 12.33, in pelvic fin the range of fin rays came out to be 6-8 with a mean 7.7, in anal fin the range of fin rays came out to be 5-8 with a mean 6.4 and in caudal fin the number of fin rays came to be 18- 26 with a mean of 2.40 (Table 3).

In the present study, various morphometric characters compared showed high coefficient of correlation (r) values, with highest correlation coefficient value between total length and standard length ($r = 0.78$) indicating that the morphometric characters investigated are highly correlated to each other. The “b” values obtained showed highest degree of correlation between total length and standard length ($b = 0.37$) and lowest between total length and head length ($b = 0.07$). There was a significant positive correlation between growths of all other parameters with respect to total length (Fig 1 and 2).

Table 1: Statistical estimates of various morphometric characters of *S. esocinus* from Dal Lake, Kashmir

Statistical estimates	Range (mm)		Mean (mm)	Median (mm)	Standard error	Standard deviation	Coefficient of variation
	Min.	Max.					
Total Length	136.63	297.00	174.22	167.10	7.13	39.07	22.42
Standard Length	115.25	186.00	138.82	137.68	3.45	18.90	13.61
Forked Length	120.61	191.46	146.21	144.87	3.59	19.66	13.42
Pre Dorsal Length	56.73	96.74	73.47	71.885	1.91	10.47	13.42
Pre Anal Length	70.01	145.93	109.75	111.92	2.89	15.85	17.89
Pre Pelvic Length	62.66	104.77	77.97	77.45	1.90	10.41	18.21
Pre Pectoral Length	28.53	46.53	37.38	37.72	0.88	4.84	16.77
Eye Diameter	5.47	9.69	7.36	7.23	0.22	1.20	16.36
Body Depth	22.87	76.7	31.81	29.68	1.73	9.49	15.10
Head Length	22.26	39.36	28.74	27.62	0.84	4.63	16.11
Post Orbital Length	13.01	24.34	18.15	18.30	0.55	3.02	16.97
Pre Orbital Length	7.05	13.6	9.49	9.16	0.31	1.71	19.06
Snout Length	4	11.02	5.93	5.65	0.31	1.71	25.76
Caudal Fin Length	24.9	47.66	32.08	31.85	0.96	5.29	16.50

Table 2: Correlation between various morphometric traits of *S. esocinus* from Dal Lake, Kashmir

Morphometric characters	Slope b	Intercept a	Y= a+bx	R ² (coefficient of determination)
Total length & Standard length	0.3788	72.84	0.3788x+72.84	0.613
Total length & Forked length	0.4377	69.816	0.4377x+69.816	0.7504
Total length & Pre dorsal length	0.2074	39.224	0.2074x+39.224	0.6414
Total length & Pre anal length	0.4636	31.504	0.4636x+31.504	0.8126
Total length & Pre pelvic length	0.3563	18.062	0.3563x+18.062	0.9098
Total length & pre orbital length	0.0365	3.1869	0.0365x + 3.1869	0.614
Total length & Head length	0.0879	13.258	0.0879x+13.258	0.6295
Head length & Eye diameter	0.1885	2.0408	0.1885x+2.0408	0.5462
Head length & Snout length	0.2774	1.599	0.2774x-1.599	0.6119
Total length & pre pectoral length	0.146	12.804	0.146x+12.804	0.7906
Total length & post orbital length	0.0638	7.0935	0.0638x + 7.0935	0.6503

Table 3: Meristic characters of *S. esocinus* from Dal Lake, Kashmir

Meristic characteristics	Range	Mean	Median	Standard deviation
Dorsal fin rays	9-12	10.53	10	1.40
Pectoral fin rays	10-15	12.33	12	1.34
Pelvic fin rays	6-8	7.7	8	1.08
Anal fin rays	5-8	6.4	6.5	0.89
Caudal fin rays	18-26	21	20	2.40

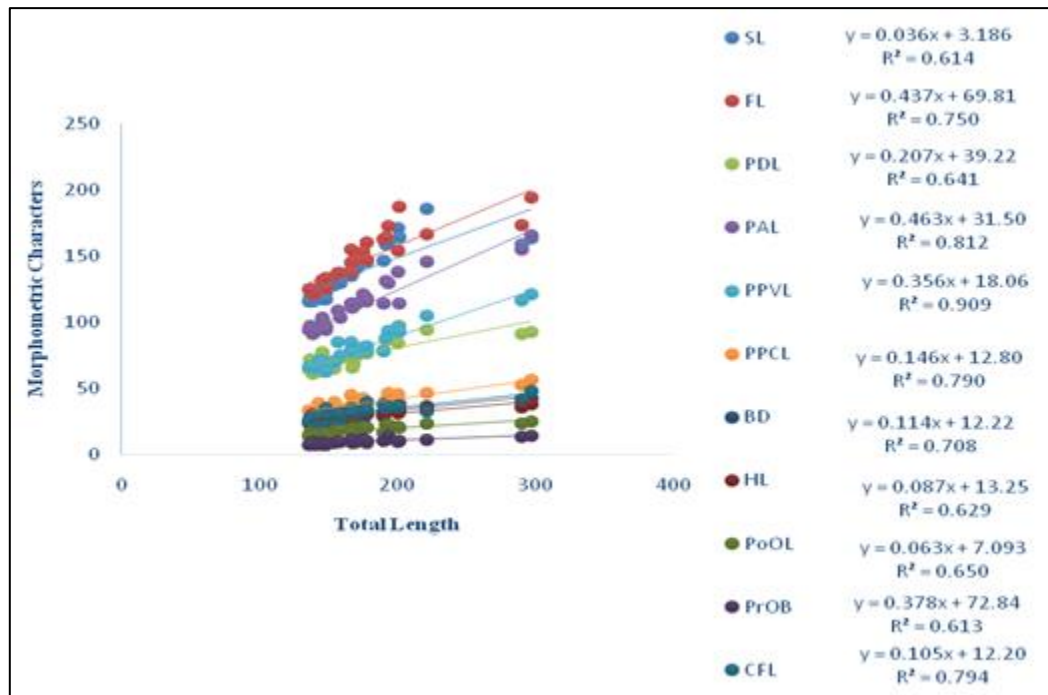


Fig 1: Logarithmic relationship of different morphometric characters with total length (mm) in *S. esocinus* from Dal Lake, Kashmir

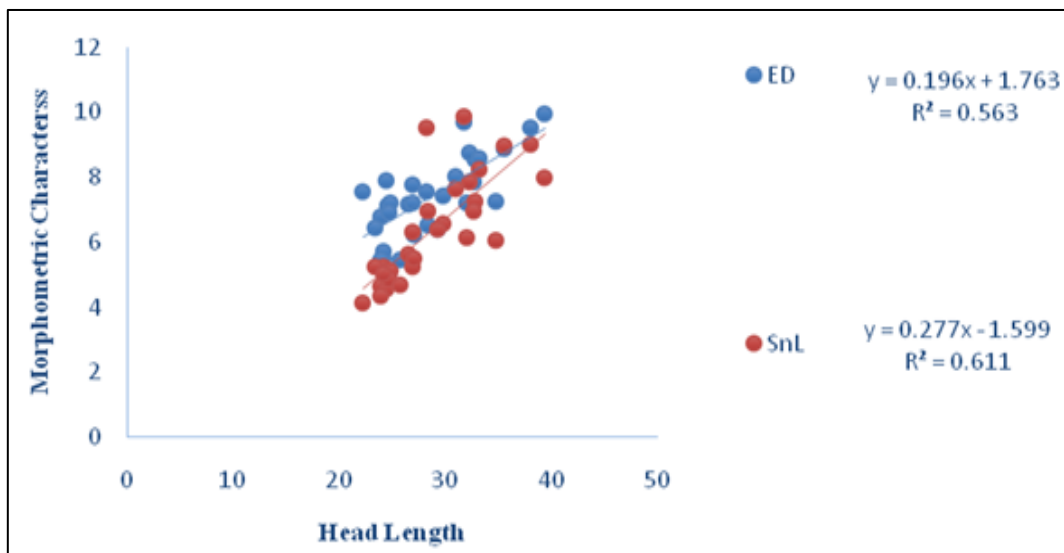


Fig 2: Logarithmic relationship of different morphometric characters with head length (mm) of *S. esocinus* from Dal Lake, Kashmir.

Discussion

Bhat *et al.* 2013 ^[16] while studying the morphometric characteristics of Schizothoracines in River Lidder of Kashmir observed positive correlation coefficient of total length with other parameters under comparison, the maximum value of correlation coefficient ‘r’ of total length with standard length was observed as (r = 0.999) compared to all other parameters studied. Sharma *et al.* 2014 during their study on the relationship of total length and external body parts of *Botia birdi* in the Indus basin, Jammu and Kashmir

reported a positive correlation in all morphometric and meristic parameters with total length. The highly correlated body parameter in relation to total length was fork length (r = 0.999) and the least correlated was Post orbital Length (r = 0.776). Gharai (2012) studied the morphometric characters of snow trout *Schizothorax zarudnyi* and reported that the studied morphometric characters were not significantly different in both sexes (P>0.05). Negi and Negi (2010) ^[11] analysed the morphometric characters of *S. richardsonii* and observed that almost all the morphometric characters show

high degree of coefficient of correlation ($r > 0.90$).

The results of the present investigation for meristic counts exhibited substantial difference in all the characters studied. The variation in fin rays falls under some specific range in all the fishes. Rehman *et al.*, 2015^[12] reported the variation in different meristic counts of silver carp. Nakamura (2003)^[10] found differences in meristic counts in Japanese charr (*Salvelinus leucomaenis*) among the river systems (Naka and Tone rivers, central Japan) and among the tributaries of the Naka River (Ashinagasawa, Akasawa, Ushirosawa and Moto-okashirasawa streams). Similar results have been found by Turan *et al.*, (2004)^[14] for anchovy, *Engraulis encrasicolus* in the Black, Aegean and north eastern Mediterranean Seas.

Conclusion

Various morphometric characters of *S. esocinus* were studied, indicating very high degree of correlation coefficient between the characters compared. The study provides basic information about the morphometric and meristic measurements of *S. esocinus* which can be used to determine the stock structure of the species. A comprehensive report on the species in the Dal Lake should be carried out to know the actual population of fish species in the lake. Continuous evaluation should be constantly carried out on the lake and its resources to know its state at all time for proper management and control. Fisheries activities should be encouraged in and around the lake, especially on a commercial level, which will employ more local people living around the lake.

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