

Morphometric and Meristic Characteristics of Birdi Loach, *Botia birdi* (Chaudhuri, 1909) from a Tributary of Indus Basin, Jammu and Kashmir, India

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Abstract: The present study describes the morphometric and meristic characteristics of Birdi loach, *Botia birdi* from Poonch River of Jammu and Kashmir, India. A total of 59 specimens ranging from 75.2-186.0 mm in total length (TL) and 7.91-60.64 g body weight (BW) were collected between July 2013 to April 2014 by using different fishing gears. Positive correlation was observed between total length and other body parts. The highly correlated body parameters in relation to total length were fork length ($r = 0.999$) and post orbital length (PoOL) was found least correlated ($r = 0.776$) and strong correlations was observed between head length (HL) and PrOL ($r = 0.991$) and least correlation ($r = 0.929$) between HL and eye diameter (ED). The meristic characters were common in all the specimens (D. I -10, A. I- 6, P. 14, V. I-7, C.19). These findings may provide useful information for the conservation and sustainable management of this important fish in the least explored tributary of Indus basin in India.

Key words: Morphometry • *Botia birdi* • Isometric Growth • Wild Population

INTRODUCTION

The order Cypriniformes represents the world's largest clade of primary freshwater fishes [1] and is divided into two superfamilies: Cyprinoidea (Carp like fishes) and Cobitoidea (loach fishes). Cobitids were recognized as a natural assemblage based on the presence of a movable bifurcated suborbital spine, the character that gave them the common name spined loaches. A similar spine is also present in the loach family Botiidae and was considered as synapomorphy of Cobitidae and Botiidae [2]. Cobitidae differ from Botiidae in the arrangement of barbels and the ossified swim bladder [3]. Loaches, fishes of the suborder Cobitoidei, are small benthic fishes known inhabiting moderately to very fast flowing waters throughout Eurasia, with two named species in Africa (Morocco and Ethiopia). Most of them inhabit rivers and streams in hilly areas but they are also known from streams in rain forest, in the black waters of peat swamp forests, or in oases (in the Taklamakan Desert). Many of them are specialized cave fishes, others

inhabit rapids and waterfalls. Some species inhabit mountainous or piedmont rapids, which in some cases led to strong morphological adaptations allowing the fish to attach to stones in very strong currents [4-6]. Several genera of the family Cobitidae developed adaptations that allow them to dig, hide and feed in fine sand using the gill apparatus for filtration of food particles out of the sand [7]. There are two major patterns exhibited by adult males: modification of pectoral fin rays and body swelling [8]. In most taxa, adult males develop a thickening and elongation of one or two rays of the pectoral fins, often in combination with a plate-like or finger-shaped ossified extension of the base of the thickened fin rays [8].

Botia birdi commonly known as birdi loach is a benthopelagic hill stream fish belonging to family Cobitidae of subfamily Botinae [9, 10]. It is widespread in the Indus drainage of India and Pakistan [10]. Spawning season of the fish commences from May to July. The feeding habit of fish is carnivore-omnivorous with diet dominated by animal food. The fecundity of *Botia*

birdi ranges from 9197-19550 with average of 13201.7 [11]. A remarkable sexual dimorphism is present including the different size of the sexes (male smaller than female), presence of enlarged pectoral fish in males. The fish is characterized by the presence of conspicuous colour pattern of brownish black elliptical loops that sends down broad brownish black bands on each side which ends to ventral surface and a bifid preorbital spine in front of eyes. It has oblong, short and moderately compressed body with dorsal surface dark yellowish in colour [12]. *Botia birdi* is well adapted to torrential streams and being capable of suspending respiration for short periods, the heart shows many features which may not been observed in any other teleosts [13].

Morphometric measurements and statistical relationships of fishes are imperative for both fishery biology [14-16] and taxonomy studies [17, 18]. Morphological variability of fish is considered to be an important adaptive strategy for populations experiencing inconsistent environments [19, 20]. Variability of environment could be explained by abiotic components such as physicochemical parameters of water, habitat and substrate types and biotic components like competition and predation, which serve as selective pressures. Information on the morphometric measurements of fishes and the study of statistical relationship among them are essential for taxonomic work [21, 22].

No data regarding morphometric and meristic characteristics of *Botia birdi* is available in the previous literature. So, this study was initiated to provide baseline data for this important freshwater fish from Poonch River of Jammu and Kashmir, India.

MATERIALS AND METHODS

Altogether 59 specimens of *Botia birdi* were collected from River Poonch (33°46'22.19"N; 74°04'42.45"E) a tributary of Jhelum River (tributary of Indus) in the Poonch region of Jammu and Kashmir, India from July 2013 to April 2014, by using different fishing gears. The mesh size of the fishing gear (cast nets: 9 m length, 9 m breadth and 1/2cm mesh size and drag nets: 100 m length, 20 m breadth, 1/2 cm mesh size) was designed for the large sized specimens to avoid any fingerling and fry capture. The fish was anaesthetized by using Clove oil (50µl/l of water); measurements were taken and fish was released back into the river. Voucher specimens were preserved in 10% formaldehyde solution. The fish were measured for 5 meristic and 27 morphometric characters. Lengths on the head were counted in percent of head length, while others in percent of total length. The total length of each fish was measured with digital slide calipers up to the nearest 0.1 mm and weighed with a digital balance up to the nearest 0.1 g. A stereomicroscope was used for the counting of meristic characters. Identification of fishes was done following [23] and [9]. All data were analyzed for combined sexes in Excel 2007 and SPSS 16.0.

RESULT AND DISCUSSION

A total of 59 specimens ranging from 7.52 and 18.6 cm TL (total length) and 7.91-60.64 g body weight (BW) were used for the studies of morphometric and meristic characteristics. The depiction of morphometric characters is presented in Fig. 1 and definitions and statistical values

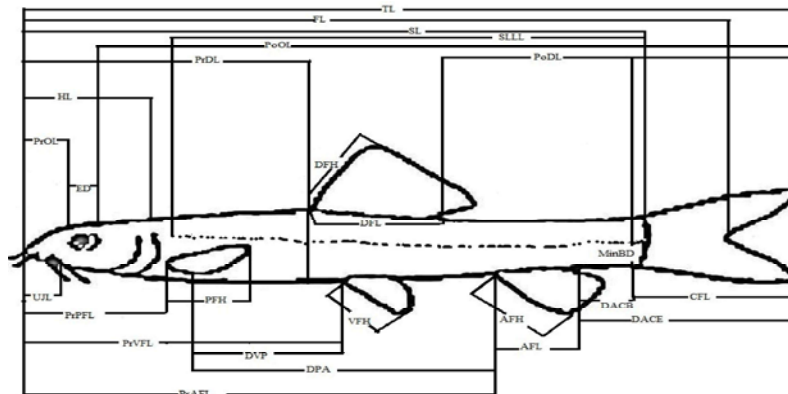


Fig 1: Morphometric measurements of *Botia birdi* from Poonch tributary of Indus basin, Jammu and Kashmir, India. Explanations of acronyms in Table 1

Table 1: Definition of morphometric measurements, range, mean and standard deviation examined in *Botia birdi* from Poonch tributary of Indus basin

Morphometric characters	Range	Mean	S.D
TL: total length	7.52-18.6	13.74	3.85
FL: fork length	5.77-16.7	11.83	3.77
SL: standard length	4.92-15.29	10.77	3.49
PoDL: post-dorsal length	3.47-10.6	7.14	2.65
PrDL: pre-dorsal length	2.47-8.3	5.40	2.14
HL: head length	1.58-3.6	2.56	0.72
PoOL: post-orbital length	1.16-15.92	10.95	4.49
PrOL: pre-orbital length	0.71-2.3	1.54	0.55
ED: eye diameter	0.19-0.41	0.29	0.07
DFH: dorsal fin height	1.28-3.2	2.17	0.59
DFL: dorsal fin length	1.0-2.39	1.74	0.51
MaxBD: maximum body depth	1.28-3.4	2.40	0.72
MinBD: minimum body depth	0.58-2.4	1.59	0.70
AFH: anal fin height	1.4-2.8	2.12	0.38
AFL: anal fin length	0.73-1.2	0.97	0.12
PFH: pectoral fin height	1.3-3.0	2.28	0.56
VFH: ventral fin height	1.11-1.48	1.85	0.48
PrVFL: pre-ventral fin length	3.42-8.5	5.88	1.81
PrPFL: pre-pectoral fin length	1.48-4.03	2.77	0.93
PrAFL: pre-anal fin length	4.99-12.5	8.47	2.65
DACE: distance from anal fin to caudal fin end	3.42-5.91	4.57	0.74
CFL: caudal fin length	2.33-3.95	2.96	0.46
DACB: distance from anal fin to caudal fin base	1.05-2.17	1.61	0.38
DPA: distance between pectoral and anal fin	3.92-7.8	5.53	1.27
DVP: distance between ventral and pectoral fin	2.1-4.1	2.83	0.59
UJL: upper jaw length	0.2-0.5	0.34	0.11
SLLL: straight lateral line length	4.03-11.46	8.20	2.71

Table 2: Meristic counts of the *Botia birdi* captured from Poonch tributary of Indus basin in Jammu and Kashmir, India

Meristic Characters	Range
PFR: pectoral fin rays	14
DFR: dorsal fin rays	I-10
CFR: caudal fin rays	19
AFR: anal fin rays	I-6
VFR: ventral fin rays	I-7

Table 3: Morphometric characters of *Botia birdi* in accordance with percent total length and head length of fish and correlation of morphometric traits with total length from the Poonch River

Characters	Mean	SD	Min.	Max.	r
In % of total length					
FL	85.02	4.40	76.72	89.84	0.999
SL	77.23	5.10	65.42	82.89	0.996
PoDL	50.47	6.23	38.65	58.89	0.992
PrDL	37.85	5.86	27.30	45.39	0.991
HL	18.75	1.33	16.07	22.50	0.977
PoOL	86.44	1.29	83.60	88.04	0.766
PrOL	10.97	1.07	9.44	12.88	0.989
ED	2.20	0.18	1.81	2.58	0.962
DFH	15.88	0.93	14.63	18.66	0.975
DFL	12.61	0.63	11.26	13.55	0.989
MaxBD	17.36	0.82	15.46	19.01	0.992
MinBD	11.00	2.57	6.88	13.49	0.984
AFH	16.00	2.16	13.75	19.97	0.977
AFL	7.51	1.62	5.73	10.33	0.889
PFH	16.78	0.96	15.28	18.30	0.983

Table 3: Continue

VFH	13.65	1.09	11.46	17.36	0.969
PrVFL	42.56	2.36	37.85	46.62	0.988
PrPFL	19.81	1.56	16.86	21.97	0.991
PrAFL	61.16	3.75	52.81	67.20	0.988
DACE	34.78	5.99	27.41	48.53	0.937
CFL	22.80	5.15	17.10	34.57	0.803
DACB	11.98	1.57	8.57	14.24	0.863
DPA	41.23	4.49	35.74	52.12	0.963
DVP	21.33	3.37	17.36	27.92	0.912
UJL	2.51	0.26	2.14	3.184	0.939
SLLL	58.71	4.86	50.06	64.71	0.991
In % of Head length					
PrOL	58.72	6.46	42.62	66.42	0.991
ED	11.78	1.17	9.42	14.69	0.929



Fig 2: Plate of *Botia birdi* from Poonch River in Jammu and Kashmir, India

of morphometric and meristic characters are given in Tables 1 & 2. Further body divisions between total length, head length versus other respective parameter is provided in Table 3. Since all the meristic parameters are almost constant in fish with different body length, therefore conclude that meristic count is independent of body length. The relationship between total length and external body parts are studied. A positive correlation (Table 3) is found in all parameters with total length and thus showed significant correlation. The most highly correlated body parameters in relation to TL is fork length (0.999) whereas least correlation for PoOL (0.776). Lengths on the head were counted in percent of head length and shows positive correlation. The most highly correlated body parameters in relation to HL is PrOL (0.991) whereas least correlation for ED (0.929). The correlation analysis (Table 3) shows that all morphometric traits change proportionally with the growth of the total length between 7.52 and 18.6 cm. All the morphometric characters examined, exhibit a significant positive correlation ($p < 0.001$) which indicate isometric growth in all organs of *Botia birdi* under natural condition. The diagnostic features showed that body is elongate and laterally compressed. Mouth is small with four pairs of barbels. Dorsal fin inserted almost equidistant from snout tip and caudal fin base. Caudal fin deeply forked with caudle

peduncle tapers posteriorly (Fig. 2). Dorsal and caudal fins yellowish-white, two to four broad black bands, others fins pale yellowish [10]. These results will be useful for fishery research, management and conservation in least explored tributary of Indus Basin.

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