Original Research

Comparative Study of Morphometric Characteristics of Rohu and Jayanti Rohu under Captive Conditions in Tarai Region of Uttarakhand

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Abstract

A comparative study of morphometric characteristics of rohu (Labeo rohita) and Jayanti rohu was conducted on the farmed fish specimen of College of Fisheries, Pantnagar, Uttarakhand. The descriptive statistical parameters and correlation coefficient (r) were analysed with independent variable (total length) and dependent variable (other morphometric parameters). The maximum correlation coefficient of average total length was obtained with fork length (0.977) and with standard length (0.979) in Jayanti rohu and rohu respectively. Minimum correlation coefficient, 0.356 in body depth-total length (BD-TL) and 0.424 in head length (HL -TL) was reported in rohu and Jayanti rohu respectively. Correlation coefficient in Jayanti rohu (BD-TL) is higher than rohu (0.778). 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.

Introduction

The Indian major carps are the Gangetic origin species and naturally found in rivers, reservoirs, lakes and in cultured ponds (Jhingran, 1968). Major carp, *Labeo rohita* is commonly known as rui, rohit, rohu and it belongs to family Cyprinidae, order Cypriniformes, is a warm-water teleost and column feeder herbivore showing rapid growth in terms of flesh. It can be identified by its fairly depressed snout, thick and fringed lips. Body colour of rohu is black brownish with silvery sides and beneath while caudal peduncle is generally short. *Labe rohita* can attain maximum length up to 200 cm, the maximum weight of 45 kg (Frimodt, 1995) and the maximum reported age of 10 years (Khan and Jhingran, 1975). It is the prime carp

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species cultivated mainly as a component of polyculture systems with other indigenous and exotic carp species (Abidi and Khan, 2004). It is one of the most important commercial and cultivable fish species and contributes a major portion to the fresh water fish production of India and also has maximum market demand (Balai *et al.*, 2017). Rohu inhabits the rivers of northern and central India and in the past decade it is also introduced in some of the rivers of Peninsular India, along with neighbouring countries like Myanmar, Nepal, Bangladesh and Pakistan (Dahankur, 2010; Froese and Pauly, 2013).

Jayanti Rohu is the first genetically improved rohu in India with higher growth efficiency released by Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar in 1997. Morphologically it is similar to rohu but grows much faster than the normal rohu. The Jayanti rohu is recording 17% more growth per generation after five generations of selection (Mahapatra *et al.*, 2007). Proportion of total length, standard length and fork length, body weight and condition factor are generally presented as morphometric measurements (Naeem *et al.*, 2010; 2011a; b). Morphometric characters and relationship have a relevant role in fisheries research and management as it is used for comparing morphological themes of populations of different regions (Stergiou and Moutopoulos, 2001). Morphometry have been used in culture studies for assessing population, cohorts, biomass and estimation of health of fish (Gerritsen and McGrath, 2007. Hockaday *et al.*, 2000). The well-being of individuals and determination of possible difference between separate unit stocks of the same species can be assessed by using morphometric relationships of different body parts of fish (King, 2007). Length measurements are often used to construct a length-weight relationship as these can be obtained under a large range of circumstances than weight measurements (Loy *et al.*, 2000). Data on morphometric measurements used to describe the shape of each fish (Pollar *et al.*, 2007).

Identification of species is a primary step towards any research work and plays a key role for the behavioural study. Morphometric measurements and meristic counts are considered as the easiest and authentic methods for the identification of specimen which is termed as morphological systematic (Nayman, 1965).The present work was taken up for the comparative morphometric study of rohu and Jayanti rohu, in a fish farm of Tarai region of Pantnagar, Uttarakhand to collect the information on growth of fish.

Materials and Methods

Study Area

The morphometric data for the present study was collected from the Instructional Fish Farm of College of Fisheries, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Utttarakhand, India. The College of Fisheries, Pantnagar is geographically located at 29° N latitude, 79.3° E longitude and an altitude of 243.3 m above mean sea level (MSL), in the *Tarai* belt of Shivalik range of Himalaya.

Fish Sample Collection

30 specimens of both rohu and Jayanti rohu, of both the sexes were randomly collected under same physico-chemical conditions from a stocking pond of Instructional fish farm of the College of Fisheries. Measurements of the collected fishes were taken with the help of a measuring board fitted with a meter scale and weighed using an electric balance during the months of October –November, 2017.

Morphometric Measurements
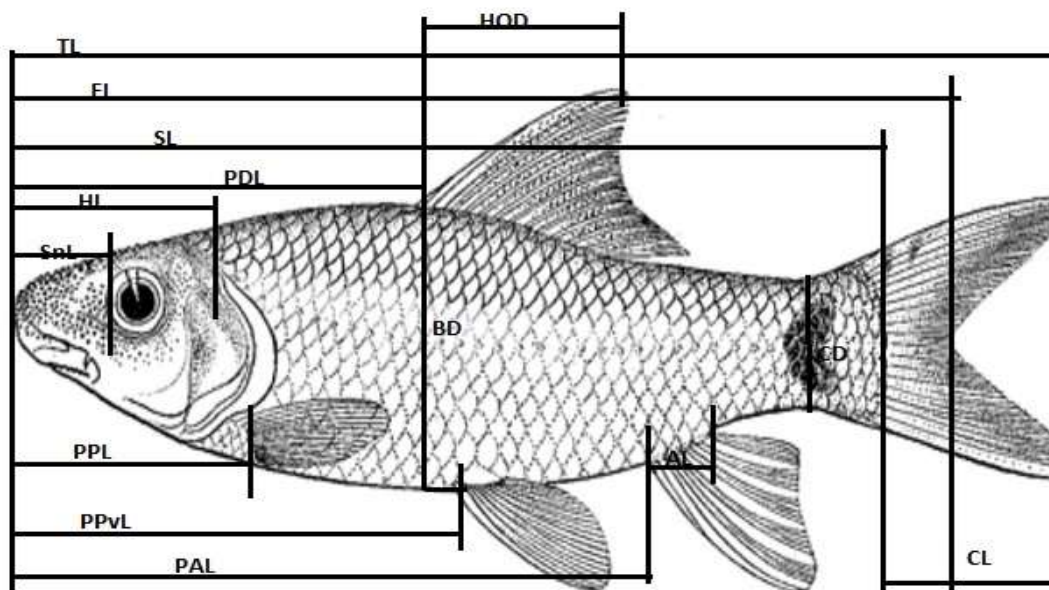
Points refer to: TL (Total length), SL (Standard length), FL (Forked length), HL (Head length), SnL (Snout length), ED (Eye diameter), PDL (Pre-dorsal length), PPL (Pre-pectoral length), PPvL (Pre-pelvic length), PAL (Pre-anal length), HOD (Height of dorsal fin), AL (Anal fin length), BD (Body depth), CD (Caudal depth) and CL (Caudal length).

Statistical Analysis

The relationship of various logarithm transformed morphometric parameters on total length was obtained by using R software. The regression equation was calculated using the equation $Y = a + b X$ where 'Y' is the dependent variable (other morphometric parameters like standard length head length etc.), 'a' is the intercept value, 'b' is the regression coefficient and X is the independent variable (total length). Condition factor (K) calculated by using formula: $K = (W \times 100) / L^3$ where W is body weight and L is total length of fish.

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Results and Discussion

Fifteen morphometric characters of both rohu and Jayanti rohu samples collected from the stocking pond of the fish farm were studied during the present course of work. The morphometric measurements for rohu and Jayanti rohu are presented in Table 1 and 2 respectively.

Table 1: Morphometric parameters of Rohu (length in cm) during the study

S. No.	Parameters	Min-Max	Range	Mean± SD	r	Y= a+b*X
1	Total length	25.0-53.5	28.5	38.40±6.71	-	-
2	Standard length	21.0-43.0	22	30.96±5.76	0.979	-0.822+0.828TL
3	Forked length	22.0-47.0	25	32.85±6.07	0.974	-1.014+0.882TL
4	Head length	5.5-10.0	4.5	7.91±1.18	0.889	1.865+0.158TL
5	Snout length	2.0-5.0	3	3.56±.086	0.8	-0.126+0.096TL
6	Dorsal fin length	5.0-9.0	4	6.91±0.95	0.706	3.054+0.101TL
7	Pre dorsal length	10.0-22.0	12	14.88±2.46	0.909	2.056+0.334TL
8	Pre pectoral length	5.5-11.0	5.5	12.00±1.21	0.886	1.952+0.160TL
9	Pre pelvic length	11.0-23.0	12	16.70±2.90	0.853	2.538+0.369TL
10	Pre anal length	17.5-34.0	16.5	24.96±4.15	0.939	2.681+0.580TL
11	Height of dorsal fin	4.5-13.0	8.5	6.65±1.60	0.538	1.702+0.129TL
12	Anal fin length	2.0-6.0	4	2.91±0.76	0.734	-0.300+0.084TL
13	Body depth	1.0-14.0	13	10.61±2.26	.356^{NS}	6.009+0.120TL
14	Caudal depth	3.0-8.5	5.5	4.98±1.32	0.811	-1.184+0.161TL
15	Caudal fin length	5.5-11.0	5.5	7.76±1.34	0.668	2.632+0.134TL

Value with super script ^{NS} stands "Not Significant" and other values are statistically significant.

The total length ranges from 25.0-53.5 cm for rohu and 28.0-46.0 cm for Jayanti rohu whereas total weight ranges from 150 to 2000 gm for rohu and 300 to 2000 gm for Jayanti rohu. The total length (independent variable) was kept on x-axis whereas other morphometric characters (dependent variable) on y-axis and it was observed that significant correlations exist in standard length-total length (SL-TL), fork length-total length (FL-TL), head length-total length (HL-TL), height of dorsal fin-total length (HOD-TL),pre dorsal fin length-total length (PDL-TL), pre pectoral fin length-total length (PPL-TL), pre pelvic fin length-total length (PPvL-TL), pre anal fin length-total length (PAL-TL) body depth-total length (BD-TL), anal fin length-total length (AL-TL), caudal depth-total length (CD-TL) and caudal length-total length (CL-TL). The correlation coefficient (r) was maximum 0.979 in standard length-total length (SL-TL) and 0.977 in forked length-total length(FL-TL) whereas it minimum 0.356 in body depth-total length (BD-TL) and 0.424 in head length (HL-TL)in rohu and Jayanti rohu respectively. The body depth of Jayanti rohu is highly correlated with total length (BD-TL, r =0.778) as compared to rohu. The standard length is the second highly correlated (r = 0.968) body part in Jayanti rohu while in rohu forked length is the second highly correlated (r = 0.974). The results are in accordance with Bhatt (1997) who found the standard length as the most correlated body part in *Tor putitora* from Gobindsagar reservoir and in the river Ganga between Rishikesh and Haridwar. Negi and Negi (2010) reported significant correlation of the morphometric

parameters with total length in *S. richardsonii* from Uttarkashi district of Uttarakhand, and Naeem *et al.* (2012) in wild species of *Labeo calbasu* from Chenab River, Pakistan and similar findings were also reported in tilapia for two ponds of Vadodara, Gujarat by Pathak *et al.* (2013) and in *Tor putitora* from Himachal Pradesh by Arora and Julka (2013).

The condition factor of rohu ranges from 0.721- 1.886 and in Jayanti rohu the range lies between 1.129-2.054, as presented in Table 2. Ujjania *et al.* (2012) reported that the condition factor (K) of *Labeo rohita* ranged from 1.695 - 2.055 which were collected from Mahi Bajaj Sagar in Banswara district of Rajasthan.

Table 2: Condition factor of Rohu and Jayanti rohu during study

S. No.	Fish Species	Min -Max	Range	Mean±SE
1	Jayanti Rohu	1.129-2.054	1.16	1.453 ± 0.039
2	Rohu	0.721-1.886	0.92	1.357± 0.0417

Similarly, Knaepkens *et al.* (2002) reported in their study that condition factor of Flemish bullhead populations varied between 0.804 and 1.331. The condition factor represents the wellness of fish and it is a measure of effect of biological and ecological factors. Khallaf *et al.* (2003) stated that higher value of condition factor describes that fish has attained a good condition. So, in present study the value of condition factor of Jayanti rohu is higher as compared to rohu which implicates that Jayanti rohu is in well condition in area under study.

It has been observed that characters like standard length, forked length, pre-dorsal length and pre anal length in relation to total fish length showed high values of correlation coefficient in both rohu and Jayanti rohu indicating that these morphometric characters increase in direct proportion. Brraich and Akhter (2015) reported that characters like standard length, head length, pre dorsal distance and pre anal distance in the percentage of total fish length showed high values of correlation coefficient indicating that these morphometric characters increase in direct proportion in *Crossocheilus latius* from Ranjit Sagar Wetland, India.

Table 3: Morphometric parameters of Jayanti Rohu (length in cm) during the study

S. No.	Parameters	Min-Max	Range	Mean± SD	r	Y=a+b*X
1	Total length	28.0-46.0	18	37.45±4.28	-	-
2	Standard length	23.0-37.0	14	29.95±3.72	0.968	-1.548+0.841TL
3	Forked length	24.0-39.0	15	32.30±4.06	0.977	-2.440+0.932TL
4	Head length	4.0-10.0	6	6.78±1.86	.424[NS]	-0.132+0.185TL
5	Snout length	2.0-4.5	2.5	2.95±0.57	0.598	-0.074+0.081TL
6	Dorsal fin length	5.0-9.0	4	7.18±1.05	0.594	1.705+0.146TL
7	Pre dorsal length	11.0-19.0	8	13.91±1.86	0.837	0.278+0.364TL
8	Pre pectoral length	5.5-14.0	8.5	8.30±1.80	0.752	-3.565+0.317TL
9	Pre pelvic length	9.0-25.0	16	16.31±3.26	0.762	5.429+0.581TL
10	Pre anal length	19.0-31.0	12	24.63±3.16	0.871	0.521+0.644TL

11	Height of dorsal fin	5.0-8.0	3	6.53±0.66	0.672	2.603+0.105TL
12	Anal fin length	2.0-3.5	1.5	2.75±0.50	0.713	-0.393+0.084TL
13	Body depth	8.5-14.0	5.5	10.71±1.19	0.778	2.593+0.217TL
14	Caudal depth	2.5-6.5	4	4.56±1.05	0.712	-2.009+0.176TL
15	Caudal fin length	5.0-10.0	5	7.60±1.10	0.571	2.095+0.145TL

Value with super script [NS] stands "Not Significant" and other values are statistically significant.

Conclusion

The present study corroborates the relationship of total length with other morphometric characteristics of rohu and Jayanti rohu. The results revealed that the total length and other morphometric parameters of both varieties were significantly correlated. The positive correlation coefficient indicated that there was proportional increase in the morphometric parameters in comparison with the total length. The body depth of Jayanti rohu is highly correlated with total length as compared to rohu, which may be one of the reasons of better growth of Jayanti rohu.

Acknowledgement

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