Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 5, No. 6, p. 200-206, 2014
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Morphometric parameters assisted studies on the variations amongst the population of *Labeo rohita*

Fayyaz Rasool[1*], Syed Shafat Hussain[1], Shakeela Parveen[1], Tanveer Hussin[2]

[1]*Department of Fisheries and Aquaculture, Faculty of Fisheries and Wildlife, UVAS, Lahore-Pakistan*

[2]*Faculty of Animal Production and Technology, UVAS, Lahore, Pakistan*

Article published on December 14, 2014

Key words: *Labeo rohita*, morphometric parameters, fish farm.

Abstract

A study on the variation amongst the different populations of *Labeo rohita* on the basis of morphometric parameters was conducted. Samples were collected from fish farm having different weight groups of same age. Data regarding the morphogenetic parameters viz., body weight, fork length, total length and lengths of dorsal, caudal, anal, pectoral and pelvic fins of each individual were measured. Analysis of variance (ANOVA) for the different morphometric parameters of study was done using Minitab 16.0. The Pearson correlation analysis of the morphometric parameters was done by XLSTAT 2012 version 1.02. The results showed that positive correlation between the body weight, total length and average length of paired pectoral fins of *L. rohita* were non-significantly different (P> 0.05), anal fin length was significantly different (P<0.05), and all the remaining parameters were highly significantly different (P<0.01) among the population groups. The correlation of fish body weight and fork length was highly significant (p<0.001) and positive with all the parameters except with the caudal fin which was positively but non-significant in correlation with fork length (p = 161).

***Corresponding Author:** Fayyaz Rasool ✉ drfayyaz1980@gmail.com

Introduction

Cyprinids are the most important constituent of freshwater fish fauna with respect to the number both of individuals and of species. The role of this family within freshwater ecosystem is therefore central. The genus Labeo under Cyprinidae family is of lot significance as many species under this genus are ornamental species, some food species, some are used for extracting oil and some are considered to be of medicinal value etc. Morphometric characters have been commonly used in fisheries biology as powerful tools for measuring discreteness and relationships among various taxonomic categories (Quilang *et al.,* 2007).

Labeo rohita commonly known as Rohu or Dumbra is a fish of the carp family Cyprinidae found frequently in rivers and freshwater lakes and in the region of South Asia and South-East Asia. This is rarely omnivorous in nature and treated as a delicacy in Pakistan, Bangladesh, India, Nepal and other Asian countries. It does not breed in the lentic environments and the major method for its breeding is the induced breeding under controlled conditions (Froese *et al.,* 2006). Labeo 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 characterized by dorsal fin with 12-14½ branched rays; lower profile of head conspicuously arched; short dorsal fin with anterior branched rays shorter than head; 12-16 predorsal scales; snout without lateral lobe (Kottelat, 2001). Adults inhabit rivers; it is diurnal species and usually not living in social groups.

Information on the biology and population structure of any species is a prerequisite for developing management and conservation strategies (Turan *et al.,* 2006) and may be appropriate for studying short-term and environmentally induced variations. Morphometric differences among stocks of a species are recognized as important for evaluating the population structure and as a basis for identifying stocks (Turan *et al.,* 2004b). Morphometric and meristic characters of fish are the measurable or countable characters common to all fishes. Morphometric characters are continuous characters describing aspects of body shape. Meristic characters are the number of discrete, in orderly repeated, countable structures that are fixed in embryos or larvae. Studies of morphologic variation between populations continue to play an important role in stock identification while stable differences in shape between groups of fish may expose different growth, mortality or reproductive rates that are relevant for the definition of stocks (Swain and Foote, 1999 and Cadrin, 2000).

Morphometric differences among stocks of a species are recognized as important for evaluating the population structure and as a basis for identifying stocks (Turan *et al.*, 2004). Many natural populations of fish species have decreased drastically in number, mainly because of the effects of over-exploitation, habitat alterations, including physiography, abiotic, and biotic features, the release and introduction of exotic fish species, etc. Over harvesting or fishing, especially when directed against a specific size or class age, can reduce the size of the population to a level where inbreeding and loss of genetic diversity may be a serious problem or may lead to extinction of local populations or segments of the population (Rasool *et al.,* 2013).

Before this study there was a lot of data on the morphometric of the species recorded for the brooders caught from the riverine water and other wild resources. But now a days as the riverine water and other resources are becoming scarce and the brood stock needed for the hatchery breeding programs are being selected from the hatchery bred farmed fish. This study will be helpful in the selection of appropriate candidates which have better morphological features and growth potential for significance aquaculture production.

Materials and methods

Species and sample size

A total of fifty specimens for each of three the weight group of fish population of *Labeo rohita* with the

same age were collected from the fish farm of UVAS, Ravi campus pattoki by random sampling. The species were identified by the characters described by Froese *et al.*, (2010). No significant sexual dimorphism with respect to the selected morphometrics was observed; therefore the data analyses were performed without taking the sex of the individual into consideration.

Morphometric Data

Data regarding the morphogenetic parameters viz., body weight, fork length, total length and lengths of dorsal, caudal, anal, pectoral and pelvic fins of each individual were recorded. All lengths were taken parallel to the anterior-posterior body (Chouhdari *et al.* 2011). The mean of the data for each species were calculated and also the standard deviation. The mean values have been used for the analyses (Table 1).

Result and discussion

The samples of the *L. rohita* having almost same age were captured from the Pattoki fish farm hatchery. The average body weights, total lengths and averages of other morphological parameters are given Table 1, 2 and 3. The results obtained by statistical analysis showed that the wet body weight and anal fin lengths of *L. rohita* were significantly different; the fork length, dorsal, caudal and pelvic fin lengths were highly significantly different; while in case of total length and pectoral fin length there was not significant difference among the groups (Table 4). The results of this study indicated that the wet body weight and total length of the *L. rohita* populations from the different sites was not significantly different, while the fork length of the populations amongst sites was highly significantly different. Same results were postulated by Khan *et al.* (2003) while working on the farmed *labeo rohita*.

Table 1. Morphometric Parameters of Group A.

Variable	N	Mean	Std. Dev	Sum	Minimum	maximum
Body weight	50	21.59	0.89707	215.92	20.35	23.12
Fork length	50	10.81	0.45570	108.10	10.40	11.80
Total length	50	12.60	0.40277	126.00	12.00	13.40
Dorsal fin length	50	2.15	0.22d730	21.50	1.80	2.60
Caudal fin length	50	3.01	0.22336	30.10	2.80	3.40
Anal fin length	50	1.66	0.164	16.60	1.40	1.90
Pectoral fin length	50	1.79	0.13	17.90	1.60	2.0
Pelvic fin length	50	1.65	0.09	16.50	1.50	1.80

Table 2. Morphometric Parameters of Group B.

Variable	N	Mean	Std. Dev	Sum	Minimum	maximum
Body weight	50	70.91	15.29	709.15	54.63	97.48
Fork length	50	15.99	0.62	159.90	15.50	17.50
Total length	50	18.11	2.07	181.10	12.80	21.00
Dorsal fin length	50	3.24	0.16	32.40	3.00	3.50
Caudal fin length	50	4.11	0.172	41.10	4.00	4.50
Anal fin length	50	2.77	0.262	27.70	2.30	3.00
Pectoral fin length	50	2.75	0.171	27.50	2.60	3.00
Pelvic fin length	50	2.43	0.170	24.30	2.30	2.80

Table 3. Morphometric Parameters of Group C.

Variable	N	Mean	Std. Dev	Sum	Minimum	Maximum
Body weight	50	120.92	10.36	1209	104.32	134.90
Fork length	50	18.10	2.15	181.00	12.50	20.00
Total length	50	21.84	0.6040	218.40	21.00	22.50
Dorsal fin length	50	3.69	0.20790	36.90	3.40	4.00
Caudal fin length	50	4.89	0.19120	48.90	4.50	5.20
Anal fin length	50	3.13	0.36530	31.30	2.60	3.90
Pectoral fin length	50	3.34	0.29136	33.40	3.00	4.00
Pelvic fin length	50	2.94	0.06992	29.40	2.80	3.00

Table 4. Statistical Summary of Morphometric Parameters (ANOVA).

Parameter / Class	Body wt. (g)	Fork Length (cm)	Total Length (cm)	Dorsal fin Length (cm)	Caudal fin Length (cm)	Anal fin length (cm)	Pectoral fin length (cm)	Pelvic fin Length (cm)
A	21.59 ±0.89	10.81±0.45	12.60±0.4	2.15±0.22	3.01±0.22	1.66±0.16	1.79±0.13	1.65±0.09
B	70.91±15	15.9±0.62	18.11±2.07	3.24±0.16	4.11±0.17	2.77±0.2	2.77±0.17	2.43±0.17
C	120.92±10.36	18.10±2.15	21.84±0.60	3.69±0.2	4.89±0.19	3.13±0.36	3.13±0.27	2.94±0.06

The body weight of group A was positively correlated with fork length, anal fin length, pectoral fin length and pelvic fin length and non significant while negatively correlated with total length, dorsal fin length, caudal fin length and non-significant. The fork length positively correlated with total length, dorsal fin length, caudal fin length, anal fin length, pectoral and pelvic fin length while significant with and fork length and pectoral fin length and non significant with dorsal fin length, caudal fin length, anal fin length and pelvic fin length. Total length is positively correlated with dorsal fin length, caudal fin length, anal fin length, pectoral fin length and pelvic fin length while significant only pectoral fin length and non-significant with all other parameters. Dorsal fin length is positively correlated with anal fin length, pectoral fin length and pelvic fin length non significantly while negatively correlated with caudal fin length non-significantly. Caudal fin length is positively correlated with anal fin length, pectoral fin length and pelvic fin length non significantly. Anal fin length is positively correlated with pectoral fin length significantly and pelvic fin length non-significantly. Pectoral fin length is positively correlated with pelvic fin length significantly (Table 5) correlation matrix of group A.

Table 5. Correlation Matrix amongst the morphometric parameters of group A.

Variable	Body weight	Fork length	Total length	Dorsal fin length	Caudal fin length	Anal fin length	Pectoral fin length
Fork length	0.58377						
	0.0764						
Total length	0.67471	0.87778					
	0.0323	0.0008					
Dorsal fin length	0.75688	0.61679	0.58256				
	0.0113	0.0575	0.0772				
Caudal fin length	-0.01231	0.45739	0.30877	-0.16414			
	0.9731	0.1838	0.3854	0.6505			
Anal fin length	0.11494	0.25766	0.46912	0.14844	0.22357		
	0.7519	0.4723	0.1714	0.6823	0.5347		
Pectoral fin length	0.51810	0.69571	0.78514	0.51725	0.40295	0.76822	
	0.1250	0.0255	0.0071	0.12570	0.2483	0.0094	
Pelvic fin length	0.50343	0.18817	0.34064	0.22635	0.28153	0.34719	0.62576
	0.1380	0.6026	0.3355	0.5295	0.4307	0.3256	0.0530

The body weight of group B was positively correlated with fork length, total length,, pectoral fin length and pelvic fin length and significant with fork ,caudal pectoral and pelvic fin length and le negatively correlated with anal fin length non significantly. The fork length positively correlated with total length, dorsal fin length, caudal fin length, anal fin length, pectoral and pelvic fin length while significant with total length and pectoral fin length and pelvic significantly while non significant with all other parameters. Total length is positively correlated with dorsal fin length, caudal fin length, anal fin length, pectoral fin length and pelvic fin length while significant only pelvic fin length and non-significant with all other parameters. Dorsal fin length is negatively correlated with caudal and anal fin length and positively correlated pectoral fin length and pelvic fin length while significantly with anal fin length and non-significantly with others. Caudal fin length is positively correlated with anal fin length, pectoral fin length and pelvic fin length while non significantly with anal fin length and significant with

pectoral and pelvic fin length. Anal fin length negative correlated with pectoral fin length and pelvic fin length and non-significantly with both. Pectoral fin length is positively correlated with pelvic fin length significantly (Table 6).correlation matrix of group B.

Table 6. Correlation Matrix amongst the morphometric parameters of group B.

Variable	Body weight	Fork length	Total length	Dorsal fin length	Caudal fin length	Anal fin length	Pectoral fin length
Fork length	0.82842 0.0031						
Total length	0.22614 0.5298	0.87778 0.0008					
Dorsal fin length	0.60020 0.0666	0.61679 0.0575	0.58256 0.0772				
Caudal fin length	0.83174 0.0028	0.45739 0.1838	0.30877 0.3854	-0.16414 0.6505			
Anal fin length	-0.31052 0.3825	0.12741 0.7258	0.63737 0.0475	-0.73986 0.0144	0.17861 0.6215		
Pectoral fin length	0.91147 0.0002	0.80831 0.0047	0.20087 0.5779	0.55057 0.0991	0.76781 0.0095	-0.38209 0.2759	
Pelvic fin length	0.88448 0.0007	0.83339 0.0027	0.61097 0.0606	0.26946 0.4515	0.89444 0.0005	-0.00248 0.9946	0.81751 0.0039

The body weight of group C was positively correlated with fork length, total length, dosal fin length. Anal fin length, pectoral fin length and negatively correlated with pelvic fin length while significant with total length, anal length and non significant with all other parameters. The fork length positively correlated with total length, dorsal fin length, , anal fin length, pelvic fin length and negatively correlated with caudal fin length and pectoral fin length while non significant with all other parameters. Total length is positively correlated with dosal fin length, caudal fin length, anal fin length, pectoral fin length and negatively correlated with pelvic fin length while non significant with all other parameters. Dorsal fin length is positively correlated with caudal fin length, anal fin length, pectoral fin length and negatively correlated with pelvic fin length while non-significantly with all. Caudal fin length is positively correlated with anal fin length, pectoral fin length and negatively correlated with pelvic fin length while non significantly with all. Anal fin length positively correlated with pectoral fin length and negatively correlated with pelvic fin length and non-significantly with both. Pectoral fin length is negatively correlated with pelvic fin length significantly (Table 7).correlation matrix of group C.

Table 7. Correlation Matrix amongst the morphometric parameters of group C.

Variable	Body weight	Fork length	Total length	Dorsal fin length	Caudal fin length	Anal fin length	Pectoral fin length
Fork length	0.26224 0.4642						
Total length	0.88574 0.0006	0.56977 0.0855					
Dorsal fin length	0.65769 0.0387	0.11136 0.0855	0.61402 0.0590				
Caudal fin length	0.21681 0.5474	-0.38478 0.2722	0.04233 0.9076	0.61217 0.0599			
Anal fin length	0.78923 0.0066	0.42954 0.2154	0.73415 0.0156	0.44330 0.1994	0.06841 0.8511		
Pectoral fin length	0.57826 0.0799	-0.53149 0.1139	0.34344 0.3312	0.52095 0.1226	0.52657 0.1179	0.14407 0.6913	
Pelvic fin length	- 0.20479 0.5703	0.022207 0.9517	- 0.41039 0.2388	-0.50448 0.1370	-0.29921 0.4010	-0.00870 0.9810	-0.41452 0.2336

Table 8. Pearson Correlation Analysis of All Groups.

variable	Body weight	Fork length	Total length	Dorsal fin length	Caudal fin length	Anal fin length	Pectoral fin length
Fork length	0.90168 <0.0001	1					
Total length	0.94191 <0.0001	0.90696 <0.0001	1				
Dorsal fin length	0.93657 <0.0001	0.90511 <0.0001	0.90552 <0.0001	1			
Caudal fin length	0.096177 <0.0001	0.88884 <0.0001	0.95003 <0.0001	0.93436 <0.0001	1		
Anal fin length	0.87577 <0.0001	0.90286 <0.0001	0.92540 <0.0001	0.88785 <0.0001	0.89213 <0.0001	1	
Pectoral fin length	0.96180 <0.0001	0.85074 <0.0001	0.92899 <0.0001	0.95275 <0.0001	0.96326 <0.0001	0.88048 <0.0001	1
Pelvic fin length	0.97030 <0.0001	0.91493 <0.0001	0.96118 <0.0001	0.93556 <0.0001	0.96977 <0.0001	0.89340 <0.0001	0.95259 <0.0001

Pearson correlation analysis of overall population show that the body weight is positively correlated with the fork length, total length, dorsal fin length, caudal fin length, anal fin length, pectoral and pelvic fin length with the significant difference. Fork length is positively correlated with the total length, dorsal fin length, caudal fin length, anal fin length, pectoral fin length and pelvic fin length with significant difference among other parameters. These results are similar with choudhur and dutta (2013) study on the Morphometric variation of selected ichthyofauna under Genus Puntius Hamilton-Buchanan (Teleostei: Cyprinidae). Total length is positively correlated with the dorsal fin length, caudal fin length, anal fin length, pectoral fin length and pelvic fin length with significant difference with all parameters. Dorsal fin length is also positively correlated with caudal fin length, anal fin length, pectoral fin length and pelvic fin length with significant difference.

The results of the present investigation clearly showed the correlation between Body weight, Total length and other morphometric parameters to be highly significant in correlation with overall population while body weight is negatively correlated with caudal fin length, anal fin length and pelvic fin length with in groups. Pelvic fin is negatively and non-significantly correlated with caudal fin length, pectoral fin length and anal fin length are in related with the results of Faith *et al.* (2004) while working on the morphometric parameters and genetic studies of the endemism of the fish populations in the sub-continent.

Manimegalai *et al.* (2010) identified different variants in a fish species *Etroplus maculatus* by morphometric analysis. Since the connectivity between population of species and its intra-specific variation is a major issue for conservation and management of species, the use of morphometry to this purpose appears to be very promising and the results of the present study may be a useful reference for further investigations and developing new strategies for conservation and breeding programmes of these species.

References

Choudhury S, Saikia S, Sougrakpam Brahma P, Dutta K. 2001. Assessment of morphometric variation and establishing taxonomic relationship among six species under Puntius genus. The Ecoscan: Special issue, **1 (1),** 233-237.

Choudhury S, Dutta K. 2013. A study on the morphometric variation in Selected Ichthyofauna under Genus Puntius Hamilton-Buchanan (Teleostei: Cyprinidae). IOSR-JPBS. **5(3)**, 01-06

Cadrin SX. 2000. Advances in morphometric identification of fishery stocks. Reviews in Fish Biology and Fisheries, **1,** 91-112.

Faith DP, Reid CAM, Hunter J. 2004. Integrating phylogenetic diversity, complementarily, and endemism for conservation assessment. Conservation Biology, **18**, 255-261.

Froese R. 2006. Cube law, condition factor and weight length relationships: history, meta-analysis and recommendations. Journal of Applied Ichthyology, **22**, 241–253.

Froese R, Pauly D. 2010. Editors, FishBase, www.fishbase.org

Frimodt C. 1995. Multilingual illustrated guide to the world's commercial warm water fish Fishing News Books, Osney Mead, Oxford, England. 215p.

Kotttelat M. 2001. Fishes of Laos. WHT Publications Ltd., Colombo 5, Sri Lanka, pp. 198.

Khan HA, Jhingran VG. 1975. Synopsis of biological data on Rohu Labeo rohita (Ham., 1822). FAO Fisheries Synopsis No III. 100.

Langer S, Tripathi NK, Khajuria B. 2013. Morphometric and Meristic Study of Golden Mahseer (Tor Putitora) from Jhajjar Stream (JandK), Indian Research Journal of Animal, Veterinary and Fishery Sciences, **1(7)**, 1-4.

Quilang JP, Basiao ZU, Pagulayan RC, Roderos RR, Barrios EB. 2007. Meristic and morphometric variation in the silver perch, Leiopotherapon plumbeus (Kner, 1864), from three lakes in the Philippines. Journal of Applied Ichthyology, **23,** 561–567.

Rasool F, Qureshi NA, Parveen S, Siddique M, Hameed A, Khan N, Iqbal K. 2013. Morphometric Parameters Based Study of the Hatchery Raised and Natural Populations of *Labeo rohita*. Pakistan Journal of Zoology, **45(4)**, 903-907.

Turan C, Erguden D, Gurlek M, Basusta N, Turan N. 2004b. Morphometric structuring of the anchovy (Engraulis encrasicolus L.) in the Black, Aegean and northeastern Mediterranean Seas. Turkish Journal of Veterinary and Animal Science, **28**, 865-871.

Turan C, Oral M, Ozturk B, Duzguneş E. 2006. Morphometric and meristic variation between stocks of Bluefish (Pomatomus saltatrix) in the Black, Marmara, Aegean and northeastern Mediterranean Seas. Fisheries Research, **79(1-2)**, 139–147.