International Journal of Zoology and Applied Biosciences **ISSN: 2455-9571**
Volume 8, Issue 6, pp: 1-6, 2023
https://doi.org/10.55126/ijzab.2023.v08.i06.001
http://www.ijzab.com

Research Article

MORPHOMETRIC CHARACTERS AND MERISTIC COUNTS OF TWO FRESHWATER FISHES OF ORDER CYPRINIFORMES FROM SONG RIVER DEHRADUN, UTTARAKHAND

***Sanjay Paunikar and Fatima Kaneez**

*Zoological Survey of India, Northern Regional Centre, 214, Kaulagarh Road, Dehradun-248195, Uttarakhand
*Present Address- Zoological Survey of India, Central Zone Regional Centre, Vijay Nagar, Jabalpur-482 002, Madhya Pradesh
Department of Zoology, Uttaranchal (P.G.) College of Biomedical Sciences and Hospital Dehradun, Uttarakhand

Article History: Received 12th September 2023; Accepted 9th October 2023; Published 30th November 2023

ABSTRACT

The study on morphometric and meristic characters of two species of fresh water fishes under order Cypriniformes were carried out in Ichthyology laboratory of Zoological Survey of India, Northern Regional Centre, Dehradun. During the present investigation, 2 families under Cyprinidae and Cobitidae fish species are molacarplet, *Amblypharyngodonmola* Hamilton (1822) and *Lepidocephalichthys guntea* (Hamilton, 1822) were identified. The 22 morphometric and 5 meristic counts were studied from Song River, Dehradun. The result showed that all the morphometric characters of two fishes are dependent on the total length. The analyzed data of morphometric dimensions of fish species would be beneficial for the policy makers or planners to develop the scientific strategies for their protection and conservation. The findings will also set the scientific principles for the management and sustainable development of the commercially essential freshwater food fishes.

Keywords: Freshwater fishes, Cypriniformes, Morphometric, Meristic, Song Rivers, Dehradun.

INTRODUCTION

Uttarakhand formerly known as Uttaranchal is a state in the northern part of India. It is often referred to as the *Devabhumi* (literally "Land of the Gods") due to a large number of Hindu temples and pilgrimage centers found throughout the state. More precisely, this is a longitudinal syndical valley with the river Ganga on the east and Yamuna in the west. The freshwater resources of Dehradun have good network of perennial rivers hill streams, pond, and reservoirs etc., which provide an ideal habitat to flourish the diversified fish fauna. Doon valley is act as a connective link between the plain and hill stream fishes. Hence, Ichthyologists and naturalists have carried out an important research work in this area especially in the field of taxonomy and ecology. Geographically, Dehradun district can be divided into Eastern and Western Doon valley. Eastern part is supported by Ganga drainage with number of tributaries i.e. Song, Suswa and Rawasan etc., Whereas Western part is supported by Yamuna drainage with an important tributaries i. e. Amlawa, Asan, and Tons etc. However the Western part of Doon valley remained less explored as compared to Eastern Doon valley, as the accessibility in Western Doon valley i.e. Tons valley, Yamuna valley and Chakrata hills (Jaunsar - Bawar) is difficult due to poor road, transportation linkage and tough terrain. There is several local rivers flow in and around Dehradun districts. The Doon Valley is recognized high icthyofaunal diversity (Uniyal and Kumar, 2006; Rana *et al*., 2017). The economically fishes constitute a very important group of animals and provide a rich source of food, liver oil and a number of other by-products, like fish meal and fish manure(Khanna and Singh, 2006). Fishes are not only source of food for human being and other animals, but also rich in proteins and vitamins especially vitamin A (retinol) thus they are source of animal protein (Wakil, *et al*., 2014).

*Corresponding Author: Sanjay Paunikar, Zoological Survey of India, Central Zone Regional Centre, Vijay Nagar, Jabalpur-482 002, Madhya Pradesh Email: sanjaypaunikarzsi@gmail.com.

The morphometric and meristic features are the two most important criteria for the classification and identification of species (Jayaram, 1999; Hossen *et al*., 2020; Das *et al.*, 2023).Growth of body parts is proportional to the growth of the total length, so morphometric measurements of fish and study of statistical relationship among them are essential for taxonomic study of a species (Tandon, *et al*., 1993; Langer *et al*., 2013). Although fishes exhibit some common characters, most of which are related to their permanently aquatic mode of life. A wide distribution of fishes into a variety of habitats has resulted in numerous adaptations in their morphology, physiology, and behavior (Khanna and Singh, 2006). The study on morphometric characters in fishes is important because they can be used for the differentiation of taxonomic units and are able to spot differences between fish population. Morphometric can be used to quantify a trait of evolutionary significance, and by detecting changes in the shape, assume something of their ontogeny, function or evolutionary relationships. Morphometric parameters of a fish species has major role to ensure whether there is any disparity between same species of different geographic region (Naeem *et al*., 2012). There are phenotypic variations in morphometric and meristic characters between fishes of the same species, due to variations resulting from sex, food availability, predator prey interactions, physical parameters and environmental condition (Dasgupta, 1991). Variations in morphometric characters explains the evolutionary adaptations of the species, for instance, mouth gap size of a species determines the feeding habit of the species (Wainwright and Richard, 1995).

Very few study on morphometric and meristic on fishes of different rivers of Dehradun. Recently, Paunikar and Panwar (2021) studied on morphometric and meristic five species fishes from Song River, Dehradun. In the present investigation, two fish species under order Cypriniformes carried out to study on morphometric and meristic characters from Song river of Dehradun, Uttarakhand.

MATERIALS AND METHODS

The two fish species of freshwater were collected from different sites of Song River (Latitude *30.0349° or 30° 2' 6" north, Longitude. 78.24921° or 78° 14' 57" east*; Elevation. 314metres, 1,030 feet), Dehradun, Uttarakhand. The specimens were brought in the Ichthyology laboratory of Zoological Survey of India, Northern Regional Centre, Dehradun. The samples were preserved in 05% formalin. The fishes were identified from their external morphological characters up to the species level using standard literature by Talwar and Jhingran (1991), Jayaram (1999). Then fishes were used for the morphometric measurements and meristic counts. The scale, digital caliber and thread, having centimeter have been used for various measurements. The rate of growth of different morphological body parts of fish in relation to its total length was studied. Twenty two morphometric and five meristic characters were studied following the standard procedures described Appa Rao (1966) as well as Dwivedi and Menezes (1974).The following Twenty two morphometric characters were obtained for each fish. The regression method has been employed for morphometric measurement with the formula: Y= bx + a, Where Y is the variable character (Dependent), such as total length, 'a' is a constant value to be determined, 'b' is the changeable value and 'x' is the independent (Snedecor and Cochran, 1967). For meristic characters, dorsal fin rays, dorsal spines, pectoral fin rays, pectoral spines and caudal fin rays were counted. The computer software Microsoft EXCEL was used for all the statistical analysis of the data. Meristic characters are those which are countable such as vertebrae, fin rays, scales. For convenience, only the fin ray and the spine count (which are more precisely known as fin formulae) was dealt here. Fin rays are of two types – undivided rays or spines and divided rays or soft rays (also termed as rays) (Jayaram, 1981).

RESULT AND DISCUSSION

The 22 morphometric characters and 5 meristic characters of two fish species of order Cypriniformes *viz.*, *Amblypharyngodon mola* and *Lepidocephalichthys guntea* were studied. From Song Rivers of Dehradun, Uttarakhand. The morphometric measurements for two Cypriniformes fish species, *Amblypharyngodon mola* and *Lepidocephalichthys guntea*, are presented in Table-1and 3 and meristic characters are presented in Table-2 and 4. The table depicts that the average value of total length (TL), standard length (SL), lateral length (LL), body depth (BD), pre-pectoral length (PPL), pre-pelvic length (PVL), pre-anal length (PAL), dorsal fin length (DFL), pectoral fin length (PFL), pelvic fin length (PFL), anal fin length (AFL), caudal fin length (CFL), base of dorsal fin length (BDFL), base of pectoral fin length (BPFL), base of pelvic fin length (BVFL), base of anal fin length (BAFL), caudal length of peduncle (CLP), head length (HL), eye diameter (ED) , snout length (SL) and were studied in *Amblypharyngodon mola* species were 6.4, 5.35, 4.25, 1.65, 2.75, 1.35, 2.5, 3.65, 1.25, 0.65, 1.0, 0.65, 1.3, 0.5, 0.25, 0.2, 0.75, 0.65 and 1.15 (mean) *cm* in respectively, whereas meristic characters such as dorsal fin rays, pectoral fin rays, pelvic fin rays, anal fin rays and causal fin rays ranges were 8-9, 10-12, 8-8, 6-8 and 19-20 cm. In *Lepidocephalichthys guntea* species were 4.45, 3.65, 2.8, 0.7, 2.1, 0.8, 2.0 , 2.9, 0.6, 0.4, 0.45, 0.4,0.7, 0.35, 0.1, 0.1, 0.25, 0.35, 0.4, 0.75, 0.15 and 0.35 (mean) cm, whereas meristic characters such as dorsal fin rays, pectoral fin rays, pelvic fin rays, anal fin rays and causal fin rays ranges were 6-8, 5-6, 7-9, 6-8 and 16-18 cm. There was no relationship reported in two Cypriniformes species *Amblypharyngodon mola* and *Lepidocephalichthys guntea* collected from river Dehradun, Uttarakhand. The morphometric and meristic characters of two species were standardized.

The results showed that all the morphometric characters of two fishes are dependent on the total length because all the value of characters (Regression equation) is found in between -1 and +1 values. The -1 and +1 values are dependent and values are below -1 and above +1 are independent.

Table 1. Mean SD and Regression equation between different morphometric characters of *Amblypharyngodon mola* Hamilton, 1822.

Sl. No	Characters studied	Min	Max	Range different	Mean	SD (Standard)	Y=a+b*X (Regression equ.)
1	Total length	5.3cm	7.5cm	2.2cm	6.4cm	1.556	
2	Standard length	4.1cm	6.6cm	2.5cm	5.35cm	1.768	Y=1.67-0.826X
3	Lateral length	3.0cm	5.5cm	2.5cm	4.25cm	1.768	Y=1.280+0.803X
4	Body width	1.3cm	2.0cm	0.7cm	1.65cm	0.495	Y=0.59-0.136X
5	Pre- dorsal fin length	1.2cm	4.3cm	3.1cm	2.75cm	2.192	Y=0.313-0.022X
6	Pre-pectoral fin length	1.0cm	1.7cm	0.7cm	1.35cm	0.495	Y=0.155-0.019X
7	Pre-pelvic fin length	2.0cm	3.0cm	1.0cm	2.5cm	0.707	Y=0.2+X
8	Pre-anal fin length	2.8cm	4.5cm	1.7cm	3.65cm	1.202	Y=0.215+0.569x
9	Dorsal fin length	0.8cm	1.7cm	0.9cm	1.25cm	0.636	Y=0.475-0.253X
10	Pelvic fin length	0.5cm	0.8cm	0.3cm	0.65cm	0.212	Y=0.555+0.019X
11	Pectoral fin length	0.7cm	1.3cm	0.6cm	1.0cm	0.424	Y=0.375+0.195X
12	Anal fin length	0.6cm	0.7cm	0.1cm	0.65cm	0.071	Y=0.707+0.007X
13	Caudal fin length	1.1cm	1.5cm	0.4cm	1.3cm	0.283	Y=0.282-0.162X
14	Base of dorsal fin length	0.4cm	0.6cm	0.2cm	0.5cm	1.556	Y=0.313-0.022X
15	Base of pectoral fin length	0.2cm	0.3cm	0.1cm	0.25cm	1.768	Y=0.155-0.019X
16	Base of pelvic fin length	0.2cm	0.2cm	0	0.2cm	1.768	Y=0.2+X
17	Base of anal fin length	0.5cm	1.0cm	0.5cm	0.75cm	0.495	Y=0.310+0.155X
18	Base of caudal fin length	0.5cm	0.8cm	0.3cm	0.65cm	2.192	Y=0.310+0.155X
19	Length of peduncle	0.9cm	1.4cm	0.5cm	1.15cm	0.495	Y=0.009+0.170X
			Head region				
20	Head length	1.4cm	1.7cm	0.3cm	1.55cm	0.212	Y=1.79+0.07X
21	Eye diameter	0.4cm	0.4cm	0	0.4cm	0.000	Y=0.4-X
22	Snout length	0.5cm	0.7cm	0.2cm	0.6cm	0.141	Y=0.302+0.558X

Table 2. Meristic Characters *Amblypharyngodon mola* Hamilton, 1822.

Sl. No.	Meristic character	Min	Max	Range	Range different
1	Dorsal fin rays	08	09	8-9	01
2	Pectoral fin rays	10	12	10-12	02
3	Pelvic fin rays	08	08	8-8	0
4	Anal fin rays	06	08	6-8	02
5	Caudal fin rays	19	20	19-20	01

Fin formula: D.8-9(1-2/7-7); P.10-12(1-2/9-10); V/P2.8-9(1-1/7-8); A.6-8(1-2/5-6); C.19-20.

Table 3. Mean SD and Regression equation between different morphometric characters of *Lepidocephalichthys guntea* Hamilton, 1822.

Sl. No.	Characters studied	Min	Max	Range different	Mean	SD (Standard)	Y=a+b*X (Regression equ.)
1	Total length	3.8cm	5.1cm	1.3cm	4.45cm	0.91cm	
2	Standard length	3.2cm	4.1cm	0.9cm	3.65cm	0.63cm	Y=3.994-0.075X
3	Lateral length	2.3cm	3.3cm	01cm	2.8cm	0.70cm	Y=3.733-0.206X
4	Body width	0.6cm	0.8cm	0.2cm	0.7cm	0.14cm	Y=0.707-0.006X
5	Pre- dorsal fin length	1.8cm	2.4cm	0.6cm	2.1cm	0.42cm	Y=2.212-0.03X
6	Pre-pectoral fin length	0.7cm	0.9cm	0.2cm	0.8cm	0.14cm	Y=0.660-0.031X
7	Pre-pelvic fin length	1.7cm	2.3cm	0.6cm	2.0cm	0.42cm	Y=1.946-0.003X
8	Pre-anal fin length	2.5cm	3.3cm	0.8cm	2.9cm	0.56cm	Y=3.275-0.080X

9	Dorsal fin length	0.5cm	0.7cm	0.2cm	0.6cm	0.14cm	Y=0.824-0.059X
10	Pelvic fin length	0.3cm	0.5cm	0.2cm	0.4cm	0.14cm	Y=0.427-0.001X
11	Pectoral fin length	0.3cm	0.6cm	0.3cm	0.45cm	0.21cm	Y=0.612-0.03X
12	Anal fin length	0.3cm	0.5cm	0.2cm	0.4cm	0.14cm	Y=0.427-0.001X
13	Caudal fin length	0.6cm	0.8cm	0.2cm	0.7cm	0.14cm	Y=0.727-0.001X
14	Base of dorsal fin length	0.3cm	0.4cm	0.1cm	0.35cm	0.07cm	Y=0.099-0.091X
15	Base of pectoral fin length	0.1cm	0.1cm	0	0.1cm	0	Y=0.1-X
16	Base of pelvic fin length	0.1cm	0.1cm	0	0.1cm	0	Y=0.071-0.042X
17	Base of anal fin length	0.2cm	0.3cm	0.1cm	0.25cm	0.07cm	Y=0.338-0.009X
18	Base of caudal fin length	0.3cm	0.4cm	0.1cm	0.35cm	0.07cm	Y=0.233-0.033x
19	Length of peduncle	0.4cm	0.4cm	0	0.4cm	0	Y=0.1-X
				Head region			
20	Head length	0.7cm	0.8cm	0.1cm	0.75cm	0.07cm	Y=0.83-0.03X
21	Eye diameter	0.1cm	0.2cm	0.1cm	0.15cm	0.07cm	Y=1-06X
22	Snout length	0.3cm	0.4cm	0.1cm	0.35cm	0.91cm	Y=X-0.4

Table 4. Meristic Characters *Lepidocephalichthys guntea* Hamilton, 1822.

Sl. No.	Meristic character	Min	Max	Range	Range different
1	Dorsal fin rays	06	08	6-8	02
2	Pectoral fin rays	05	06	5-6	01
3	Pelvic fin rays	07	09	7-9	02
4	Anal fin rays	06	08	6-8	02
5	Caudal fin rays	16	18	16-18	02

Fin formula- D.6-8(1-2/5-6); P.5-6(1-1/4-5); P2/V.7-9(1-2/6-7); A.6-8(2-2/4-6); C.16-18.

Significant correlation of the morphometric parameters with total length was reported in *Hypophthalmichthys* sp. from Pantnagar farm of Uttarakhand (Pant *et al*., 2018). Similar results were also observed by Negi and Negi, (2010) in *S. richardsonii* from Uttarkashi district of Uttarakhand. Morphometric analysis helps to understand the relation between the body parts. Proportion of each and every body part with its total length is used for morphometric analysis. From the results of the present examination, it was observed that, the body parameters grew symmetrically when observed in different length groups. In the present investigation, morphometric characters undertaken for the growth in relation to the total length of the fish showed a linear relationship. The linear relationship of various morphometric characters and total length has been reported by Safi *et al*. (2014). Gogoi and Goswami (2015) made an enquiry on the morphometric characters of *Amblypharyngodon mola* from a wetland of Assam. Devi and Das (2017) investigated the length-weight relationships of molacarplet *Amblypharyngodon mola* from wetlands of Assam, India. Several authors reported variation between body parameter occurred due to the influence of biological (size, genetic factors) and environmental factors (Temperature, turbidity and depth of water) (Ramasamy and Rajangam, 2016).

Most of the parameters showed negatively allometric growth in relation to total length. Similar observations were made by Dasgupta (1991) in *Tor putitora*. From the present findings it is clear that dorsal fin (1/7), Pectoral fin (1/12), anal fin (17-20) and caudal fin (26-32) remained constant in all groups of fishes having different length groups. Therefore all the meristic characters remained constant with increasing body length. Several groups of fishes showed meristic characters which does not changes with increase in body size. Langer *et al*., (2013) stated that the meristic parameters of *Tor putitora* were almost constant in the entire length group. Work of Hazharika *et al*., (2011) on *Barilius bendelisis* also showed no change in meristic characters with increase in size. Most of the fishes exhibited no change in meristic count in increasing in length (Safi *et al*., 2014; Razzaq *et al*., 2015). Variations in meristic characters have been documented by many workers (Jayshankar *et al.*, 2004). Many factors influence the variations in meristic characters particularly by temperature. Meristic variation related to temperature was studied by Sfakianakis *et al*. (2011) and genetic factors by

Yousefian (2011). The study of morphometric and meristic characters are important for identification of specimens and for experimental studies. Therefore, study of morphometric and meristic measurements is important for knowing taxonomic position of a species (Roy *et al*., 2016). Paunikar and Panwar (2021) showed that 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 in studied fish species.

CONCLUSION

It has been concluded from the above study that different species of fishes are available in rivers, streams, ditches, wetland, ponds, lakes and reservoirs in and around Dehradun, Uttarakhand. The morphometric and meristic characters are dependants on the genetic variation and environmental conditions of different in species to species and place to place. The morphometric and meristic characters of two freshwater fishes of Dehradun, Uttarakhand were standardized. Information of present study gives a clear idea of morphometric characteristics and meristic count of two Cypriniformes species which can be helpful to fishery researchers for further study and identification as well as it can also help to plan future conservation strategy of these species. There will be many species of fishes available in rivers, streams, wetlands, ponds, ditches and reservoirs of Dehradun. It is needed to explore of fish fauna of Dehradun, which above unexplored areas and will be study the morphometric and meristic characters for future benefits.

ACKNOWLEDGMENT

The authors are highly grateful to the Director, Zoological Survey of India, Kolkata, for providing facilities and encouragement**.** Sincere thanks are due to Officer in-Charge, Zoological Survey of India, Northern Regional Centre, Dehradun, Uttarakhand for the facilities provided to carry out this research work.

REFERENCES

Appa Rao, T. (1966).On some aspects of biology of *Lactarius lactarius* (Schn). *Indian Journal of Fisheries*, *13*, 334 - 349.

Dasgupta, M.(1991). Biometry of Mahseer (*Tor putitora*) collected from Garo Hills, Meghalaya, *Indian Journal of Fisheries*, *38*, 129-131.

Das, M, Mandal S, Bhanja A, & Mandal B. (2023).Morphomeristic characteristics, length-weight relationship, and condition factors of one stripe spiny Eel, *Macrognathus aral* (Bloch and J. G. Schneider, 1801). *Research Journal of Agricultural Sciences*, *14*(1), 131-138.

Devi, G.&Das, M.K. (2017).Length-weight relationships of molacarplet *Amblypharyngodon mola* (Hamilton) (Cypriniformes: Cyprinidae) from wetlands of Assam, India. *International Journal of Fisheries and Aquatic Studies*, *5*(1), 70-72.

Dwivedi, S. N. &Menezes, M. R. (1974).A note on morphometry and ecology of *Brachiunius orientalis* (Bloch & Schenider) in the estuary of Goa. *Geobios*, *1*, 80 -83.

Gharaei, A. (2012). Morphometric and Meristic Studies of Snow Trout *Schizothorax zarudnyi* (Nikolskii, 1897) as A Threatened Endemic Fish. *World Journal of Fish and Marine Sciences, 4* (4), 426-429.

Gogoi, R. & Goswami, U.C. (2015) Morphometric and meristic study of *Amblypharyngodon mola* (Ham-Buch) from different habitats of Assam. *Annals of Biological Research*. *6*(2),10-14.

Hazarika, Aj. Borah, U & Bordoloi, L. (2011).Studies on Morphometric Measurements and Meristic Counts of Hill Trout (*Barilius Bendelisis*, Hamilton) From the River Buroi at the Boundary Areas of Assam and Arunachal Pradesh, India. *Indian Journal of Fundamental and Applied Life Sciences, 1* (3), 194-198.

Hossen, M.A., Pramanik, M.Y., Khatun, D., Pramanik, M.N.U., Parvin, M.F., Jasmin, J., Sharmin, S., Rahaman, O., Mawa Z., Rahaman M.A. & Hasan M.R. (2020). Morphometric and meristic traits of three ambassid fish species (*Chandanama*, *Parambassislala*, and *Parambassisranga*). *Indian Journal of Geo-Marine Sciences*, *49*(3), 398-405.

Jayaram, K.C. (1999).*The freshwater fishes of Indian region*. Narendra Publishing House, Delhi., 471.

Jayaram, K.C. (1981).*The fresh water fishes of India*: A hand book. Zoological Survey of India, Kolkata, p.475.

Jayshankar, P., Thomas, P. C., Paulton, M. P. & Mathew, J. (2004). Morphometric and genetic analyzes of Indian mackerel (*Rastrelligerkanagurta*) from peninsular India. *Asian Fisheries Science*, 17, 201-215.

Khanna, S.S. & Singh, H.R. (2006). A text book of fish biology and fisheries. Narendra Publishing House Delhi, 362.

Langer S. Tripathi N.K.&Khajuria B.(2013). Morphometric and meristic study of Golden Mahseer, *Tor putitora*from Jhajjar Stream (J & K), India, *Research Journal of Animal Veterinary Fisheries Sciences, 1*(7), 1-4.

Naeem, Muhammad, Asif Hussain Bhatti & Muhammad Fahad Nouman (2012).External Morphological Study of Wild *Labeocalbasu* with Reference to Body Weight Total Length and Condition Factor from the River Chenab, Punjab, Pakistan. *International Journal of Biology, Bimolecular, Agriculture, Food and Biotechnology Engineering, 6*(7), 429-432.

Negi, R.K. & Negi, T. (2010).Analysis of morphometric characters of *Schizothoraxrichard sonii* (Gray, 1832)

from the Uttarkashi district of Uttarakhand state, India. *Journal of Biological Sciences*, *10*(6), 536-540.

Pant, B., Kaur, R., Lohani,V. &Ram, R.N. (2018). Morphometric characteristics of silver carp (*Hypophthalmichthy smolitrix*) under captive conditions. *The Pharma Innovation Journal*, *7*(2), 17-20.

Paunikar, S & Panwar, S. (2021).Morphometric and meristic study of five freshwater fish species of Song River, Dehradun, Uttarakhand. *Journal of Entomology and Zoology Studies*, *9*(5), 288-292.

Ramasamy, M. & Rajangam, S. (2016) Threatened species of IUCN red list: *Labeocalbasu* (Hamilton, 1822) with requirement of imperative conservational management from Lower Anicut, Tamil Nadu, India. *International Journal of Fisheries and Aquatic Studies*, *4*(1), 294-303.

Rana, D., Gupta, S. K. & Rana R. (2017). Fish fauna of Doon Valley, District Dehradun, Uttarakhand, India. *International Journal of Advance Research Biological Sciences, 4*(12), 120-132.

Razzaq, W., Iqbal,F Zubia M. & Khawar, M (2015). Study of some Morphometric and Meristic Characters of a Parassi mullet, *Mugilincilis* (Mugilidae: Mugiliformes) from the Indus River at Sukkur District of province Sindh, Pakistan. *Biological Forum an International Journal, 7*(1), 767-772.

Roy, P. R. Lucky, N. S. &Hossain M. A. R. (2016). Morphological Characterization of Two Fresh Water Eels,*Monopterus cuchia* (Hamilton, 1822) and *Ophisternon bengalense* (McClelland, 1844). *Journal of Environmental Science and Natural Resources*, *9*(1), 127-137.

Safi, A., Khan, M.A. & Khan, Z. (2014). Study of some morphometric and meristic characters of striped piggy fish, *Pomadasysstridens* (Forsskal, 1775) from Karachi Coast, Pakistan. *The Journal of Zoology Studies*, *1*(4), 1-6.

Sfakianakis, D.G., Leris,I., Laggis, A. &Kentouri, M. (2011). The effect of rearing temperature on body shape and meristic characters in zebrafish (*Daniorerio*) juveniles. *Environmental Biology of Fishes, 92*(2), 197-205.

Snedecor, G.W. & Cochran, W.G. (1967). Statistical Methods.6th*Edition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi*, India, Pages: 593.

Talwar , P.K. & Jhingran,A.G. (1991). Inland fishes of India and adjacent countries.Vols. 1 and 2, Oxford & IBH Publication, New Delhi.1158 p.

Tandon, K.K., Johal M.S. & Bala S. (1993). Morphometry of *Cirrhinusreba* (Hamilton) from Kanjli wetland, Punjab, India. *Research Bulletin Punjab University Sciences*, *43*(1-4), 73-78.

Uniyal, D. &Kumar, A. (2006).Fish diversity in selected streams of Chakrata and Shiwalik hills (District Dehra Dun, Uttarakhand), India. *Records on Zoological Survey of India.* No. 253, 1-120.

Wakil, U. B., Haruna, A. B., Mohammed, G. A., Ndirmbita, W. L., Bukar-kolo, M. Y. &Mohammed, U. K. (2014). Examinations of the stomach contents of two fish species (*Clariasgariepinus* and *Oreochromisniloticus*) in Lake Alau, North-Eastern Nigeria. *Agriculture, Forestry and Fisheries, 3*(5), 405- 409.

Wainwright, P.C. & Richard, B.A. (1995).Predicting patterns of prey use from Morphology of Fishes, *Environmental Biology of Fishes*. 44, 97-113, ISSN 0378-1909.

Yousefian, M. (2011).Study on Morphological Variation in Iran Grass Carp Stocks. *World Applied Sciences Journal, 12* (8), 1234-1239.