Anand P Singh
Department of Zoology, Agra
College Agra, Agra, Uttar
Pradesh, India

Jahnavi Saxena
Department of Zoology, Isabella
Thoburn College, Lucknow,
Uttar Pradesh, India

Rajesh K Srivastava
Department of Zoology, Isabella
Thoburn College, Lucknow,
Uttar Pradesh, India

Sunil P Trivedi
Department of Zoology,
University of Lucknow,
Lucknow, Uttar Pradesh, India

Arun Ratn
PG-Department of Zoology,
Sanatan Dharm College,
Muzaffarnagar, Uttar Pradesh,
India

Corresponding Author:
Arun Ratn
PG-Department of Zoology,
Sanatan Dharm College,
Muzaffarnagar, Uttar Pradesh,
India

Comparative analysis of morphometrics of fish species from river Ganga and Gomti of Uttar Pradesh (India)

Anand P Singh, Jahnavi Saxena, Rajesh K Srivastava, Sunil P Trivedi and Arun Ratn

DOI: https://doi.org/10.22271/fish.2022.v10.i5b.2735

Abstract
The present study aimed to investigate the morphometric characters of fish species, *Labeo rohita*, *Rita rita, Wallago attu* and *Mystus aor* sampled from two aquatic habitats, Gomti River nearby Lucknow and Ganga River at Ghazipur, Uttar Pradesh, India. Both rivers are extremely cherished rivers as they are full of natural resources and highly rich in faunal and floral diversity. A total of 100 specimens of each fish species were collected during October, 2021 to January, 2022. The seventeen morphometric parameters were selected for the comparative differential analysis of population stocks of each fish species in two aquatic habitats. The quantitative measurements of all the morphometric characters delivered the important information about the growth of body parts of fishes in different aquatic ecosystem. The variations in morphometry of individuals of a species illustrated the alterations in the population status under the differential environmental circumstances. The approach of morphometric analysis can be a strategic tool to explore the body shape formation of fish species in different ecosystems. The analyzed data of morphometric dimensions of four 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: *Labeo rohita*, morphometric parameters, *Mystus aor*, population stocks, *Rita rita*, *wallago attu*

Introduction
The morphometric characters, utmost cost-effective keys, are pervasively used as tools to identify fish species in differential spatio-temporal environments [4, 29]. The morphological parameters illustrate the phonotypical plasticity and are influenced by the changes in the environmental factors [13]. The assessment of these growth features of fish expresses about their general health. Consequently, the dissimilarities in the measurable characters will disclose the adaptation to different conditions of the particular environment and are helpful in expounding the identity of individuals of fish [6]. So the morphological dimensions or parameters have been used in the identification and characterization of the fish species. These measurements of the body parts of fish are extensively important for the taxonomical examinations and fishery sciences [22]. The analysis of these measurements exemplifies the variations in size and shape of fish [30]. The study expresses the major keys for defining the variable systematic growth and the different parameters of fishes [32]. For the growth and identification, the morphometric characters are used as marked keys [33]. The identity of fishes may be determined by two biometric factors which are morphometric and meristic parameters. Generally, the morphometric defines the rate of fish growth and its rate is estimated by measuring the body parts of the fishes in order to decide their species and their classes [8].

India rank seventh in the list of top ten exporters of fish and fishery products and is second largest fish producing country. The Indian sector of aquaculture has enormous resources and have a greater potential to grow in future scenarios. Among commercial producing freshwater fishes, *Labeo rohita* is one of the major carps in India and is commonly known as rui and rohu. It belongs to order Cypriniformes and family Cyprinidae. *Labeo rohita* is a warm water teleost and column feeder herbivore fish showing rapid growth in terms of flesh. *Labeo rohita* (Rohu; Hamilton, 1822) is mainly found in the natural habitats such as streams, river, lake, canals,

ponds, ditch, ox-bow Lake and other similar type of water bodies. Maximum length up to 200 cm, the maximum weight of 45 kg can be attained by fish *Labeo rohita* and the maximum reported age of 10 years. The fish *Labeo rohita* identified by its fairly depressed snout, thick and fringed lips with a distinct inner fold. Its body color was bluish black with silvery sides and beneath while caudal peduncle is generally short. Its body is covered with scales especially cycloid except head region. A pair short and thin maxillary barbles were present. *Labeo rohita* was one of the major source of protein and essential amino acid leucine. It is most important commercial and cultivable fish species. It contributes a major portion of the freshwater fish production in India and also has maximum market demand. It is marketed locally without the post-harvest processing. Geographically, it inhabits in the rivers of northern and central India and in some of the rivers of Peninsular India along with neighboring countries, like Myanmar, Nepal, Bangladesh and Pakistan of south-east Asian countries. Second fish species *Rita rita*, greenish brown carnivorous fish, is a commercially imperative catfish and important for fishery farming in freshwater bodies like rivers. It is one of the well-known food fishes, rich in protein content, and having good taste [20]. Also, it is considered as an ornamental fish and recognized as a native ornamental fish of various countries. It is extensively distributed in south-Asian countries [12]. Third fish *Wallago attu*, one of the twenty mega fishes on Earth, is known as many names such as the Asian silurid catfish, Asian sheat catfish and the freshwater shark [26]. Taxonomically, it belongs to the family siluridae and widely distributed in freshwater bodies of south-east Asian countries including India. In Indian regions, three species of genus *Wallago* are primarily occurred. Among the catfishes, the dominance of *W. attu* happened due to the plenty of benthic organisms and weed fishes [10]. Fish *Wallago attu* is also generally termed as Padhani or Barari. Fourth fish species *Mystus* belongs to the family Bagridae and the order Siluriforms. The characteristic features of this family are four pairs of barbells, elongated body and depressed head [34]. It is an essential food fish in India and its species easily get adapted in different environmental circumstances [19]. Morphologically, this fish has many similarities by which, the identification of its individuals is so difficult. Thus, an ambiguity was found in the taxonomic characterization of the species of *Mystus* [7]. Also, the study of fish morphometry is decisive as it provides the comprehensive evidences for the taxonomic and evolutionary aspects [21].

Therefore, the objective of present study is to record the morphometric parameters exploring the differential external features of fish stocks of *Labeo rohita*, *Rita rita, Wallago attu* and *Mystus aor* for their management and sustainable development or growth in two following geographical natural locations. This approach makes suggestions and strategies for their protection and their conservation under different environmental circumstances.

Materials and Methods
Sampling locations
For the measurement of morphometric characters, the fishes (*Labeo rohita*, *Rita rita, Wallago attu* and *Mystus aor*) were sampled from the River Gomti at Lucknow district and Ganga at Ghazipur district of Uttar Pradesh, India. The latitude and longitude coordinates are 26° 52′N and 80° 56′E for Gomti River nearby Lucknow region as well as 25.58′N and 83.57′E for Ganga River at Ghazipur city of Uttar Pradesh, India.

Collection of fish specimens
100 specimens of each fish species (*Labeo rohita*, *Rita rita, Wallago attu* and *Mystus aor*) were collected from two above said aquatic habitats (Gomti River nearby Lucknow and Ganga River at Ghazipur) by using net with the help of local fishermen from October, 2021 to January, 2022.

Identification of fish species
The collection of fish specimens was carried out in the early morning (between 08:00 to 11:00 AM) due to the better availability of fish. The collected fishes washed thoroughly and preserved in 10% formaldehyde solution on the sampling site. The identification of fish species was done with the help of standard reference books [14, 34].

Morphometric measurements
A total of 17 morphometric parameters were measured by using the measuring tape, scales and digital calipers (Fig. 1). The larger length was estimated with measuring tape and the smaller length with the scales and digital calipers. All the morphometric measurements were expressed in cm except weight. The body weight of the fishes was measured in electric or manual balance and expressed in gram (g).
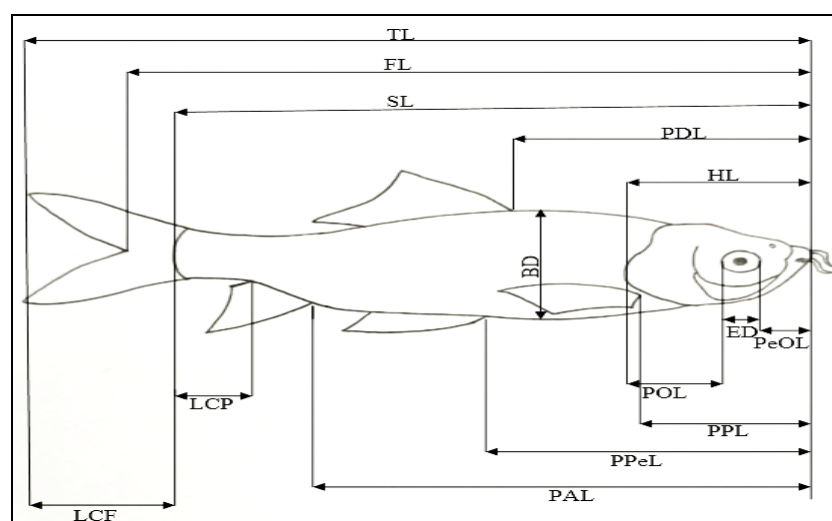
Fig 1: Morphometric dimensions are T.L. - Total Length, F.L. - Fork Length, S.L. - Standard Length, Pe.O.L. - Pre-Orbital Length, P.O.L. - Post-Orbital Length, E.D. - Eye diameter, H.L. - Head Length, P.P.L. - Pre-Pectoral Length, P.D.L. - Pre-Dorsal Length, P.Pe.L. - Pre-Pelvic Length, P.A.L. - Pre-Anal Length, L.D.F. - Length of Dorsal Fin, L.P.F. - Length of Pectoral Fin, L.C.F. - Length of Caudal Fin, L.C.P. - Length of Caudal Peduncle, B.D. - Body Depth, B.W. - Body Weight.

Statistical analyses

All the measured parameters were expressed as mean ± standard error mean (mean ± S.E.M.). All the values were analyzed by using SPSS software (Version 20: IBM, Armonk, NY, USA).

Results and Discussion

The morphometric measurements were recorded for all the fish species, *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor* sampled from Gomti River nearby Lucknow (Table 1) and from River Ganga at Ghazipur district (Table 2) of Uttar Pradesh, India. The total seventeen different aforesaid morphometric parameters were considered for the analysis of their variations in each species of fish. The values (Mean ± S.E.M) of morphometric dimensions were found in the narrow range for all the specimens of individual species. Likewise, the morphometric dimensions of 119 samples were studied for rohu fish. Also, they varied according to the change in the total length of fish specimens. Thus, it was revealed that the direct proportionality relations were observed between other parameters and their respective total length. The total length were positively associated with the remaining morphometric parameters of fish *Labeo rohita* of River Gomti and Ganga and these findings were correlated with the outcomes of previous studies [15, 16, 28].

All the morphometric measurements increased with an increase in total length of *Rita rita* from both the rivers. The similar morphometric parameters were studied in fish *Rita rita* [17]. Also, the physiological features related to morphometric characters were described in the specimens of *Rita rita* collected from the Indus river nearby Jamshoro [12]. Further, the total weight and length of *Rita rita* fish were also measured and the weight of fish ranged from 200-400 g as well as the length of fish varied from 20-30 cm for its all the specimens collected from Ganga river India [20]. Moreover, several investigations reported the association between total length and weight of fish *Rita rita* [1, 11, 25].

For the fish *Wallago attu*, the morphometric parameters elicited with the increase in total length of specimens sampled from both the rivers. Notably, the mean value of total length were recorded as 42.64 and 48.92 for fish specimens collected from river Gomti and Ganga, respectively. A linear relationship was observed between total length and each of the body lengths (TL, SL, FL) for *Wallago attu*. Length weight relationship was studied for the various specimens of fish *Wallagu attu* [27]. Further, there were several previous studies which defined the different morphometric parameters of *Wallago attu* and their associations [2, 26].

Finally, the morphometric parameter values enhanced with an augmentation in the total length of fish *Mystus aor*. A direct and linear relationship was found between total length and each of the body lengths (TL, SL, FL) in fish *Mystus aor*. The length weight relationship of *Mystua aor* from both the river Gomti and Ganga were determined and the findings correlated with results of previous study [27]. The different studies recorded the morphometric dimensions of fish *Mystua aor* from river Ganga [18, 23].

Table 1: Morphometric parameters of four fish species, *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor* sampled from River Gomti at Lucknow district of Uttar Pradesh, India.

Sr. No.	Morphometric parameters (in cm)	Fish species			
		Labeo rohita	*Rita rita*	*Wallago attu*	*Mystus aor*
1.	Total length	43.08±0.95	30.30±1.16	42.64±0.65	36.60±0.97
2.	Fork length	35.44±0.84	27.04±1.15	39.4±0.65	31.88±0.68
3.	Standard length	33.02±0.68	25.88±0.92	37.52±0.53	31.00±0.63
4.	Pre-orbital length	2.32±0.18	2.02±0.16	2.98±0.21	1.92±0.09
5.	Post-orbital length	5.12±0.20	3.48±0.27	4.48±0.23	5.26±0.19
6.	Eye diameter	1.10±0.15	0.84±0.07	0.90±0.07	0.60±0.07
7.	Head Length	8.54±0.52	6.32±0.50	8.36±0.50	7.78±0.35
8.	Pre-pectoral length	7.44±0.23	5.96±0.26	7.50±0.28	7.26±0.35
9.	Pre-dorsal length	14.48±0.24	8.74±0.26	10.04±0.36	12.92±0.16
10.	Pre-pelvic length	16.36±0.24	13.26±0.44	12.98±0.32	17.04±0.19
11.	Pre-anal length	24.86±0.27	17.74±0.60	18.10±0.30	23.66±0.17
12.	Length of dorsal fin	6.70±0.21	5.08±0.33	4.86±0.14	5.82±0.17
13.	Length of pectoral fin	6.56±0.21	4.64±0.28	5.46±0.22	4.64±0.18
14.	Length of caudal fin	10.06±0.27	4.34±0.30	5.12±0.12	5.60±0.34
15.	Length of caudal peduncle	5.50±0.21	4.30±0.32	1.58±0.18	4.88±0.14
16.	Body depth	10.24±0.31	5.70±0.23	7.06±0.27	5.26±0.12
17.	Body weight (in gm)	916.80±28.70	384.60±15.99	506.80±16.75	292.00±13.62

(Values expressed as mean ± S.E.M., n = 100 specimens of each species)

Table 2 Morphometric measurements of four fish species, *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor* sampled from River Ganga at Ghazipur district of Uttar Pradesh, India.

Sr. No.	Morphometric parameters (in cm)	Fish species			
		Labeo rohita	*Rita rita*	*Wallago attu*	*Mystus aor*
1.	Total length	47.70±0.54	35.88±0.93	48.92±1.45	40.84±1.14
2.	Fork length	40.06±0.59	32.70±0.91	44.78±1.37	35.64±1.07
3.	Standard length	35.94±0.33	30.58±0.79	43.2±1.24	33.96±0.75
4.	Pre-orbital length	3.46±0.12	2.90±0.23	3.58±0.32	2.46±0.15
5.	Post-orbital length	6.16±0.12	5.64±0.24	5.44±0.07	6.14±0.23
6.	Eye diameter	1.76±0.05	1.14±0.11	1.16±0.09	0.96±0.09
7.	Head Length	11.38±0.29	9.68±0.57	9.98±0.30	9.50±0.51
8.	Pre-pectoral length	8.62±0.14	7.42±0.27	8.86±0.38	8.54±0.26

9.	Pre-dorsal length	15.56±0.12	10.50±0.43	11.98±0.28	14.30±0.37
10.	Pre-pelvic length	17.94±0.21	15.78±0.33	15.06±0.27	18.42±0.33
11.	Pre-anal length	27.64±0.49	20.58±0.42	19.32±0.25	25.08±0.40
12.	Length of dorsal fin	8.22±0.23	6.48±0.31	5.32±0.16	6.62±0.22
13.	Length of pectoral fin	8.36±0.28	6.18±0.33	6.30±0.16	5.86±0.30
14.	Length of caudal fin	11.76±0.22	5.30±0.14	5.72±0.25	7.08±0.27
15.	Length of caudal peduncle	6.66±0.15	5.30±0.20	2.22±0.20	6.02±0.25
16.	Body depth	11.72±0.14	6.88±0.34	8.48±0.27	6.12±0.22
17.	Body weight (in gm)	1313.20±25.20	458.40±16.18	626.60±23.65	348.60±15.81

(Values expressed as mean ± S.E.M., n = 100 specimens of each species)

On the basis of fish morphometry, the identification of fish populations and the relationships amongst their specimens are extensive facts for their sustainable growth, management, protection and conservation [3, 5]. In current and future aquatic scenarios, the morphological characters engendered the baseline and elementary information about the variations amongst the individuals of all four fish species in well-known River Gomati and Ganga of India. Also, it endorses that the usage of morphometric parameters produce the trustworthy information for the fish stocks discernment of *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor.* Although the various morphometric dimensions of freshwater fishes of river Gomti and Ganga, the most important natural resource and highly rich in ecological diversity, showed the proportional growth rate of fish species increased with an increase in fish length as well as the higher correlation illustrated among all the described parameters. This morphometric information indicated that the fish species, *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor* population were well growing and surviving in the current study locations.

Conclusion
The present study provided the information of fish morphometry on the length-weight relationship and between other parameters associations. Therefore, all the morphometric parameters of fish species, *Labeo rohita*, *Rita rita*, *Wallago attu* and *Mystus aor* would be beneficial for fishery biologists and conservationists who actively work on the protection of fish biodiversity of different geographical locations of the world under the current and future scenarios. Also, the findings would serve as primary information of the management of different fish stocks of various aquatic habitats and allow to develop the efficient strategies and conservation plans for their management in near future.

Conflict of interests
Authors declared that there is no conflict of interests.

References
1. Ankita Khan MA, Khan S. Relationships between length-weight, length-length, and fish length to otolith morphometry in *Rita rita* (Hamilton, 1822). Zoology and Ecology. 2022;32(1):49-55.
2. Attaullah M, Ullah U, Ilahi I, Ahmad N, Rahman FU, Ullah J, *et al*. Taxonomic, morphometric and limnological assessment of the commercially important ichthyofauna of Sakhakot Stream, Malakand, Pakistan. Brazilian Journal of Biology. 2021 June 21;82:e243774.
3. Bano S, Srivastava RK, Singh C, Trivedi SP, Chand S, Ratn A. Investigation of morphometric characters and their correlations in fish *Channa punctatus* from Barabanki, Uttar Pradesh (India). Journal of Global Biosciences. 2022;11(7):9393-9402.
4. Chaklader MR, Siddik MAB, Nahar A. Taxonomic diversity of paradise threadfin *Polynemus paradiseus* (Linnaeus, 1758) inhabiting southern coastal rivers in Bangladesh. Sains Malaysiana. 2015;44(9):1241-1248.
5. Chowdhary L, Srivastava RK, Trivedi SP, Chand S, Ratn A. Comparative Analysis of Morphometric and Meristic Parameters of Fish Species from Lucknow Zone, Uttar Pradesh (India). International Journal of Research and Analytical Reviews. 2022;9(3):50-56.
6. Dars BA, Narejo NT, Awan KP. Morphometric, meristic characters and their relationship in *Channa punctatus* (Bloch) from River Indus near Jamshoro Sindh, Pakistan. Sindh University Research Journal. 2012;44(1):91-96.
7. Darshan A, Mahanta PC, Barat A, Kumar P. Redescription of the Striped Catfish *Mystus tengara* (Hamilton, 1822) (Siluriformes: Bagridae), India Journal of Threatened Taxa. 2013;5(1):3536-3541.
8. Fakunmoju FA, Akintola SL, Ijimakinde B. Comparative analysis of the Morphometric and Meristic Character of Lutjanidae from Lekki and Badagry Lagoons in Lagos State Nigeria. Journal of Agriculture and Veterinary Science. 2014;7(1):81-88.
9. Sharma P, Sharma S. "Data analysis of protein, moisture, ASH and FAT profile of the fishes of upper Ganga". International Journal of Fisheries and Aquatic Research,2021:6(2):24-26.
10. Goswami PK, Devaraj M. Breeding, age and growth of the freshwater shark *Wallago attu* (Bloch and Schneider) from the Dhir Beel of the Brahmaputra basin, Assam, India. Journal of the Indian Fisheries Association. 1992;22:13-20.
11. Gupta S. *Rita rita* (Hamilton, 1822), A Threatened Fish of Indian Subcontinent. International Research Journal of Biological Sciences. 2015;4(11):70-73.
12. Jalbani S, Khan P, Narejo NT, Laghari AJ, Memon F. Bio-chemical composition of Catfish, *Rita rita* from Indus River near Jamshoro. Pure and Applied Biology (PAB). 2017;6(1):47-52.
13. Jalbani S, Narejo NT, Jalbani YM, Iqbal R. Morphometric characters and their relationship in relation to total length in *Cirrhinus reba* (Hamilton) from Manchar Lake, District Jamshoro, Sindh Pakistan. Sindh Univ. Res. Jour (Sci. Ser.). 2014;46(2):117-118.
14. Jayaram KC. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka-A Handbook. Zoological Survey of India, Calcutta Laser Graphics (P) Ltd. 71, Hari Ghosh Street, Calcutta, 1994, 511.

15. Jayraj P, Machavaram R, Sahu G, Paradkar V. Measurement of Morphometric Dimensions and Mechanical Properties of Rohu Fish for Design of Processing Machines. Journal of aquatic food product technology. 2019;28(2):150-164.

16. Kamboj N, Kamboj V. Morphometric and meristic study of four freshwater fish species of river Ganga. The Indian Journal of Animal Sciences. 2019;89(4):470-473.

17. Khan A, Jafar K, Ahmad S, Khan MS, Wajid M, Waheed A. Revision of some morphometric characteristics and building the standard haematological reference value in *Rita rita* from Pakistan. Journal of Entomology and Zoology Studies. 2020;8(5):1503-1507.

18. Khan MA, Nazir A. Stock delineation of the long-whiskered catfish, Sperata aor (Hamilton 1822), from River Ganga by using morphometrics. Marine and Freshwater Research. 2018;70(1):107-113.

19. Maurya AK, Radhakrishnan KV, Sahu P, Prasad L, Pal J, Shukla BN. Length weight relationship and condition factor of *Mystus bleekeri* (Day, 1877) in Rudrasagar Lake, a Ramsar site in Tripura. Journal of Entomology and Zoology Studies. 2018;6(2):2500-2503.

20. Mitra T, Ganguly S, Banerjee S, Mahanty A, Raman RK, Bhowmick S, *et al*. Nutritional composition of different size groups of catfish *Rita rita* (Hamilton, 1822) from river Ganga. Indian Journal of Fisheries. 2017;64:68-74.

21. Mwita C. Morphometric Relationships among the Clariid Fishes of the Lake Victoria Basin, Tanzania. Open Journal of Marine Science. 2015;5(1):26-32.

22. Narejo NT, Lashari PK, Jafri SIH. Morphometric and meristic differences between two types of Palla, *Tenualosa ilisha* (Hamilton) from River Indus Pakistan. Pakistan J. Zool. 2008;40(1):31-35.

23. Nazir A, Khan MA. Stock-specific assessment of precise age and growth in the long-whiskered catfish *Sperata aor* from the Ganges River. Marine and Freshwater Research. 2020;71(12):1693-1701.

24. Prasad H, Desai AY, Jogi A. Morphometric and meristic characters of *Wallago attu* from bhadar reservoir of Gujarat, India. Journal of Entomology and Zoology Studies. 2020;8(2):941-950.

25. Priyanka C, Tewari G, Hassan SS. Study on biometric growth parameters in different fish species of family Bagridae from Harike wetland, Punjab, India. Journal of Entomology and Zoology Studies. 2018;6(4):1667-1672.

26. Rufus T, Eldho PS, Ali A, Dahanukar N, Raghavan R. Length-weight relationship and condition factor of a large predatory catfish, *Wallago attu* (Schneider, 1801) from the rivers of central Kerala, India. Journal of Aquatic Biology & Fisheries. 2015;3(1):105-110.

27. Sarkar UK, Khan GE, Dabas A, Pathak AK, Mir JI, Rebello SC, *et al*. Length weight relationship and condition factor of selected freshwater fish species found in River Ganga, Gomti and Rapti, India. Journal of Environmental Biology. 2013;34:951-956.

28. Sharma L, Pant B, Tamta E, Ram RN. Comparative Study of Morphometric Characteristics of Rohu and Jayanti Rohu under Captive Conditions in Tarai Region of Uttarakhand. International Journal of Livestock Research. 2018;8(11):239-245.

29. Siddik M, Chaklader M, Hanif M, Islam M, Sharker M, Rahman M. Stock identification of critically endangered olive barb, *Puntius sarana* (Hamilton, 1822) with emphasis on management implications. J. Aquac. Res.

Development. 2016;7(2):411.

30. Sparre P, Venema SC. Introduction to tropical fish stock assessment- part I: Manual. FAO Fisheries Technical paper, Rome, Italy, 1998, 407.

31. Reyes AT, Agbisit KMB, Darca LG, Marquez RC, Quilinguin JB. Morphometry and length-length relationship of Jagora spp. collected from the river and stream of Aurora Province, Philippines. Int. J. Biol. Sci. 2020;2(1):18-21.
    DOI: 10.33545/26649926.2020.v2.i1a.18

32. Vatandoust S, Abdoli A, Anvarifar H, Mousavi-Sabet H. Morphometric and meristic characteristics and morphological differentiation among five populations of Brown Trout *Salmo trutta fario* (Pisces: Salmonidae) along the southern Caspian Sea basin. European Journal of Zoological Research. 2014;3(2):56-65.

33. González MA, Rodriguez JM, Angón E, Martínez A, Garcia A, Peña F. Characterization of morphological and meristic traits and their variations between two different populations (wild and cultured) of *Cichlasoma festae*, a species native to tropical Ecuadorian rivers. Arch. Anim. Breed. 2016;59(4):435-444.

34. Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India. 1991;1&2:1158.