



Morphometric and Meristic Analysis of *Tor putitora* (Hamilton Buchanan) from Ujh River, Kathua (J&K)

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Abstract: The morphology of fishes has been the major source of information for taxonomic and evolutionary studies. The present communication deals with the taxonomic analysis of Golden Mahseer- *Tor putitora*, collected from river Ujh, a tributary of Ravi in District Kathua, (Jammu & Kashmir). The morphological characters are generally divided into two major categories, the morphometric and the meristic. For morphometric studies the parameters considered were: the total length, standard length, head length, pre-dorsal length, pre-ventral length, pre-anal length, caudal length, snout length, eye diameter and maximum body depth. The growth of parameters were studied in relation to three independent variables, i.e., total length, standard length and the head length. Meristic counts of fin rays and fin spines etc. were also studied.

Key words: *Tor Putitora*, Morphometric analysis, Meristic analysis, Growth interdependency

Introduction

Taxonomy is an important aspect of fish biology. The identification of fish is based on inter-relationships of morphometric and meristic characters apart from some morphological characters.. Golden Mahseer (*Tor putitora*) is the most commercial fish of Jammu & Kashmir. It is generally known as a game fish and found all along the Himalayan region inhabiting different rivers throughout the length and breadth in India, Pakistan, Bangladesh, Srilanka and even Thailand (Thomas 1897). In India, it is found in Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Uttar Pradesh, Bihar, Assam, West Bengal, Sikkim, Manipur, Meghalaya and Nagaland. The National Commission on Agriculture (1976) in its report on fisheries has stated that there was a decline in mahseer fishery in India due to indiscriminate fishing of broods and

juvenile as well as due to adverse effects of dams. A considerable decline in mahseer fishery in lakes and streams of Northern region has also been reported from time to time by number of workers by (Jhingran and Sehgal, 1978; Joshi et al., 1978; Sehgal, 1983). The present study is designed with an objective to study the taxonomic aspects of *Tor putitora* and variability, if any.

Material and Methods

A total number of 30 specimens of *Tor putitora* were collected from river Ujh, Kathua district of Jammu and Kashmir with the help of standard fishing gears from January(2020) to June(2020). The specimens were preserved in 5 % formalin solution on the spot and were brought to the laboratory for further analysis. The meristic counts and morphometric measurements were recorded within 48 hours



of collection to avoid any shrinkage due to preservation.

Morphometric Study: For morphometric study of *Tor putitora*, the parameters considered were the total length, standard length, head length, pre-dorsal length, pre-ventral length, pre-anal length, caudal length, snout length, eye diameter and maximum body depth. These (pre-dorsal length, pre-ventral length, pre-anal length, caudal length, snout length, eye diameter and maximum body depth) variables were studied in relation to total length, standard length and head length separately as per taxonomy requirement. Fish measurement board and sharp pointed dividers were used for taking body measurements.

Meristic Study: Meristic counts of the characters like fin rays and fin spines etc. were also studied with the help of fine forceps and hand lens. The observed characters were compared / verified with the help of Talwar and Jinghran (1991).

Regression Analysis: Characters were analysed with the help regression analysis ($Y = a + b X$) where Y is the dependent variable and X is the independent variables like Total length, Standard length and Head length individually. “a” is the intercept and “b” is the regression coefficient or slope.

Results

Morphometrics characters of *Tor putitora* are summarized in Table 1. The minimum sample size of fish being 5 was considered in size

group 35 - 40 cm and maximum 9 in the size group 25 - 30 cm and 20 - 25 cm.

Statistics regarding how body parameters grow in ratio of total length is presented in Table 2. The ratio of total length and standard length fluctuated in between $1.18 \pm 0.05:1$ in size group 35 to 40 cm to a maximum of $1.2 \pm 0.06:1$ in the size group of 20 to 25 cm. Ratio of total length and head length fluctuated from $5.44 \pm 0.28:1$ in the length group of 25 to 30 cm to a maximum of $5.94 \pm 0.19:1$ in the length group of 35 to 40 cm. Ratio of total length to pre dorsal length was minimum $2.49 \pm 0.09:1$ in the size group 30 to 35 cm and maximum $2.88 \pm 0.21:1$ in the size group 35 to 40 cm. Ratio of total length to pre pectoral length was minimum $4.9 \pm 0.33:1$ in the size group 20 to 25 cm and maximum $6.02 \pm 0.31:1$ in the size group 35 to 40 cm. Ratio of total length to pre pelvic length was minimum $2.45 \pm 0.1:1$ in the size group 25 to 30 cm and maximum $2.88 \pm 0.33:1$ in the size group 35 to 40 cm. Ratio of total length to pre anal length was minimum $1.62 \pm 0.06:1$ in the size group 20 to 25 cm and maximum $1.92 \pm 0.1:1$ in the size group 35 to 40 cm. Ratio of total length to eye diameter was minimum $29.65 \pm 4.37:1$ in the size group 25 to 30 cm and maximum $37.9 \pm 4.77:1$ in the size group 35 to 40 cm. Ratio of total length to snout length was minimum $21.52 \pm 1.72:1$ in the size group 20 to 25 cm and maximum $25.3 \pm 1.05:1$ in the size group 35 to 40 cm. Ratio of total length to maximum body depth was minimum $5.99 \pm 0.6:1$ in the size group 30 to 35 cm and maximum $6.48 \pm 0.35:1$ in the size group 20 to 25 cm. Ratio of



total length to caudal length was minimum 4.73 ± 0.09:1 in the size group 20 to 25 cm and maximum 5.34 ± 0.29:1 in the size group 35 to 40 cm.

Table 1: Summarized Data on the Mophometrics of *Tor putitora*

S.No.	Size Groups (cm)	TL	SL	HL	PDL	PPL	PVL	PAL	ED	SL	MBD	CL	No. of fish
1	20-25	21.52±1.72	18±1.44	3.89±0.26	8.4±0.65	4.41±0.47	8.63±0.6	13.3±0.84	0.73±0.18	1±0	3.32±0.24	4.56±0.37	9
2	25-30	27.18±1.23	22.61±1.54	5.01±0.35	10.54±0.47	5.58±0.58	11.09±0.36	16.12±0.41	0.93±0.13	1.17±0.2	4.32±0.36	5.64±0.15	9
3	30-35	30.79±1.78	26.04±1.56	5.61±0.38	12.36±0.85	6.07±0.31	12.54±0.88	18.01±1.34	1±0	1.41±0.1	5.17±0.49	5.81±0.32	7
4	35-40	37.9±1.14	32.2±2.17	6.38±0.16	13.2±0.84	6.3±0.2	13.3±1.6	19.8±0.84	1±0	1.5±0.07	5.88±0.11	7.12±0.57	5

TL=Total length, SL=Standard length, HL=Head length, Snt.L=Snout length, MBD=Max.Body depth, PAL=Pre anal length, PDL=Pre dorsal length, PVL=Pre Ventral length, ED=Eye diameter, CL=Caudal length

Table 2: Growth of different body lengths in ratio of Total Length of *Tor putitora*

SN	Size groups (cm)	SL	HL	PDL	PPL	PVL	PAL	ED	Sn.L	MBD	CL
1	20-25	1.2±0.06	5.54±0.2	2.56±0.08	4.9±0.3	2.49±0.08	1.62±0.06	30.48±5.4	21.52±1.7	6.48±0.3	4.73±0.09
2	25-30	1.2±0.05	5.44±0.2	2.58±0.04	4.9±0.3	2.45±0.1	1.69±0.04	29.65±4.3	24.08±4.2	6.31±0.3	4.82±0.19
3	30-35	1.18±0.07	5.51±0.4	2.49±0.09	5.08±0.3	2.46±0.07	1.71±0.07	30.79±1.7	22.16±3.6	5.99±0.6	5.3±0.33
4	35-40	1.18±0.05	5.94±0.1	2.88±0.2	6.02±0.3	2.88±0.33	1.92±0.1	37.9±1.1	25.3±1.05	6.45±0.2	5.34±0.29
Average		1.19±0.06	5.57±0.3	2.6±0.1	5.13±0.5	2.54±0.2	1.71±0.1	31.54±4.7	23.07±3.3	6.31±0.4	4.99±0.35

TL=Total length, SL=Standard length, HL=Head length, Snt.L=Snout length, MBD=Max.Body depth, PAL=Pre anal length, PDL=Pre dorsal length, PVL=Pre Ventral length, ED=Eye diameter, CL=Caudal length

Body parameters in ratio of standard length were calculated and presented in Table 3. The ratio of standard length and head length fluctuated from a minimum 4.52 ± 0.15:1 in the size group of 25 to 30 cm to a maximum of 5.05 ± 0.35 :1 in the size group of 35 to 40 cm. Ratio of standard length to pre dorsal

length was minimum 2.12 ± 0.018:1 in the size group of 30 to 35 cm and maximum 2.45 ± 0.27 :1 in the size group 35 to 40 cm. Ratio of standard length to pre pectoral length was minimum 4.07 ± 0.17:1 in the size group 25 to 30 cm and maximum 5.12 ± 0.14 :1 in the size group 35 to 40 cm.



Table 3: Growth of different Body Parts in ratio of Standard Length in *Tor putitora*

SN	Size Groups (cm)	HL	PDL	PPL	PVL	PAL	ED	SN. L	MBD	CL
1	20-25	4.63±0.28	2.14±0.11	4.09±0.21	2.09±0.09	1.35±0.04	25.4±4.05	18±1.44	5.42±0.33	3.96±0.28
2	25-30	4.52±0.15	2.14±0.08	4.07±0.17	2.04±0.12	1.4±0.07	24.66±3.72	20.11±4.12	5.25±0.34	4.01±0.26
3	30-35	4.66±0.41	2.12±0.18	4.3±0.37	2.08±0.13	1.45±0.06	26.04±1.56	18.77±3.33	5.06±0.4	4.49±0.41
4	35-40	5.05±0.35	2.45±0.27	5.12±0.41	2.45±0.32	1.63±0.13	32.2±2.17	21.48±1.28	5.48±0.38	4.53±0.27
Average		4.67±0.34	2.19±0.19	4.3±0.47	2.13±0.21	1.44±0.12	26.46±4.07	19.39±3.06	5.3±0.38	4.19±0.39

TL=Total length, SL=Standard length, HL=Head length, Snt.L=Snout length, MBD=Max.Body depth, PAL=Pre anal length, PDL=Pre dorsal length, PVL=Pre Ventral length, ED=Eye diameter, CL=Caudal length

Ratio of standard length to pre pelvic length was minimum $2.04 \pm 0.12:1$ in the size group 25 to 30 cm and maximum $2.45 \pm 0.32:1$ in the size group 35 to 40 cm. Ratio of standard length to pre anal length was minimum $1.35 \pm 0.04:1$ in a length group 20 to 25 cm and maximum $1.63 \pm 0.13:1$ in the length group 35 to 40 cm. Ratio of standard length to eye diameter was minimum $24.66 \pm 3.72:1$ in the size group 25 to 30 cm and maximum $32.2 \pm 2.17:1$ in the size group 35 to 40 cm. Ratio of standard length to snout length was minimum $18 \pm 1.44:1$ in the size group 20 to 25 cm and maximum $21.48 \pm 1.28:1$ in the size group 35 to 40 cm. Ratio of standard length to maximum body depth was minimum $5.06 \pm 0.4:1$ in the size group 30 to 35 cm and maximum $5.48 \pm 0.38:1$ in the size group 35 to

40 cm. Ratio of standard length to caudal length was minimum $3.96 \pm 0.28:1$ in the size group 20 to 25 cm and maximum $4.53 \pm 0.27:1$ in the size group 35 to 40 cm.

Body parameters in ratio of head length were calculated and presented in Table 4. The ratio of head length to eye diameter fluctuated from minimum $5.46 \pm 0.82:1$ in the size group of 25 to 30 cm and maximum of $6.38 \pm 0.16:1$ in a length group of 35 to 40 cm. The ratio of head length to snout length was minimum $3.89 \pm 0.26:1$ in size group 20 to 25 cm and maximum $4.46 \pm 0.93:1$ in the size group 25 to 30 cm. The ratio of head length to maximum body depth was minimum $1.09 \pm 0.02:1$ in the size group 35 to 40 cm and maximum $0.17 \pm 0.03:1$ in the size group 20 to 25 cm.

Table 3.4: Growth of different Body parts in ratio of Head Length in *Tor putitora*

S.No.	Size groups (cm)	Eye-Diameter	Snout-Length	Maximum Body depth
1	20-25	5.51±0.97	3.89±0.26	1.17±0.03
2	25-30	5.46±0.82	4.46±0.93	1.16±0.06
3	30-35	5.61±0.38	4.06±0.88	1.09±0.08
4	35-40	6.38±0.16	4.26±0.28	1.09±0.02
Average		5.67±0.77	4.16±0.69	1.14±0.06



Regression analysis of various body parameters with total length, standard length and head length were calculated and statistical values of intercept (a), regression coefficient

(b), coefficient of correlation(r) and coefficient of determination (r^2) are presented in table 5, 6 and 7 respectively.

Table 3.5: Regression Analysis and Correlation Coefficient between Total Length and Dependent Parameters of *Tor putitora*

S.No.	Dependent parameter	Intercept (a)	Regression coefficient (b)	Correlation coefficient (r)	Coefficient of Determination (r^2)
1	Standard Length	-0.56	0.86	0.97	0.95
2	Head length	0.76	0.15	0.94	0.89
3	Pre-Dorsal Length	1.92	0.31	0.94	0.88
4	Pre-Pectoral Length	1.94	0.12	0.85	0.72
5	Pre-Pelvic Length	1.96	1.13	0.89	0.79
6	Pre-Anal Length	4.71	0.41	0.96	0.92
7	Eye-Diameter	0.37	0.02	0.67	0.40
8	Snout-Length	0.30	0.03	0.76	0.58
9	Maximum Body depth	-0.01	0.16	0.94	0.88
10	Caudal Length	1.35	0.15	0.98	0.90

Different models and allied statistical parameters are as follows:

- Standard length = $-0.56 + 0.86$ Total length, Correlation coefficient (r) = 0.97, Coefficient of determination (r^2) = 0.95
- Head length = $0.76 + 0.15$ Total length, Correlation coefficient (r) = 0.94 Coefficient of determination (r^2) = 0.89
- Pre dorsal length = $1.92 + 0.31$ Total length, Correlation coefficient (r) = 0.94 Coefficient of determination (r^2) = 0.88
- Pre pectoral length = $1.94 + 0.12$ Total length, Correlation coefficient (r) = 0.85 Coefficient of determination (r^2) = 0.72
- Pre pelvic length = $1.96 + 1.13$ Total length, Correlation coefficient (r) = 0.89 Coefficient of determination (r^2) = 0.79
- Pre anal length = $4.71 + 0.41$ Total length, Correlation coefficient (r) = 0.96 Coefficient of determination (r^2) = 0.92.
- Eye diameter = $0.37 + 0.02$ Total length, Correlation coefficient (r) = 0.67 Coefficient of determination (r^2) = 0.40
- Snout length = $0.30 + 0.03$ Total length, Correlation coefficient (r) = 0.76 Coefficient of determination (r^2) = 0.58
- Maximum body depth = $-0.01 + 0.16$ Total length, Coefficient of correlation (r) = 0.94 Coefficient of determination (r^2) = 0.88
- Caudal length = $1.35 + 0.15$ Total length, Coefficient of correlation (r) = 0.98 Coefficient of determination (r^2) = 0.90.



Table 3.6: Regression Analysis and Correlation Coefficient between Standard length and Dependent Parameters

S.No.	Dependent parameter	Intercept (a)	Regression coefficient (b)	Correlation coefficient (r)	Coefficient of Determination (r ²)
1	Head length	1	0.17	0.935958	0.87
2	Pre-Dorsal Length	2.77	0.33	0.894351	0.8
3	Pre-Pectoral Length	2.1058	0.1421	0.851443	0.725
4	Pre-Pelvic Length	3.2237	0.3317	0.867185	0.752
5	Pre-Anal Length	5.4692	0.4597	0.942319	0.888
6	Eye-Diameter	0.3938	0.0214	0.673859	0.454
7	Snout-Length	0.3971	0.0353	0.72125	0.52
8	Maximum Body depth	0.2118	0.1807	0.94042	0.884
9	Caudal Length	1.71	0.16	0.917	0.84

11. Head length = 1 + 0.17 Standard length, Coefficient of correlation (r) = 0.9359
Coefficient of determination (r²) = 0.87
12. Pre Dorsal length = 2.77 + 0.33 Standard length, Coefficient of correlation (r) = 0.8943
Coefficient of determination (r²) = 0.8
13. Pre pectoral length = 2.1058 + 0.1421 Standard length, Correlation coefficient (r) = 0.85144
Coefficient of determination (r²) = 0.725
14. Pre pelvic length = 3.2237 + 0.3317 Standard length, Correlation coefficient(r) = 0.8671
Coefficient of determination (r²) = 0.752
15. Pre anal length = 5.4692 + 0.4597 Standard length, Correlation coefficient (r) = 0.9423
Coefficient of determination (r²) = 0.888.
16. Eye diameter = 0.3938 + 0.0214 Standard length, Correlation coefficient (r) = 0.6738
Coefficient of determination (r²) = 0.454
17. Snout length = 0.3971 + 0.0353 Standard length, Correlation coefficient (r) = 0.72125
Coefficient of determination (r²) = 0.52
18. Maximum body depth = 0.2118 + 0.1807 Standard length , Coefficient of correlation (r) = 0.94042 , Coefficient of determination (r²) = 0.884
19. Caudal length = 1.71 + 0.16 Standard length, Coefficient of correlation (r) = 0.917
Coefficient of determination (r²) = 0.84.
20. Eye diameter = 0.2709 + 0.1247 Head length , Correlation coefficient (r) = 0.7164
Coefficient of determination (r²) = 0.513
21. Snout length = 0.3106 + 0.1823 Head length, Correlation coefficient (r) = 0.68111
Coefficient of determination (r²) = 0.464
22. Maximum body depth = 1.6579 + 1.0187 Head length, Coefficient of correlation (r) = 0.9685
Coefficient of determination (r²) = 0.938



Table 3.7: Regression Analysis and correlation coefficient between Head length and dependent parameters

SN	Dependent parameter	Intercept (a)	Regression coefficient (b)	Correlation coefficient (r)	Coefficient of Determination(r ²)
1	Eye-Diameter	0.2709	0.1247	0.716485	0.513
2	Snout-Length	0.3106	0.1823	0.681164	0.464
3	Maximum Body depth	0.6579	1.0187	0.968584	0.938

Meristic Analysis: On the basis of meristic analysis conducted on 30 specimen of *Tor putitora*.

The fin formula was summarised as follows:

D - 11(2/9), Pi -14-16 , Pii- 9 A-7(2/7), C-22.

Discussion

The present study on *Tor putitora* is conducted based on morphometric and meristic analysis. *Tor putitora* is commonly known as Golden Mahseer. The relationship between total length and related body parts is studied. A positive correlation (Table 5) is found in all the parameters with total length and thus showed significant correlation in body growth. The most highly correlated body parameter with total length is caudal length ($r = 0.98$) and least correlated is eye-diameter($r = 0.67$). The most highly correlated body parameter in relation to standard length is pre-anal length ($r = 0.94$) and least correlated is eye diameter($r = 0.67$) (Table 6). The most highly correlated body parameter in relation to head length is maximum body depth ($r = 0.96$) and least correlation with snout length ($r = 0.68$) (Table 3.7). All relationships were positively correlated which showed isometric growth in all the parts of *Tor putitora* under natural conditions. Singh and Dobriyal (1983) studied the morphometric characters and their

relationships in the hill stream cat fish *Pseudecheneis sulcatus* (McClelland) collected in the river Alaknanda at Srinagar Garhwal and found no second stock of population. According to Dobriyal and Bahuguna (1987), there was no significant difference in the stock of population of *N. montanus* collected from Khanda stream. Dobriyal *et al.* (1988) also reported single stock in *Noemacheilus denisonii* and *Noemacheilus multifaciatius* from the same stream. Uniyal *et al.* (2005) also studied the morphometric characters and their relationship in the fish *Tor chilinoides* at Western Nayar and found no any second stock. Bahuguna (2007) concluded that there was a single stock of the population of *Puntius conchoniis* (Ham-Buch) in Mandal river. Kar and Barbhuia (2010) worked extensively on morphometric and meristic characters of Chocolate mahseer *Neolissochilus hexagonolepis* and considered 26 morphometric characters. The diagnostic features shows that body of *Tor putitora* is



elongated and both profiles (dorsal and ventral) nearly straight and somewhat compressed. Head is bigger than body depth. Mouth small and upper jaw slightly longer than that of lower jaw, Lips thick and fleshy barbells with two pairs. Last unbranched ray of dorsal fin is comparatively strong, smooth and osseous. Pelvic fin contains a scaly appendage. Caudal fin deeply forked. Colour of the side is greenish silvery. Belly silvery to white. Scales are golden with dark base and formed of minute black spot. Pectoral, Pelvic, and Anal fins reddish yellow in colour.

Meristic characters are the countable characters. Dorsal fin having 11 number of rays, Pectoral fin having 14 - 15 number of rays, Pelvic fin having 9 number of rays, Anal fin having 7 number of rays, Caudal fin having 22 number of rays, scales above lateral line are 3.5 to 4 in numbers and scales below lateral line is 5 to 3 in numbers. These characters are constant with increase in the length of the fish and makes Fin formula which is similar to the study carried out by Rahman (1989) and Langer *et al.* (2013) but show deviation from those observed by Zafar *et al.* (2012) in *Tor putitora* in foot hills of river Korang, Pakistan which in present case has been observed to be 11(2/9) for dorsal fin rays while the number recorded by Zafar *et al.* (op cit) to be 12(4/8) for dorsal fin ray of *Tor putitora*. Present study on Morphometric and meristic characters concludes that all the specimens collected were having similar characteristics, hence showed no deviation in population. These results will be helpful for research in fishery,

management and conservation in least explored tributary of Ravi river.

References

- Bahuguna PK, Joshi HK and Dobriyal AK (2007). Fecundity and sex ratio in *Puntius conchonioides* (Pisces; Cyprinidae) from Garhwal Himalaya, *Environmental Conservation Journal* 8(1-2): 37-43.
- Desai VR (1973). Studies on Fishery of *Tor tor* (Ham.) from river Narbada. *Proc. Indian. Nat.Sci. Acad.* 39 (2b): 228-248.
- Dobriyal AK and Bahuguna AK (1987). Morphometric character and their relationships in the hillstream loach *Noemacheilus montanus*. *Him. J. Env. Zool*, 1: 23-27.
- Dobriyal AK, Bahuguna AK and Singh HR (1988). Morphometric characters and their relationship in two *Noemacheilus* species from Garhwal Himalaya. *Agra. Boil. Res.*4(2):21-24.
- Jain Sharad K, Agarwal Pushpendra K, Singh Vijay P (2007). Hydrology and Water Resources of India, *Springer Science and Business Media*, p. 482, ISBN 978-1-4020-5180-7.
- Jhingran VG and Sehgal KL (1978). Cold water fisheries of India, *Inland Fisheries Society of India*, Barrackpore, 239pp.
- Joshi CB, Sehgal KL and Shyam Sunder (1978). Observation on the fishery resources of the hill



- streams of Jammu province with special reference to Mahseer and other commercially important species, *Indian Journal of Fisheries*, 25: 197-206.
- Joshi P C (1994). Ecological restoration of water and fish population in the Himalayan Rivers of U.P. *J. Freshwater Biol.*, 6(2): 101-107.
- Langer S, Tripathi NK and Khajuria B (2013). Morphometric and meristic study of Golden Mahseer (*Tor putitora*) from Jhajjar stream (J&K), India. *Res. J. Animal, Veterinary and Fishery Sci.*, 1(7): 1-4.
- Rahman A K A (1989). Fresh water fishes of Bangladesh. *Zoological Society of Bangladesh. Department of Zoology University of Dhaka.*
- Rathore V and Dutta S P S (2015). Fish fauna of river Ujh, an important tributary of the river Ravi, District Kathua, Jammu. *Environment Conservation Journal*, 16: 81- 86.
- Sehgal K L (1983). Himalayas Mountain and Men, T.V. Singh and J. Kour (Eds.), *Print House Lucknow* (U.P), 225-272.
- Singh H R and Dobriyal A K (1983). Morphometric characters and their relationships in the catfish *Pseudeche-neis sulcatus*. *Indian J. Anim. Sci.* 53: 541-546.
- The National Commission on Agriculture (NCA) 1976. Report on NCA Part III- Fisheries, pp 8-8. Govt. of India, New Delhi.
- Thomas H S (1897). Rod in India, London Mullocks Auctions.
- Uniyal S P, Dobriyal A K, Bisht M S and Joshi HK (2005b). Morphometric and meristic analysis of *Tor chelynooides* (Pisces: cyprinidae) from the river Western Nayar of Garhwal, Central Himalaya. *Panjab UnivRes. J. (Sci)*, Vol. 55: 63-67.
- Zafar Muhammad, Nazir A, Akhtar N, Naquei SMHM and Rehman M (2012). Studies on Meristic counts and Morphometric measurements of Mahseer (*Tor putitora*) from a spawning ground of Himalayan fool-hill river Korang Islamabad, Pakistan. *Pak. J. Bio. Sci.* 5(6): 733-735.