

*Rec. zool. Surv. India* : 107(Part-2) : 21-30, 2007

## **MORPHOMETRIC STUDY OF THE MUD EEL *MONOPTERUS CUCHIA* (HAM.) FROM THE NEW ALLUVIAL ZONE OF WEST BENGAL**

D. JANA AND M. DASGUPTA

*Bidhan Chandra Krishi Viswavidyalaya, Regional Research Station,  
Gayeshpur-741 234, Nadia, West Bengal*

### **INTRODUCTION**

*Monopterusuchia*, commonly known as Gangetic mud eel, is a fish with snake like appearance and smooth slimy skin. The eel belongs to the family Synbranchidae and order Synbranchiformes. It is an indigenous fish species of the New Alluvial Zone of West Bengal, locally known as 'Cuhe'. The natural habitat of the fish is rivers, ponds, beels and other freshwater bodies. The eel is rich in protein, iron and vitamin content and quite relished as a food fish by the economically backward people and tribals of West Bengal. The fish population has dwindled to a considerable extent in the New Alluvial Zone of West Bengal due to urbanisation, intensive agriculture and above all population explosion. This fish has been determined to be an endangered fish (Das and De, 2002).

Though the biological study of other food fishes like Indian Major Carps have been done by several workers, the study on *M. cuchia* is very few. No work has been done from West Bengal. Thus, the present study was undertaken to study the biology of *Monopterus cuchia* from the New Alluvial Zone of West Bengal and this paper deals with the morphometry of *M. cuchia* from the New Alluvial Zone of West Bengal. This kind of study is very much essential for solving the race problem, Zupanovic (1968) stated "As it is essential to distinguish between different species, so it is essential to distinguish between the self perpetuating sub-groups within the species. These subgroups may be equivalent to what taxonomists call sub-species, but they may be equivalent to what taxonomists call sub-species, but they may be generally of lesser rank, in the fishery literature, they are often called races or populations."

### **MATERIALS AND METHODS**

The material for the present study pertains to the specimens of *Monopterus cuchia* collected from various beels of the New Alluvial Zone of West Bengal (21.5–24.5° North Latitude and

86–89° East Longitude) during the period February 2005 through January 2006. Specimens were collected every month and immediately after collection specimens were fixed in 10% formalin and brought to the laboratory for detailed measurements. The study is based on the examination of 62 specimens in the size range of 15.0 to 80.5 cm. A total of 12 morphometric parameters (Fig. 1) have been taken up for study according to the methods described by Lowe-McConnel (1976). Divider and measuring board, having graduations in centimeter have been used for various measurements. All linear measurements were made to nearest centimeter.

The number of times each morphometric character went into reference length of the fish was considered as Biometric Index (Tobor, 1974). For each character, a mean biometric index for each 10 cm length group has been calculated.

The regression of various morphometric characters on total length was obtained by least square method with the formula :

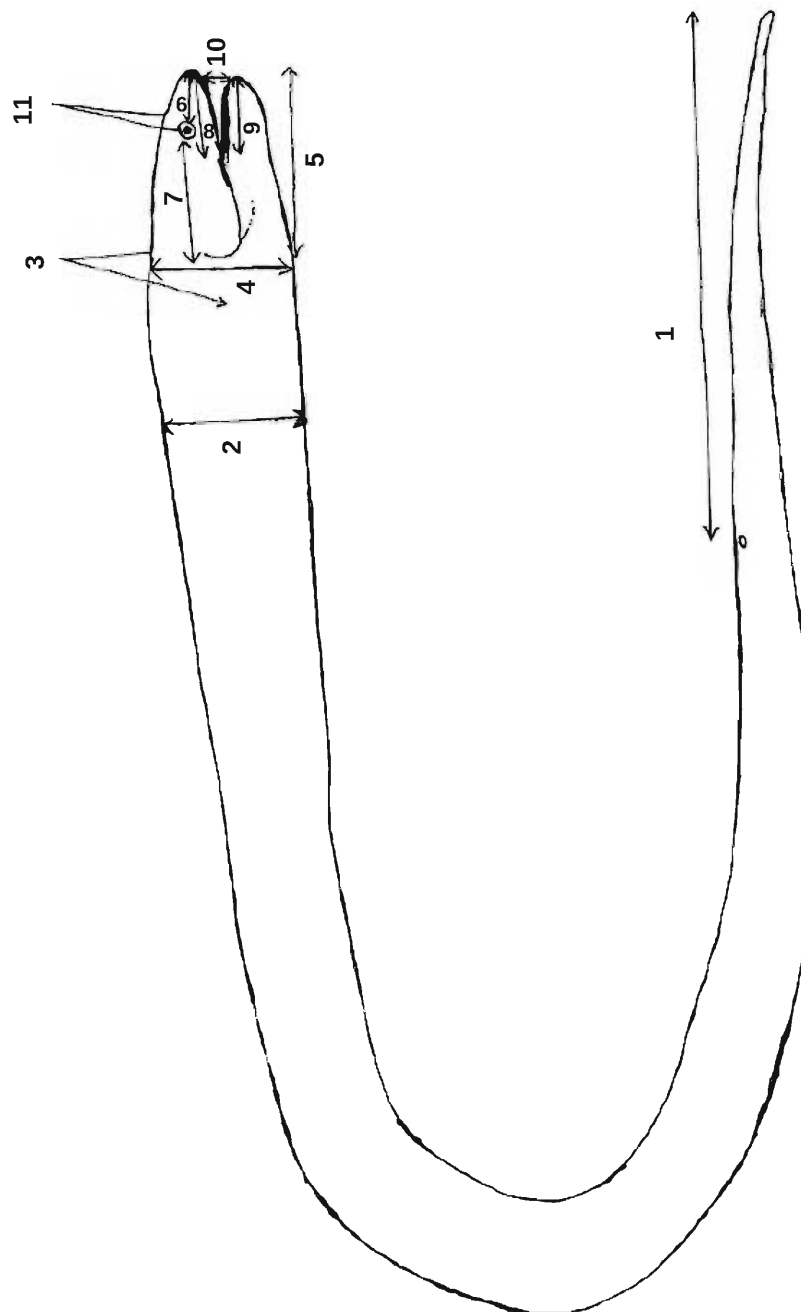
$$Y = a + bx$$

where 'Y' is the variable character such as head length, body depth etc., 'a' is the constant value to be determined, 'b' is the regression co-efficient and 'x' is the total length. The correlation co-efficient 'r' of these regressions was computed.

## RESULTS AND DISCUSSION

The mean and range of various morphometric characters of *M. cuchia* has been presented in Table 1. The morphometric characters showed a positive increase with increase in length of the fish. The regression equation of different variable characters (Y) on total length/head length (X) has been presented in Table 2. The regression co-efficient 'b' of different variable characters indicates that the rate of growth in respect to total length is highest in case of head width and lowest in case of pre-orbital length in relation to head length. High values of correlation co-efficient 'r' (Table 2) obtained indicates a high degree of positive correlation between the different morphometric parameters with the reference length (Total length/Head length). Biometric index of *M. cuchia* (Fig. 2) studied indicates that the indices of length of caudal peduncle, gape of mouth, and inter-orbital length were almost constant. According to Bayagbona (1963), a constant index in any of the biometric characters in relation to its reference length is isometric. The indices of the growth of head depth and body depth in relation to total length and upper jaw length in relation to head length was found to be allometric.

The mean and range of different morphometric characters of males and females of *M. cuchia* has been presented in Table 3. Considerable difference in the morphometric characters has been observed between males and females in their head regions. The males were found to have greater pre-orbital length. On the other hand the females had greater gape of mouth. According to



**Fig. 1. :** Diagrammatic representation of the morphometric parameters of *Monopterus albus*.

1. Length of caudal peduncle (LCP); 2. Body depth (BD); 3. Head width (HW); 4. Head depth (HD); 5. Head length (HL); 6. Pre-orbital length (Pre-OL); 7. Post-orbital length (Post-OL); 8. Upper jaw length (UJL); 9. Lower jaw length (LJL); 10. Gape of mouth (GOM); 11. Inter orbital length (IOL).

**Table 1. :** Morphometric analysis of *Monopterusuchia* from the New Alluvial Zone of West Bengal (Jungle beel).

Sl. No.	Parameters	Mean (mm)	Range (mm)
1.	Total length (TL)	452.7	150–805
2.	Length of caudal peduncle (LCP)	116	43–200
3.	Head length (HL)	34.8	9–55
4.	Pre-orbital length (POL)	7.6	3–14
5.	Post-orbital length (POL)	20.6	6–42
6.	Head depth (HD)	17	5–36
7.	Body depth (BD)	20.8	7–45
8.	Upper jaw length (UJL)	15.2	5–28
9.	Lower jaw length (LJL)	15.4	5–29
10.	Gape of mouth (GOM)	9.9	4–23
11.	Inter orbital depth (IOD)	7	3–13
12.	Head width (HW)	18.8	6–35

**Table 2. :** Regression equations of morphometric parameters of *Monopterusuchia*.

Parameters	Regression equation	Correlation coefficient
Length of caudal peduncle (Y) on total length (X)	$Y = 2.0600 + 0.2077 X$	0.9927
Head length (Y) on total length (X)	$Y = 0.1574 + 0.0637 X$	0.9925
Head depth (Y) on total length (X)	$Y = 0.1187 + 0.0349 X$	0.9855
Body depth (Y) on total length (X)	$Y = 0.1546 + 0.0424 X$	0.9957
Length of upper jaw (Y) on total length (X)	$Y = 0.2096 + 0.0300 X$	0.9703
Length of lower jaw (Y) on total length (X)	$Y = 0.2240 + 0.0289 X$	0.9827
Head width (Y) on total length (X)	$Y = 0.0910 + 0.0379 X$	0.9976
Post orbital length (Y) on total length (X)	$Y = 0.0210 + 0.0457 X$	0.9897
Gape of mouth (Y) on head length (X)	$Y = -0.2150 + 0.7297 X$	0.9720
Pre orbital length (Y) on head length (X)	$Y = 0.1458 + 0.3570 X$	0.9310
Inter orbital length (Y) on head length (X)	$Y = -0.0220 + 0.4140 X$	0.9650

**Table 3.** : Morphometric analysis of *M. cuchia* (Male and Female).

Parameters	Male		Female	
	Mean	Range	Mean	Range
Total length (TL)	64.81	47–80.5	69.18	55–80.5
Length of caudal peduncle (LCP)	15.36	10.4–20	16.37	14.5–20
Head length (HL)	4.37	3.2–5.5	4.65	3.7–5.5
Pre-orbital length (POL)	1.02	0.8–1.4	1.01	0.9–1.3
Post-orbital length (POL)	3.0	2.2–3.8	3.31	2.5–4.2
Head depth (HD)	2.53	1.9–3.6	2.32	1.6–3.2
Body depth (BD)	3.03	2.5–4.5	2.97	2.2–4.2
Upper jaw length (UJL)	2.15	1.3–2.8	2.12	1.7–2.6
Lower jaw length (LJL)	2.15	1.4–2.9	2.02	1.6–2.5
Gape of mouth (GOM)	1.42	0.6–2.0	1.96	1.2–2.3
Inter orbital depth (IOD)	1.0	0.8–1.2	1.02	0.9–1.3
Head width (HW)	2.7	2.0–3.5	2.52	1.9–3.0

Gold (1966) ratios between morphological characters of fish will not necessarily be constant for the organisms of the same species due to variation resulting from differences in sex, race and nutrition and/or other environmental factors.

In the present study an attempt has been made to compare the morphometric characters between dark and white varieties of *M. cuchia*. Variations have been observed between various characters (Table 4). Percentage of length of caudal peduncle, head length, post-orbital length and body depth in relation to total length was found to be higher in white varieties. Such variations are also evident from the regression equations (Table 5). From the 'r' values of the different parameters it is clear that the different parameters in case of dark variety are more correlated with their reference length in comparison to the white variety.

The biometric indices (Table 6) shows that the growth of length of caudal peduncle in relation to total length is isometric in both varieties and the growth of inter-orbital length in relation to head length is isometric in both the varieties. The growth of gape of mouth in relation to head length is isometric in the dark variety and head length in relation to total length is isometric in the white variety. All the other characters are allometric in both the varieties.

Johal *et al.*, (1994) classified various morphometric characters on the basis of range difference into genetical (less than 10%), intermediate (10–15%) and environmentally (greater than 15%) controlled characters.

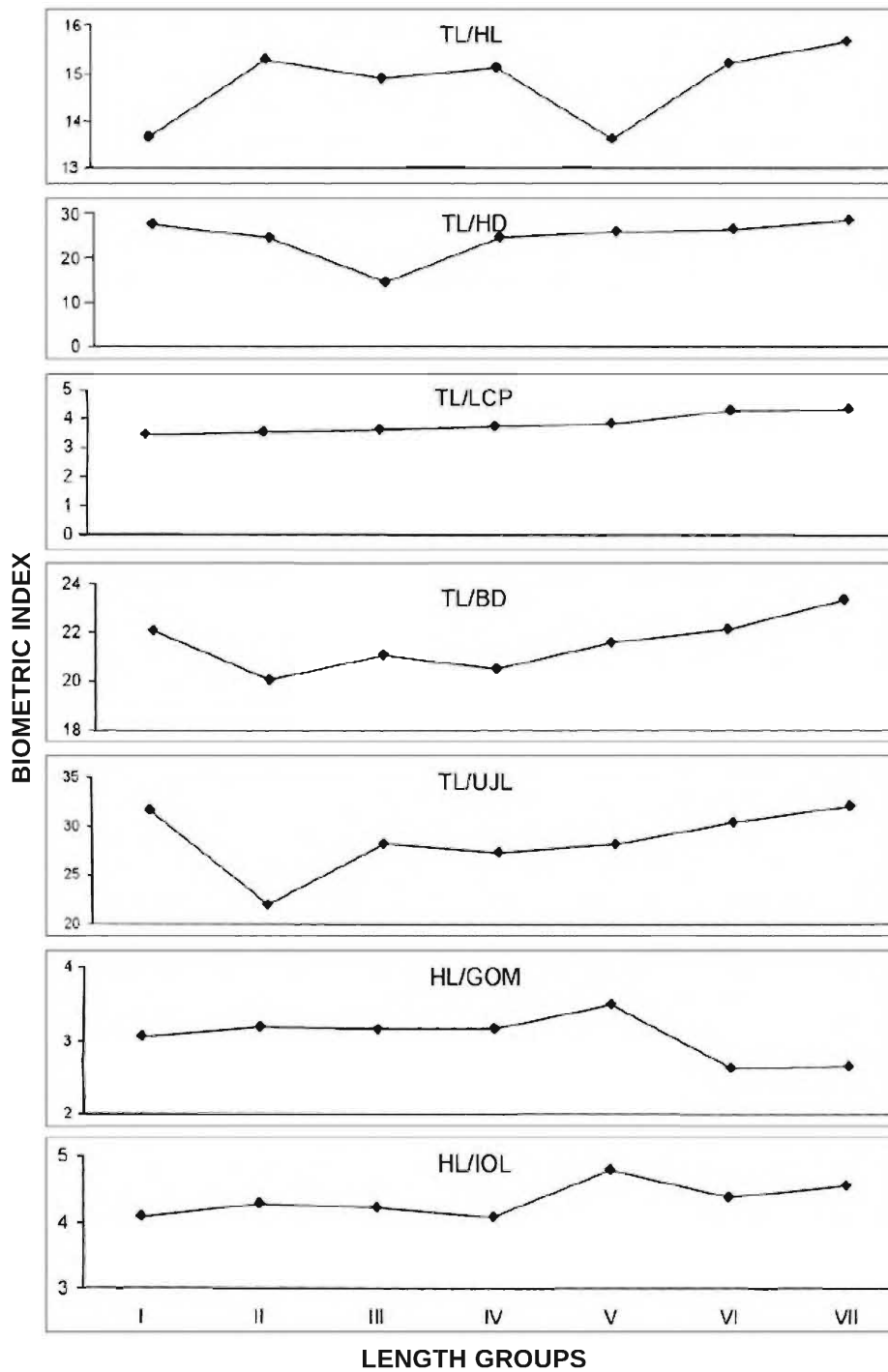


Fig. 2. : Biometric indices of *M. chuchia* at different length groups.

**Table 4. :** Morphometric analysis of *M. cuchia* (Black and White variety).

Parameters	Black variety		White variety	
	Mean	Range	Mean	Range
Total length (TL)	57.40	15–80.5	41.5	24.3–68.5
Length of caudal peduncle (LCP)	11.97	4.3–20	10.98	6.5–20
Head length (HL)	3.03	0.9–5.5	5.83	1.6–5.5
Pre-orbital length (POL)	0.78	0.3–1.3	0.7	0.4–1.4
Post-orbital length (POL)	2.12	0.6–4.2	1.9	1.0–3.8
Head depth (HD)	1.77	0.5–3.2	1.61	1.0–3.6
Body depth (BD)	2.15	0.7–4.2	1.95	1.2–4.5
Upper jaw length (UJL)	1.5	0.5–2.8	1.44	0.9–2.5
Lower jaw length (LJL)	1.53	0.5–2.9	1.46	0.9–2.7
Gape of mouth (GOM)	1.09	0.4–2.0	0.73	0.5–1.2
Inter orbital depth (IOD)	0.7	0.3–1.2	0.63	0.4–1.2
Head width (HW)	1.9	0.6–3.2	1.65	0.8–3.5

**Table 5. :** Regression equations of morphometric parameters of *M. cuchia* (Black and White variety).

Parameters	Regression equations	Correlation coefficient	Regression equations	Correlation coefficient
	Black variety		White variety	
Length of caudal peduncle (Y) on total length (X)	$Y = 2.077 + 0.2069 X$	0.9908	$Y = 1.927 + 0.217 X$	0.9922
Head length (Y) on total length (X)	$Y = 0.068 + 0.065 X$	0.9989	$Y = 0.8517 + 0.046 X$	0.6697
Head depth (Y) on total length (X)	$Y = -0.038 + 0.039 X$	0.9934	$Y = 0.482 + 0.0298 X$	0.6738
Body depth (Y) on total length (X)	$Y = -0.016 + 0.047 X$	0.9900	$Y = 0.529 + 0.036 X$	0.6910
Length of upper jaw (Y) on total length (X)	$Y = -0.025 + 0.034 X$	0.9895	$Y = 0.749 + 0.020 X$	0.5424
Length of lower jaw (Y) on total length (X)	$Y = 0.0325 + 0.0328 X$	0.9839	$Y = 0.222 + 0.0318 X$	0.9272
Head width (Y) on total length (X)	$Y = -0.054 + 0.04 X$	0.9931	$Y = -0.186 + 0.045 X$	0.9775

**Table 5. :** (Cont'd.).

Parameters	Regression equations	Correlation coefficient	Regression equations	Correlation coefficient
	Black variety		White variety	
Post orbital length (Y) on total length (X)	$Y = -0.041 + 0.046 X$	0.9949	$Y = -0.187 + 0.049 X$	0.8389
Gape of mouth (Y) on head length (X)	$Y = -0.154 + 0.404 X$	0.9207	$Y = 0.417 + 0.122 X$	0.8082
Pre orbital length (Y) on head length (X)	$Y = 0.155 + 0.202 X$	0.9830	$Y = 0.042 + 0.242 X$	0.9998
Inter orbital length (Y) on head length (X)	$Y = 0.018 + 0.218 X$	0.9653	$Y = -0.089 + 0.199 X$	0.9775

**Table 6. :** Biometric index of *M. cuchia* in different length groups (Black and White variety).

	Black variety							White variety				
	I	II	III	IV	V	VI	VII	II	III	IV	V	VI
TL/HL	13.6	15.24	14.86	15.18	14.23	15.28	15.02	15.58	15.33	15.64	14.72	15.18
TL/HD	28	24.67	24.68	25.14	27.08	27.82	24.88	25	25.97	27.21	22.08	24.74
TL/LCP	3.45	3.48	3.73	3.74	3.82	4.37	4.35	3.63	3.58	3.82	3.75	4.15
TL/BD	22.1	20.25	20.56	20.69	22.11	23.5	20.24	20.38	22.02	21.69	21.2	19.64
HL/GOM	3.07	2.69	3.23	3.08	3.39	2.21	2.77	2.83	3.44	3.58	4.0	4.73
HL/IOL	4.1	4.23	4.22	4.18	4.60	4.32	4.76	3.95	4.05	4.28	4.5	4.58
TL/UJL	31.7	24.67	30.85	30.27	31.59	30.35	28.11	24.09	29.24	29.93	22.08	30.92

In the present study head width, post-orbital length, head depth and body depth where range difference is greater than 10% can be considered as genetical characters. Head length, where range difference is 10–15% can be considered as intermediate character and length of caudal peduncle, pre-orbital length, upper jaw length, lower jaw length, gape of mouth and inter-orbital length where range difference is greater than 15% can be considered as environmentally controlled characters according to the classification given by Johal *et al.*, (1994).

Johal *et al.*, (1994) reported 13 characters in relation to total length to be genetically controlled in *Tor putitora*.

Bhatt *et al.*, (1998) reported 11 characters in relation to total length to be genetically controlled in the same species. This knowledge is important since Vladykov (1934) maintains that in the fish species showing restricted distribution, the majority of morphometric characters show narrow range



and are genetically controlled. On the contrary in species which have a wide range of Zoogeographical distribution, most of the characters are strongly influenced by the environment. These characters can be used to compare other populations of the mud eel *Monopterus cuchia* and to study the tendency of subspeciations if any.

Variations in the body proportions in the same species according to hydrographic conditions have been reported by various authors. Hubbs (1922), Burlow (1961) associated these variations with the effect of the duration of the periods of growth and of the relating differentiations which determines the number of vertebrae and of segments. The cause of variation in the morphometric and meristic characters may range from genetic variability to the influence of environmental parameters (Mottugh, 1954). Habitat, temperature, elevation, slope, gradient, stream velocity, food, productivity, length, sex and age also affect (Hubbs, 1922; Barlow, 1961; Hempel and Blaxter, 1963; Hopkrik, 1973 and Krika, 1974).

#### SUMMARY

Morphometric characters of the mud eel *Monopterus cuchia* (Ham.) from the new alluvial zone of West Bengal has been analysed. The morphometric characters of the species showed a proportional positive growth with the increasing length of the fish and a high degree of positive correlation with the reference length. Biometric index of *M. cuchia* studied indicates that the indices of length of caudal peduncle, gape of mouth and interorbital length was almost constant. The indices of the growth of head depth and body depth in relation to total length and upper jaw length in relation to head length was found to be allometric. Considerable difference in the morphometric characters has been observed between males and females in their head regions. Variations have also been observed between the dark and white variety of *M. cuchia* between various characters.

#### ACKNOWLEDGEMENTS

The authors are indebted to Director of Research, BCKV for his help and encouragement. This work was supported by the research grant 4(58)/98-ASR-1-1-8-2000 from the Indian Council of Agricultural Research, New Delhi (to MD), DJ is grateful to ICAR for providing Senior Research Fellowship for the work.

#### REFERENCES

- Bhatt, J.P., Nautiyal, P. and Singh, H.R. 1998. Comparative study of morphometric characters of Himalayan mahseer, *Tor putitora* (Ham.) between Ganga and Gobindsagar reservoir stocks. *Indian J. Fish.*, **45**(1) : 85-87.

- Burlew, G.W. 1961. Causes and significance of morphological variations in fishes. *Syst. Zool.*, **10** : 105-117.
- Byagbona, E.O. 1963. Biometric study of two species of *Pseudo talithus* from the Lagos trawling ground. *Bulletin de Ifan*. 15 Ser. A.I.
- Das, P. and De, S.P. 2002. Piscine biodiversity conservation with particular reference to West Bengal. *Proc. of the sixth Indian Fisheries Forum, 17–20 Dec., 2002* : PP 104-114.
- Gould, S.J. 1966. Allometry and size in ontogeny and phylogeny. *Biol. Rev. Cambridge Philos. Soc.*, **41** : 587-640.
- Hempel, G. and Blaxter, J.H.S. 1963. The experimental modification of meristic characters in herring (*Clupea harengus* L.). *Journal of Conseil Perm International Explor Marine*, **26** : No. 3.
- Hopkrik, J.D. 1993. Endemism in fishes of the dear lake region of central California. *University of California Pub. Zoology*, **96** : 1-135.
- Hubbs, C. 1922. Variations in the number of vertebrae and other meristic character of fishes correlated with the temperature of the water during development. *Amer. Nat.*, 55.
- Johal, M.S., Tandon, K.K. and Sandhu, G.S. 1994. Mahseer in lacustrine water, Govindsagar reservoir. In : *Mahseer – The Game fish, Srinagar (Garhwal)*. P. Nautiyal (Ed.), Jagadamba, Prakashan, Dehradun for Rachna, **B** : 67-85.
- Kirka, A. 1974. Variation in somatic characters of the brown trout (*Salmo trutta fario* Linn, 1758) in the head waters of the Poprad river (High Tatra Mts). *Zoologické Listy*, **23**(1) : 85-94.
- Lowe-McConnel, R.H. 1971. Identification of freshwater fishes. In *Methods for Assessment of fish production in Freshwaters*. Ed. W.E. Ricker. Blackwell Scientific Publications Oxford and Edinburgh : 45-81.
- Mohugh, 1954. Geographic variations in pacific herring. *Copeia*, **2** : 139-51.
- Tobor, J.G. 1974. A contribution to the study of *Lates niloticus* Nile perch, in Lake chad. Federal Ministry of information Printing Division, Lagos. Occasional paper No. **17** : 1-23.
- Vladykov, V.D. 1934. Environmental and taxonomic character of fishes. *Trans. R. Can. Inst.*, **20** : 99-140.
- Zupanovic, S. 1968. An introduction to Marine Fishery (Lecture notes), Marine Fisheries Department, Karachi (Mimiographed).