Rec. zool. Surv. India, 87(3) : 207-214, 1990

BIOMETRY OF THE MAHSEER *TOR TOR* (HAMILTON)

M. DASGUPTA*

Department of Zoology, North-Eastern Hill University, Shillong - 793 014.

INTRODUCTION

Though some work has been done on the biology of *Tor tor* from other parts of India (Jhingran, 1975; Chaturvedi, 1976; Desai, 1970) there is practically no information on this aspect of *Tor tor* from the North-Eastern India. Hence a work on the biology of *Tor tor* was under taken and this paper deals with the biometry of this species of mahseer from Garo Hills, Meghalaya.

This kind of study is very much essential for solving the race problem of the species. Regarding the race problem Zupanovic (1968) stated, "As it is essential to be able to distinguish between different species, so it is essential to distinguish between the self perpetuating sub-groups within th species. These sub-groups may be equivalent to what taxonomists call sub-species, but they are presumably more 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 *Tor tor* (Ham.) collected from River Simsang, situated in the East Garo Hills, Meghalaya (25°30'N, 90°40'E and altitude 1138 feet above sea level) during the period August 1978 through July 1980. Specimens were collected every month with the help of a cast net having a mesh size of 0.5 cm. Immediately after collection specimens were fixed in 10% formalin and brought to the laboratory for detailed measurements, weights and counts. The study is based on the examination of 256 specimens in the size range of 85.0 to 355.0 mm. A total of 31 morphometric and meristic characters have been taken up for study according to the methods described by Lowe-Mc Connel (1971). Divider and measuring boards, having graduations in millimeter have been used for various measurements. All linear measurements were made to the nearest mm.

The number of times each morphometric character went into the reference length of the fish was considered as the Biometric Index (Tobor, 1974). For each character, a mean biometric index for each 50.0 mm length group has been calculated.

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

$$Y = a + bx$$

Where 'Y' is the variable character such as total length, head length etc., 'a' is the

* Present address : Department of Zoology, Shibpur Dinobundhoo Institution (College), 412/1, G. T. Road (South), Shibpur, Howrah 711 102.

constant value to the determined, 'b' is the regression coefficient and 'X' the standard length. The correlation coefficient 'r' of these regressions was computed.

RESULTS AND DISCUSSION

The morphometric characters showed a proportional positive increase with increase in length of the fish. The mean and range of these values have been presented in Table I. Among the meristic characters (Table II) the number of pectoral fins rays and lateral line scales showed variations without any relation to length of the fish. The number of other meristic characters were constant.

TABLE - I

Morphometric analysis of *T. tor*

Parameters	*Species* % Standard length		*Sexes* % Standard length	
	Mean	*Range*	*Male*	*Female*
Total length	131.51	128.37 - 133.29	159.83	132.57
Fork length	112.39	110.72 - 114.02	113.66	111.79
Predorsal length	53.72	53.12 - 54.32	54.46	58.06
Head length	27.72	26.58 - 29.21	29.32	26.86
Head depth	19.61	17.72 - 20.56	21.31	19.50
Body depth	30.33	28.68 - 31.35	30.78	30.19
Least Height	12.37	11.43 - 13.08	13.75	12.26
Length of caudal peduncle	16.45	15.74 - 18.22	15.48	16.76
Dorsal fin length	14.64	13.50 - 15.61	15.75	14.91
Length of free margin of dorsal fin	18.22	16.03 - 19.22	20.40	16.97
Dorsal fin height	26.05	24.05 - 28.58	28.32	25.27
Pectoral fin height	21.51	21.09 - 22.46	22.31	20.72
Ventral fin height	19.53	18.98 - 20.88	20.03	18.98
Anal fin height	21.69	21.04 - 22.36	21.58	21.15
Anal fin base	7.68	7.17 - 7.88	7.92	7.19
Girth	74.31	70.75 - 76.89	66.48	66.63
Snout length	39.78	37.18 - 40.86	36.64	39.96
Eye diameter	21.31	19.04 - 26.35	24.80	20.37
Post-orbital length	44.17	41.17 - 45.97	42.85	45.47
Inter-orbital length	47.17	45.84 - 46.03	45.96	47.63
Length of upper jaw	26.37	25.49 - 27.49	24.80	26.77
Gape	37.80	35.81 - 37.90	35.71	38.77
Rostal barbel length	31.20	31.04 - 33.74	30.12	30.90
Maxillary barbel length	34.06	31.74 - 35.40	34.47	24.25

TABLE - II

Meristic characters of *T. tor*

Parameters	*T tor Mean*	*Range*
No. of dorsal fin rays	4/8	4/8 (Const.)
No. of pectoral fin rays	17.07	17 - 18
No. of pelvic fin rays	9	9 (Const.)
No. of anal fin rays	3/5	3/5 (Const.)
No. of caudal fins rays	19	19 (Const.)
No. of lateral line scales	25.8	25 - 27
No. of lateral line transverse scales	4/2	4/2 (Const.)

The regression coefficient 'b' (Table III) of different variable characters (Y) on standard length (X) indicates that the rate of growth in respect to standard length is highest in case of total length (b = 1.3283) and lowest in case of eye diameter (b = 0.0335) High values of correlation coefficient 'r' (Table III) obtained indicates a high degree of positive correlation of the different morphometric parameters with the reference length (standard length).

TABLE - III

Regression equations of morphometric parameters of *T. tor*

Parameters	*Regression equation*	*Correlation coefficient*
Total length (Y) on standard length (X)	Y = – 1.7729 + 1.3283 X	0.9996
Fork length (Y) on standard length (X)	Y = 9.5745 + 1.0578 X	0.9983
Predorsal length (Y) on standard length (X)	Y = 1.1029 + 0.5299 X	0.9997
Head length (Y) on standard length (X)	Y = 4.0956 + 0.2502 X	0.9997
Snout length (Y) on standard length (X)	Y = – 0.1675 + 0.1103 X	0.9998
Eye diameter (Y) on standard length (X)	Y = 4.1495 + 0.0335 X	0.9990
Inter-orbital distance (Y) on standard length (X)	Y = 1.4395 + 0.1205 X	0.9923
Gape (Y) on standard length (X)	Y = 1.9590 + 0.0922 X	0.9800
Rostal barbel length (Y) on standard length (X)	Y = 0.9323 + 0.0803 X	0.9932
Head depth (Y) on standard length (X)	Y = 9.6250 + 0.1297 X	0.9900
Body depth (Y) or standard length (X)	Y = – 2.0831 + 0.3165 X	0.9972
Length of caudal peduncle (Y) on standard length (X)	Y = – 1.0792 + 0.1727 X	0.9836
Dorsal fin length (Y) on standard length (X)	Y = 3.3634 + 0.1241 X	0.9941
Dorsal fin height (Y) on standard length (X)	Y = 5.8411 + 0.2215 X	0.9941
Pectoral fin height (Y) on standard length (X)	Y = 1.3756 + 0.2058 X	0.9992
Anal fin height (Y) on standard length (X)	Y = – 0.8480 + 0.2220 X	0.9965
Anal fin base (Y) on standard length (X)	Y = 1.3195 + 0.0681 X	0.9867
Girth (Y) on standard length (X)	Y = 0.1177 + 0.7422 X	0.9962

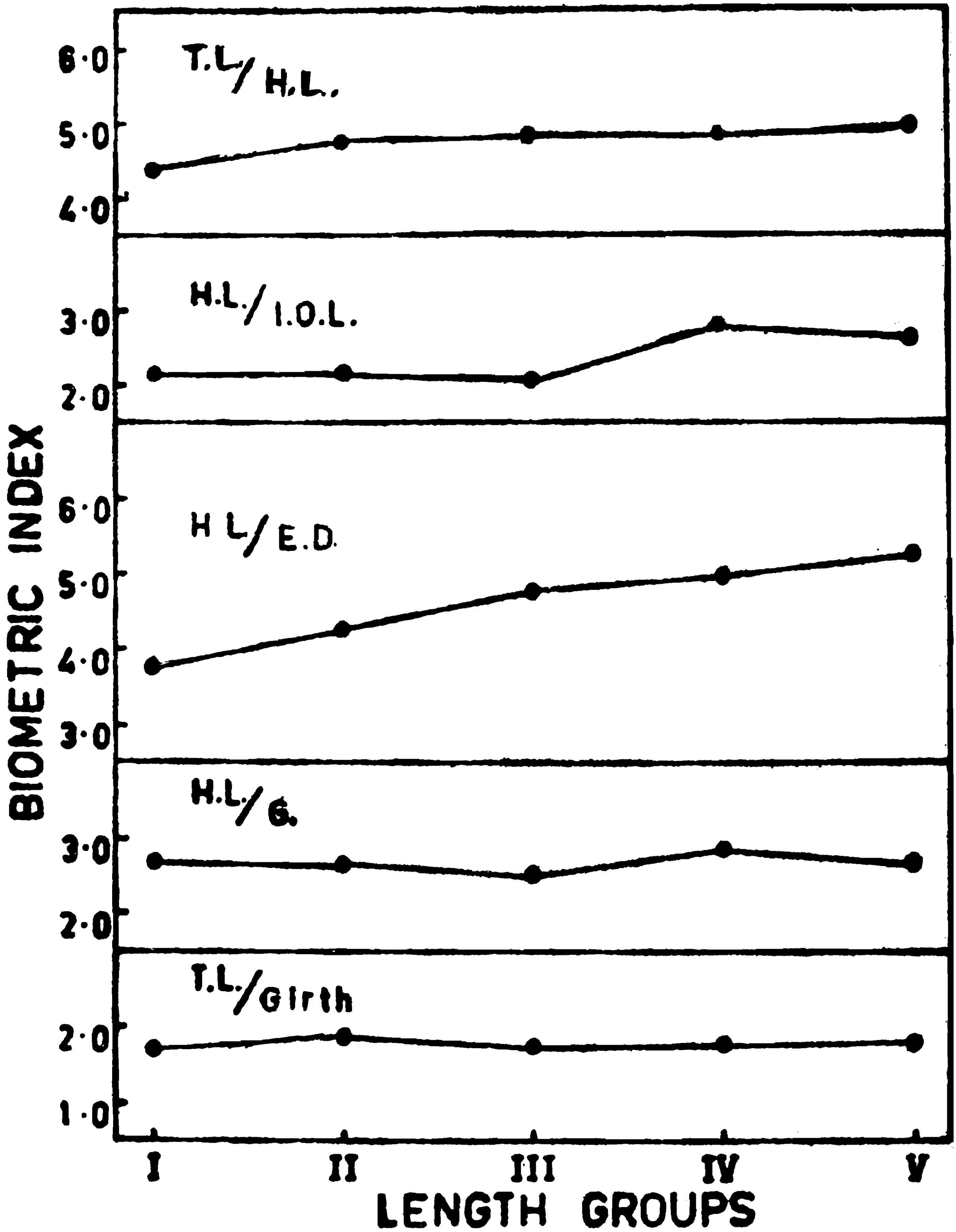

Fig. 1. Biometric indices of *T tor* at different length-groups.

Biometric Index of *T tor* (Fig. 1) indicates that the eye diameter becomes progressively smaller in relation to head length. A similar case has been reported by Tobor (1974) in case of *Lates niloticus*. The growth of head length and girth in relation to total length and gape in relation to head length was almost constant. According to Bayagbona (1963) a constant index in any of the biometric characters in relation to its reference length is isometric. The growth of inter-orbital distance in relation to head length was found to be allometric and showed wide variations.

The morphometric ratios and meristic counts in *T tor* observed in the present study, were found to be quite similar to that observed by earlier workers (McClelland, 1839; Hora, 1940 a, c; Hamilton, 1822).

Considerable difference in the morphometric characters has been observed between males and females (Table I). The males were found to have greater height of dorsal, pectoral and pelvic fins than the females. On the other hand the females had greater height of anal fin, greater length of free margin of dorsal fin, greater eye diameter and maxilary barbel length and also the predorsal length, snout length and gape were greater.

Nikolsky (1963) stated that males and females often differ in the length and shape of the fins. According to him, in the males of many Cyprinoids, both the paired and the unpaired fins are slightly larger than the females. He cited examples of some species where males were found to differ in shape of the fins. For example in the males of certain lake baikal Sculpins, *Cotio comephorus*, the thoracic fins were found to be significantly larger. He further stated that in *Xiphophorus* (Fam. Poecilidae) there is a long outgrowth on the caudal fin, whereas in the males of many pleuronectids of the family Bothidae, the rays of the dorsal fin are elongated, and so on. In majority of cases the difference between the structure of the fins in males and females is connected with the peculierities of reproduction, as for example, the dorsal fin which is larger in male than in the female of the grayling, *Thymallus*, and increases still further towards the time of spawning, creates a turbulence close to te spawning fish during the spawning process, and delays the dispersal of the sperm by fast currents (Brown, 1938). The larger size of the pelvic fins of the male Tinch facilitates a more successful fertilization of the eggs and their attachment to plant stalks (Nikolsky, 1963). Hence such a difference in the morphometric characters of males and females may be represented as sexually dimorphic characters.

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

Various authors have shown that morphometric characters of fish can vary under the influence of environment and in particular the thermal factor during the period of incubation and the beginning of larval life (Schmidt, 1921; Barlow, 1961). According to Hubbs (1922) and Taning (1944) variation occurs in the numer of rays in the unpaired fins in several species which is also related to an adaptation to movement of water of various density.

Variations in the body proportions in the same species according to hydrographic conditions have also been recorded by various authors (Hubbs, 1922; Barlow, 1961). They associated these variations with the effect of the duration of periods of growth and of the relating diffrentiations which determine the number of vertebrae and of segments.

Many authors (Schmidt, 1921; Vladykov, 1934; Taning, 1944; Lindsay, 1954; Barlow, 1961) have reprted that meristic characters, exhibit plasticity under the influence of environmental factors.

SUMMARY

Morphometric and meristic characters of *T tor* (Hamilton) have 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. Some of the meristic characters were found to be constant while some varied without showing any relation to the length ofthe fish. The biometric index indicated that the growth of head length, girth and gape is isometric while the growth of interorbital distance is allometric. The eye diameter becomes progressively smaller in relation to head length. Some difference has been observed between male and female of the species.

ACKNOWLEDGEMENTS

The author is grateful to Dr. S. A. K. Nasar, Department of Zoology, North-Eastern Hill University, Shillong for guidance. Thanks are also due to Professors R. G. Michael and M. K. Khare of the same department and to Professor H. L. Sarkar, Ex-Director, Jawaharlal Nehru University, New Delhi for help and encouragement. Financial assistance for this work was extended by the Indian Council of Agricultural Research, Hindustan Lever Research Foundation and Council of Scientific and Industrial Research.

REFERENCES

Barlow, G. W. 1961. Causes and significance of morphological variation in fishes. *Syst. Zool.* **10** : 105-117.

Bayagbona, E. O. 1963. Biometric study of two species of *Pseudotalithus* from the Lagos trawling ground. *Bulletin de Ifan,* T. XXV Ser. A.I.

Brown, C. 1938. Observations on the life history and breeding habits of the Montana grayling, *Copeia* No. 3.

Chaturvedi, S. K. 1976. Spawning biology of tor mahseer, *Tor tor* (Ham.) *J. Bombay nat. Hist. Soc.* **73** (1) : 336-344.

Desai, V. R. 1970. Studies on the fishery and biology of *Tor putitora* (Ham.). *J. zool. Soc. India.* **24**(1) : 47-51.

Gould, S. J. 1966. Allometry and size in ontogeny and phylogeny. *Biol. Rev. Cambridge Phules. Soc.* **41** : 587-640.

Hamilton, B. 1822. An account of the fishes found in the River Ganges and its Branches. Edinburgh, 405 pp.

Hora, S. L. 1940a. The game fishes of India IX. The mahseers or the large-scaled barbels of India. 2. The tor mahseer *Barbus (Tor) tor* (Hamilton). *J. Bombay Nat. Hist. Soc.* **41** : 518-525.

Hora, S. L. 1940c. The game fishes of India XI. The masheers or the large-scaled barbels of India IV. The bokar of the Assamese and Katli of the Nepalese, *Barbus (Lissocheilus) hexagonolepis* McClelland. *Ibid.* **42** : 78-88.

Hubbs, C. 1922. Variation in the number of vertebrae and other meristic character of fishes correlated with the temperature of the water during development. *Amer. Nat.* 56.

Jhingran, V G. 1975. *Fish and fisheries of India.* Hindustan Publishing Corporation, New Delhi, India, 954 p.

Le Cren, E. D. 1951. The length weight relationship and seasonal cycle in gonad weight and condition in the perch *(Perca fluviatilis). J. Anim. Ecol.* **20** : 201-219.

Lindsay, C. C. 1954. Temperature controlled meristic variation in the Paradise Fish *Macropodus opercularis* (L.) *Can. J. Zool.* **32** : 87-98.

Lowe-McConnel, R. H. 1971. Identification of frewhwater fishes. In : Methods for Assessment of Fish production in Freshwaters.. Ed. W. E. Ricker. Blackwell Scientific Publications Oxford and Edinburgh : 45-81..

Mclelland, J. 1839. Indian Cyprinidae. In : Asiatic Researches. **19**(2) : 217-465.

Nikolsky, G. V. 1963. *The Ecology of Fishes.* Academic Press. London and New York.

Schmidt, J. 1921. Racial investigation. VII. Annual fluctuations of racial characters in *Zoarces viviparas* L. C. R. Lab. Carlesberg. 14 : 1-20.

Taning, A. V 1944. Experiments on meristic and other characters in fishes. 1. On the influence of temperature on some meristic characters in sea trout and the fixation period of these characters. *Medd. Dan. Fisk,. Havenders.* **11**(3) : 1-66.

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).