BIOMETRY OF THE MAHSEER TOR TOR (HAMILTON)

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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 undertaken 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 the 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

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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 | Sexes |
|-----------------------------------------|---------|-------|
|                                         | Mean    | Range | Mean   | Range |
| 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 maxillary 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, *Cottio 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 peculiarities 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 the 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 variation 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 number 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 differentiations which determine the number of vertebrae and of segments.

Many authors (Schmidt, 1921; Vladykov, 1934; Taning, 1944; Lindsay, 1954; Barlow, 1961) have reported 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 of the 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.

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