Comparative length-weight relationship of two species of catfishes, *Arius caelatus* (Valenciennes, 1840) and *Arius tenuispinis* (Day, 1877) from Mumbai waters

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Received 19 April 2011; revised 13 January 2012

Based on the length weight data collected from New Ferry Wharf (NFW), Sassoon Docks (S.D) & Versova landing centres, the length-weight relationship for two important catfishes, *Arius caelatus* and *A. tenuispinis* from Mumbai waters has been reported in the present communication. There is no significant difference in growth between sexes for both the species, based on the ANACOVA test. Length-weight relationship derived were $W = 0.00419 \times L^{3.263}$ ($R^2 = 0.899$) and $W = 0.0306 \times L^{2.720}$ ($R^2 = 0.953$), for *A. caelatus* and *A. tenuispinis* respectively. Growth pattern study showed isometric growth for *A. caelatus* and *A. tenuispinis*.

**Keywords**: Length, weight, catfish, Mumbai.

Introduction

Catfishes of the family Tachysauridae constitute nearly 2.3% of the annual marine fish landings and 13.6% of total demersal fish landing of India during 2008\(^1\). Catfish resources are distributed along the Indo-West Pacific region, more precisely west coast of India to Bangladesh, Myanmar, Singapore, Malacca, Indonesia, Brunei, Darussalam, Malaysia and Pakistan. Catfishes had formed significant seasonal fisheries along the west and east coasts of India since early artisanal days, but had seldom been viewed as anything more than of local importance. With the introduction of mechanized fishing especially trawling on a large scale, there was a drastic change in the exploitation pattern of demersal resources and this brought the marine catfishes to the forefront. Catfish fishery is significant along the Maharashtra coast and among about a dozen of species landed in Mumbai, *Arius caelatus* and *A. tenuispinis* are the most important. In view of the unique behavioral characteristics of incubating males entering coastal waters during spawning season, making them being vulnerable to destructive gears like trawlers and purse seines, there is an urgent need for monitoring the status of catfish resources on regular basis. Length-weight relationship is one of the important parameters which give the estimate of the weight at a given length or vice versa. As it indicates index of health condition\(^2,3\), the life history of species between regions and in time can also be compared.

The studies on length-weight relationship of catfishes from Indian waters include that of *Tachysurus thalassinus* from Waltair and Mandappam\(^4,5\). Dan and Mojumder\(^6\) investigated the length-weight relationship of *T. tenuispinis* from Waltair. Raje\(^7,8\) studied length-weight relationship of *T. caelatus* and *T. tenuispinis* from Veraval. Banerjee-Sawant and Raje\(^9\), studied length-weight relationship of *T. caelatus* and *T. thalassinus* from Veraval, Mumbai and Visakhapatnam during different years. Pantulu\(^10\) reported the length-weight relationship of *Osteogeneiosus militaris* from Hoogly-Matlah estuary.

As recent studies on the length-weight relationship of these two species, *A. caelatus* and *A. tenuispinis* from Mumbai coast appears to be lacking, the present study was undertaken by collecting samples during September, 2008 to June, 2010.

Materials and Methods

Study of length-weight relationship was based on the weekly collection of samples from New Ferry Wharf, Sassoon Docks and Versova landing centers along Mumbai coast. Immediately after bringing the specimens to the laboratory, the total length (TL) was measured from the tip of the anterior most part of the body to the tip of the longest caudal fin ray of lower lobe in mm using measuring board and weight was recorded to the nearest 0.01 g accuracy in an electronic balance. Specimens were dissected and sex was
determined. Length-weight relationship was calculated separately for male and female following Le Cren\textsuperscript{11}. Analysis of covariation was performed to determine variation in ‘b’ values among the sexes at 1% and 5% level of significance by following Snedecor and Cochran\textsuperscript{12}. To test ‘b’ value against the value of ‘3’, Student’s t-test was employed to predict any significant deviation. The t-statistic was calculated as follows:
\[
t = \frac{(b-3)}{S_b}
\]
where, \(S_b\) = Standard error of ‘b’ = \(S_b = \sqrt{(1/(n-2)) \cdot [(S_x^2 + S_y^2) - b^2]}\),

\(S_x\) and \(S_y\) are the standard deviations of x and y respectively. The significance of t-value was calculated at 1% and 5% level of significance with (n-2) degrees of freedom.

**Results and Discussion**

The total length and weight of *A. caelatus* varied from 192 to 482 mm and 110 to 1210 g, while for *A. tenuispinis* from 196 to 522 mm and 96 to 1356 g, respectively.

Scatter diagrams of length and weight for males, females and pooled, exhibited curvilinear relationship (Figs. 1 and 2). Analysis of co-variance did not reveal significant difference in growth in relation to length between the sexes (Tables 1 and 2). Hence, the data of males and females were pooled together to derive a common equation. The relationships were established for both the species as follows:

**A. caelatus**

Male  Log \(W = -2.347 + 3.234 \cdot \text{Log} L\)  \(r^2 = 0.977\)
Female  Log \(W = -4.411 + 3.291 \cdot \text{Log} L\)  \(r^2 = 0.971\)
Pooled  Log \(W = -2.308 + 3.263 \cdot \text{Log} L\)  \(r^2 = 0.974\)
\[\text{Or } W = 0.00419 \cdot L^{3.263}\]

**A. tenuispinis**

Male  Log \(W = -1.350 + 2.583 \cdot \text{Log} L\)  \(r^2 = 0.928\)
Female  Log \(W = -1.778 + 2.858 \cdot \text{Log} L\)  \(r^2 = 0.962\)
Pooled  Log \(W = -0.514 + 2.720 \cdot \text{Log} L\)  \(r^2 = 0.947\)
\[\text{Or } W = 0.0306 \cdot L^{2.720}\]

Student’s t-test of regression co-efficient, revealed no significant difference between length-weight

**Fig. 1**— Length weight relationship of *A. caelatus**

**Fig. 2**— Length weight relationship of *A. tenuispinis**
relationship of the males and females at 5% level for *A. caelatus* and for *A. tenuispinis* (Tables 1 and 2).

The present study did not reveal significant variation in the growth of male (b, 3.233) and female (b, 3.238) of *A. caelatus* in relation to length. Generally, it is observed that the weight of fish increases as the cube (b=3) of length, however, the value of “b” fluctuates between 2.5 and 4\(^13\) and 2.2 to 4.5\(^14\). For an individual fish which maintains the shape throughout life, the value of ‘b’ should be 3.0\(^15\). Beverton and Holt\(^16\) agrees to the existence of cubic relationship between length and weight of fishes and opines that instances of deviation from isometric growth in adult fishes are rare. For a fish having an unchanged body form and specific gravity, the value of “b” is 3, which describes “isometric growth”. Ricker\(^17\) also observed that a fair number of species obey this law. Not much work has been done on length weight relationship of *A. caelatus*, except those by Raje\(^7\), who found b value of *T. caelatus* from Veraval as 3.2685 for males and 2.9104 for female, which were found to be significantly different from each other at 1% and 5% levels as evidence by ANACOVA test. Furthur, Banerjee-Sawant and Raje\(^9\), reported regionwise b values for *A. caelatus* in Veraval and Mumbai coasts, wherein, b values for both sexes were 3.0983 and 3.2430 respectively.

Mojumder\(^4\) found no significant difference in male and female length-weight relationship of *T. thalassinus* from Visakhapatnam coast. He found the value of “b” as 2.9889, but Menon\(^5\) reported significant difference in the “b” value for yolked larvae, immature female and male of this species from Mandapam waters. Singh and Rege\(^18\) determined the length-weight relationship of *T. sona* from Bombay waters, where, “b” value obtained was 2.931. According to Dan and Mojumder\(^6\) cubic formula does not hold good for *T. tenuispinis* in Visakhapatnam coast. Pantulu\(^10\) found no significant difference in “b” value (3.23) between male and female of *O. militaris*. Krishna\(^19\) worked out the “b” value for *O. militaris* as 3.145 from Mumbai waters and mentioned that there is no significant difference in “b” value for male and female.

During the present investigations, for *A. caelatus* regression co-efficient ‘b’ was obtained as 3.233 for males, 3.291 for females and 3.265 when pooled. Similarly, for *A. tenuispinis* ‘b’ was obtained as 2.583 for males, 2.858 for females and 2.743 when pooled. The ANACOVA revealed that no significant difference in “b” value between male and female at 5% level as mentioned by majority of workers.

### Acknowledgements

Authors are thankful to the Director, CIFE, Mumbai for providing facilities.

### References


