Study of allometric relationships in the great clam, *Meretrix meretrix* (Chemnitz) from the south west coast of India

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ABSTRACT

The great clam, *Meretrix meretrix* is a major contributor in the clam catches along the south west coast of Maharashtra, India. The colour and shape of the shell are generally used as the identifying characters of the clam, but these characteristics mainly depend on the habitat and food availability and may show variation accordingly. Present work analyses the relationship between the total shell length to shell width, shell height and hinge length. The morphometrical equation for the samples collected were Ht = 2.713 + 0.054 L, Wd = 0.9034 + 0.8963 L and Hg = -1.3926 + 0.30 L.

Keywords: Allometric relationship, total shell length, shell width, shell height, hinges length

1. INTRODUCTION

The change of form due to the different environment conditions and habits has long been known in the animal world. The relative growth of different parts of the body changes thereby bringing about changes in form. The clams found mostly in the estuarine environment are naturally subjected to fluctuating ecological conditions, which exert great influence on their growth and breeding. Studies relating to these fluctuations of many species of edible bivalves have been carried out and many workers furnish valuable information on their growth. A study on the Indian bivalves has been carried out by Winckworth (1931) on *P. undulata*, Rao (1951) on *K. opima*, Abraham (1953) on *M. casta* Durve (1970). A change in the form of the shell of *M. casta* during growth has been observed by Durve and Dharmaraja (1969), Durve (1970) studied the growth of *M. casta* in the marine fish farm at Mandapam reported a monthly, and he attributed this slower growth rate in the fish farm at Mandapam to high saline conditions which was not a natural habitat of the clam. Comparison of the age and growth of bivalves from temperate and tropical estuarine ecosystem had been done by Parulekar (1984). The present study was therefore undertaken to understand the relationship between these various environmental conditions on the rate of growth and spawning of *M. meretrix*. Since not much work on the biology of *M. meretrix* is done along the south west coast of Mahasrttra, India, the study of this clam was undertaken. This knowledge would be beneficial in undertaking the culture programmes as this species is being considered as a cultivable candidate species and in determining the best season for the fishery, spawning and growth patterns.

2. MATERIAL AND METHODS

The clams are collected from clam beds of estuarine areas covering Kajali and Kalbadevi estuaries along this coast (Figure 1). Topography of the south west coast of Maharashtra, India is interesting one as it offers variety of shores such as sandy, rocky, muddy and their admixtures. The sandy and muddy coasts offer an excellent habitat for burrowing invertebrates such as clams. Commercial exploitation of *M. meretrix* in this region is mostly done by hand operated dredge net locally called as ‘Kurud’. The study was conducted from March 2011 to February 2012. Weekly random samples were collected with hand dredge net and by hand picking. From the samples, morphometric parameters like shell length (the maximum distance along axis of the valves), height (the maximum thickness between the two valves when they are closed), width (the maximum distance along the short axis of the valves), hinge, total weight, shell weight and wet meat weight were recorded at weekly intervals. Sizes of the broods for every three months, from the collected samples, were used to estimate Lₙ. All morphological measurements such as shell length, height, width, total weight, wet weight and dry weight were measured following the method adopted by Abraham (1953). Regressions of growth, weight, hinge length, total weight, wet weight and dry weight on shell length were studied by the simple equation for linear regression \( Y = aX^b \).

**Table 1 Logarithmic relationship between the morphometric characteristics of *M. meretrix***

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Equation</th>
<th>a</th>
<th>b</th>
<th>r</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (Ht) on length (L)</td>
<td>Ht = 2.713 + 0.054 L</td>
<td>2.713</td>
<td>0.054</td>
<td>0.90*</td>
<td>2400</td>
</tr>
<tr>
<td>Width (Wd) on length (L)</td>
<td>Wd = -0.9034 + 0.8963 L</td>
<td>-0.9034</td>
<td>0.8963</td>
<td>0.97*</td>
<td>2400</td>
</tr>
<tr>
<td>Hinge (Hg) on Length (L)</td>
<td>Hg = -1.3926 + 0.30 L</td>
<td>-1.3926</td>
<td>0.2972</td>
<td>0.85*</td>
<td>2400</td>
</tr>
</tbody>
</table>

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where Y is taken as height (Ht.), width (Wd.), hinge length (Hg). X is taken as shell length (Lt.). 'a' and 'b' are constants to be determined empirically.

3. RESULTS
Allometric relationships between total shell length, width, height and hinge length were studied. The present study on the relationship between various parameters of M. meretrix would help in taxonomical identification of this clam, which otherwise becomes difficult due to the variations in colour patterns and shell features. The constants were determined from the morphological data collected. The relationships between length and width, length and height, length and hinge length were calculated for the clams. The relationships were determined using the simple linear equations, where Ht is shell height, Wd is width, Hg is hinge length, L is shell length. The regression analysis of the allometric data is presented by Table 1 and Fig. 2 to 4.

4. DISCUSSION
In the present study, the total length of M. meretrix collected from clam beds of estuarine area Ratnagiri ranged from 21 to 55 mm. The morphometric equation for the samples collected were Ht = 2.713 + 0.054 L, Wd = -0.9034 + 0.8963 L and Hg = -1.3926 + 0.30 L. Similarly relationships between the length and total weight in the males and females from both the stations were also found to exhibit allometric relationships. Rao (1951) found that in the case of the clam K. opima, the length of 22.5 mm was attained at the end of the first year, while it was only 31.5 mm and 40.5 mm at the end of second and third years respectively.

Ranade (1964) reported growth of 40 mm in one year, 49 mm in two years and 55 mm in three years in the clam, M. meretrix from Ratnagiri. The growth rate reported by the same author for K. opima is 21 mm, 31 mm and 42 mm in first, second and third year respectively. The growth rate of K. opima reported by Kalyansundaram and Kashinathan (1983) in Vellar estuary was 15.15 mm in 0 year, 26.55, 36.2 and 41.15 mm during first, second and third year respectively.

The length-height equation given by Rao (1987) for M. casta was H = -1.7777 + 0.8025 L (r = 0.9882), length-thickness relation was T = -4.3286 + 0.8706 L (r = 0.9842) and correlation coefficient was close to 1 showing high degree of correlation between the parameters studied. Narsimham et al. (1988) stated the length-height equation for M. meretrix in Korampallam creek, Tuticorin was Y = 0.07859 + 0.8584 X 0.9936 and length-thickness equation was Y = -2.4855 + 0.5617 X 0.9783. Also he gave the length-height equation for larvae during its rearing and spat production of M. meretrix was H = -21.3529 + 1.0 L, where Length and height in micron and the parameters the
correlation coefficient $r$ is 0.9828. In similar studies conducted at Ashtamudi estuary, Modassir (1990) has worked on $M. \text{casta}$ from Mandovi estuary, Goa. An equation of $Y = -0.6228 + 3.233 X$ was estimated for $M. \text{casta}$, using the regression of total weight on shell length. Appukuttan (1996) has studied the age and growth in $P. \text{malabarica}$ and reported that this clam grows to 30.05 mm in one year, 38.21 mm in second year and 41.44 mm in the third year in the Ashtamudi estuary. It was also reported that 1 year class (30.1 – 38.2 mm) ranked first in the commercial catches, followed by 0 – year class (less than 30.1 mm) and 2 + year class and 3 + year class (above 38.2 mm). Length-height equation given by Mohite (2010) was $Ht = 0.159 + 0.69 L$ and length-weight equation was $Wd = 1.051 + 0.246 L$. In the present work, $M. \text{meretrix}$ showed allometric relationships between the total length to the shell height, shell width and hinge length. This clam attained the length of 30 mm at first year, 42 mm at second year and 45 mm at third year. These relationships were seen to be species specific and could be used as to identify the species, which otherwise becomes difficult to identify using the shell colours as the main character.

REFERENCES

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