Indian J. Fish., 55(3) : 281-283, 2008

Note

Allometric relationships of the clam *Marcia opima* (Gmelin, 1791), collected from two longitudinally separated areas

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ABSTRACT

The relationship between various morphological attributes such as shell-on weight, length, width, height, wet meat weight and dry meat weight of the baby clam, *Marcia opima* was studied from two longitudinally separated localities *viz*., Tuticorin Bay along the south-east coast and Ashtamudi Lake along the south-west coast of India. Using the equation, $W= aL^b$, the relationship between length and shell-on weight was established. The relation between a part and the whole body or between parts of a growing animal is described by the general equation Y= a+bX. The slope values of the length - weight relationship of the baby clam followed the cube law. It was also observed that true allometric relationships exist between weights and linear measurements. The values of correlation coefficient for different morphological relationships were very close to unity. Length is found to be the most useful parameter to predict other biomass parameters from field study.

Clams are the most important bivalve resources in India. The clam fishery in India is localised and at sustenance level. The main species of clams like *Villorita cyprinoides, Meretrix casta, M. meretrix, Paphia malabarica, Marcia opima* and *Anadara granosa* together contributed about 36,172 t during 1999 to 2000 (Ramadoss *et al.*, 2001). Venerid clams, with an estimated annual production of 14,000 t, form 30.9% of the total landings.

Allometric relationships of bivalves have received considerable attention in view of their application, particularly in the commercial exploitation of the species in India (Mohan *et al*., 1984; Narasimham *et al*., 1988; Jayabal and Kalyani, 1989). The allometric relationship is different for the various size groups of animals in some bivalve species (Shafee, 1977; Jayabal and Kalyani, 1989), whereas in some other bivalves the fitted regression line is the same for the entire size range of animals (Durve and Dharma Raja, 1965 a,b). In the present study, the morphological relationships of *Marcia opima* from two longitudinally separated areas were studied.

Marcia opima were collected from the intertidal zones of the sampling sites at Tuticorin (8° 45’ N and 78° 12’ E) and Ashtamudi (9° 28’ N and 76 ° 28’ E) from December 1998 to January 2000. A wooden frame of 50 m^2 area was placed in the exposed area at low tide and the clams were handpicked. They were cleaned and wiped dry. A total of 1009 clams ranging in size from 13.80 to 45.10 mm were measured from Tuticorin Bay and 304 clams ranging in size from 23.1 to 54.6 mm were measured from Ashtamudi Lake. The shell-on weight of the animal was determined to the nearest of 0.01g. The length (the maximum distance along the long axis of the valves), width (the maximum distance along the short axis of the valves) and height (the maximum distance between the two valves when they are closed) were determined to the nearest of 0.01 mm. The meat was extracted, blotted to remove excess moisture, weighed and subsequently dried to a constant weight in an oven at 60ºC. Shell-on weight, width and height were examined to establish a relationship with length. Another relationship was established between the height and width of the clams. Shell-on weight and dry tissue weight were taken to establish a relationship with the wet tissue weight.

The relation between length and weight of the sampled population has been described by the equation:

$$W= aL^b$$

where, W is the weight, L is the length of the clam and ‘a’ and ‘b’ are constants.

As weight is a power function of length, logarithms were used so that the exponential relationship can be expressed by a linear equation:

$$\text{Log } W= \text{Log } a + b \text{ Log } L$$

The relation between a part and the whole body or between parts of a growing animal can usually be described by the general equation,

$$Y= a+bX$$

where Y is some measure of a part, X is a measure of the whole body or another part, 'a' and 'b' are constants (John, 1980).

This equation can also be expressed in logarithmic form as:

Log Y = log a + b log X

The value b=1 indicates that the organism grows symmetrically or isometrically. Values other than 1 indicate allometric growth. Growth is positively allometric if b>1 and if b<1, it is negatively allometric. Pauly (1993) reported that if fishes have to maintain their shapes as they grow, 'b' values must be equal to 3, but there is no theory that says in which case the estimated 'b' values can be expected to be negatively or positively allometric. Garcia *et al.* (1998) reported that biological interpretation of the numerical values of the parameters 'a' and 'b' is not straight forward, except that when growth is isometric, 'a' can be interpreted as a condition factor. When growth is allometric, the role of 'a' as the condition factor is questionable. The length-weight data was analysed using ordinary least squares regression (at 95% confidence) using STATISTICA version 5.0.

Following relationship was established for length-weight of clams collected from Tuticorin:

Log W= -2.3337+ 2.248 Log L

The relationship for length-weight of clams collected from Ashtamudi was:

Log W = 0.0003 + 3.007 Log L

t-test showed that the 'b' value of both the clam population was not significantly different from b=3 (Tuticorin: n=1009, df=1008, p>0.05; Ashtamudi: n=304, df=303, p>0.05).

The derived equations for various morphological relationships are given in Table 1 for the clams collected from Tuticorin and Ashtamudi. In addition, the table shows the values of correlation coefficient 'r', which gives an estimate of how well the data fit the allometric model. From the tables it is evident that the values of correlation coefficient for various morphological relationships are very close to unity. For length-weight relationship, the slope value (b) obtained in the present study is 2.248 and 3.007 for the clams collected from Tuticorin and Ashtamudi respectively. These values are very close to the slope value obtained for other species of clams as observed by earlier workers (Narasimham *et al.*, 1988; Jayabal and Kalyani, 1989). It may, therefore be said that the length-weight relationship in the baby clam is of an allometric form and follows the cube-law as in the case of fishes.

Table 1. Comparison of allometric relationships of *M. opima* at Tuticorin and Ashtamudi

Parameters	N		Regression equation		Allometry		Correlation coefficient (r)	
	Tuticorin	Ashtamudi	Tuticorin	Ashtamudi	Tuticorin	Ashtamudi	Tuticorin	Ashtamudi
Length (X) on Width (Y)	1009	304	- 0.2643 + 0.7801 X	4.0120 + 0.6524 X	-ve	-ve	0.9733	0.9919
Length (X) on Height (Y)	1009	304	- 1.7999 + 0.5445 X	- 4.1108 + 0.6899 X	-ve	-ve	0.9151	0.9926
Length (X) on Shell-on weight (Y)	1009	304	- 2.3337 + 2.2485 X	- 3.5317 + 3.0070 X	+ve	+ve	0.9510	0.9561
Width (X) on Height (Y)	1009	304	3.0661 + 0.6575 X	-8.0106 + 1.0458 X	-ve	+ve	0.9234	0.9895
Wet tissue weight (X) on Shell on weight (Y)	1009	304	0.5096 + 0.1253 X	0.4821 + 0.1050 X	-ve	-ve	0.9519	0.9751
Wet tissue weight (X) on Dry Tissue weight	1009	304	-0.0382 + 0.2366 X	0.0063 + 0.1822 X	-ve	-ve	0.7465	0.9788

$p < 0.05$

The linear relationships between various morphological factors are in accordance with the findings of Nayar (1955) and Talikhedkar *et al*. (1976) in *Donax cuneatus*. True allometric relationships exist in all relationships involving weights and linear measurements. The length may be recommended as the most useful character to predict other biomass parameters because of higher correlation coefficient values in those relationships using length. The proportionate increase in the width and thickness with length indicates that the general form to be more or less same throughout the life (Pauly, 1993).

Acknowledgements

The authors are grateful to the Director, Central Marine Fisheries Research Institute, Cochin for providing necessary facilities. The financial support in the form of fellowship received from the Central Institute of Fisheries Education, Mumbai is greatly acknowledged by the first author.

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Date of Receipt : 16-02-07
Date of Acceptance : 11-06-08