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BIOLOGY OF THE GREAT CLAM, *MERETRIX MERETRIX* IN THE KORAMPALLAM CREEK, TUTICORIN

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ABSTRACT

In the great clam *Meretrix meretrix* spawning period is prolonged and the reproductive cycle is biannual in January–April and June–October with peak spawning activity in January–February and September. The proportion of males to females is not significantly different at 5% probability from the theoretical 1:1 ratio. The condition index, expressed as percentage of wet flesh weight in total weight varied from 7.6 to 16.1 with an average of 12.1. The parameters of the Von Bertalanffy growth equation in *M. meretrix* are $L\infty$ = 99.1 mm, K = 0.3221 per year and t = -0.0745 year. The life-span is estimated at 7.8 years. The various dimensional and length-weight relationships are given. Also the environmental conditions of the clam bed are described.

INTRODUCTION

Among the venerid clams, the great clam *Meretrix meretrix* Linnaeus grows to a large size of 91 mm in length and to shell-on weight of 230 g. Although it does not occur in great abundance in any particular area, it is exploited along both east and west coasts of India for its meat and shell (Alagarswami and Narasimham, 1973; Nayar and Mahadevan, 1974). In recent times forzen meat of the venerid clams is increasingly in demand in the export market. Earlier studies on this species were on spawning (Hornell, 1922; Rai, 1932; Jayabal and Kalyani, 1987) and on age and growth (Jayabal and Kalyani, 1986).

MATERIAL AND METHODS

Monthly samples of about 20 clams, varying in length from 14.6 to 91 mm were collected during November, 1987 to October, 1988 by hand-picking from the Korampallam creek. Length was measured with a vernier calipers to the nearest 0.1 mm along the antero-posterior axis, height in dorso-ventral axis. The maximum distance between the valves when they are close together was considered as thickness. The total weight and shell weight were recorded to the nearest g and the wet flesh weight to the nearest 0.1 g. Gonad smear was examined under microscope to determine the maturity stage and Ropes (1968) was followed in the classification of the maturity stages. The condition index was determined as percentage of wet flesh weight in total weight of the clam. Age and growth was studied by rearing the hatchery produced seed in the field and by tagging 46 clams measuring 14.6–82.7 mm. The clams were tagged using plastic tag (numbered by letterex machine) pasted with epoxy resin. The parameters $L\infty$ and K of the Von Bertalanffy growth equation were estimated by the Gulland and Holt plot (1959). The various length-weight and morphometric relationships were studied by the least square method. Data on temperature, salinity and dissolved oxygen of the surface waters on the clam bed were collected at fortnightly intervals.

RESULTS

The clam bed and environmental conditions

The Korampallam creek (Fig. 1) opens into the Tuticorin Bay in the north. The clam bed has a water spread of about 2 ha and lies between the rail and road bridges, at a distance of 1 km from the creek mouth. The bed is shallow and at low tide the depth is < 1m. The sediment is mainly composed of fine sand.

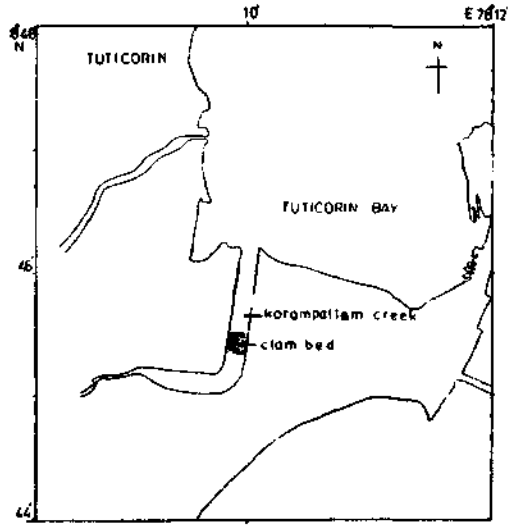

Fig. 1. Map of the Korampallam Creek.

The water temperature (Fig. 2) varied from 25°C in July to 31°C in February and showed two peaks in February and December and two depressions in January and July. The temperature was generally low during January and June-September period.

The salinity varied from 5.3 ‰ in November to 42.5 ‰ in August (Fig. 2). It was low during November–January due to the effect of northwest monsoon and showed an increasing trend from April onwards.

The dissolved oxygen varied from 2.77 ml/l in October to 6.3 ml/l in December. It was low (3 ml/l) during April, July and October and moderate to high in the rest of the months.

The pH values of the waters over the clam bed were generally steady and varied from 7.9 in May to 8.4 in December.

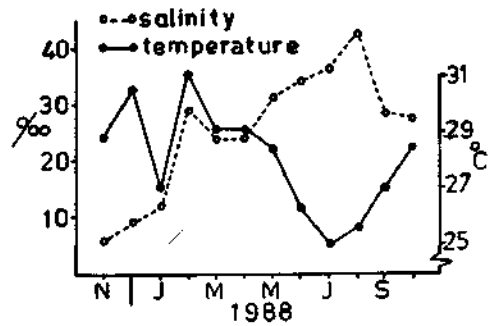

Fig. 2. Monthly variations of the temperature and salinity of the waters over the clam bed.

Reproductive cycle

In November all the clams were in spent stage and the sex could not be determined (Fig. 3). In December, gametogenesis was in progress in 70% of the clams while 15% were still indeterminates. During January–February in 40-50% of the clams, omission of the gametes was observed and the high proportion of partially spawned clams suggested peak spawning activity in these two months. In the following two months active gametogenesis was noticed in 80% of the clams

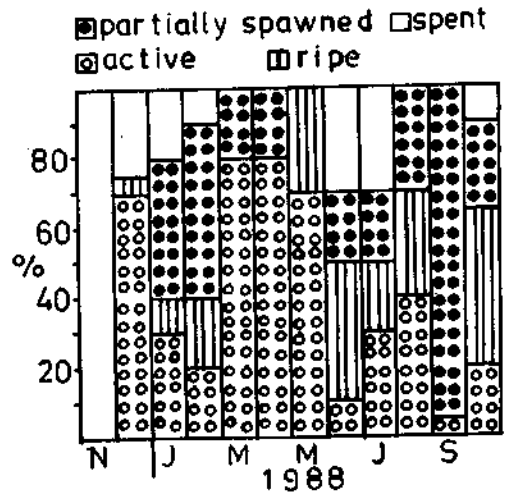

Fig. 3. Monthly percentage occurrence of maturity stages in *M. meretrix*.

while the remaining were in partially spawned stage. In May the clams were either in active or ripe stages and none in spawning condition, suggesting the progress of a second reproductive cycle. Spawning was initiated in June and continued till October with peak in September. Thus in *M. meretrix* at the Korampallam creek, spawning period is prolonged and the reproductive cycle is biannual in January–April and June–October periods.

Sex ratio

The indeterminate clams formed 20.9%, males 33.5% and the rest females. Indeterminates occurred for 8 months during November–February, June–August and October. Among the clams which could be sexed, the male, female ratio was 1:1.36 indicating slight predominance of females. However, the x^2 test showed that the female dominance was not significant at 5% probability.

Condition index

The condition index in individual clams for the 12 month study period varied from 7.6 to 16.1 with an average of 12.1. It increased from 12.0 in November to 13.3 in April with minor fluctuations and touched a low value of 9.3 in May followed by a rise in July and a minor decline in September (Fig. 4).

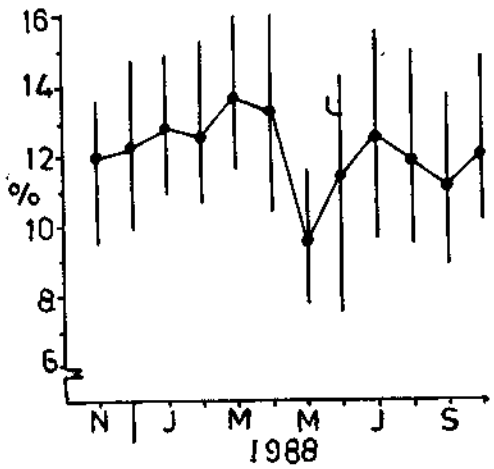

Fig. 4. Condition index in *M. meretrix*. Vertical lines indicate the range and solid circles the mean.

Age and growth

Growth of hatchery produced juvenile clams: In the Shellfish Hatchery Laboratory at Tuticorin, *M. meretrix* spawned on 8–3–1988 and the larvae/spat were reared in the hatchery for three months with algal diet. At the end of the third month 20 juvenile clams measuring 6.9–9.0 mm length (average 7.8mm) were transferred to the field where they attained 9.4–14.0 mm length (average 11.8 mm) in the first month and 11.0–19.0 mm length (average 14.5 mm) in the second month. Thus when 5 months old, they had grown to 14.5 mm average length.

Growth of tagged clams: Out of a total of 46 clams tagged (length 14.6–88.1 mm) and released in the clam bed, growth could be studied in 19 clams for periods varying from 1 to 10 months (Table 1). The monthly growth rate varied from 0.15 mm to 2.20 mm depending upon the initial length of the clams and the time lag between release and recapture.

Estimation of the parameters of the Von Bertalanffy growth equation: Based on the Gulland and Holt plot of ΔL against L of the tagged clams, the growth coefficient K was estimated as 0.0263 (monthly) and the asymptotic length, $L\infty$ as 99.1 mm (Fig. 5). By taking the age of 14.5mm long clam as 5 months *(vide supra)* and by using the equation

$$t - t_o = \frac{\mathrm{Ln}\left(1 - \frac{L_t}{L\infty}\right)}{-K}$$

the arbitrary origin of the growth curve, t_o was estimated as –0.0745 year. The Von Bertalanffy growth equation for growth in length in *M. meretrix* is written as

$$L_t = 99.1\ (1 - \exp - 0.3221\ (t + 0.0745).$$

Based on the above growth equation the

TABLE 1. *Growth of tagged* M. meretrix *in mm*

Initial length	Final length	Duration in months	Average growth rate (mm/month)
14.6	16.8	1	2.20
42.3	44.0	1	1.70
42.3	49.9	6	1.27
66.0	71.7	9	0.63
67.4	70.5	4	0.78
68.0	80.0	10	1.20
69.1	73.8	9	0.52
70.0	76.2	9	0 69
71.0	72.4	2	0.70
72.3	79.6	10	0.73
73.0	75.0	2	1.00
73.1	74.6	3	0.50
77.8	78.6	2	0.40
78.0	84.7	9	0.74
78.5	80.7	6	0.37
78.7	80.0	3	0.43
80.1	82.3	5	0.44
82.7	84.0	3	0.43
88.1	88.7	4	0.15

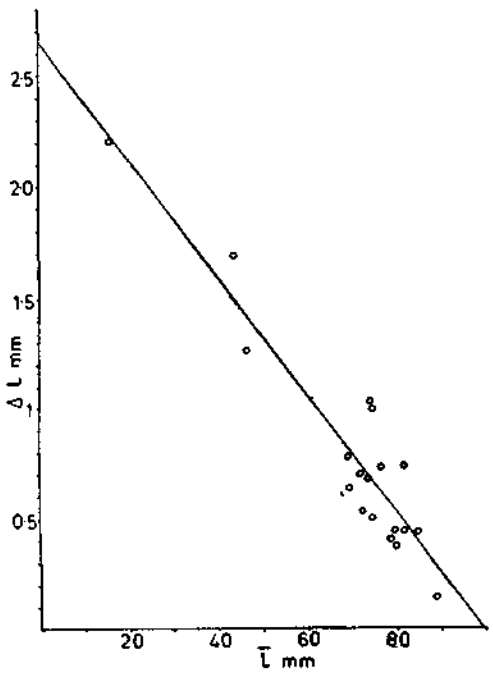

Fig. 5. Gulland and Holt plot in *M. meretrix*.

estimated lengths at ages 1–5 are 29.0, 48.3, 62.3, 72.4 and 79.8 mm respectively. The maximum length of the clam recorded in the clam bed was 91 mm and its life-span was estimated as 7.8 years.

Dimensional and length-weight relationships

The regression equations describing the relationship between length-height and length-thickness are given in Table 2. In both the cases the coefficient of correlation, r was high. The regression equations, after logarithmic transformation, between length-total weight, length-shell weight and length-wet flesh weight also showed high degree of correlation between the parameters studied (Table 2). The *t* test showed that the regression coefficient in the above three length-weight relationships is not significantly different from 3 at 5%. This indicates that the growth of total weight, shell weight and wet flesh weight in relation to length in *M. meretrix* is isometric.

DISCUSSION

In Bivalves, as reviewed by Sastry (1979) among various exogenous factors, spawning was related to either rise or fall in water temperature/salinity. In *M. meretrix* at Korampallam, the spawning season is prolonged and spread for a period of 9 months. It occurred when the temperature varied over a narrow range from 25–31°C and the salinity showed marked variation from 11.9–42.5 ‰. The absence of spawning in November – December when the salinity was < 10 ‰ indicates that the salinity requirement for successful spawning in *M. meretrix* is probably above 10 ‰. However, controlled experiments are called for before any conclusions can be drawn based on field observations.

According to Hornell (1922) spawning in *M. meretrix* is biannual, at the beginning of September and again in May in the east coast. Rai (1932) stated that the principal spawning season of this species along the Bombay coast lasts from March to June and under favourable weather conditions it may

TABLE 2. *Morphometric and length-weight relationships in* Meretrix meretrix

Parameters	Length range (mm)	No. of clams	Regression equations
Height (Y) on length (X)	17.5–91.0	53	Y = -0.7859 + 0.8584X 0.9936
Thickness (Y) on Length (X)	17.5–91.0	53	Y = -2.4855 + 0.5617X 0.9783
Total weight (Y) on Length (X)	17.5–91.0	66	*Y = -3.6377 + 3.0885X 0.9961
Shell weight (Y) on length (X)	31.0–91.0	52	*Y = -3.7538 + 3.0568X 0.9907
Wet flesh weight (Y) on Length (X)	31.0–91.0	52	*Y = -4.2128 + 2.9084X 0.9479

* After Log 10 transformation

spawn throughout the year, except during the monsoon. In the Vellar estuary this species spawns for eight months from February to September (Jayabal and Kalyani, 1987) and these results are to a large extent in agreement with those obtained in the present study.

The lowest condition index in the clams was recorded in May which may be due to the completion of spawning, and similar observation was made by a number of workers in Bivalves (Alagarswami, 1966; Durve, 1964 and Narasimham, 1980, 1988).

In a field culture experiment on the Mulki estuary at Mangalore, Rao and Rao (1983) observed that *M. meretrix* of 16–28 mm length showed a growth of 22 mm in four months. In the Vellar estuary, according to Jayabal and Kalyani (1986) this species attained 24.5, 47 and 61.5 mm length in 0, 1st and 2nd years respectively. These authors fitted the Von Bertalanffy growth equation to the growth data obtained by the probability plot method and they did not give the estimated values of the parameters. Also their theoretical growth curves given in figures 3B and 4B show inflexion which appears to be an error. The growth of *M. meretrix* at Korampallam is slow and also the life-span is longer.

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