Note

Maturation and sex ratio in edible oyster, *Crassostrea madrasensis* (Preston) around the Moheshkhali Channel, Bay of Bengal

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ABSTRACT

Maturation and sex ratio in *Crassostrea madrasensis* based on the distension of the gonads have been studied during October 1993 to September 1994 from the Moheshkhali Channel. Five maturity stages comprising from early active, late active, ripe, spawned and indeterminate were distinguished on the basis of morphological characteristics of the gonads and gonadal index. Two spawning peaks viz. one major (post-monsoon) in October and another minor (monsoon) in May were observed in the study area. The sex ratio was explained by chi-square test and the ratio of female *C. madrasensis* to male was found to be 1 : 1.13.

Edible oysters form a good fishery in different parts of the world. For successful implementation of oyster culture, a precise knowledge on maturation and sex ratio is necessary. Maturation and sex ratio of various commercially important bivalve molluscs have been studied from different parts of the world (Loosanoff and Davis, 1952; Rao, 1967; Brousseau, 1978; Stephen, 1980; Eversole et al., 1984; Fournier, 1992). The present note embodies the results of a study on the maturation and sex ratio of *Crassostrea madrasensis* around the Moheshkhali Channel in the Bay of Bengal.

Specimens of *C. madrasensis* of different sizes were collected randomly from selected places of the Moheshkhali Channel in the Bay of Bengal during October 1993 - September 1994. Shell length and weight of each individual were taken to the nearest 0.1 mm and 0.01 g respectively. The ovaries were identified by the presence of rounded ova in the body cavity (Quayle and Newkirk, 1989). Based on the distension of the gonads the following five stages of maturity were distinguished by using the method of Chipperfield (1953), Imai and Saki (1961), Goodwin (1976), Velez and Epifanio (1981) and Kanti et al. (1993).

**Stage I (Early active)**: Body contains good quantity of gonad tissue (25-49%).

**Stage II (Late active)**: Body contains large amount of gonad tissue (50-75%) in which digestive diverticulum is slightly observed.
Stage III (Ripe): Body contains large amount of gonad tissue (76-100 %) in which most of the digestive diverticulum was not observed.

Stage IV (Spawned): The gonad is soft and filled with canals containing very small amount of gonad tissue (5-24 %).

Stage V (Indeterminate): Water oyster in which digestive diverticulum is fully observed.

Staging criteria of 0 to 4 were employed for early active (EA = 2), late active (LA = 3), ripe (R = 4), spawned (S = 1) and indeterminate (In = 0) (Kanti et al., 1993). These categories are the only approximations of gonadal development which is a continuous process and distinctions between stages are not always clear (Ropes, 1968; Jones, 1981). The monthly gonad index (G.I) for both the sexes was determined by multiplying the number of specimens ascribed to each category scor, summing all those values and dividing this figure by the total number of oyster analysed (Kanti et al., 1993). Calculated male and female ratio were compared to the expected 1:1 ratio using chi-square analysis for both individual collections and pooled data for the entire study period. Chi-square test was examined from the following formulae (Sokal and Rohlf, 1981).

\[ \chi^2 = \frac{(O-E)^2}{E} \]

with (r-1) (c-1) degree of freedom

Monthly qualitative assessment of the reproductive conditions are illustrated in Fig. 1. It is apparent that C. madrasensis showed two spawning seasons with two peaks, one major in October-January and another minor in May. The specimens showed a gametogenic cycle beginning in June-July (EA) with an increase through August (LA) and final maturation (R) in September. Another early active stage developed in November-January attained ripe stage in April (Fig. 1). Mean gonad index of female (2.5817 ±0.6198) was found slightly higher than males (2.4982±0.6055) in the present analysis.

Major spawning peak in October-January (5.33-14.29 %) showed an increasing phase from May-July (6.25-10 %) and March-April (25-92.31 %) in relation to percentage of oocyte area (Fig. 2) of male. A declining phase in May-June (6.67-9.09 %) increased again in July-August (25-28.57 %) and the peak maturity stage was attained in

Fig. 1. Qualitative monthly gonad index of C. madrasensis

Fig. 2. Percentage of male oyster C. madrasensis in each phase of the reproductive cycle.
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September (81.25%) by female gonad (Fig. 3). The sex ratio of female C. madrasensis to male was found to be 1 : 1.13 and distribution was tested by Chi-square ($\chi^2$) test. The calculated value is $\chi^2 = 16.2639$ with 23 degree of freedom at 5 % level of significance. The tabulated value (44.18) is higher than the calculated value of $\chi^2$ with 23 df. at 5 % level of significance. So the null hypothesis may be rejected and that is why the proportion of male and female individuals are dependent with each other. Fig. 4 shows the distribution of male and female (per cent) in different months of the year.

It was observed that C. madrasensis spawned at Moheshkhali Channel in October and May and the ripe stage reached its peak in September and April. These mature oysters remained in the same condition throughout the monsoon period (May-August) probably due to very low salinity (Kamal, 1992; Ferdous, 1995). After monsoon the salinity increases which stimulates the gravid oysters to spawn in post-monsoon period. Rao (1956) showed that C. madrasensis breeds continuously in marine but discontinuously in the estuarine environment.

Disproportionate occurrence in the number of female and male C. madrasensis slightly disagrees with the report of Cox and Mann (1992). The inclusion of small oysters in the present study may account for the observed preponderance of males.

The per cent gonad area and oocyte area decreased in the ripening stage which associated with partially spawned specimens (Fig. 2 & 3). Giese and Pearse (1979) reported this decline to be a common feature in marine invertebrates.

Quantitative data showed increasing and decreasing phase of maturity stages.
in different months for the males and females (Fig. 2 & 3). But qualitative data did not differentiate these events suggesting a continuous maturation cycle which agrees well with Kanti et al. (1993).

References


