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Seasonal gonadal changes, spawning and condition index of oyster *Crassostrea madrasensis* (Preston) in the Korampallam creek, Tuticorin

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ABSTRACT

Seasonal changes in the gonad of edible oyster *Crassostrea madrasensis* were observed histologically in samples collected from Korampallam creek during February 1987 to January 1988. Two peak spawning seasons were observed in March and September. Gametogenesis started in May 1987 and ripe stages were noticed from September 1987. Spawning occurred during September to October. A second cycle of gametogenesis began during November 1987 and higher percentage of ripe stages were noticed during March 1987 and spawning commenced in early March. Oysters showed 5-60% of spent stages with residual eggs throughout the year except August, September, December and February. Oysters passed through indeterminate stage before the advance of gametogenesis. No hermophrodites were observed during this period.

Studies on seasonal changes of the gonad of oysters are useful in spat fall prediction and also in selecting the broodstock for hatchery production of the seed. The gonadal condition of the oysters *Crassostrea madrasensis* in different seasons was reported by Rao (1956), Durve (1965), Stephan (1980), Rajapandian and Rajan (1983) and Narasimham (1987). Nair and Mahadevan (1983) elucidated the various aspects in oyster culture carried out in the Tuticorin bay. The present study gives the results on the seasonal changes in the gonad and meat condition of oysters collected from the Korampallam creek, near Tuticorin.

MATERIALS AND METHODS

Monthly, 20 oysters were collected from Korampallam creek during February 1987 to January 1988, and the length (dorsoventral measurement) ranged from 50 to 150 mm. Apart from observing fresh gonad smear under a microscope, histological sections (7-10μ) stained in Delafield's hameotoxylin and eosin were examined for determining the sex and maturity stage. The condition factor for 20 oysters was determined using the formula,

$$\frac{\text{Dry weight of meat} \times 1\,000}{\text{Volume of shell cavity}}$$

The meat was dried in hot air oven at 80°C for 24 hr. Also, hydrological data of the waters over the oyster bed were recorded.

Oyster bed and environmental conditions

The Korampallam creek opens into the Tuticorin bay in the north. Oysters are found attached on the granite stones on the banks, pillars of the bridge (Plate 1 a) and also on the muddy bottom of the creek, at a distance of 1 km from the creek mouth. The depth is less than 1 m during low tide and greater part of the oyster bed is exposed at low tide.

The water temperature varied from 24.2°C in February to 30.5°C in December. There was no marked variation in the pH value (7.5 to 8.4). Salinity fluctuated from 5.5 ppt in November to 39.5 ppt in June. During October to January the low salinity

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was due to the effect of north-east monsoon and it showed an increasing trend from February onwards due to reduced freshwater influx into the creek. The dissolved oxygen ranged from 2.8 ml/litre in May and October to 5.96 ml/litre in August.

Sex ratio

The percentage occurrence of sexes in different size groups showed that males outnumbered females in the 50-60, 60-70 and 110-120 mm size groups with a high of 60 in the 60-70 mm oysters. Among the oysters in the 140-150 mm length, 80% were females followed by 70% in 130-140 mm. In the remaining size groups the females were dominant forming 50 to 60%. The percentage of oysters in indeterminate stage varied from nil to 15 (120-130 mm). The male: female ratio was 1:1.4.

Maturity stages

Early maturing stages : The gonad starts developing in patches over the digestive diverticula. This stage occurred during May to August, November and December. In August and December the percentage of oysters in this stage was 55 and 80 respectively (Plate 1 b, c).

Advanced maturing stage : In this stage, the connective tissue was much reduced and the follicles were enlarged. Matured spermatids (Plate 1 d), and eggs (Plate 1 e) attached inside follicles were discernible in the sections. In July - October and January - February 30-60% of oysters were in this stage.

Ripe stage

The gonads were creamy white, massive and the meat was plump. In gonadal sections the follicles were full either with mature ova (Plate 1 f) or with spermatozoa (Plate II a) and the connective tissue was absent. The eggs measured 36-44μ. Ripe gonads formed 20-50% during September - February, 90% in March and 55% in April.

Spent stage

The follicles were either empty or with a few residual ova (Plate II b). In males, after the release of sperms, the central parts of the follicles became vacuolated and appeared narrow. The meat becomes watery and thin. After peak spawning in May, 60% of the gonads were in spent stage.

Indeterminate stage

In this stage cells were absent in the gonad and the digestive diverticulae were prominent (Plate II c). There is conspicuous development of the vesicular connective tissue. In June, 30% of the oysters were in this stage.

The occurrence of a high proportion of oysters in ripe stage during March - April followed by spent oysters in April - May indicated peak spawning in March - April. Gametogenesis was initiated in May and the maturation process continued till August. The occurrence of ripe oysters in considerable numbers in September - October together with spent oysters in October - November suggested a secondary spawning in September-October period. This may continue till November.

Condition factor

The average monthly condition factor ranged from 50 in August to 128 in March. The condition factor was high before the commencement or at the beginning of the spawning periods, i.e. March and September - October. After spawning, the values came down to 62 and 52 in May and November respectively. A monitor peak in the condition during June - July could not be related to the reproductive cycle.

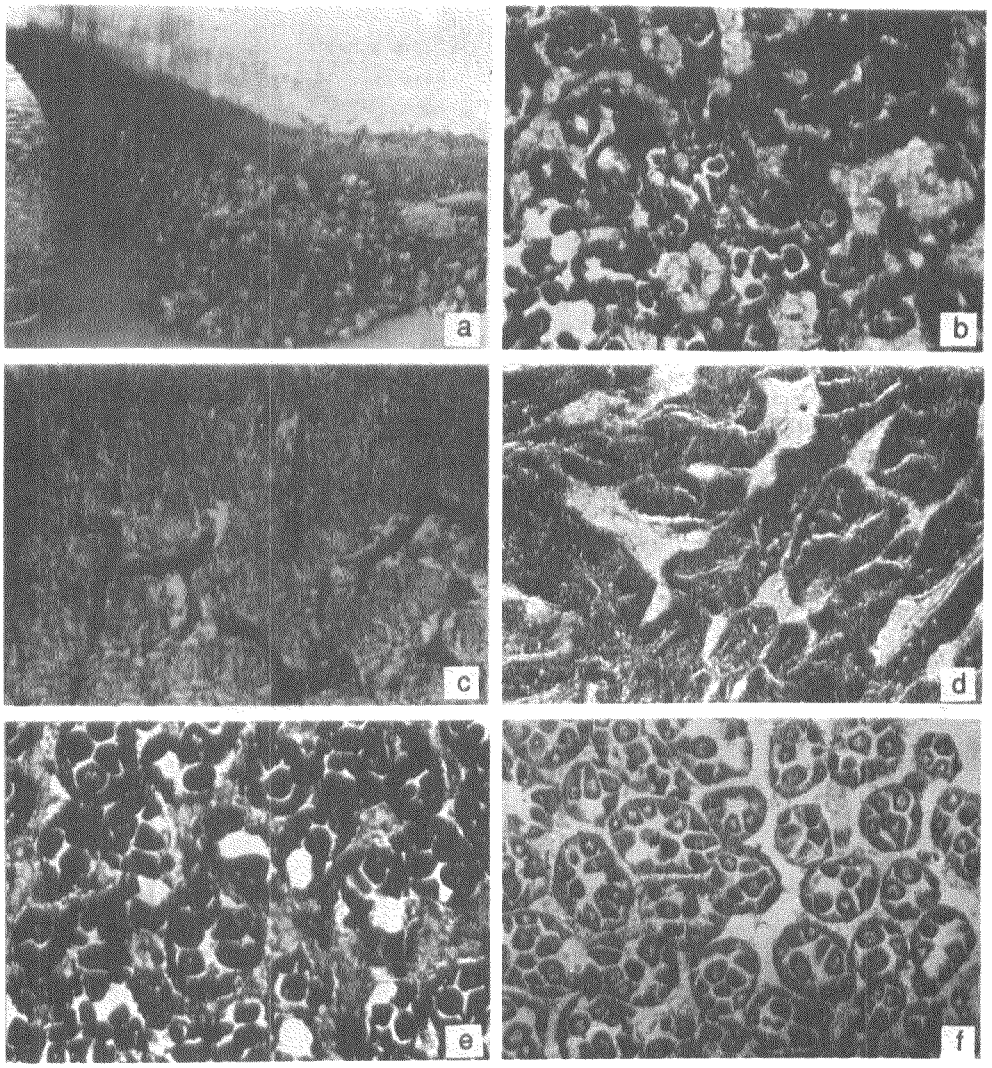

Plate I. a. Oysters attached to the pillars of the bridge at Korampallam creek; b. female, early maturing stage; c. male, early maturing stage; d. male, advanced maturing stage; e. female, advanced maturing stage; f. female, ripe stage.

Parasites

The gonads of some oysters were found infested (Plate II d) with bucephalid parasites. The high incidence was observed in the oysters of 110-120 mm size group and the overall infection rate was 4.5% among the 200 oysters examined.

DISCUSSION

Sastry (1979) reviewed the various exogenous and endogenous factors influencing the gametogenesis of bivalves. Among the exogenous factors rise in temperature and both rise and fall in salinity had great influence on gamete development and spawning

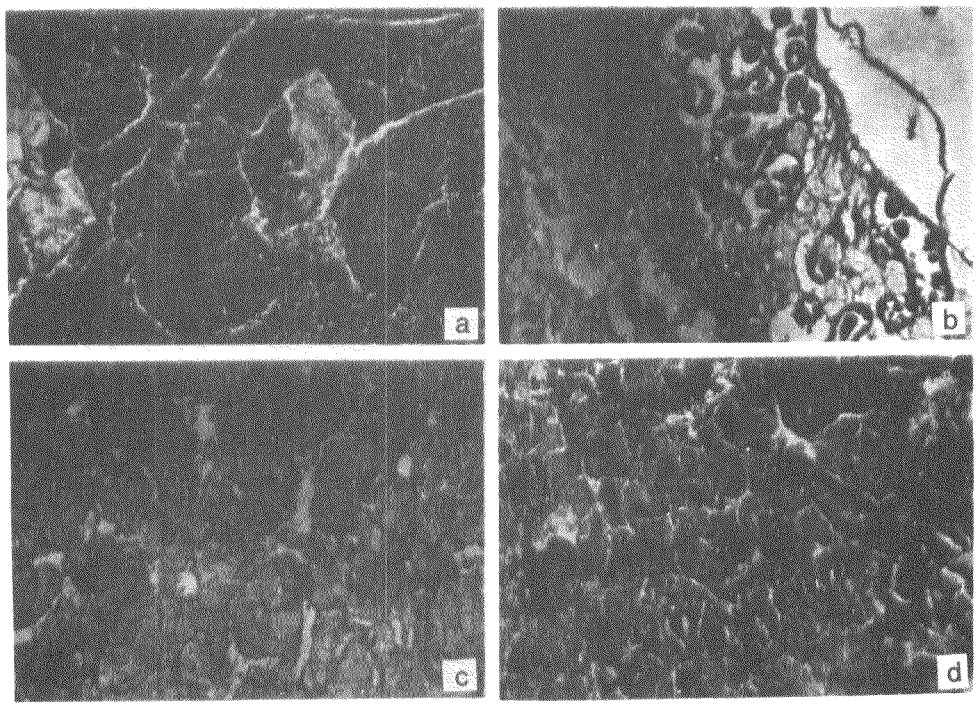

Plate II a. Male, ripe stage; b. spent; c. indeterminate; d. gonad infected by the bucephalid.

of oysters (Hornell 1910, 1922, Rao 1956, Rajapandian and Rajan 1983, Narasimham 1987).

Active gametogenesis was observed during January, and by March 90% of the oysters were in ripe condition resulting in spawning during March - April. This period coincided with rise in water temperature and salinity. After completion of this spawning a secondary spawning was observed during September - October. During this period salinity was lowered. However critical experimental studies are needed to establish the role of the above-mentioned exogenous factors in inducing the maturation and spawning.

Rao (1956) and Narasimham (1987) observed decline of condition index after spawning. Because of gonadal proliferation the condition factor was high at the beginning of spawning in March and October. Subsequent to release of gametes, it declined in May and November. This is in agreement with the studies of Rao (1951), Rao and Nayar (1956) and Rao (1974).

Bucephalids cause loss of weight (Menzel and Hopkins 1955) in oysters. Samuel (1978) recorded 1% incidence of *Bucephalopsis haimeanus* in *C. madrasensis*. In this study the bucephalid infection ranged from nil to 10%, with an average of 4.5%. No attempt was made to study the effect of infection, if any, on the gonad development and condition index.

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