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# PRELIMINARY OBSERVATIONS ON THE GROWTH OF SPAT OF THE OYSTER *CRASSOSTREA GRYPHOIDES* (SCHLOTHEIM)

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Some of the notable works on the study of the rate of growth in oysters are those of Loosanoff (1947), Loosanoff and Nomejko (1949), Quayle (1951) and Ingle and Dawson (1952). Rao and Nayar (1956) have given a detailed account of the growth of the oyster *Ostrea* (*Crassostrea*) *madrasensis* on the Indian coast. Earlier, Hornell (1910) and Paul (1942) made some preliminary observations on the growth of spat of *O.* (*C*) *madrasensis*. However, the growth of spat of *Crassostrea gryphoides*, an edible oyster occurring commonly on the west coast of India, has not received attention hitherto. Hence, a few preliminary observations on its rate of growth are presented in this paper.

## Material and Methods

The rate of growth of spat was studied at fortnightly intervals at an oyster farm at the village Kelwa, 50 miles north of Bombay, during 1957-58. Bricks, broken tiles and stones on the oyster farm were scraped clear and kept in small heaps at the farm-site to collect the spat. From the time of setting, measurements of the spat were taken fortnightly, by means of sliding callipers. The data are arranged in size-groups with a class interval of 3 mm., taking height as the standard of measure for estimating the rate of growth. Height is defined here as the maximum distance between the hinge and the opposite margin of the oyster. Separate size-frequency diagrams are drawn for the fortnightly samples collected during the period of setting. In the months where there was no spatfall, the data were grouped together and represented by a single diagram for each month.

## Observations

*Spawning and setting*

The spawning of *C. gryphoides* begins in July and lasts till about early October. The earliest set obtained in the third week of July ranged from 1.7 to 6.3 mm. in height. The setting continued for about ten weeks, till the end of September.

*Rate of growth of spat* (Table 1)

In the earliest spat obtained, the maximum number of oysters measured 1.9 mm. It could be further observed from the table that the minimum, maximum, mean and the modal values gradually shifted from July to September. The increase in the mean height during this period was 5.3 mm.

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From October onwards there seems to be a rapid growth in the spat as could be seen from the increase in all values from October to March. The increase in the mean height from October to March was 21.7 mm. which was much more than that from July to September. These observations show two distinct periods of growth, one of slow growth from July to September and the other of rapid growth from October to March. By the end of the period of nine months, the mean size of the spat increased by 29.9 mm.

TABLE I

Minimum, maximum and mean height and modal values of the spat of *C. gryphoides* in samples examined during the period, July 1957 to August 1958

| Month | No. of specimens examined | Minimum height mm. | Maximum height mm. | Mean height mm. | Modal height mm. |
|---|---|---|---|---|---|
| July* | — | — | — | — | — |
| ** | 98 | 1.7 | 7.3 | 2.5 | 1.9 |
| Aug.* | 100 | 1.8 | 9.8 | 3.0 | 2.1 |
| ** | 75 | 1.9 | 10.2 | 4.2 | 2.8 |
| Sept.* | 100 | 2.0 | 12.6 | 8.9 | 6.3 |
| ** | 69 | 1.9 | 14.3 | 7.8 | 7.2 |
| Oct. | 100 | 2.8 | 19.5 | 10.7 | 9.9 |
| Nov. | 100 | 4.3 | 25.3 | 15.2 | 11.5 |
| Dec. | 100 | 8.9 | 37.2 | 21.3 | 20.3 |
| Jan. | 100 | 12.8 | 40.8 | 27.4 | 25.9 |
| Feb. | 100 | 15.6 | 43.7 | 26.9 | 25.9 |
| Mar. | 97 | 19.4 | 48.3 | 32.4 | 29.2 |
| April | 100 | 19.4 | 48.4 | 32.8 | 29.3 |
| May | 100 | 19.3 | 47.8 | 33.2 | 29.6 |
| June | 100 | 19.6 | 48.8 | 33.5 | 30.0 |
| 1957 Year-class July | 63 | 20.5 | 47.9 | 33.8 | 30.0 |
| 1958 New Spat | 150 | 1.8 | 5.9 | 2.5 | 2.8 |
| 1957 Year-class | 100 | 20.4 | 48.4 | 32.9 | 29.9 |
| Aug. 1958 | 150 | 2.3 | 8.7 | 5.3 | 3.3 |

* first half of the month. ** Second half of the month.

From April 1958, the growth seemed to have slackened as the increase in the mean and the modal values was slight. The period of retarded growth prevailed for about a month.

The growth in this year-class, which may be regarded as the 1957 year-class, appears to have stopped from July 1958 as indicated by the modal and mean values from June to August 1958. Spatting was once again observed in July as in the previous year.

Spat of July 1958, had the minimum height of 1.8 mm. and a maximum of 5.9 mm., with a mean of 2.5 mm. and a modal value of 2.8 mm. In August, the new spat had a minimum height of 2.3 mm., a maximum of 8.7 mm. and a mean of 5.3 mm. The modal height was 3.3. mm. The growth rate of the new year-class is more or less the same as the earlier year-class, for the same periods, from the time of their setting.


FIG. 1. The size-frequency diagrams of the oyster spat of 1957 and 1958 year-classes in different months during the period July 1957 to August 1958.

The percentage frequency of the spat in different height-groups in different months during the period of observations is shown in Fig. 1. The mean growth curve in the spat of 1957 and 1958 year-classes is shown in Fig. 2.

The mean rate of increase in height of spat in different months during the period of study is shown in Fig. 3. The values plotted there are derived from the mean growth curve in Fig. 2. In the three months, July to September 1957, the values at the end of respective months as read from the mean curve are 2.5, 4.2 and 7.8 mm. and the monthly rate of increase, therefore, is 2.5, 1.7 and 3.6 mm. respectively. This rate of increase denotes very slow growth of the spat during these three months. In the next period, October 1957 to February 1958, the mean monthly growth values are 12.5, 19.0, 23.0, 28.0 and 31.0 mm. and accordingly the mean monthly rates of increase are 4.7, 6.5, 4.0, 5.0, and 3.0 mm. These values are considerably higher than those of the preceding period, thus showing rapid growth from October to February. In the next period, March to May 1958, the growth is extremely slow, the monthly rate of increase being only 1.0, 1.0, and 0.5 mm. respectively. Thereafter, the growth seems to stop completely as there is no increase in the modal and mean values from June to August 1958, in 1957 year-class oysters.

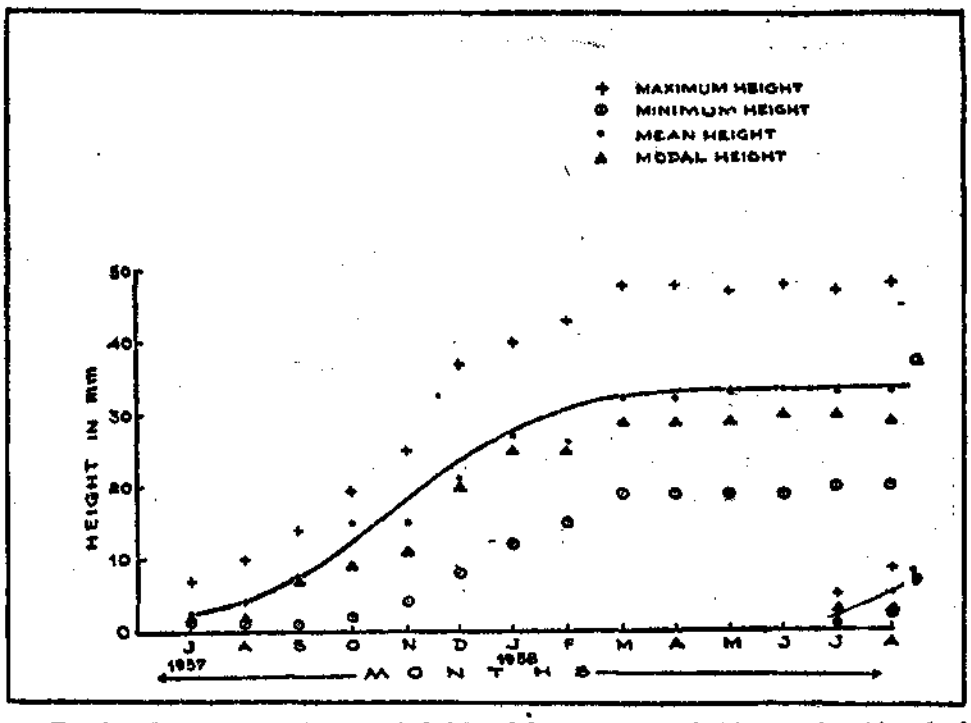


FIG. 2. The mean growth curves in height of the oyster spat of 1957 year-class (a) and of 1958 year-class (b).

It appears from the foregoing account that the growth in *C. gryphoides* is slow as compared to that of *C. madrasensis* (Rao and Nayar, 1956). The population of *C. madrasensis* attains a maximum size of about 60 mm. with a mean of 40 mm. when it is six months old and the maximum of 84.0 mm. and the mean of 51.0 mm. at the end

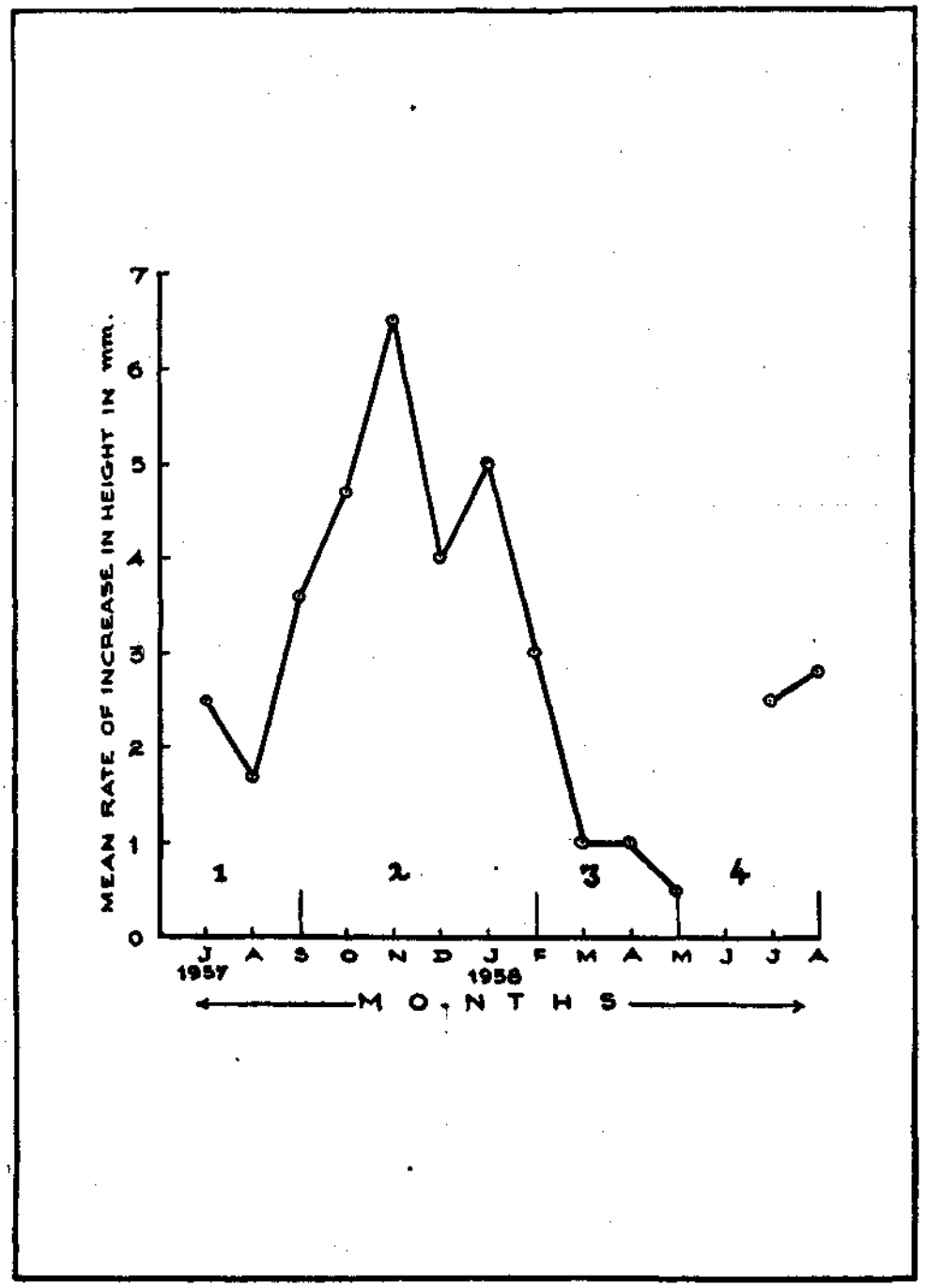


FIG. 3. The rate of increase in mm. in different months, of the spat of *C. gryphoides of* 1957 year-class (a) and of 1958 year-class (b). (Sections 1 and 3 in the figure, indicate the period of slow growth, 4 of arrested growth in 'a' and 2 of rapid growth).

of one year. The spat of *C. gryphoides* on the other hand has a maximum of 37.2 mm. with a mean of 21.3 mm. at the end of six months and the maximum of 47.9 mm. with a mean of 33.8 mm. at the end of one year.

The samples of *C. gryphoides* examined in different months present a wide range in size. At the end of a 12 month period, the individuals vary in height from the minimum of 20.5 to maximum of 47.9 mm. with a mean at 33.8 mm. Similar variation in size range has been observed in *O. edulis* (Orton 1926-37) and *O.* (*C.*) *madrasensis* (Rao and Nayar 1956).

*Observations on the new growth shoots in adult* C. gryphoides

These observations were made during the regular collections of adult oysters for the study of gonads, etc. in 1956-57. In all 1710 oysters were examined. The main purpose in collecting this data was to find out the period when oysters put on fresh marginal shell shoots indicating growth. Accordingly, from the regular samples, the oysters even with slight new shoots were counted every fortnight and their percentages determined. The fortnightly data were grouped to give monthly percentages. Fig. 4 shows the percentages of oysters with new shoots in different months during the period September 1956 to October 1957.

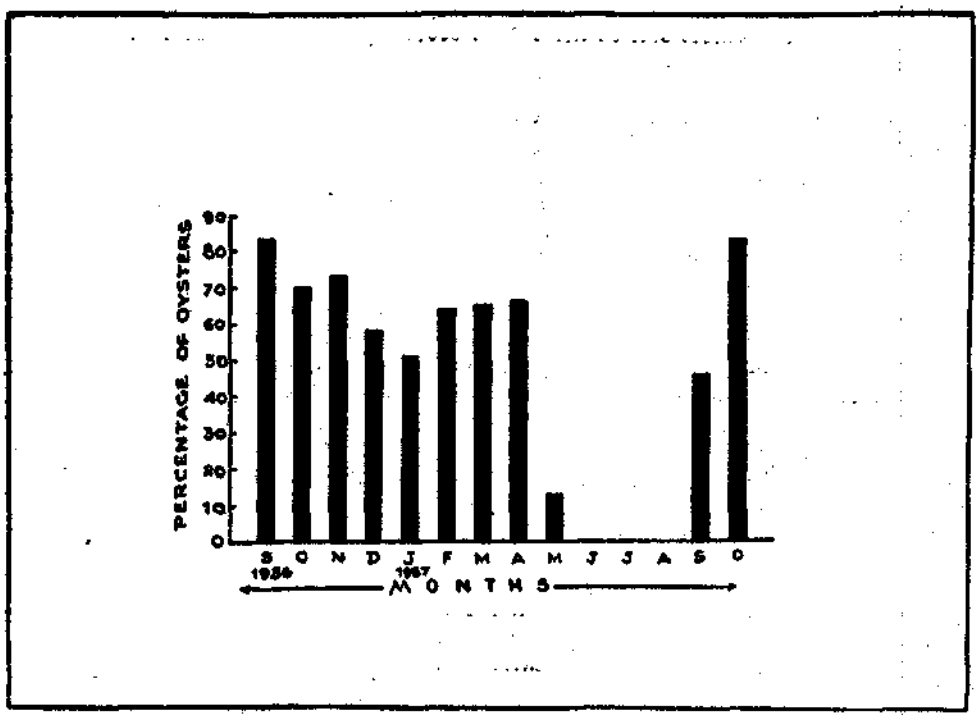


FIG. 4. The monthly variations in the percentage of adult oysters having new shoots during the period, September 1956 to October 1957.

Oysters with new shoots which are colourless and more or less transparent, appeared in great numbers in the second half of September. Thereafter, the percentage of oysters having new shoots remained high till February 1957. In March and April, the shoots which appeared in earlier months were seen ripening i.e., they

were getting darker and gradually becoming opaque. Since it was extremely difficult to differentiate between the new and the freshly ripening shoots, the values from March to April include oysters with new as well as ripening shoots. In May, oysters with ripening shoots were present in small numbers. From June to August no oyster was found with fresh shoots but they occurred again in large numbers in the samples from September.

These preliminary observations tend to show that growth in *C. gryphoides* starts vigorously in late September and continues till February or March. Thereafter, the growth seems to slacken since oysters show ripening shoots. The total absence of oysters with new or even ripening shoots from June onwards tends to show the stoppage of growth during this period. These observations made in 1956-57 are in conformity with the observations on the growth of spat made during 1957-58.

*Age at which oysters reach marketable size*

From the earlier observation it could be seen that *C. gryphoides* attains the mean size of 33.8 mm. in a year, and therefore, it is likely to attain the size of 60-70 mm. in about 2 years. This size is considered a marketable size in Bombay. In the Madras backwater oyster, *C. madrasensis* marketable size of over 70 mm. is reached in one and half years, in the case of some individuals at least. However, majority of these oysters reach marketable size at the end of second year or the middle of third year (Rao and Nayar 1956).

*Factors influencing growth rate in oysters*

In temperate waters growth is confined to summer and autumn (Orton 1937, Loosanoff 1948, Korringa 1953). The low temperatures during winter adversely affect the opening of the valves and consequently the feeding (Nelson 1921, Galtsoff 1928, Hopkins 1931, Loosanoff 1950). Low temperature conditions that would hinder the normal activities of oysters are never obtained in tropical waters (Rao and Nayar 1956). During the period of present study, water temperature of the Kelwa backwater was found to fluctuate between 25.7° C to 33.4° C (Durve and Bal 1960). There were also no marked fluctuations in the temperature during the different periods of growth of *C. gryphoides*. Therefore, it seems unlikely that temperature of Kelwa backwater can influence the growth in *C. gryphoides*.

The changes in salinity may have indirect relationship with the growth of oyster since they affect the rate of pumping and the subsequent feeding. Rao and Nayar (1956) observe that the growth is retarded to some extent under constant high salinity and is slackened by constant low salinity.

In the present case also, oysters show rapid rate of growth only during the period when the salinity is moderate, i.e. from October to February (post-monsoon and winter). During the period of constant high salinity i.e. from March to May or June (summer), there is a retardation of growth and during the period of low salinity, from July to August or early September (Monsoon), there is practically no growth.

## SUMMARY

Growth of spat of the oyster *Crassostrea gryphoides* (Schlotheim) is studied by taking height as the standard of measure for estimating the rate of growth. Observations are also made on the growth shoots of the adult oysters. Studies indicate

four distinct periods of growth in the oyster under discussion. Growth of *C. gryphoides* is discussed in comparison with that of other oysters and in relation to the prevailing environmental conditions.

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