SOME OBSERVATIONS ON THE BACKWATER CLAM, *MERETRIX CASTA* (CHEMNITZ) IN THE BEYPORE AND KORAPUZHA ESTUARIES

G. SESHAPPA
Central Marine Fisheries Research Institute; Sub-station, Calicut-5

INTRODUCTION

The backwater clam, *Meretrix casta* (Chemnitz), is a bivalve mollusc of considerable commercial importance and occurs in estuaries and backwaters of both the east and west coasts of India. Any biological study of this species will therefore be of interest from the scientific and also the fisheries points of view. Before the 'fifties Hornell's work seems to be the only instance in the country, of any considerable interest in this species (Hornell, 1917 and 1921) both from a systematic and the economic points of view. In 1953 Abraham made some detailed studies on certain aspects of the biology of the species including a study of the environment and also the growth rate under natural as well as experimental conditions, based on material from the Adyar waters near Madras. More recently, Durve (1963 and 1964) made some detailed investigations on the rate of filtration, gonadal changes and spawning behaviour in the species at Mandapam and Durve and Dharma Raja (1965) have also studied the dimensional relation in this clam from two localities at Mandapam and also the probable change of form with growth in one locality (1968). Reddiah and Mammen (1966) have described the copepod parasites of *M. casta* from Adyar. While all this work and the earlier observations of Hornell related in detail to the east coast material, not much work of a biological nature has so far been published on this species from the west coast, though Hornell has considered the west coast also for his systematic researches. Silas and Alagarswami (1965) have studied a case of parasitism by the peacrab (*Pinnotheres* sp.) on this clam at Malpe.

During the years 1949-50 and 1950-51 the Calicut Sub-station of the Central Marine Fisheries Research Institute made some standard weekly collections of fish and fauna from the Beypore and Korapuzha estuaries respectively at selected stations. One of the common animals in the dredge collections during the above work was the clam, *Meretrix casta*, and the present paper is based on the counts and measurements taken of these samples during the period and throws some light on the probable growth rate and the spawning periods of the species on the west coast.

METHODS

Dredge collections of constant duration, speed and coverage were made at three stations in the Beypore estuary once a week commencing from 14-5-1949 and ending with 20-5-1950. The mouth of this estuary is situated about 8 miles south of Calicut. Samples from the Korapuzha estuary were also taken in the same manner as at Beypore commencing from 27-5-1950 and ending with 26-5-1951. The comprehensive programme in both the estuaries was a collaboration work by various workers, the animals in dredge samples (excluding crustaceans) being handled by the present author. Part of the Korapuzha work was continued subsequently by other workers; Rao and George (1960) have given an account of the hydrology of this estuary including also the stations covered in the present work. A map of the Korapuzha estuary is also included in the publication of Rao and George.

The measurement of the clams taken was the height, that is, the distance between the umbo and the ventral margin in a direction perpendicular to the antero-posterior axis. This dimension is referred to as the "breadth" by Abraham (1953). Durve (1965) treats the height as the "maximum distance between the umbo and the gaping end of the shell".

THE ENVIRONMENT

Details of the topography of the Korapuzha estuary are found in the paper of Rao and George (*op. cit.*). The nature of the bottom as well as the seasonal features such as the effects of the monsoons are more or less similar in both the estuaries. The substratum is mainly of fine sand and muddy sand. During the rainy season torrential flow of silt-laden freshwaters run down the river suppressing almost completely the ebb-tide. One marked difference between the Beypore estuary and the Korapuzha estuary is, however, that while the former seems to be subjected to some industrial pollution the latter is mostly free from any such pollution. According to Hornell (1917) *M. casta* would appear to thrive well in an environment rich in organic wastes and suspended matter. Practically marine conditions prevail in both the estuaries during the period from January to May; a quick change to fresh-water conditions occurs with the starting of the rains. Winter conditions of temperature and salinity prevail during the period December to February.

SIZE-FREQUENCIES

Tables 1 and 2 show the monthly total numbers of clams obtained in the random samples and their frequencies in the different sizes (i. e. heights) in mm.

(a) *The clam population of the Beypore estuary*— Table 1 relating to Beypore includes data only from October onwards as prior to that date the samples were very meagre, and no measurements were taken on one day in May when they occurred in some numbers. Excluded in the same way from the table are three specimens each obtained on two occasions in July (one specimen having a shell height of only 5 mm).

TABLE 1. *Monthly size-distribution of* Meretrix casta *in the Beypore estuary during* 1949-50.

Shell height (mm)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
3	—	—	—	—	—	—	1	—
4	—	2	8	2	—	—	0	—
5	3	15	20	7	1	2	8	9
6	8	31	38	13	0	2	11	20
7	6	38	51	13	0	1	6	15
8	5	23	46	26	0	5	5	5
9	—	12	24	33	1	0	6	2
10	—	7	22	26	6	1	8	3
11	—	3	14	26	11	2	1	1
12	—	0	10	26	16	3	2	2
13	—	0	2	41	8	1	0	—
14	—	1	1	20	14	4	0	—
15	—	—	—	15	11	4	1	—
16	—	—	—	10	33	0	1	—
17	—	—	—	5	43	3	0	—
18	—	—	—	1	18	4	1	—
19	—	—	—	1	8	3	0	—
20	—	—	—	0	4	—	0	—
21	—	—	—	0	5	1	0	—
22	—	—	—	0	1	—	0	—
23	—	—	—	0	1	—	0	—
24	—	—	—	0	1	1	0	—
25	—	—	—	0	0	—	0	—
26	—	—	—	0	0	—	1	—
27	—	—	—	0	2	—	0	—
28	—	—	—	0	1	—	0	—
29	—	—	—	0	0	—	0	—
30	—	—	—	0	0	—	0	—
31	—	—	—	1	1	—	1	—

TABLE 2. *Monthly size-distribution of* Meretrix casta *in the Korapuzha estuary during* 1950-51.

Shell height (mm)	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
5	—	1	—	—	—	—	1	—	—
6	3	1	1	—	—	—	0	—	—
7	0	0	3	5	1	—	0	—	1
8	0	1	2	5	4	1	0	1	0
9	0	—	4	5	2	2	0	2	2
10	0	—	6	8	9	3	1	4	2
11	0	—	4	6	10	3	2	1	2
12	0	—	1	5	4	0	0	1	1
13	0	—	0	3	5	2	1	1	—
14	0	—	1	1	3	—	—	0	0
15	0	—	—	0	1	—	—	1	1
16	0	—	—	2	0	—	—	—	1
17	0	—	—	1	0	—	—	—	1
18	0	—	—	1	2	—	—	—	—
19	0	—	—	—	0	—	—	—	—
20	0	—	—	—	1	—	—	—	—
21	0	—	—	—	—	—	—	—	—
22	1	—	—	—	—	—	—	—	—

In October the range was from 5 to 8 mm, the largest frequency of 8 being found at 6 mm; the total for the month was only 22. In November a total of 128 clams was obtained ranging in shell height from 4 to 14 mm with a well-marked mode at 7 mm; there was only one specimen above 11 mm. In December the total number was significantly high (235), the size range as well as the mode being the same as in the previous month. During January a still larger number (266) of clams was available, the size extending from 4 to 19 mm with a single specimen measuring 31 mm also. Two modes were noticeable in the length figures of this month, one at 9 mm and the other at 13 mm. During February the range was mainly from 9 to 24 mm but there were also, a single specimen measuring 5 mm, three specimens in the 27-28 mm group, and one specimen of 31 mm at the higher end. The main mode in the month was at 17 mm and well-marked. Some minor modes were noticed for this month, these being at 12 mm, 14 mm and 27 mm. The total number fell to only 31 in March, the size-range being from 5 to 19 mm with one specimen each at 21 mm and 24 mm also. The distribution of the different sizes in the month appears irregular, there being no significant mode though the largest number of specimens (5) occurs at 8 mm and the next largest (4) at 14 and 18 mm. The position is not much better in April also, though the total is 50. The main range in this month may be said to be between 3 and 18 mm with single specimens at 26 mm and 31 mm. But the continuous occurrence of specimens in all the sizes is seen only from 5 to 12 mm, there being two modes (at 6 mm and 10 mm). This latter is actually the absolute size-range during May when a total of 57 individuals were obtained (with mode at 6 mm).

Considering the totals of the year, it is found that the main range (in the continuous size series) is from 3 to 24 mm, with four specimens in the 26-28mm groups and 3 specimens at 31 mm. In this continuous series there are two well-marked modes at 7mm and 17mm.

(b) *The clam population of the Korapuzha estuary*— Compared to the Beypore estuary, the Korapuzha showed a rather small population of *M. casta*. The monthly totals ranged from the smallest number of 3 (October) to 42 in December and January. These numbers are not sufficient to consider the modes as helpful in the assessment of growth-trends but they do give an idea of the absolute size-ranges and also a rough comparative idea of the relative density of the populations in the two areas. The sizes which are dominantly frequent may be treated as the prevailing sizes with some limitations. During the two months of maximum frequency (December and January) the main modes were at 10 mm and 11 mm respectively, minor modes occurring at 16 and 18 mm respectively.

In the absence of large numbers for the determination of modal values, the size-ranges themselves do give some valuable information and hence these are described here for the different months. The table commences with September as there were no specimens in the dredge samples of the earlier months. In September there were only four specimens and 3 of these were at 6 mm, the 4th measuring

22 mm. October showed three specimens ranging from 5 to 8 mm. November gave a total of 22 individuals ranging from 6 to 14 mm, the largest frequency being at 10 mm. January showed a range from 7 to 15 mm, with two specimens at 18 mm (second mode) and one specimen at 20 mm. The total number in February fell to 8, the size-range being 8 to 13 mm. The five individuals of March ranged mainly from 10 to 13 mm with one specimen at 5 mm. The range was 8-15 mm in April and 7-17mm in May, the total in each of these months being 11. The annual total of 148 (compared to 990 of Beypore samples) showed the size-range from 5 to 22 mm with a regular and well-marked mode at 10 mm.

Remarks

A point that immediately strikes one on seeing Tables 1 and 2 is the small numbers obtained in the Korapuzha estuary, while the numbers obtained in the Beypore estuary are much better though not really very high by themselves; in the latter case they are sufficient to indicate to a considerable extent the growth and recruitment trend of the species in the area under question. The chief features noticeable in the population trends of *M. casta* in the Beypore estuary are as follows: (1) Only insignificant numbers were obtained during the monsoon months, following a fairly abundant occurrence on one day in May; (2) The population was poor in October, improved in November and the best numbers were obtained in the months of December and January; the numbers decreased in February and a further decline occurred subsequently; (3) Juveniles occurred practically during all the months from October onwards (and a single juvenile each was obtained in August and September also); the numbers of juveniles 6 mm and below are highest during November-December and lowest in February-March (only one specimen of 5 mm size occurring in February); the numbers again increased from April to May; (4) The maximum size obtained was 31 mm, only 3 specimens of this size being obtained during the entire year; of the smaller sizes there were seven specimens above 21 mm, all the rest ranging below this and upward of 3 mm, forming a continuous series in the annual totals. There are two well-defined modes in the year's totals.

Durve (1964) and Durve and Dharma Raja (1965) found the clam to be a continuous breeder in the Mandapam fish farm with a break of a few months in late summer. According to Abraham (1963) clams spawned in August 1948 in the Adyar waters and grew to 29.5 mm by the beginning of April 1949 (with the growth suspended twice in the year and the growth conditions being more favourable in the backwater than in the river). The present environment is estuarine with the salinity even at the bottom during the monsoons reaching freshwater conditions. The lowest salinity in Adyar was 22.6‰ (December) according to Abraham's work. Durve (1964) found a wide range of salinity tolerance for the species at Mandapam (25-56‰). Abraham also states that the clam is about 2 months old when it is 12 mm in shell height, the next monthly increment being in the order of 6.5 mm. If similar trends can be assumed in the present case, the juveniles 6 mm and

below would be only in the first month of their lives. As no specimens were as a rule obtained during the months of June to September, those seen in October-November must be the products of a spawning that might have taken place either during or just after the monsoon, the latter being more probable; in such a case the juveniles of this group may be only a few weeks old. The shells of these juveniles however already showed deeply impressed growth marks which indicated some clear environmental effect of arrested growth. If this is a monsoon effect, then the clam must be some *months* old, a possibility not supported by published data on the species. The occurrence of juveniles is however in accord with a similar occurrence of juveniles of various groups at this time the nearby inshore sea at Calicut (unpublished observations of the author).

The peak breeding activity was noticed in Adyar backwaters in March-May, July-August and October-November, there being some variability from year to year and from one environment to another; in the river there were only two peaks namely, in the summer months and again in September-November. According to the work of Panikkar and Aiyar (1939) the species breeds discontinuously all through the year, often irregularly and determined by the rains. The influence of continued spawning on the size-frequency figures is also discussed by Abraham (*loc. cit.*). In the Beypore figures of the present work, the upward shifting of the mode for the first time in the year in January indicates a break in the spawning activity during the relevant period, this trend being more clearly marked in the figures of the next month when the higher sizes become dominant and only a single mode prevails in the size-distribution. The position of the mode in November and December in the same group may be the result of continued recruitment at the lower end of the size-range. The February mode represents only one of the two modes seen in January, most probably the second one (at 13mm) which would give a growth of about 4 mm in a month, corresponding to the growth rate given for the fourth month of life by Abraham. It seems likely, however, that at this size the clams here may be even in the fifth month of life. As the second recruitment of juveniles commences from March onwards it is probable that the second spawning starts by about February when the temperature starts rising after the winter effects. The two modes in the annual total of the size-distribution figures reflect the two peak spawning periods of the species which are quite well marked. The samples studied indicate that very few clams survive in the area to reach the age of one year. The largest specimens found are in any case too few to be of any significance irrespective of their age. Abraham found in Adyar that 50% of the clams lived only up to 16 mm length (2 months).

The data from Korapuzha show a slightly different picture in that juveniles 6 mm and below have occurred only during September to November (and a single specimen in March). No sizes above 22 mm occurred here during any month and there is only a single mode in the annual totals of the size-distribution figures. The lower size in the range gradually shifts upwards from November onwards, the

minimum size of February being comparable to that seen in Beypore, in a rough way. It would appear that there are two spawning periods in this estuary also, but the second one is masked largely due perhaps to subnormal recruits for reasons not known. It is also possible that the environment in Korapuzha is in general less suited for clam populations than the Beypore estuary, while the latter itself seems by no means an ideal situation for any sustained clam fishery. Venkataraman and Sreenivasan (1955) found that in the Korapuzha estuary the waters over the mussel beds were "grossly polluted" with bacteria during the south-west monsoon (containing more than 700 coliforms per 100 ml) but not so during the other seasons. Conditions in this respect are not known for the Beypore estuary.

Summary

Standard weekly dredge collections were made in the Beypore estuary during 1949-50 and in the Korapuzha estuary during 1950-51. The clam *Meretrix casta* occurring in these samples was studied for size-frequencies in terms of height of the shell. The numbers were very small in the Korapuzha estuary where the size-range was also less. Juvenile clams 6 mm and below were more numerous during November and December than during other months in the Beypore estuary. The mode of 7 mm in November shifted to 17 mm in February.

The trend of occurrence of the juvenile clams in both the estuaries indicated the occurrence of two spawning peaks during the year, the second one being less marked (and even masked in the case of the Korapuzha estuary). Very few clams survived to reach the age of one year, especially in the Korapuzha estuary. Large specimens that occurred in Beypore were in any case too few to be significant.

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