

FISHERY AND BIOLOGY OF THE CLAM *MERETRIX CASTA* (CHEMNITZ) IN THE PULICAT LAKE

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ABSTRACT

The fishery and biological aspects of *Meretrix casta* of Pulicat Lake have been studied. The clam production of the lake was estimated to be 309.7 and 168.2 tonnes in 1980 and 1981 respectively. During 1980, the clam fishery was supported by clams ranging between 34 and 49 mm and the dominant size groups were 37-39.9 and 40-42.9 mm. The percentage edibility was found to be high twice in a year during February-March and July-August. Females were dominant sex and indeterminates were found to be high during the periods of March-May and October. Sexually mature clams were found almost throughout the year in the lake and three peaks of spawning activity were noticed in March-April, July-August and October-November. The larvae of the trematode parasite *Bucephalopsis haemeanus* was noticed in the species during the period September-November and it caused considerable damage to the gonad.

INTRODUCTION

THOUGH there are rich clam beds in the estuaries and backwaters of India, there are no detailed information on the magnitude of production in most of the areas. Hornell (1916, 1917 a) focused the attention on the significance of clam resources of the Madras Presidency, and he (1917 b) recorded that *Meretrix casta* is the most important food mollusc of the Madras Presidency. Rai (1932) estimated the production of *Meretrix meretrix* and *M. casta* from the Bombay Presidency at approximately 4 million pounds. Ranade (1964) investigated the clam resources of 70 creeks from Thane to Ratnagiri District and estimated it to be about 24,03,000 pounds. Later Alagarwami and Narasimham (1973) reported the landings of clams from Ratnagiri, Goa, North Kanara, Karwar, South Kanara, Kozhikode, Beypore, Vempanad lake and

Quilon; Vaigai Estuary, Cooum, Adyar, Pulicat Lake and Chilka Lake. Fishing clams from the Adyar, Ennore and Pulicat Lake has been reported by Nayar and Mahadevan (1974). Distribution of the seed and growth of the clam *Meretrix casta* has been studied by Sreenivasan (1983) at Vellar Estuary.

A number of clams like *Meretrix casta*, *Katelysia opima*, *Donax* spp, *Anadara granosa*, *Tellina* sp. and *Paphia* sp. occur in Pulicat Lake in Tamil Nadu of which *M. casta* is most common species and forms a fishery. In view of its fishery in the lake the biological aspects, size composition, sex ratio, stages of maturity, percentage of edibility and parasitic infection have been studied and the findings from the work are presented in this paper.

MATERIAL AND METHODS

The fishery for *M. casta* was studied during 1980-82 by collecting data on landings weekly once and estimating the monthly production.

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Random samples were taken and the size frequency composition, linear measurements and weight of the clams noted in successive months. The clams were shucked, the meat removed and the meat weight was noted separately. The flesh weight expressed as a percentage of the total weight was taken as the percentage edibility. Smears of gonads were examined under the microscope and sex and stages of maturity ascertained. The occasional presence of parasites in the gonads was also noted. The observations were made once in a fortnight and the data was pooled to represent monthly observations. The clam bed was also surveyed to study the distribution pattern in the lake.

DISTRIBUTION OF THE CLAM IN THE PULICAT LAKE

M. casta was distributed in the shallow areas of the lake lying between the Kottakuppa, and Gunakuppam. A triangular weed infested area is exposed between these villages harbouring enormous number of small gastropods like *Cerithidium*, *Nassa* etc. On the eastern side of this area the clam bed was found and clams in this region were distributed at a density of 139 to 270/sq. m. Clams are also found to occur on the northern side of the Kottakuppam lock area and in the vast submerged sandy stretches adjacent to the eastern portion of the lake lying between Dhonirevu and Moosamani lock, but the distribution in these areas was estimated to 8 to 10/sq. m.

CLAM FISHERY

Fishing methods

Clam fishing is done in Pulicat Lake by women by hand picking. The women engaged in hand-picking of clams usually keep the clams collected in a bag made of palmyrah leaves. The catch per unit effort showed that a woman may collect about 42.9 to 111.3 kg. clams per day (Table 1). From time to time the bag

full of clams is emptied into heaps on the adjacent small island. These heaps of clams are carried by a canoe to the shell industry on the western bank of the lake.

Shucking of clams

Shucking is done by smashing the clams one by one with a granite stone and scrapping the meat with the nail or thumb. The flesh which is collected is put in small earthen pots. Usually the shells are left behind for making poultry grit at the shell industry and only flesh is taken by the women.

CLAM LANDINGS FROM THE PULICAT LAKE

The annual landings of *M. casta* were highest, 309.7 tonnes in 1980 and decreased to 168.2 tonnes in 1981 (Table 1). The total production in 1982 was much less, 85.9 tonnes as clam fishing was stopped in the area from May, 1982 as the shell industry which purchased the clam shells shifted to Sullurpet in Nellore District, Andhra Pradesh.

Clam fishing begins in January or February and continuous till October or November. The best clam catches were observed during March-June. High monthly landings of 52-57 tonnes were obtained in the months of March, April and June 1980. Maximum monthly production of 30 and 40 tonnes were obtained in March 1981 and May 1982 respectively.

MANPOWER EMPLOYED

Usually women from Athipedu, Minjur, Anuppampattu, Pakkam and Enncre were engaged in fishing the clams. The man power employed during 1980 for fishing the clams was high from March to June and declined slowly from July to October. In 1981, the manpower expended was less as compared to previous year and correspondingly the landings were less.

TABLE 1. *Monthly landings (in tonnes) of the clam Meretrix casta from the Pulicat Lake. The figures in brackets indicates the manpower engaged and catch per man-day in kg*

Month	1980	1981	1982
January	—	13.02 (205, 63.5)	Nil
February	30.80 (420, 73.3)	23.52 (241, 97.6)	8.40 (126, 66.7)
March	51.67 (630, 82.0)	30.38 (273, 111.3)	13.18 (163, 80.8)
April	57.00 (645, 83.4)	28.00 (290, 96.6)	24.00 (293, 81.9)
May	36.00 (589, 61.1)	12.40 (205, 60.5)	40.30 (397, 101.5)
June	55.50 (600, 92.5)	19.38 (266, 72.9)	Nil
July	27.90 (341, 81.8)	10.33 (186, 55.6)	Nil
August	21.70 (341, 63.6)	12.40 (236, 52.5)	Nil
September	15.00 (290, 51.7)	15.00 (189, 79.4)	Nil
October	12.40 (289, 42.9)	3.75 (53, 70.8)	Nil
November	1.75 (35, 50.0)	Nil	Nil
December	Nil	Nil	Nil
Total	309.72	168.18	85.88

PER CAPITA INCOME

The clams are not usually marketed at Pulicat, but in 1980, there was a demand from prawn culturists for clam meat for using it as feed for juvenile prawns. It is sold at the rate of Rs. 4 or 5 per kg. Apart from this, the clam meat was sold to the poor people in nearby villages. During the peak period of fishing March-April the per capita income from the clam meat only was estimated to be Rs. 37 and this was found to decrease to Rs. 15.70 during October (Table 2). Apart from clam

meat the shells which are given to the shell industry are usually sold to the company under barter system for commodities like clothing.

SIZE GROUPS OF CLAMS LANDED

Clams varying between 34 mm and 49 mm in size (length) appeared in the fishery samples (Table 3). Among the five different size groups of clams observed, only two size groups 37.0-39.9 and 40.0-42.9 mm are regularly noticed in the fishery samples. The size

TABLE 2. Total weight, meat weight and percentage of *Meretrix casta* caught from Pulicat Lake and number of women engaged in fishing, average quantity of clam meat collected per head and per capita income during 1980

Month	Total weight of clams landed (tonnes)	Total meat weight in kg.	Percentage of meat weight	Number of women engaged	Average collection of meat per head in kg.	Per capita income Rs.
January	.. —	—	—	—	—	—
February	.. 30.80	2473.34	8.03	420	5.89	29.45
March	.. 51.67	4407.20	8.53	630	7.00	35.00
April	.. 57.00	4514.40	7.92	645	7.00	35.00
May	.. 36.00	2721.20	7.56	589	4.62	23.10
June	.. 55.50	4190.25	7.55	600	6.98	34.90
July	.. 27.90	2360.34	8.46	341	6.92	34.60
August	.. 21.70	1772.90	8.17	341	5.20	26.00
September	.. 15.00	1174.50	7.83	290	4.05	20.25
October	.. 12.40	906.44	7.31	289	3.14	15.70
November	.. 1.75	132.15	7.55	35	3.78	18.88
December	.. —	—	—	—	—	—

TABLE 3. Percentage frequency of *Meretrix casta* observed in the fishery samples of Pulicat Lake during 1980

Length (mm)	Month											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
34.0-36.0	.. —	—	—	—	10.0	—	—	—	—	2.5	2.5	—
37.0-39.9	.. —	30.0	20.0	46.7	50.0	58.8	69.2	69.2	33.3	67.5	42.5	—
40.0-42.9	.. —	50.0	63.3	30.0	40.0	32.4	28.2	30.8	56.7	30.0	47.5	—
43.0-45.9	.. —	13.3	16.7	13.3	—	8.8	2.6	—	10.0	—	7.5	—
46.0-48.9	.. —	6.7	—	10.0	—	—	—	—	—	—	—	—

groups 34.0-36.9 mm and 46.0-48.9 mm occur very rarely in the fishery. During February and March 40.0-42.9 mm size group was dominant and formed 50% and 63.33% respectively. From April to August, these size groups were very much less common and the size group 37.0-39.9 mm was the dominant one. Again in September and November, the percentage of 40.0-42.9 mm size group was high. In October, the percentage of 37.0-39.9 mm size group of clams was found to be high. From the above, it is clearly understood, eventhough the clams appeared in between the sizes of 34.0 and 49.0 mm in the fishery, usually the size groups 37.0-39.9 and 40.0-42.9 mm were dominant ones.

PERCENTAGE EDIBILITY

The percentage edibility was found to be high during February and March and show a fall during the subsequent months till June (Table 2). Again in July and August, there was a rise in the percentage edibility with a decrease in September-November. This shows, that the meat quality is high during the periods February-March and July-August.

PERCENTAGE OF MALES, FEMALES AND INDETERMINATES IN THE FISHERY POPULATION

Females always dominated in the population throughout the period of observations (Fig. 1). Both sexes showed a declining trend

of females in the population declined and that of males decreased markedly. In this month, the indeterminates showed a peak indicating the spawning of clams in the month. In November females outnumbered males.

SPAWNING

Females

Sexually active and ripe females of *M. casta* were recorded throughout the year in the Palicat Lake (Fig. 2). During February, the gonads of a large percentage (55.6%) of female clams were to be in ripe condition and 44.4% of the clams were in the gametogenic phase showing the advancement towards maturity. During the month of March, both ripe and

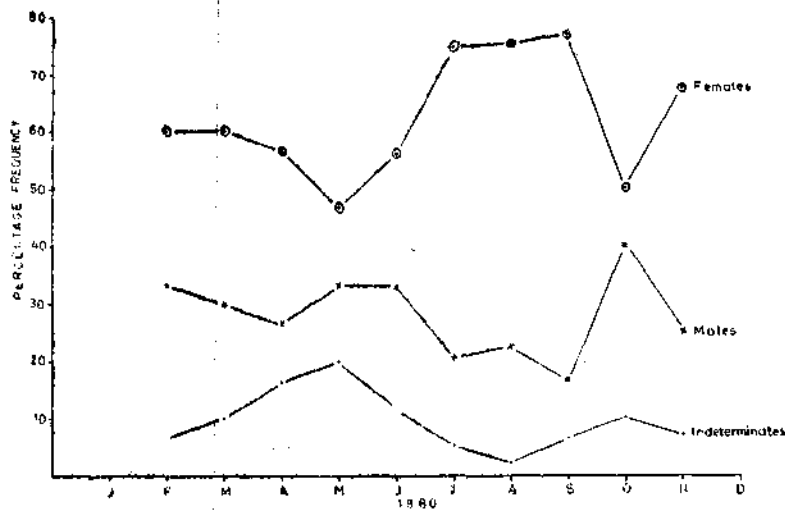


FIG. 1. Percentage of females, males and indeterminates of *Meretrix casta* in the fishery population.

from February to April. Indeterminates showed an upward trend from March to May indicating spawning of clams during this period. Maximum number of clams in indeterminate condition was observed during May. From the month of May to September, the females showed an upward trend, whereas the males showed a downward trend, and also the percentage of indeterminates gradually decreased upto August. In October '80, the percentage

maturing individuals decreased and spent ones formed 27.8%. Further decrease of ripe females during April and a simultaneous rise in the percentage of partly spent and spent clams indicated the spawning of clams during March and April. As a result of this spawning spent and partly spent individuals were found to form 64.3% in May. In June, the gametogenic activity was observed in 47.4% of clams and ripe clams

accounted for 31.6%. The presence of partly spawned and spent females during the months of July and August showed another peak during this period. Gametogenic activity was observed in 78.9% of females during the month of September and a few spent ones were also noted. The percentage of ripe ones increased during October and simultaneously spent and partly spawned ones were also observed in the samples. The two stages were common in November also indicating the spawning of clams during October-November.

and accounted for 40% and partly spawned and spent individuals formed 33.3%. In November, spent and partly spawned individuals constituted as much as 90% indicating active spawning. Males in maturing stages were also observed to be very low.

Based on gonadal studies on *M. casta* of Pulicat Lake, it is inferred that clams with gametogenic activity and also ripe ones occur almost throughout the year and there are chances for spawning all round the year when-

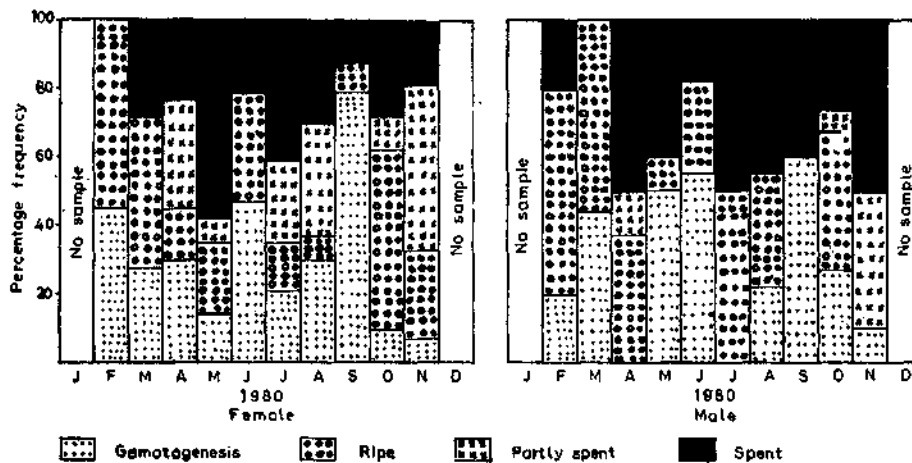


FIG. 2. Female and male gonadal phases of *M. casta* from the Pulicat Lake.

Male

Mature males were observed throughout the year except September and November. Majority of the males were observed to be in maturing or ripe condition during February and March. In April, maximum number of individuals with spent and partly spawned gonads occurred in the sample indicating spawning during this period. During May and June, gametogenic activity was observed in the majority of clams and in the subsequent months especially July and August spent males were common indicating second spawning of clams during this period. Again in September, the gametogenic activity was observed as in females. In October, the ripe males were dominant

ever the environmental factors are favourable. However, in the present investigation three spawning periods were observed during March-April, July-August and October-November.

PARASITIC INFECTION

During the period of observations of gonadal smear under the microscope, occasional occurrence of larval forms of trematode parasite *Bucephalopsis haemeanus* in the gonad was noticed. They were observed to be present only during three months from September to November. In this period maximum infection of 16.7% was observed during September, and in the subsequent months October and Novem-

ber infected clams formed only 7.5 and 5% respectively. The reduction in the infection may perhaps be due to low saline condition which prevailed in the lake as it was observed in the case of oysters (Thangavelu, 1983). Most of the infected clams seem to be lean, flabby and watery and the gonads of the clams were found to be castrated by their presence.

FEASIBILITY OF CLAM CULTURE AT PULICAT LAKE

Based on the trend of clam fishery of Pulicat Lake during the period 1980-82, it was observed that the present stock of clams could be exploited within a short time. This stock can be replenished by culturing good quantities of clams wherever vast and flat stretches of submerged shallow areas occur in the lake. The clam bed where extensive fishing was carried out lies between Kottakuppam lock on the western side and Gunakuppam village on the eastern side. For culture of molluscan shellfish the Pulicat Lake is ideal as it is free from pollution. There are vast stretches of shallow water areas lying between Kottakuppam and Gunakuppam, between Dhonirevu and eastern bank of the Pulicat lake and the shallow water area lying adjacent to the lake between Dhonirevu and Moosamani lock, where clam culture could be carried out with simple and inexpensive methods. The nature of the bottom in these areas of the lake is sandy mud which is suitable for clam culture. The velocity of water current is very low and there is no erosion in the above area. Transportation and transplantation of seed clams can be done without involving great expenditure.

DISCUSSION

There are several reports (Hornell, 1916, 1917a and 1917d; Rai, 1932; Ranade, 1964; Alagarwami and Narasimham, 1973; Nayar and Mahadevan, 1974) about the clam fishing

in India. Alagarwami and Narasimham (1973) and Nayar and Mahadevan (1974) have reported about the clam fishing in the Pulicat lake, but no fishery data was available till recently. The present work has shown that good quantities of *M. casta* are fished regularly from the Pulicat Lake and the annual production fluctuated between 310 and 168 tonnes during 1980-81. Apart from crabs and prawns, clams form a sustenance fishery in the lake among shellfish group. A considerable portion of the clam meal is utilised as food by the poor people and a portion sold to the fish culturists.

Clams ranging in size between 30 and 45 mm supported to clam fishery usually two size groups 33.0-35.9 and 36.0-38.9 mm seem to be dominant in the samples. Female clams dominated over males throughout the period of observation with seasonal fluctuations of the sexes.

Studies on spawning of *M. casta* have been made by a number of workers like Hornell (1922), Panikkar and Aiyar (1939), Abraham (1953), Durve (1964), Parulekar *et al.* (1973), Harkantra (1975) and Krishnakumari *et al.* (1977). Hornell (1922) observed that spawning in *M. casta* appeared to take place twice in a year during April-May and again in September. Abraham (1953) mentioned that *M. casta* of Adyar Estuary breeds in July-August with another peak in October-November and a third one during summer months. Durve (1964) recorded continuous spawning except for a break in late summer due to hypersaline conditions in the marine fish farm at Mandapam. Parulekar *et al.* (1973) stated that this species breeds throughout the year at Banastrim near Goa. Harkantra (1975) also reported similarly but stated there was a possible break in spawning activity in the winter at the Kali Estuary. At Goa, continuous spawning with a minor peak in March-April was observed by Krishnakumari *et al.* (1977). Sreeni-

vasan (1983) has reported the spawning of this clam from April to December in the Vellar estuary.

The observations made in the present investigation on the spawning of clam *M. casta* of Pulicat Lake agrees with the views of Abraham (1953) in the occurrence of three peaks during March-April, July-August and October-November. However, clams with gametogenic activity and also the ripe ones occur in the fishery throughout the year and probably the environmental factors are quite favourable in the clam bed and there are probable changes for spawning throughout the year as mentioned by Durve (1964), Parulekar *et al.* (1973), Harkantra (1973) and Krishnakumari *et al.* (1977).

Venkataraman and Chari (1951) reported the percentage edibility of *M. casta* of Ennore backwater to vary between 7.62 to 15.75. Durve (1964) reported the percentage of edibility of the species of Mandapam to vary between 4.22 and 6.46. Krishnakumari *et al.* (1977) found that this factor ranged between 11.26 and 12.08 in the same species at Goa. The percentage edibility of the clams of Pulicat Lake was found in this work to vary between 6.98 and 8.53 which is higher than that reported by Durve (1964) and lower than that reported from Ennur and Goa. On the basis of the work done on the percentage edibility it was inferred that high quantity of meat could

be obtained during February-March and July-August and this period may be ideal for fishing the clams for consumption.

The presence of commensal crab *Pinnotheres* sp. in the clam *M. casta* has been reported by Silas and Alagarwami (1967) and Harkantra (1975). Durve (1964) observed that the infection in the gonad of *M. casta* by the Bucephalid cercaria. Samuel (1976) and Stephen (1977) have reported the occurrence of the trematode parasite in the edible oyster *Crassostrea madrasensis* and their probable effect on the host. Thangavelu (1983) has made a study on the host-parasite relation between the parasite and the oyster from the Pulicat Lake and found that the percentage of infection was 17.37%. According to Samuel (*loc. cit*) infection at Karapad during 1976 was 1% and it was 0.61% as observed by Stephen (1977) at Mulki Estuary. In the present investigation the percentage of infection is also more or less equal to that of the oysters at Pulicat Lake and it is higher than the percentage of infection of oysters of Karapad and Mulki Estuary. In the clams of the Pulicat Lake the larvae of the trematode parasite *Bucephalopsis haemeanus* was fairly common in September and in the subsequent months it decline which may be due to a fall of salinity of the lake. The gonads of the infected clams seem to be castrated by the parasitic activity and as a result the meat of the clams is found to be thin, transparent and watery.

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