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## 12. EDIBLE OYSTER RESOURCES OF ENNORE ESTUARY AND MUTTUKADU BACKWATER, MADRAS

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### ABSTRACT

Survey conducted of the standing crop of edible oyster *Crassostrea madrasensis* population in Ennore Estuary and Muttukadu Backwater Indicated the existence of beds in both areas- At Ennore, the oyster beds are located over a distance of 2 km extending to 1 km on either side of the railway bridge. An oyster bed present below the Ennore railway bridge is the largest with an area of 40 ha and the population of oysters is dense in its eastern portion. The other beds are small.

At Muttukadu, the oyster beds are present from the mouth of the backwater to the road bridge near Fisherman's Cove Hotel. A bed on the western side of bridge is the biggest one in the backwater and is 2.6 ha in area. Environmental factors play significant role in limiting the distribution of oysters in both areas.

Exploitation of oyster beds in Ennore Estuary and Muttukadu backwater is limited. Shells are utilized for lime preparation and meat for local consumption.

### INTRODUCTION

Oysters constitute one of the commercially important molluscan fishery resources, providing both food for human consumption and raw material in lime and cement industries. Their importance as a fishery resource and the possibility of their cultivation have been highlighted by Awati and Rai (1931), Hornell (1910,

1917, 1922 and 1951), Rao (1958), Jones (1968), Rao (1974) and Nayar and Rao (1985). The oyster *C. madrasensis* is widely distributed on the east coast of India, occurring in Sonapur backwaters in Orissa (Alagaraswami and Narasimham 1973), Pulicat Lake, Ennore (Hornell 1917), Muttukadu backwater, Sadras, Killai backwaters, Athankarai, Pinnaka/al and Tuticorin (Rao, 1974). Although extensive beds of

*C. msdrasensis* are distributed along the coast, resources survey of the oysters has not been carried out till recently. A comprehensive knowledge about the distribution and a proper estimation of the standing stocks are essential for planning any large scale utilization of this resource and also for effective culture production. Therefore a survey was undertaken during September-December 1986 to study the general features, hydrological conditions, distribution and quantitative information on the standing stocks of oysters of Ennore estuary and Muttukadu backwater, and the results are presented in this account.

### MATERIAL AND METHODS

A preliminary survey was made by inspection of the oyster beds and the formation of

patches in the Ennore estuary and Muttukadu backwater by diving and observations during low tide.

While the Ennore estuary was sampled at 16 stations spaced at an interval of 300m, Muttukadu backwater was sampled at 19 stations located at 200m intervals. The structure and shape of oyster beds were noted. In each station, oysters were sampled using a quadrat 1 m x 1 m to determine the density of oysters for 1 m<sup>2</sup>. Percentages of live and dead oysters were estimated by weighing them separately in each sample. Based on the weight of the live oysters in 1 m<sup>2</sup>, the total biomass of the bed was calculated. Samples of live oysters were analysed for size composition and meat weight.

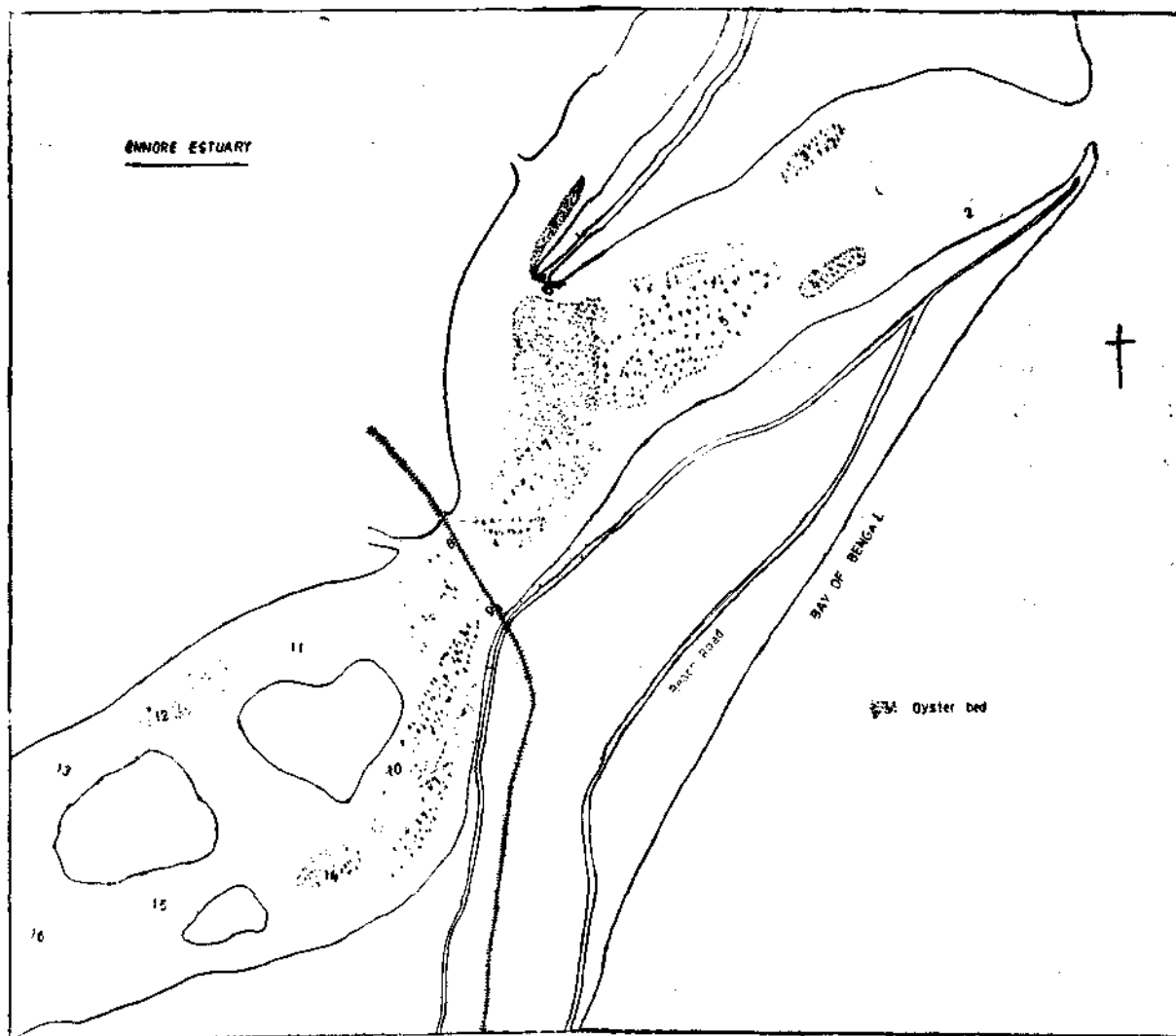


Fig. 1 Ennore estuary showing survey stations and Oyster beds in the estuary

## PHYSIOGRAPHY OF ENNORE ESTUARY

The Koratalayar estuary popularly known as Ennore estuary is situated at 13° 14' N and 80° 20' E and is about 15 km north of Madras. The estuary runs parallel to the sea coast and extends over a distance of 3 km in length and about 1 km in width with depth varying between 0.6 m and 3.0 m. The Koratalayar river forms the main channel for the estuary besides the Buckingham Canal (Raghunathan and Srinivasan 1983). The estuary joins the Sea at Ennore village. The bar mouth is kept open throughout the year due to the dredging operations by Ennore Thermal Power Station (ETPS) to draw a large volume of water from the estuary for cooling purposes. This results in regular mixing of sea water with the estuarine system.

## LOCATION AND DESCRIPTION OF OYSTER BEDS AT ENNORE

Details regarding the location of stations and distribution of oyster beds are given in Fig 1, hydrographic data at various stations in Table. 1 and the estimated area of oyster beds, density by number a weight in Table 2- Of the 16 stations examined there were no oysters at stations 1, 2, 11, 13, 15 and 16. At stations 5, 7, 8 and 9 the oyster beds were observed to be continuous.

The general description and the observations made on the oyster beds are as follows.

*Oyster bed 1.* This small oyster bed was located about 600 m away from the mouth near the western bank in station 3 in the vicinity of the tourist spot. The bottom was of muddy and

TABLE 1. *Hydrography of oyster beds in Ennore estuary*

Station	Depth (m)	Nature of substratum.	Salinity (‰)	Temperature (°C)	Dissolved oxygen (ml/l)
1.	3.0	Sandy	32.80	32.0	4.2
2.	0.8	Sandy-mud	31.70	31.3	4.6
3.	1.5	Muddy	32.17	31.8	4.9
4.	1.2	Oozy-mud	30.38	30.3	3.9
5.	1.3	Muddy	30.95	31.0	4.0
6.	2.1	Granite stone	30.52	33.0	3.8
7.	0.6	Muddy	31.01	32.9	3.6
8.	2.2	Concrete & mud	29.31	28.6	3.8
9.	1.5	Muddy	27.80	29.6	3.7
10.	1.2	Muddy	23.31	29.6	4.0
11.	1.4	Muddy	24.81	29.1	3.2
12.	0.5	Muddy	25.85	28.9	3.0
13.	1.7	Muddy	22.82 <sup>^</sup>	28.8	3.1
14.	0.9	Muddy	24.62	29.1	3.8
15.	1.7	Muddy	25.25	29.2	3.3
16.	2.4	Muddy	25.53	28.9	3.2

TABLE 2. *The estimated area of oyster bed in Enriore estuary, numbers and biomass of oysters and meat weight*

Station	Estimated area of bed (sq.m.)	Estimated density of oyster (No/m <sup>2</sup> )	Estimated total number	Estimated biomass of oysters (kg)	Estimated meat weight of oysters (kg.)
1.	—	—	—	—	—
2.					
3.	280	120	33,600	560	36.4
4.	200	152	30,400	1,360	63.9
6.	500	160	80,000	5,200	306.8
5&7.	4,00,000	356	14,24,00,000	1,80,80,000	10,769.2
8&9.	9,776	240	23,46,240	1,99,430	18,162.1
10.	32,760	92	30,13,920	2,88 288	—
11.	—	—	—	—	9,40,160.0
12.	1,500	168	2,52,000	16,200	1,075.2
13.	—	—	—	—	—
14.	2,480	172	4,26,560	21,824	1,331.2
15.					
16.					—
Total.	4,47,496		14,85,82,720	1,86,15,862	9,71,904.8

the depth varied between 8.5 m and 3.0 m during low tide. The oyster bed consisted of two closely positioned thick patches roughly ovate in shape, in all measuring 35 m long and 8 m wide with a total area of 280m<sup>2</sup>. The density of oysters in the total area was 120/m<sup>2</sup> and the total biomass was estimated to be 33,600 oysters with a total weight of 560 kg and meat weight 36.4 kg. In this bed the live oysters formed only 31% of the population and they ranged in size between 24 and 51mm. About 17% of the oysters were of small size 20-29 mm. The other organisms found in the bed were a few *Balanus* sp and *Modiolus undulate*.

*Oyster bed 11.* In station 4 another smaller bed of the size 40 m in length and 5 m in width was located lying almost parallel to the eastern bank at a distance of 20 m from it. This narrow strip of oyster bed included a total area of 200m<sup>2</sup> a total biomass of 30,400 oysters. The density was 152/m<sup>2</sup> and the total meat weight 63.9 kg. The oysters ranged in size from 16 to 19mm.

The modal sizes observed were 35-39 mm, and 70-79 mm. Although this is a smaller oyster bed, a good number of green mussels, *Perna viridis* 5-45 mm in size were present along with oysters.

*Oyster bed III.* The oyster bed located in station 6 was of moderate size near the southern lock Of Buckingham Canal. The size of the bed is 53 m in length and 10 m in width. The shape of the bed was roughly rectangular. The bed, with thick clumps of oysters had a total area of 500m<sup>2</sup>, on the flat hard muddy substratum and heavy concentrations on the granite stones of the lock. The bed was partly exposed during low tide and the depth of water column was around 2.1 m. The oyster population and total biomass in the bed were 80,000 and 5,200 kg. The estimated meat weight of the live oysters in the bed amounted to 306 kg.

*Oyster bed /v.* This is the largest oyster bed with an area of 400,000 m<sup>2</sup> which extends from almost middle of the estuary towards the

railway bridge on the western side reaching upto a distance of 1 km. The bed extends from station 5 and covers the station 7. The general shape of the bed is roughly triangular with the broad base in parallel position to the eastern bank, one extension of the triangle on the east towards mouth, and another extension on the north upto the railway bridge and a third extension towards the northern lock. The dense concentration of oysters in this particular bed is of significance. The number of oysters present in the entire area was estimated to be 42,40,000; with a concentration of 356/m<sup>2</sup>. The live oysters contributed to a meat weight of 9,01,60 Kg and the total biomass of dead and live oysters was estimated to be 180,80,000 kg. The oyster population of the bed included individuals of the size range 86-189 mm at the northern portion of the bed and 20-122mm at the southern part of the bed. The modal sizes were 40-44 mm, 50-54 mm, 70-74mm, 80-84mm, 95-99mm and 165-169mm.

Among the other organisms associated with the oyster bed the distribution of green mussel, *perna viridis* was noteworthy. Both adult and spat of the green mussel were found attached to the hard substratum provided by the oyster shells. The green mussels ranged in size between 16-137 mm. They were not found in dense clustures but distributed sparsely. In addition to this, *Modiolus undulata* and *M. metacalfi* were common among the oysters. The oyster borer, *Thaisrudolphi* was rare whereas the barnacle (*Balanus* sp) were seen attached to the live and dead shells of oysters in small numbers. A part of the bed gets exposed during the low tide especially at the northern extremity, at station 7.

*Oyster bed V* This bed extends between stations 8 and 9 at the eastern and western ends of the railway bridge. The depth range was between 1.5 m and 2.1 m. Heavy concentration of oysters formed a broad strip of the bed at this site extending for about 340 m under the bridge. Good settlement of oysters was also seen on all the concrete pillars of the railway bridge. The bed area had a total expanse of 9,776 m<sup>2</sup> having a biomass of 1,99,430 kg consisting of 23,46,240 oysters. The density of oysters found in an unit area was

240 numbers. The oyster population of the bed consisted of 42% live and 58% dead oysters. The oyster shells formed a strong solid substratum for the live oysters to settle over it. Live oysters ranged from 24 to 155mm in size with modal groups 40-44mm, 50-54 mm, 75-79 mm and 90-94 mm. The weaving mussel, *Modiolus undulata*, amphipods and alpheids were commonly met within samples taken from this bed.

*Oyster bed VI.* Running parallel to the south eastern bank of the estuary and located in between the large *thittu* (islet) and the bank were to long patches of oysters. Both patches occupy a total bed area of 32,760m<sup>2</sup> having a total biomass 2,88,288 kg and total density of 30,13,920 oysters distributed at 92 numbers per 1 m<sup>2</sup>. Although this bed is large in area, the number of oysters present in unit area was less when compared to other beds. The oysters were of the size range 37-103 mm and the modes recorded at 50-54 mm and 85-89 mm. The estimated total meat of the oysters was in the order of 18,162 kg.

*Oyster bed VII.* This moderate size bed was located near the eastern bank and occupied a total area of 1,500 m<sup>2</sup>. The total population of 2,52,000 oysters had total weight and meat weight of 19,200 kg and 1,075 kg respectively.

*Oyster bed VIII.* The oyster bed was situated very close to the western bank at the southern extremity of the estuary and had a total spread of 2,480 m<sup>2</sup> with biomass of 21.824 kg and 4,26,530 numbers which had an estimated meat weight of 1,331 kg. The density per unit area was 172 oysters. Live oysters formed only 39% of the oysters in the bed. The size of oysters ranged from 19 to 81 mm with a prominent mode of 40-44 mm.

#### PHYSIOGRAPHY OF THE MUTTUKADU BACKWATER

The Muttukkadu backwater (Lat. 12° 49' N; Long. 80° 15' E) extends for a distance of 20 km from the mouth. The backwater runs at right angle to the coast for a distance of about 3 km and branches into southern and northern wings. The Mariculture Farm of

CM.F.R.I, is located as a separate extension of the backwater on the northern side, close to the mouth. The backwater is connected to the sea by a bar mouth, the width of which is variable from a few metres to 200 m in different months. The backwater is normally cut off from the sea during May-September; when a sand bar is formed. During October-December, due to inundation by the freshes from the upper reaches, the sand bar gets eroded and the connection with the sea is restored.

The width of the estuary ranges from 800 m to 1050 m. The estuary is shallow, the maximum depth being 2 m, in the middle of the channel, while in most of the areas, it is 1 m or less. Granite stones are found along the banks of the southern side. Due to limited fresh water supply, even during the monsoon, and limited flushing, the salinity of the backwater goes up appreciably during summer months, particularly in the Mariculture Farm and in the shallow areas of the open channel. Numerous salt pans lie along the southern side of backwater, the seepage of which also results in increase of the salinity.

#### OYSTER BEDS IN MUTTUKADU BACKWATER

Compared to Ennore, the distribution of oyster beds is limited in Muttukadu backwater. Of the 19 stations examined in this area, a thick bed of *C. madrasensis* was found at station 6, while scattered to moderate patches were noticed at a few other stations. Location of the different stations and the distribution of oyster beds are given in Fig. 2.

*Oyster bed I* This bed is located in stations in the middle portion of backwater. This is the largest bed located in Muttukadu backwater where the depth was between 1.5m and 2.0 m, depending on low and high tides. The bed has large number of dead eroded oysters forming the basis for attachment of successive generations and is exposed at low tide. The total area of the bed was 26,068 m<sup>2</sup> with a population of 72,99,040 oysters at an average density of 280/m<sup>2</sup>. Estimated biomass of the bed was 4,17,088 kg which could yield 23,357 kg of meat. The size of oysters ranged from 22 mm to 139 mm with modal sizes of 35 mm, 105 mm and 125 mm.

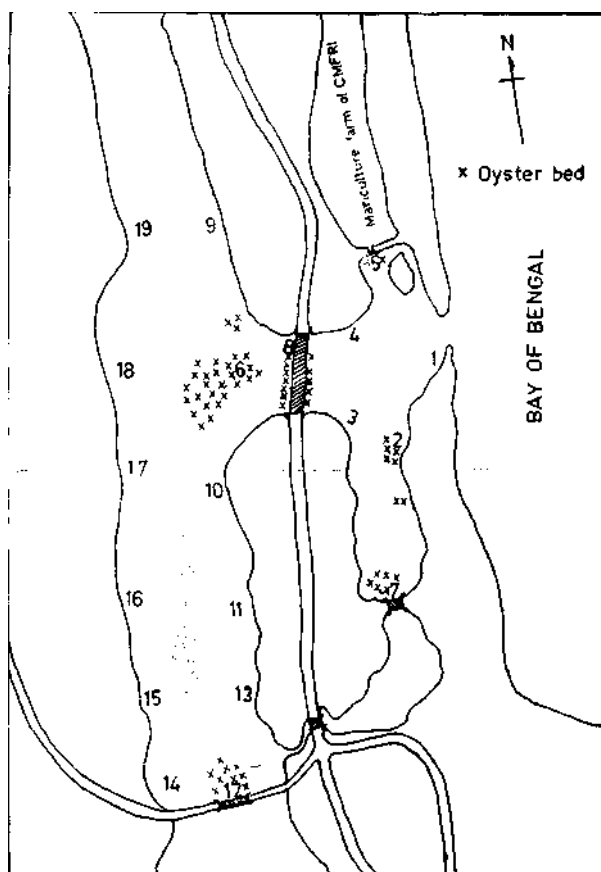


Fig. 2 Muttukadu Backwater showing survey stations and distribution of Oyster beds

*Oyster bed II.* This bed was located at station 8 just below the bridge on the Madras-Mahabalipuram highway. The concrete pillars as well as the bottom were observed to harbour oyster populations. A total area of 8,704 m<sup>2</sup> was covered by the oysters at this area. An estimated number of 3,23,788 oysters were found at an average density of 372 numbers/m<sup>2</sup>. The size range was 25 mm to 128 mm and the modal size 45 mm. Total biomass of the bed was 1,01,184 kg with a meat yield of 6,091 kg.

Oyster beds at other stations were of limited quantity and were seen at stations 2, 5, 7, and 12. In all these stations, scattered granite stones form the base for the attachment of oyster spat. Details regarding the areas of oyster bed, biomass, density and meat weight are given in Table 3. In all, the oyster beds at Muttukadu covered an area of 36,109 m<sup>2</sup> and a biomass of 54,50,054 kg of oysters, with a meat yield of 30,938 kg. The total number of

TABLE • 3. *Estimated biomass, density, area of oyster bed (m<sup>2</sup>), and meat weight of oysters in Muttukadu Backwater*

Station	Estimated area of oyster bed (sq.m)	Estimated biomass of oysters (kg)	Numbers of oysters per sq m	Estimated number of oysters	Estimated meat weight of oysters (kg)
2	446	4,906.0	174	77,604	220.8
5	40	672.0	320	12,800	41.3
6	26,068	4,17,088.0	280	72,99,040	23,358.9
7	816	20,889.6	316	2,57,856	1,211.6
8.	8,704	1,01,183.8	372	3,23,788	6,091.3
12	35	266.0	60	2,100	16.3
Total.	36,109	54,50,054.4		79,73,188	30,938.2

oysters was estimated as 79 73,188 with an average of 221/m<sup>2</sup>. In almost all the beds, incidence of *Balanus* infestation was noticed.

#### GENERAL REIMARKS

Quantitative survey of the edible oyster resources of Ennore estuary and Muttukadu backwater has been attempted for the first time. Estimated total area of the Ennore oyster beds is 44.74 ha and the estimated oyster biomass was 18,616 tonnes with total meat weight of 971.9 tonnes. The oyster beds of Muttukadu are moderate with a total area of 3.61 ha having a biomass 5,450 tonnes and meat weight of 30.9 tonnes. The oyster beds at Ennore are fiat, uniformly distributed and often form continuous stretch extending even upto 1.5 km in distance. The oysters are also formed of thick formations. The oyster beds at Muttukadu occurred in patches and found attached to the submerged stones or the concrete boulders of the road bridge. The oysters in the Ennore Estuary were found to be healthy whereas in Muttukadu the oysters appear to be stunted in growth.

The probable reason may be the maintenance of sea connection with Ennore estuary throughout the year which provides ample food supply and other congenial conditions for growth and reproduction while exposure during low tides and closure of bar mouth during summer inhibits growth of oysters at Muttukadu.

Both at Ennore estuary and Muttukadu backwaters, oysters are found abundantly indicating the suitability of these areas for their existence. Hunter (1964) suggests that species in estuarine and backwater systems are relatively few because of the unstable environment. However, certain species which succeeded in colonizing the environment proliferate and are found abundantly. The existence of rich beds of oysters at Ennore and Muttukadu substantiates this conclusion of Hunter (1964).

Rao *et al* (1987) have given a vivid account on the oyster resources of Athankarai estuary in which they have estimated a total biomass of 389 tonnes. The oyster beds occur in patches at Athankarai estuary. The oyster beds are much larger and extend over an area of 44.74 ha. In Muttukadu oyster beds occur in patches over an area of 3.61 ha.

The oyster beds in both the places are restricted to 2.5 km from the mouth- This is due to the prevailing brackish water conditions upto this distance by infiltration of sea water. Of the environmental factors such a salinity temperature, configuration of bottom, water level and availability of food influencing the survival and growth of sedentary benthic organisms, salinity appears to be the most' important (Rao, 1951, Rao and Nayar, 1956. (Desai and Krishnamurthy, 1967; Kurian, 1972) that limits the distribution of oysters within the area where brackish water conditions exists



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