

THE LIME-SHELL FISHERIES OF THE VEMBANAD LAKE, KERALA*

E. J. RASALAM AND M. J. SEBASTIAN**

*Lime-shell Research Station, Department of Fisheries, Govt. of Kerala,
Kumarakom, India*

ABSTRACT

The paper reviews the available information on the lime-shell fishery resources of the Vembanad Lake, Kerala. The commercial uses of the lime-shell in major and minor industries and in agriculture are described and the prospects of a better and fuller utilisation of the clam meat, which at present is largely discarded, are examined. The methods of fishing for the subfossil shells as well as for the clams or the live shells are described. The intensity of fishing in the different clam beds, the species composition, the catch statistics for the years 1965 to 1968, the per capita income, the licencing system and the role of Fishermen Co-operative Societies are discussed. The problem of overfishing and the possible repercussions of salt-water-exclusion projects on the clam fisheries are discussed. The possibility of conservation of this renewable resource by methods such as the establishment of a clam sanctuary is also discussed.

INTRODUCTION

In Kerala, lime-shell is the chief source of calcium carbonate, as the occurrence of lime-stone is very scanty. The lime-shells and the living clams that contribute these shells occur in large quantities in the different backwaters and estuaries of the State. Extensive beds of sub-soil deposits or white shells are found in the Kodungallore, Vembanad and Ashtamudi Lakes and in the estuaries of the Kadalundi and Korapuzha rivers. The Vembanad being the largest lake is the major source of lime-shell to the State. Lime-shell dredged from this Lake is sent to the neighbouring States also.

A systematic survey of the lime-shell deposits and the clam resources of the Lake, with a view to have a rational exploitation and conservation of this natural resource has not been conducted so far. However, rough assessments of the quantity of this raw material were made on a few occasions in order to know how long an industry may depend on it. According to one report, 'the sub-soil shells are concentrated in beds varying in thickness from 9 to 20" under a silt burden of 8 to 24". The reserves of these shells were surveyed by the Associated Cements Company, in collaboration with the Department of Research of the erstwhile University of Travancore in 1941 in connection with a project for the manufacture of cement in the State, and seven zones of concentration with an aggregate area exceeding 1,000 million sq. feet containing a total deposit of 4½ million tons were mapped'

* Presented at the Symposium on 'Indian Ocean and Adjacent Seas—Their Origin, Science and Resources' held by the Marine Biological Association of India at Cochin from January 12 to 18, 1971.

** Kerala Agricultural University, Mannuthy, Trichur, Kerala, India.

(Anonymous, 1948). It is reported (Kunju Panicker, 1957) that Mr. Bennet, a geologist, had submitted a report to the Government in 1942 regarding the lime-shell resources in the State. The Travancore Cements Limited, Nattakam, Kottayam, engaged in 1946 M/S. S. Rudinger, Engineers, Bombay, and conducted a survey of the Vembanad Lake from Ariad Light House in the south to Thanneermukkom in the north and estimated a deposit of 3 million tons of lime-shell in the Lake. Ordinarily, these reports are not available for reference. The shells occurred amidst much sand and clay and this mixed deposits varied in thickness from 1 to 7 feet (Loganathan, 1962). The Lime-shell Conservation Officer, Alleppey, completed a preliminary investigation of the lime-shell resources in the erstwhile Travancore-Cochin area in 1958-59 (Administration Report of the Dept. of Fisheries, Kerala, for 1958-59). It has also been estimated that shell deposits of the Lake was only 2 million tons (Bijawat and Sastry, 1957 ; Macedo, 1958).

In the comprehensive report on the progress of the lime-shell fishery on co-operative basis, Kunju Panicker (1957) has stressed the need for a survey to be conducted by the fisheries, geology and industrial experts in consultation with the officials of the lime-shell co-operative societies to formulate necessary steps for increased and sustained fishing of lime-shells. But the lime-shell was continued to be looked upon as a mere mineral resource, completely overlooking the biological source and the renewable nature of this resource. Industries using lime-shell as a major raw material were soon licensed and these industries began exploiting the resources by mechanised means. Eventhough specified areas were allotted, it is reported that there was no effective restriction as to the area of mechanised fishing activity and as a result, shallower and easily exploitable beds were fished and only the upper strata of the deposits were exploited. The environment of the living clams was seriously disturbed by this haphazard mechanised fishing activity. Indiscriminate fishing of under-sized clams and illicit fishing became rampant. Soon complaints were voiced from many quarters regarding the depletion of shells in some of the clam beds. The Department of Fisheries, Government of Kerala, examined the problem and drew up a scheme with partial financial aid from the Indian Council of Agricultural Research, New Delhi, to find out ways and means of rehabilitating the depleted clam beds of the Lake. The present report is based on the studies conducted under the above scheme and aims at giving a general idea of the lime-shell and clam resources of the Lake, their economic importance, the present rate of their exploitation, the future of the fisheries and the measures to be taken for their conservation.

The authors are grateful to the Government of Kerala and the Indian Council of Agricultural Research, New Delhi, for financing a scheme entitled ' Rehabilitation of the depleted clam beds of the Vembanad Lake ' under which the present studies were conducted. Their sincere thanks are due to Shri. A. I. George, Director of Fisheries, Kerala, for the kind interest shown in this work and for guidance. Their thanks are also due to Shri. P. M. G. Menon, Joint Director of Fisheries, for his encouragements and to Shri. A. K. Kesavan Nair, Central Marine Fisheries Research Institute, Ernakulam, for going through the statistical part and suggesting improvements.

THE LIME-SHELL RESOURCE

History of the Lake and the lime-shell deposits

The Vembanad Lake, as we know it today, was formerly part of the Arabian Sea and the separating land now existing between the Lake and the Sea was not

extant centuries back. Menon (1913) reports that in the year 1341 as a result of a deluge, parts of the Alleppey and Ernakulam district arose, thus separating a large inland water-body from the Sea with openings to the Sea at Thottapally, Andhakaran Azhi and at Cochin. This conversion of an originally marine environment into a brackishwater one is evidenced by the existence of a large quantity of marine shells in the Lake. Shells of bivalves of the genera *Placenta* and *Arca* were observed by the authors, and gastropods of the genera *Nassodonta*, *Bittium*, *Travardia*, *Stenothyra*, etc. were recorded by Preston (1916) from the Vembanad Lake which with the passage of time became brackish as a result of which all the typically marine molluscs died out. Species of the genera *Meretrix* and *Villorita* found an ideal environment. In the northern part of the Lake where salinity is comparatively high, the genus *Meretrix* became established. In the southern parts of the Lake, the more fresh-water tolerant species of the genus *Villorita* flourished. According to Hornell (1922) '*Villorita* was originally, as other Cyrenids still are, a purely freshwater species and its presence in quantity in estuarine backwaters, subject during a considerable portion of the year to brackishwater conditions, indicates a marked change in its habits and a re-acquired tolerance for saline conditions'.

The clams which got an ideal habitat for growth were yearly subjected to the South-West and the North-East monsoon rains. During monsoon, flood waters from the Rivers Pamba, Achancoil, Manimala, Meenachil and Moovatupuzha carry large quantities of mud and silt into the lake which settle on the clam beds. It is presumed that the larger clams which do not exhibit much locomotor effort to escape are buried and perish. This process and others like natural mortality might have contributed over the centuries to the accretion of a wealth of lime-shell deposits in the Lake. For an account of the hydrography and fisheries of the Vembanad Lake reference is invited to Shetty (1963).

Sub-soil or sub-fossil or 'white' shells

The lime-shell that contribute to the fishery may be broadly classified as the 'white shells' and the 'black shells'. The so-called white shells are found as sub-soil deposits and are known to extend at places upto 7 feet below the surface of the soil (Loganathan, 1962). The dredgings conducted by the Travancore Cement Factory show that the deposits extend to more than double the above depth. These sub-fossil deposits which form the bulk of the resource have accumulated there through the centuries as the dead remains of the once living populations of clams. These shells originally coloured have become worn out and bleached, losing the periostracum. Such deposits are also found in some of the purumboke lands, coconut plantations and paddy fields adjoining the Lake and show the lacustrine origin of these places.

'Black' or 'brown' shells

These shells are obtained from the present population of living clams or shell-fish. The shells of *Villorita* spp. are black in colour and that of *Meretrix* spp. varies from a distinct pale cream to a rufous yellow or even brown (Hornell, 1922). The live clams found on the bottom of the Lake are collected, boiled, flesh is separated and the empty shells are marketed. The average chemical composition of lime-shells from the Vembanad Lake (Anon, 1948) is furnished in Table 1.

TABLE 1. *Chemical composition of shell and meat of clams.*

Shell	CaO	SiO ₂	Al ₂ O ₃	MgO	Fe ₂ O ₃	Total	CaCO ₃
(Per cent-Range)	52.2-53.7	0.8-2.3	0.6-1.4	0.1-0.3	0.4-1.0	93.3-95.8	
Clam meat	Protein	Fat	Ash	Calcium	Phosphorus	Iron	Moisture
(Per cent)	14.4	7.8	2.9	1.01	0.48	0.06	72.0

THE CLAM RESOURCE

The species composition

The clams that contribute to the fishery are: *Villorita cyprinoides* (Gray); *V. cyprinoides* var. *cochinensis* (Hanley); *V. cyprinoides* var. *delicatula* (Preston); *V. cornucopia* Prashad [Pl. I, fig. 1, 2]; *Meretrix meretrix* (Linnaeus) [Pl. I, fig. 3, 4] and *M. casta* var. *ovum* (Hanley).

The most important clam of the fishery is *Villorita* spp. which contribute more than 90 per cent of the clams from this Lake. A taxonomic review of this genus was carried out by Prashad (1921), and that of *Meretrix* by Hornell (1917). The sub-fossil shells of bivalves *Placenta* and *Arca* and gastropods *Nassodonta*, *Bittium*, *Travardia* and *Stenothyra* are occasionally met with.

Biology

In the common clam *Villorita cyprinoides* var. *cochinensis*, the growth during the first year is rapid and the clam attains a length of about 14 mm. At this time the clam is mature and it breeds from January to July, when the salinity is higher in the Lake or at least over the bottom of the Lake. Veliger larvae were recorded only from January to July and the gonad during this period was found to have sperm in the males and fully ripe ova in the females.

The largest species of *Villorita* namely *V. cornucopia* thrives in a salinity of 1.5 per cent, at an optimum depth of about 1.25 metres of water on soft muddy bottom with plenty of organic remains (Anonymous, 1948).

ECONOMIC IMPORTANCE

Major industries

Three large factories are now in operation depending on the lime-shells of the Vembanad Lake as a major source of raw material.

[4]

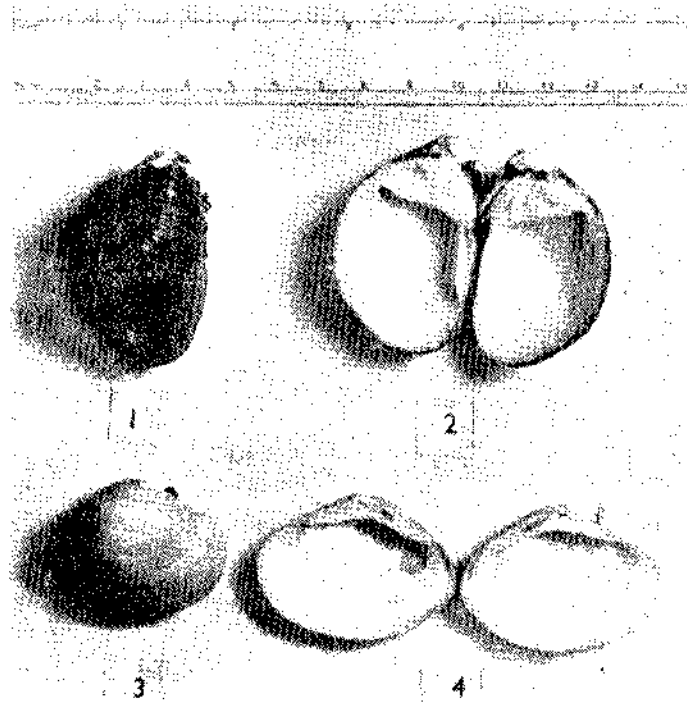


PLATE I. (1) An adult specimen of *Villosia cornucopia* Prasad from Vembanad Lake near Perungthiath. (2) Left and right valves of *V. cornucopia* Prasad. (3) *Meretrix meretrix* (Linnaeus) from Vembanad Lake near Edacochinnal and (4) Left and right valves of *M. meretrix* (Lin.).

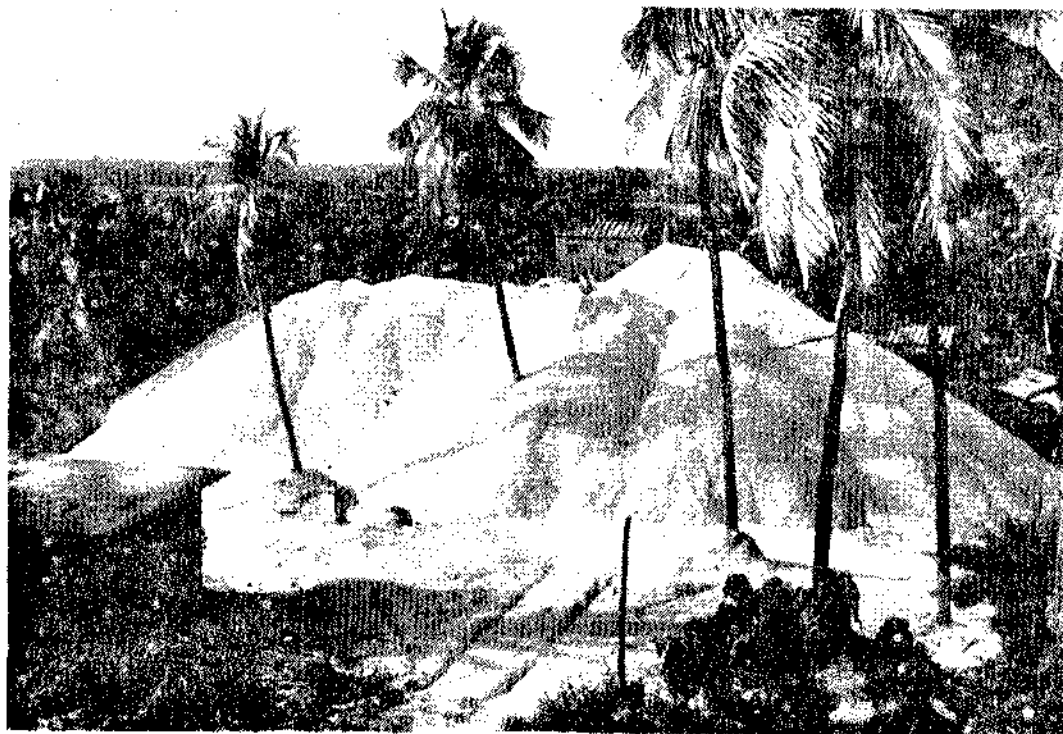


Plate II. A. Cement Factory jetty-side with a heap of lime-shells and the washing plant in the background.

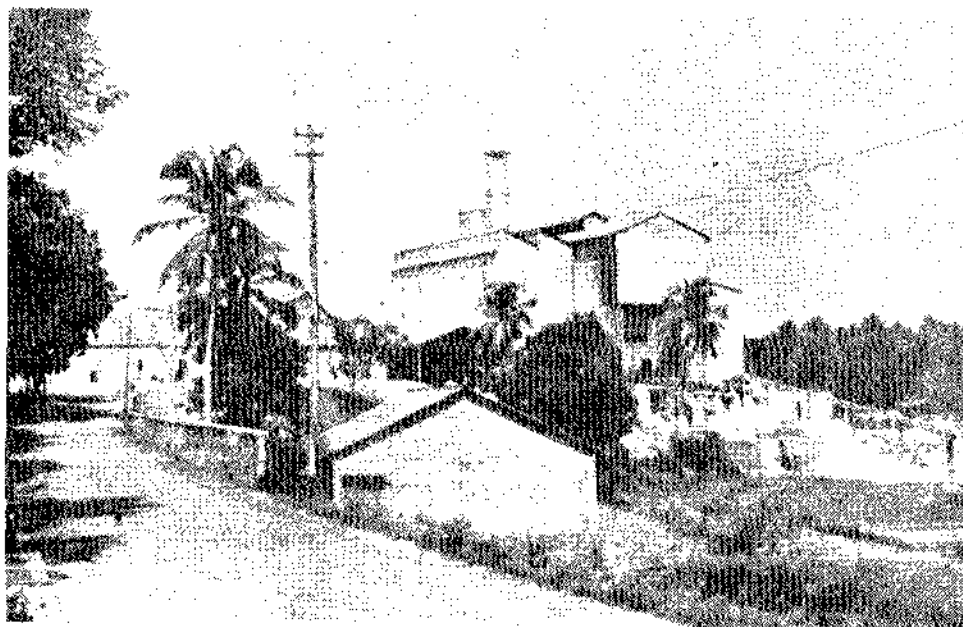


Plate II. B. The Electro-chemical Factory, Chingavanam.



Plate III. A. The double lime-shell furnace at Kumarakom.

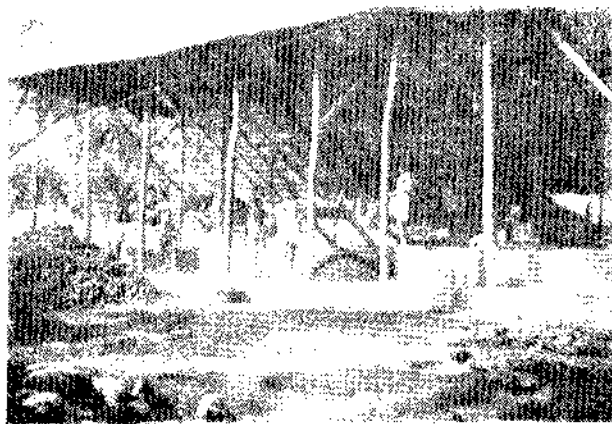


Plate III. B. The treble lime-kiln of South Ariad.

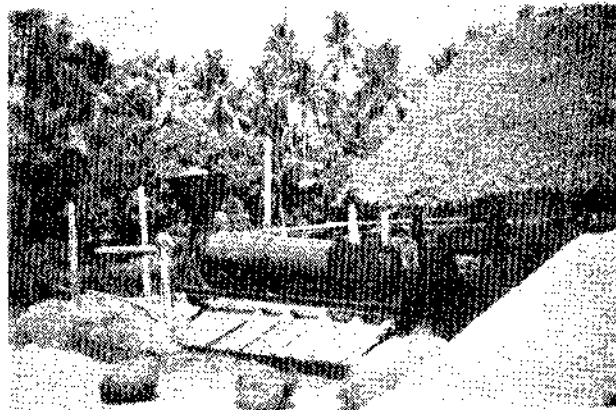


Plate III. C. The lime-shell washing machine of the treble lime-kiln at South Ariad, for greater purity of lime.

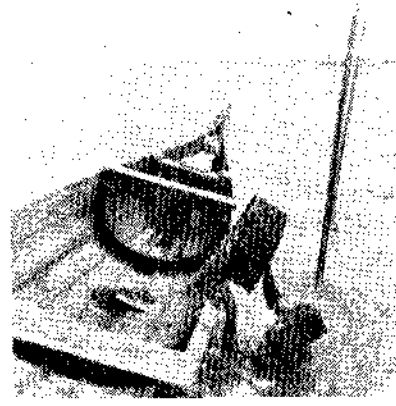
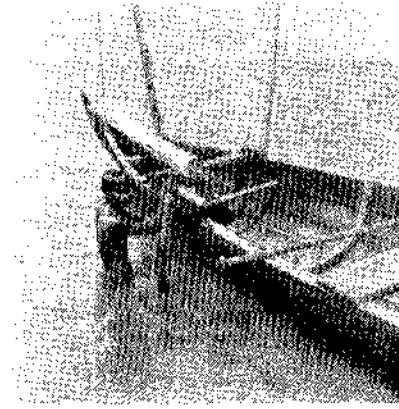
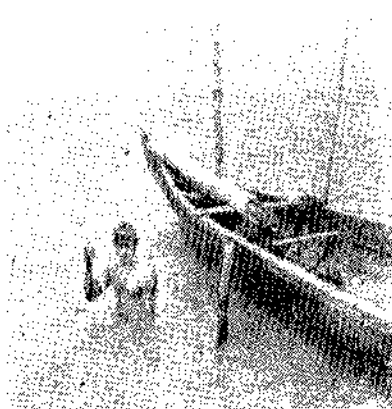


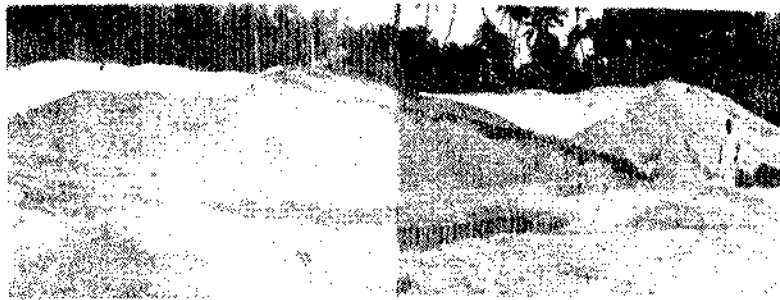
Plate IV. A. Live lime-shell fishing at Kumarakom; the fisherman is seen washing the clams with the round basket using the pole to support himself (the legs twisted round the pole).

B. The washed live clams are seen emptied into the canoe moored nearby; the iron plate used to heap up clams at the lake bottom prior to the washing is also seen inside the canoe on a small heap of clams.



C. White (dead or sub-fossil) lime-shell fishing; the fisherman is seen loosening the shell-laden mud with a long handled spade and heaping the shells standing on a 'Vechuketta', a crude platform.

D. The dead lime-shells with mud are taken in the basket to the surface of the water and shaking on the 'Vechuketta' the fisherman cleans the lime-shells off mud in the basket with vigorous shaking and the fisherman is seen emptying the shells into the canoe. The spade used for loosening the mud is also seen on the canoe in the foreground.



E. A heap of 1,659.2 tonnes of white lime-shell in the Sales Depot, Lime-Shell Co-operative Society, Kumarakom.

(a) The Travancore Cements Limited, Nattakam, Kottayam

For the manufacture of cement, especially white cement, the lime-shell is an ideal raw material. About 50,000 tonnes of lime-shell are utilised annually by the above factory for this. The raw materials used are lime-shell, clay, river sand and gypsum. The shells, clay and sand are intimately ground with water in a set of grinding mills to form a slurry, the composition of which is subsequently adjusted in a correction tank. The slurry is fired in a rotary kiln to clinkering temperature and the resultant cement clinkers are ground with a small percentage of gypsum in a composite grinding mill to fine powder to form grey cement and stored in silos. For the manufacture of white cement the process is essentially the same, but ordinary clay, sand and gypsum are replaced by white clay, white sand and white gypsum and the lime-shells are washed clean (Pl. II A).

The full complement of staff of this factory is 559, with thousands of people employed indirectly for the transport of raw materials and finished product. The production per day is 150 tonnes (capacity) and the production per annum is about 50,000 tonnes of cement (Table 2).

TABLE 2. *Production of cement by the factory from 1965 to 1968.*

Year		Production of grey cement (Tonnes)	Production of white cement (Tonnes)	Total production of cement (Tonnes)
1965	..	16,140	28,400	44,540
1966	..	42,060	6,700	48,760
1967	..	39,550	10,000	49,550
1968	..	39,260	11,040	50,300

(b) The Travancore Electro-Chemical Industries Limited, Chingavanam

About 15,000 tonnes of lime-shell are used annually by this factory for the manufacture of calcium carbide. The main raw materials used are lime-shell and carbon in the form of charcoal, hardcoke, lignite, and so on. The important process is the mixing of the calcium carbonate and carbon materials in pre-determined proportions and feeding to the electrical arc furnace. In the furnace, these materials are electrically reacted at very high temperature of 2500 to 3000°C, when calcium carbide is formed. In the formative stage, it is in the form of molten liquid and is tapped out and cooled within 24 to 36 hours (Pl. II B).

Roughly 150 people are employed in the factory. Daily production of calcium carbide averages 27 tonnes and annual capacity is 10,000 tonnes (Table 3).

TABLE 3. *Production of calcium carbide by the factory from 1965 to 1968.*

Year	Calcium carbide (Tonnes)		
1965	3,770
1966	6,118
1967	8,815
1968	7,478

(c) Pallathra Bricks and Tiles Limited, Kochuramapuram, Shertallay

The raw materials used for the manufacture of sand-lime bricks are silica sand and lime-shell. The shells burnt into lime and sand are fed into the double shaft mixer with the help of conveyors at a ratio of 1 : 9. This is mixed with water and conveyed to the brick pressing machine where it is pressed into shape. The pressed materials are loaded in the heating chamber and this chamber is heated with steam to a temperature of 200°C at a pressure of 100 kg per square feet for about 6 hours.

The production of brick per day is estimated to be 21,000 for a shift of 8 hours (only one shift a day). The annual production of bricks is approximately 3 million (Table 4). The factory employs 53 people, including 10 office staff. The factory is not producing tiles at present.

TABLE 4. *Production of bricks by the factory from 1965 to 1968.*

Year	Number of bricks produced per annum					
	Big	Medium	Small	Metric	Total	
1965	..	2,59,160	8,38,450	19,23,450	—	30,21,060
1966	..	10,04,597	12,99,141	—	—	23,03,738
1967	..	1,01,018	—	1,78,500	8,37,552	11,17,070
1968	..	—	—	66,080	30,41,781	31,07,861

*Lime-shell burning and minor uses in industries**(a) Lime-burning*

The use of these shells in lime-burning in the erstwhile Madras Presidency is described by Hornell (1916). Lime-shells required for the lime-shell kilns around the Vembanad Lake are met from the lime-shell deposits of the Vembanad Lake. For the present report, the lime-shell furnaces about 2 km inland around the Lake were observed. Four types of lime-shell furnaces are seen, viz., the single furnace, the double furnace, the treble furnace and the small conical furnace,

The single furnace, which is the typical one, has a brick-walled, well-like, cylindrical furnace constructed above ground level. Plastering is done either with mud or cement. The furnace has an opening in the centre, through which air is pushed in by means of a fan and wheel mechanism. In an actual operation, one layer of dry coconut husks is laid on the bottom of the furnace and kindled with fire. When all the husks begin burning, one layer of lime-shell and coke, mixed at the ratio of 3 : 2 is placed over the burning husks. A continuous current of air is maintained and when the coke begins to burn, another layer of shell and coke mixture is placed over it. This operation is repeated till the furnace is filled to capacity. The air current is provided for about 8 hours, when all the lime-shell inside the furnace would be completely burnt. After about 16 hours when the contents have cooled down, the furnace is emptied and the shells are sprinkled with water, when the burnt shells become powdered into lime.

There are 142 typical lime-shell furnaces in the area studied and the average cost of construction of a furnace, inclusive of all the accessories, is Rs. 1,374.74 and the average returns therefrom is Rs. 1,942.72 per annum. 2 to 4 men are required to operate this furnace.

A double lime-shell furnace is being used at Kumarakom (Pl. III A). Here, two furnaces are built side by side and for maintaining an air-current a single fan is used. The other operations are the same. The double furnace costs about Rs. 2,400 and the annual returns amounts to Rs. 14,400. There are 5 such furnaces in the area studied.

A treble lime-shell furnace is operated at South Ariad (Pl. III B, C). For maintaining an air current for the 3 furnace, electrically or mechanically operated fans are used. The treble furnace, inclusive of all accessories, costs about Rs. 24,000 and the returns is reported to be of the order of Rs. 48,000 per annum. Only a single such furnace is under operation.

At Kuthiathode and Kodamthuruth, a small conical furnace is used. It is about 90 cms high and 60 cms in diameter at the top. The wall of the furnace is made out of mud and strengthened with poles, and wire ropes would around it. Only firewood is used for burning the shells. It is operated mainly to get small quantities of lime for chewing purposes. It costs only Rs. 22 and the returns is only Rs. 60 per annum.

The total lime production in the area studied comes to about 35,310 tonnes. The details are presented in Table 5.

(b) Minor uses in industries

Lime-shell is burnt into lime and is used in appreciable quantities in mortar for building construction, in paddy fields for neutralising acid soil and as slaked lime for white-washing of buildings. Lime is used in the manufacture of distemper and the like and is also used by the glass, rayon, paper and sugar industries. It is learned that the treble lime-shell kiln at South Ariad supplies 600 tonnes of burnt lime-shells per annum to the Seshasayee Paper Mills, Erode and the Sakthi Sugar Mills, Erode.

It is desirable that the Lime-shell Co-operative Societies and the State Handicrafts Societies pay attention to the making of curios and toys out of these shells.

TABLE 5. Details of lime-shell furnaces around the Vembanad Lake for 1968

Place	Number of lime-shell furnaces	Average cost of one furnace		Average number of men engaged per furnace		Average number of loading per year per furnace		Average capacity of furnace	Average cost of materials per load for burning including labour charges	Cost of lime per tonne	Total income per load		Profit per load	Yearly lime production per furnace	Yearly profit per furnace	
		Rs.	P.	Tins (20 Kgs)	Rs.	P.	Rs.				P.	Tonne			Rs.	P.
I. Typical single lime-shell furnaces*																
Kuttanchal	2	986.00		3	12	150		217.00	80.00	240.00	23.00	36.000	276.00			
Kuthiathode	10	693.00		2	36	175		250.50	75.00	262.50	12.00	126.000	432.00			
Kodamthuruth	1	820.00		3	48	250		338.50	70.00	350.00	11.50	240.000	552.00			
Chandiroor	3	620.00		2	36	183		231.70	67.00	245.22	13.52	131.760	486.72			
Eramallur	2	665.00		2	48	200		263.00	69.00	276.00	13.00	192.000	624.00			
Aroor	5	658.00		2	48	190		241.10	67.00	254.60	13.50	182.400	648.00			
Edacochin	21	847.09		3	72	182		322.80	95.00	345.80	23.00	262.080	1,656.00			
Kallanchery	1	950.00		2	24	150		189.50	67.00	201.00	11.50	72.000	276.00			
Kumbalam	2	950.00		2	24	150		189.50	67.00	201.00	11.50	72.000	276.00			
Ezhupunna	1	950.00		2	24	150		189.50	67.00	201.00	11.50	72.000	276.00			
Kumpalanghy	5	950.00		2	36	180		216.20	67.00	241.20	25.00	129.600	900.00			
Velleythode	3	950.00		2	24	180		229.70	67.00	241.20	11.50	86.400	276.00			
Vayalar	6	592.00		3	50	125		201.50	85.00	212.50	11.00	125.000	550.00			
Chakirikuzhivalavu	1	711.00		3	48	150		250.00	90.00	270.00	20.00	144.000	960.00			
Kokkothamangalam	1	711.00		3	48	150		252.00	90.00	270.00	18.00	144.000	864.00			
Veliampira	2	701.00		4	48	150		248.00	90.00	270.00	22.00	144.000	1,056.00			
Varanam	2	701.00		4	48	150		233.00	85.00	255.00	22.00	144.000	1,056.00			
Puthanangadi	1	682.00		2	60	100		153.00	85.00	170.00	17.00	120.000	1,020.00			
Kayipuram	2	682.00		2	60	100		153.00	85.00	170.00	17.00	120.000	1,020.00			
Perumthuruth	3	549.00		2	48	100		154.00	85.00	170.00	16.00	96.000	768.00			

Mannanchery	..	4	691.00	2	48	150	243.00	85.00	255.00	12.00	144.000	576.00
Pallipurathussery	..	6	746.00	2	24	84	130.60	90.00	151.20	20.60	40.320	494.40
Ithipuzha	..	1	855.00	2	24	100	150.00	85.00	170.00	20.00	48.000	480.00
Chempu	..	2	846.00	2	24	113	159.85	85.00	192.10	32.25	54.240	774.00
Edachempu	..	2	812.00	4	48	100	140.00	85.00	170.00	30.00	96.000	1,440.00
Paravoor	..	1	902.00	4	48	100	140.00	85.00	170.00	30.00	96.000	1,440.00
Panavally	..	1	832.00	3	36	100	150.00	85.00	170.00	20.00	72.000	720.00
Pallipuram	..	1	782.00	4	48	100	150.00	85.00	170.00	20.00	96.000	960.00
Vaduthala	..	1	874.00	4	48	125	146.50	75.00	187.50	41.00	120.000	1,968.00
Oodupuzha	..	1	252.00	4	48	25	36.50	85.00	42.50	6.00	24.000	288.00
Kumarakom	..	10	1,500.00	3	120	125	250.00	120.00	300.00	50.00	300.000	6,000.00
Kariyil	..	1	1,000.00	3	48	125	180.00	80.00	200.00	20.00	120.000	960.00
Vechoor	..	3	1,500.00	3	60	125	200.00	90.00	225.00	25.00	150.000	1,500.00
South Ariad	..	6	1,200.00	3	60	125	200.00	90.00	225.00	25.00	150.000	1,500.00
Thattampally	..	2	1,500.00	3	120	150	250.00	90.00	270.00	20.00	360.000	2,400.000
Kainakary	..	2	1,500.00	3	96	125	220.00	100.00	250.00	30.00	240.000	2,880.00
Chennankary	..	8	1,200.00	3	60	125	200.00	90.00	225.00	25.00	150.000	1,500.00
Pulinkunnu	..	16	5,000.00	3	120	250	350.00	80.00	400.00	50.00	600.000	6,000.00
Average	..	3.74	1,374.74	2.71	63.38	158.04	241.93	85.87	267.06	25.13	213.159	1,942.72
II. Double lime-shell furnaces*												
Kumarakom	..	5	2,400.00	6	120	300	600.00	120.00	720.00	120.00	720.000	14,400.00
III. Treble lime-shell furnace**												
South Ariad	..	1	24,000.00	9	120	600	2,000.00	200.00	2,400.00	400.000	1,440.000	48,000.00
IV. Conical lime-shell furnaces†												
1. Kuthiathode	..	1	22.00	1	12	4	5.60	95.00	7.60	2.00	0.960	24.00
2. Kodamthuruth	..	1	22.00	1	48	4	5.60	95.00	7.60	2.00	3.840	96.00
Average	..	1	22.00	1	30	4	5.60	95.00	7.60	2.00	2.400	60.00

[9]

* The lime is used for agricultural and building purposes.

** Motor operated furnace. The lime is sold to paper and sugar factories in Tamil Nadu.

† The lime is used for chewing purposes.

Clam meat as food

Out of 1,98,809.179 tonnes of lime-shell obtained during 1968 (inclusive of company dredgings) from the Vembanad Lake, 26,858.557 tonnes were provided by the black live clams. From this much of clams 2,417.27 tonnes of clam meat are obtainable when estimated at the rate of yield of 90 kgs meat per tonne of live clams with shells on. The clam meat is highly nutritious and its nutritive value, estimated at the Applied Chemistry Laboratory of the erstwhile University of Travancore in 1958 is shown in Table 1. The whole yield of clam meat is not used for human consumption. At Chandiroor and elsewhere, the clams were left in the open till their flesh was decayed and washed away by the rains. (Recently this practise by the people was banned by the Panchayat.) The empty shells are collected and burned in kilns. However, a good quantity of the clam meat is sold in the local markets or cooked and consumed by the fishermen themselves. When fish is not readily available the clam meat has a ready market and is sold at 10 to 20 paise per litre or even at higher prices. The clam meat supplements the poor man's diet consisting chiefly of tapioca and rice. With the adoption of proper cleaning methods and by means of quicker transport to inland markets, the whole yield of clam meat can be utilized for human consumption. Sebastian (1970) has discussed in detail the prospects of a better and fuller utilisation of clam meat by means of canning.

EXPLOITATION OF LIME-SHELL (THE FISHERY)

Fishing for white shells or sub-fossil deposits

(a) Indigenous methods and implements

For the white shell fishing, a canoe, a 'Bench' or 'Vechukettu', a basket and a spade are used. On reaching the site of collection in a canoe, a wooden platform with long pointed legs or the 'Bench' is forced down into the mud by the fisherman. The fisherman stands on the platform and heaps up the shells on the bottom of the Lake with a long-handled spade (Pl. IV C). These shells are periodically collected in baskets, washed and emptied into the canoe (Pl. IV D). This type of fishing is in vogue in the southern parts of the Lake. But at Kumbalam a drag net is used. This small net has semi-circular metal frame at its mouth with the horizontal portion toothed. A long handle is attached to the arched portion of the frame and a long rope is tied to it. A fisherman standing in a canoe forces the meta frame down into the mud by pushing the handle, when another man in a second canoe drags the net along by pulling the rope. The shells are cleaned in water inside the net itself and transferred into the canoe.

(b) Mechanised methods

The suction type dredgers are used by the Cement Factory and the Electro-Chemical Industries. Shells are sucked in along with silt, mud and water from the bottom of the Lake and are delivered to a rotary filter which separates the shells which are stored in the dredger or are conveyed into barges.

Fishing for black shells or live clams

The implements used in the black shell fishing are simpler than those used in the white shell fishing. The simplest method involves hand-picking; a better one is fishing with a collecting basket and emptying into a country canoe (Pl. IV A, B). A more effective method is the use of a toothed iron rake. The rake, locally known as 'Varandi' or 'Kolli' is used for combing the lake bottom for heaping

up the clams which are removed to the canoe in collecting baskets. As the 'Varandi' helps the fisherman to comb the area thoroughly, after the fishing, such areas are often devoid of living clams. The use of the rake is supposed to have a deleterious effect on the clam population in that the clams left behind after the sweep of the rake are covered with mud and, only those clams which succeed in coming back to the surface live and the rest die.

Lime-shell fishery statistics

Collection of statistics of lime-shell fishery in the Vembanad Lake was started from December 1964 onwards with the establishment of the Lime-Shell Research Station at Kumarakom. Four Field Investigators were entrusted with the collection of these data. Each Investigator was assigned the work of collection of catch statistics at the landing centres in his region. These centres were visited by them systematically in rotation. Every month the average daily landing of lime-shell in respect of each fishing centre was calculated. This figure was multiplied by 25, the average number of fishing days in a month, to arrive at the monthly landing at each centre. The total value of lime-shell fished was calculated according to the prevailing prices at each landing centre, which at present is about 38 paise per tin weighing about 20 kgs for white shell and 30 to 60 paise per tin for black shells, the price dependent on the availability of shells in the market. The illicit fishermen sell the lime-shells below the standard prices shown above, often leading to accumulation of lime-shells in the depots of co-operative societies. The number of illicit fishermen varies from season to season. From the average number of fishermen for Vembanad Lake the per capita monthly and annual incomes were calculated (Tables 6 and 7).

In 1965, about 20,542 tonnes of live lime-shells were fished from the Vembanad Lake, valued at Rs. 3,78,486 with a per capita income of Rs. 784.69 per annum. For the period 1965 to 1968, maximum shellfish catch was recorded in 1968, when about 26,858 tonnes were fished. In 1968 the fishing effort was also considerably higher than those for the previous years and the per capita annual income was Rs. 796.22. Similarly, the dead lime-shell catch was the maximum in 1968, when 1,01,312 tonnes were fished by the fishermen. The three companies also fished dead lime-shell, which in 1968 was 70,639 tonnes (Table 8). But the maximum collection of 75,639 tonnes by the companies was in 1967.

In 1968, nearly 1,815 fishermen were engaged in lime-shell fishing in Vembanad Lake and, out of this, only 331 and 257 were licensed to fish live and dead lime-shells respectively (Tables 9 and 10).

Distribution of clams, of fishing effort and rate of exploitation

At present very little is known regarding the abundance and distribution of the shell resources in the Lake. Special equipments like the bottom core sampler may be required to study the extent of vertical distribution of the sub-fossil deposits in the Lake, for which the Lime-Shell Research Station is not equipped at present. However, the horizontal distribution of the clams, the distribution of fishing effort and the rate of exploitation at the different centres are being studied by the Station.

Preliminary observations on the distribution of clams in the Lake show that the genus *Meretrix* is restricted to the northern portion of the Lake, roughly north of Oodupuzha, where as *Villorita* spp. are recorded almost throughout the Lake, but are abundant especially south of Eramallur. Remarkable intensities of 4,620 specimens

TABLE 6. *Statistics of live lime-shell fishing for 1965 to 1968*

Month	1965				1966				
	Total landing (Tonnes)	Number of men engaged	Total value	Earning per capita per month	Total landing (Tonnes)	Number of men engaged	Total value	Earning per capita per month	
			Rs. P.	Rs. P.			Rs. P.	Rs. P.	
1	2	3	4	5	6	7	8	9	
January	2,027.425	415	37,164.35	89.55	955.000	317	21,525.80	67.90
February	2,873.125	411	35,580.25	86.57	1,233.850	447	27,528.50	61.59
March	1,547.075	365	29,181.50	79.95	1,267.225	467	26,657.00	57.08
April	1,694.425	436	33,455.75	76.73	1,545.000	529	34,647.00	65.50
May	2,996.950	859	54,596.25	63.56	1,695.790	628	38,779.70	61.75
June	1,441.375	622	36,313.25	58.38	1,388.625	534	27,756.75	51.98
July	1,346.100	526	24,320.50	46.24	1,558.025	549	29,029.00	52.88
August	1,207.850	440	19,249.25	43.75	1,622.225	605	33,226.50	54.92
September	974.975	437	19,254.60	44.06	1,493.375	583	25,341.50	43.47
October	1,570.075	419	31,045.75	74.09	689.525	205	13,026.75	63.55
November	1,585.900	431	32,492.25	75.39	417.475	195	8,367.50	42.91
December	1,276.900	427	25,832.50	60.50	887.900	536	19,955.40	37.23
Total	20,542.175	5,788	3,78,486.20	66.56*	14,754.015	5,595	3,05,841.40	55.06*

		1967				1968			
January	.. ..	1,141.825	400	25,067.75	62.67	2,632.075	929	53,642.25	57.74
February	.. ..	754.125	254	27,192.00	107.06	2,440.225	791	62,621.25	79.17
March	.. ..	1,424.750	408	35,043.45	85.89	2,006.350	775	49,677.50	64.10
April	.. ..	739.625	580	26,844.50	46.28	2,597.850	899	65,091.25	72.40
May	.. ..	2,000.350	719	39,825.20	55.39	3,231.875	1,023	74,840.25	73.16
June	.. ..	1,731.000	717	39,568.25	55.19	2,328.350	916	55,787.75	60.90
July	.. ..	1,367.075	458	27,180.25	59.35	856.725	515	20,356.75	39.53
August	.. ..	2,048.275	805	40,839.35	50.73	2,021.275	835	51,123.75	61.23
September	.. ..	1,537.500	565	32,462.50	57.46	2,659.750	869	62,400.25	71.81
October	.. ..	1,492.150	554	31,843.25	57.48	2,192.832	744	59,717.75	80.27
November	.. ..	880.850	333	30,767.25	92.39	1,748.750	712	44,871.50	63.02
December	.. ..	1,773.050	588	44,411.75	75.53	2,142.500	708	51,189.75	63.35
Total		16,890.575	6,381	4,01,045.50	67.12*	26,858.557	9,816	6,51,320.00	65.56*

Per capita annual income : (in Rupees)	Year			
	1965	1966	1967	1968
	784.69	655.96	754.19	796.22

*Annual average

Remarks :

For collecting statistics the lime-shell landing places were divided into four jurisdictions, viz. Kumarakom, Muhamma, Kuthiathode and Vaikom each under one Field Investigator.

Catch statistics were not collected in Kuthiathode jurisdiction in February 1967 and in Vaikom and Kumarakom jurisdictions in July 1968.

TABLE 7. *Statistics of dead lime-shell fishing for 1965 to 1968*

Month	1965				1966			
	Total landing (Tonnes)	Number of men engaged	Total value		Total landing (Tonnes)	Number of men engaged	Total value	
			Rs.	P.			Rs.	P.
1	2	3	4	5	6	7	8	9
January	5,591.830	396	74,882.85	189.10	4,425.675	517	87,422.60	169.10
February	4,640.400	376	66,097.50	175.79	7,259.125	784	1,02,766.50	131.08
March	5,480.375	409	65,705.25	160.65	5,865.500	700	94,051.00	134.36
April	5,402.875	405	76,924.60	189.94	8,415.500	700	1,36,109.90	194.44
May	4,615.100	444	72,396.25	163.05	7,287.225	713	1,12,647.25	157.99
June	4,123.375	452	55,812.50	123.48	4,839.250	475	65,744.75	138.41
July	4,209.755	434	59,249.25	136.52	3,878.240	461	55,226.50	119.80
August	3,994.825	452	59,319.00	131.24	6,359.900	696	95,607.00	137.37
September	7,070.225	587	89,564.45	152.58	6,489.450	723	98,350.50	136.03
October	5,394.225	559	82,691.75	147.93	3,580.825	381	47,378.00	124.35
November	4,634.675	588	63,545.00	108.07	2,945.500	211	18,820.00	89.19
December	4,871.875	546	67,260.00	123.17	8,965.420	830	1,97,794.75	238.31
Total	60,029.535	5,648	8,33,448.40	150.13*	70,311.610	7,191	11,11,917.85	147.54*

		1967				1968					
January	.. ..	10,785.525	1,060	2,07,833.25	196.07	10,263.200	1,110	2,07,098.50	186.58	
February	.. ..	9,344.525	874	1,64,790.50	188.55	7,738.350	886	1,55,741.00	175.78	
March	.. ..	9,814.725	998	1,99,774.00	200.17	11,621.100	1,206	2,33,525.00	193.64	
April	.. ..	8,926.400	884	1,44,571.00	163.54	8,691.500	1,061	1,74,251.00	164.23	
May	.. ..	7,553.025	761	1,35,564.75	178.14	10,597.650	1,212	2,11,707.25	174.68	
June	.. ..	6,193.725	725	1,12,531.25	155.22	10,170.000	1,117	2,05,272.60	183.77	
July	.. ..	4,021.325	456	74,802.75	164.04	226.222	104	6,497.75	62.48	
August	.. ..	6,132.075	745	1,00,080.00	134.34	7,034.600	982	1,43,120.00	145.74	
September	.. ..	6,184.000	782	1,15,649.75	147.89	8,906.000	1,100	1,88,232.00	171.12	
October	.. ..	9,210.050	929	1,64,635.50	177.22	8,682.250	1,070	1,79,076.50	167.36	
November	.. ..	6,357.900	721	1,54,140.25	213.79	7,952.500	960	1,66,030.75	172.95	
December	.. ..	9,901.750	901	1,90,188.75	211.09	9,428.250	1,156	1,91,784.75	165.90	
Total	....	94,425.025	9,836	17,64,561.75	177.51*	1,01,311.622	11,964	20,62,336.50	163.69*	
		1965				1966				Year	
Per capita annual income (in Rupees) :		1,770.78		1,855.51		2,152.78		2,068.54		1967	
										1968	

*Annual average

Remarks :

Catch statistics were not collected in Kuthiathode jurisdiction in February 1967 and in Vaikom and Kumarakom jurisdictions in July 1968.

TABLE 8. *Quantity (Tonnes) of lime-shell used by the three factories from 1965 to 1968.*

Year	Pallathra Bricks and Tiles Ltd., Kochuramapuram, Shertallay	Travancore Electro-chemical Industries Ltd., Chingavanam	Travancore Cements Ltd., Nattakom	Total
1965 ..	932.5	7,850.0	56,655.0	65,437.5
1966 ..	450.1	11,974.0	49,050.0	61,474.1
1967 ..	917.0	14,837.0	59,885.0	75,639.0
1968 ..	1,142.0	14,772.0	54,725.0	70,639.0

TABLE 9. *Fishing village-wise live shell catch statistics for 1968.*

Place	Number of licensed fishermen	Number of illicit fishermen	Total landing (Tonnes)	Total value Rs. P.	Earning per capita Rs. P.
Eramallur ..	—	23	511.713	12,243.00	532.30
Chandiroor ..	1	17	410.769	9,906.00	550.33
Aroor ..	5	63	1,588.443	38,115.00	560.51
Edacochin ..	—	21	1,017.459	21,573.00	1,027.29
Velleythode ..	—	6	91.766	1,827.00	304.50
Ezhupunna ..	3	31	656.100	13,311.00	391.50
Kumpalanghy ..	—	4	105.924	2,421.00	605.25
Kallanchery ..	—	23	643.845	14,826.00	644.61
Kuttanchal ..	3	6	195.360	4,029.00	447.67
Kuthiathode ..	3	9	202.320	4,602.00	383.50
Kodamthuruth ..	5	14	419.400	8,019.00	422.05
Vayalar ..	3	39	1,438.665	27,900.00	664.29
Vilakkumaram ..	—	21	680.700	13,773.00	655.68
Chakirikuzhivalavu ..	8	14	819.660	19,338.00	879.00
Nedumbrakkad ..	—	19	339.300	7,164.00	377.05
Kokkothamangalam ..	22	—	693.999	17,349.00	788.59
Varanam ..	13	—	441.000	11,025.00	848.08
Perumthuruth ..	41	—	1,665.000	36,900.00	900.00
Mannanchery ..	18	—	597.000	14,949.00	830.50
North Ariad ..	41	—	1,554.900	39,441.00	961.98
Pallipurathussery ..	65	28	4,482.270	1,20,420.00	1,294.84
Vaikom ..	—	6	224.100	5,376.00	896.00
Chempu ..	—	21	866.700	22,782.00	1,084.86
Champakara ..	—	10	479.100	12,642.00	1,264.20
Pallipuram ..	8	26	1,666.350	43,740.00	1,286.47
Thycattussery ..	9	16	1,038.570	27,003.00	1,080.12
Olavaipu ..	—	5	171.300	4,194.00	838.80
Oodupuzha ..	—	1	9.300	228.00	228.00
Panangad ..	—	5	240.600	5,925.00	1,185.00
Udayamperoor ..	—	12	413.100	8,934.00	744.50
Paravoor ..	—	10	282.900	6,225.00	622.50
Edachenpu ..	—	8	315.000	6,498.00	812.25
Muthentacone ..	—	17	136.800	3,600.00	211.76
Thottumugappu ..	20	—	99.900	2,499.00	124.95
Kariyil ..	—	12	68.100	1,584.00	132.00
Vechoor ..	27	—	1,025.646	27,381.00	1,014.11
South Ariad ..	13	—	436.398	11,883.00	914.08
Thattampally ..	10	—	324.800	8,826.00	882.60
Kavalam ..	13	—	504.300	12,869.00	989.92
Total ..	331	487	26,858.557	6,51,320.00	796.23

TABLE 10. Fishing village-wise dead shell catch statistics for 1968.

Place	Number of licensed fishermen	Number of illicit fishermen	Total landing (Tonnes)	Total value		Earning per capita	
				Rs.	P.	Rs.	P.
Kumbalam	19	10	1,746.300	39,408.00		1,358.90	
Chandiroor	—	4	32.001	813.00		203.25	
Eramallur	—	9	57.600	1,440.00		160.00	
Edacochin	2	19	334.500	8,892.00		423.43	
Chakirikuzhivalavu	—	6	559.500	12,037.50		2,006.25	
Veliampira	—	68	7,825.400	1,57,650.00		2,318.38	
Varanam	17	—	2,116.800	40,665.00		2,392.06	
Puthanangadi	—	25	2,918.700	56,286.00		2,251.44	
Kayipuram	—	28	3,016.941	60,780.00		2,170.71	
Perumthuruth	—	10	902.400	17,592.00		1,759.20	
Ponnadumunni	—	96	10,629.300	2,14,170.00		2,230.94	
Mannanchery	39	—	4,204.800	84,567.00		2,168.38	
Vaduthala	28	84	7,908.000	1,55,418.00		1,387.66	
Muthentacone	49	16	7,626.000	1,50,906.00		2,321.63	
Thottumugappu	48	13	7,368.900	1,46,793.00		2,406.44	
Kariyil	—	76	6,984.300	1,49,466.00		1,966.66	
Cheepingal	—	25	2,487.300	52,149.00		2,085.96	
Vechoor	—	105	11,925.900	2,54,550.00		2,424.29	
Achinakam	—	29	2,931.180	61,413.00		2,117.69	
South Ariad	—	31	3,720.000	74,400.00		2,400.00	
Chennankary	—	86	9,632.700	1,97,292.00		2,294.09	
Kainakary	55	—	6,383.100	1,25,649.00		2,284.53	
Total	257	740	1,01,311.622	20,62,336.50		2,068.54	

of *Villorita* spp. per square metre and 2,860 specimens per sq. metre were observed in the Veluthully kayal and Vayalar respectively. These young specimens ranged in size from 2 to 8 mm and were observed during October, 1969. But, *Villorita* spp. was conspicuously absent in the Lake around Perumbalam Island and in the portion of the Lake west of Kumbalanghy. The sub-fossil shells are reported to be abundant in the Lake bed between Vechoor and Kuttamangalam and continue in the form of three veins underneath the paddy fields in the reclaimed areas of Kuttanad upto Muttar, Mithrakary and Chennankary (Anon, 1948).

There are not less than 39 clam fishing and 22 sub-soil shell fishing centres in the Lake, of which the heavily exploited white shell beds are located in the villages of Veliampira, Vechoor, Vaduthala, Ponnadumunni, Muthentacone, Thottumugappu, Kariyil, Chennankary and Kainakary and, black shell fishing centres in Aroor, Edacochin, Ezhupunna, Kallanchery, Vayalar, Vilakkumaram, Chakirikuzhivalavu, Kokkothamangalam, Perumthuruth, North Ariad, Pallipurathussery, Chempu, Pallipuram, Thyccattussery, and Vechoor (Tables 8 and 9 and, Fig. 1).

Lime-shell fishing right and issue of licences

The Government of India has listed lime-shell as a minor mineral and in the Mineral Concession Rules 1949, framed under section 5 of the Mines and Minerals (Regulation and Development) Act 1948, the Government of India has directed the State Governments to prescribe rules for the extraction of minor minerals. The

[17]

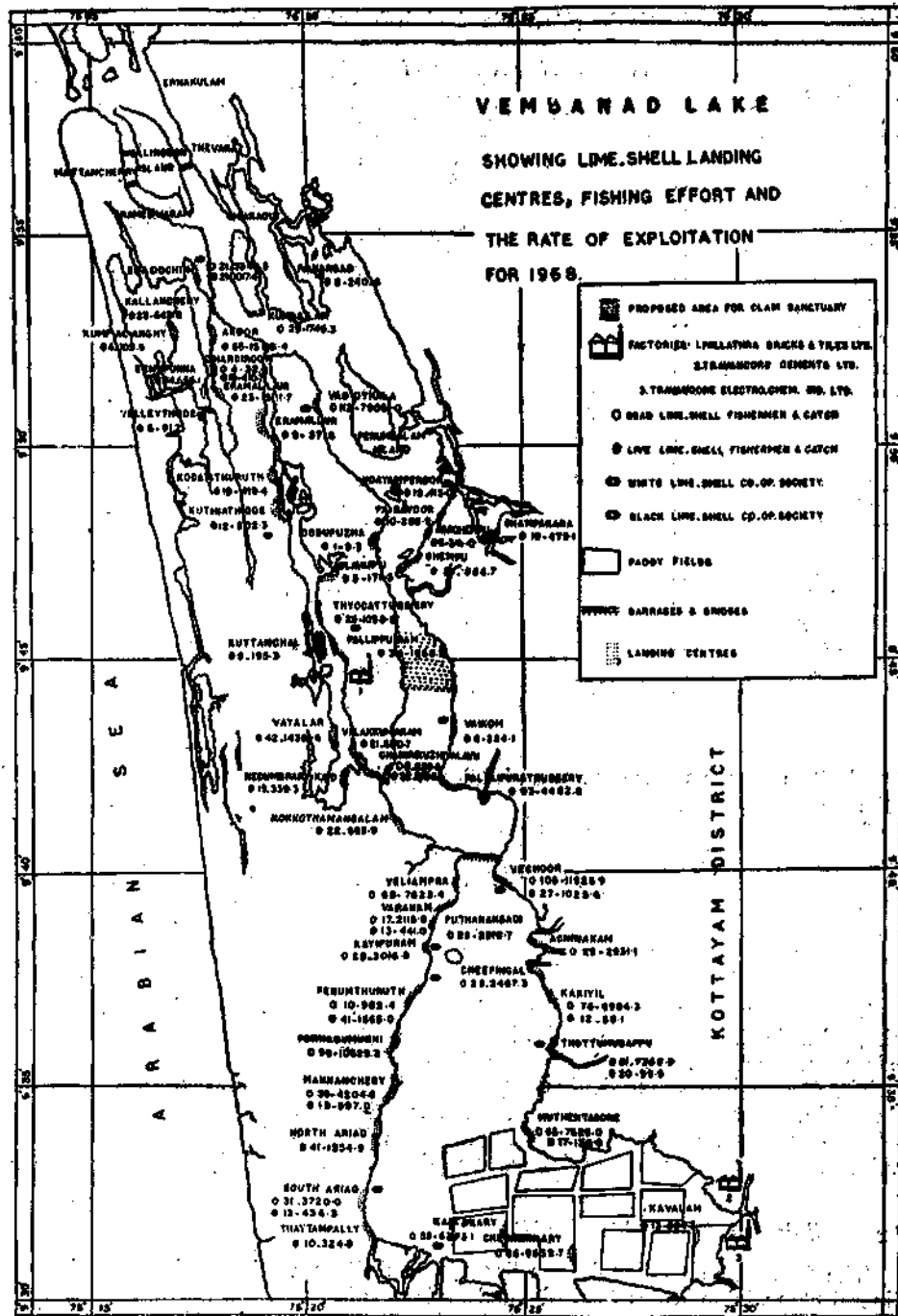


Fig. 1. Map of Vembanad Lake.

[18]

11

acquisition, sale, supply and distribution of lime-shell in the State of Kerala is at present controlled by the Kerala Lime-shells (Control) Act, 1958 and the rules made thereunder. Accordingly, collection of lime-shells and stocking the same by the producer, and stocking and selling of shells by a dealer shall not be permitted within the State except under a licence issued by the Government. However, the provisions of this Act do not apply to the collection of lime-shell as curios, for making ornaments, for conversion into lime as an ingredient in chewing material, or for the extraction of meat. The State Government as far back as in 1943 has ordered that licences for the collection of lime-shells should be issued only in favour of Co-operative societies formed exclusively of lime-shell fishermen. Till 1958-59 licences were issued by the Inspector of Co-operative Society, Kumarakom. The Lime-shell (Control) Act 1958 came into force from 1st April 1959 and the Assistant Directors of Fisheries (Zonal) were vested with powers to issue licences to dealers and producers of lime-shell. The details of producer's and dealer's licence fees are furnished in Table 11. In 1968-69 (the financial year from April to March), the Department of Fisheries, Kerala State, issued 157 dealer's licences and 1,568 producer's licences, with a total revenue on this head of Rs. 31,817 (Table 12).

The firm M/S. Travancore Cements Ltd., Nattakom, continued to collect shells from the Lake on payment of a royalty to the Department of Fisheries. During 1959-60 an amount of Rs. 10,844 was realised from the above firm as royalty. From 1960-61 onwards the amount was remitted to the credit of the Department of Geology, Kerala. Fresh mining lease was granted to this firm and to two new firms, viz., M/s. Pallathra Bricks and Tiles Ltd., Kochuramapuram, Shertallay and M/s. Travancore Electro-Chemical Industries Ltd., Chingavanam, by the Department of Geology, Kerala. Specific areas are allotted to each firm for shell collection and details of the leases are furnished in Table 13.

The quantity of lime-shell extracted by the above three firms and the revenue to the State Government therefrom during the years, 1965-66 to 1967-68 are shown in Table 14.

Lime-shell Co-operative Societies

Kunju Panicker (1957) discusses in detail the lime-shell fishing on co-operative basis in the erstwhile Travancore-Cochin State, and suggested that if the whole business of collecting the lime-shell, burning into lime, transport, marketing etc. were organised on sound co-operative basis, the workers engaged directly in the shell fishery could be saved from the capitalists and the middlemen, and the socio-economic condition of the fishermen improved.

Two lime-shell co-operative societies were organised, one at Kumarakom in 1928 and the other at Kainakary in 1937. In 1943 the Government decided to issue licences for shell collection only in favour of societies and appointed a Special Co-operative Inspector invested with powers to take cognizance of illicit fishing. These two societies showed steady progress and in 1950 the Government was pleased to permit the functioning of six more societies. With financial aid from the Kumarakom society, the new societies started functioning from April 1951. The post of Special Inspector was abolished from the above date, which upset the whole scheme. The Travancore Central Lime-shell Co-operative Society, formed at Alleppey to co-ordinate the working of all the primary societies, could not function for want of funds.

TABLE 11. *Producer's and dealer's licence fees*

I. <i>Producer's Licence</i>		<i>Licence Fee</i>	
		Rs.	
White shell	(a) Member of co-operative society	10.00	Each
(Sub-soil shell)	(b) Other individuals	15.00	..
Black shell	(a) Member of co-operative society	7.00	..
	(b) Other individuals	10.00	..
Sea shell	(a) Member of co-operative society	3.00	..
(Drift shell)	(b) Other individuals	3.00	..
II. <i>Dealer's Licence</i>			
Individuals			
White, black and sea shell			
	(a) From 1,000 to 25,000 tins	4.00	..
	(b) From 25,000 to 50,000 tins	150.00	..
	(c) For 1,00,000 tins	300.00	..
	(d) For 2,00,000 tins	500.00	..
<i>For Lime-shell co-operative societies :</i>			
	(a) 25,000 to 50,000 tins	50.00	
	(b) 1,00,000 tins	100.00	
	(c) 2,00,000 tins	200.00	
	(d) above 2,00,000 tins	1.00	For every additional 250 tins (one tin = 20 Kgs)

TABLE 12. *The number of lime-shell licences issued by the Department of Fisheries 1964-65 to 1968-69*

Year	No. of dealer's licence	No. of producer's licence	Revenue collected Rs.
1964-65	140	419	8,336
1965-66	231	965	17,165
1966-67	203	1,345	19,452
1967-68	239	1,250	26,573
1968-69	157	1,568	31,817

TABLE 13. Details of areas of Vembanad Lake leased to the three firms.

Name and address of the firm (lessee)	Total area granted with survey Nos.	Village, Taluk and District	Date of grant	Period of Lease
The Travancore Cements Limited, Nattakom, Kottayam.	10 sq. miles or 2590 hectares. Survey Nos. 378/1, 475/1, 279/1, 197/1 of Alleppey District and 444/1, 653/1, 768/1, 539/1, 701/1 of Kottayam District.	Portion of Vembanad Lake in Taluks - Kottayam, Vaikom, Ambalapuzha and Shertallay; Districts-Alleppey and Kottayam.	13-4-1962	20 years
Pallathra Bricks and Tiles Limited, Kochuramapuram P.O., Shertallay.	$\frac{1}{4}$ sq. mile or 320 Acres Survey No. 175/1.	Portion of Vembanad Lake in Village-Thannermukkom South; Taluk-Shertallay; District-Alleppey.	30-4-1962	20 years
Travancore Electro-chemical Industries Limited, Chingavanam.	1102.906 hectares or 2725.34 acres. Survey Nos. 226, 227/1, 98/1 and 226/2.	Village-Panavally, Vaduthala, Mattathilbhagam; Taluk-Shertallay; District-Alleppey.	30-1-1965	20 years

TABLE 14. Quantity (Tonnes) of lime-shells used by the factories and the revenue (Rupees) remitted to the Government.

Year	The Travancore Cements Limited, Nattakom		Pallathra Bricks and Tiles Limited, Kochuramapuram		Travancore Electro-chemical Industries Limited, Chingavanam		Total	
	Quantity	Revenue	Quantity	Revenue	Quantity	Revenue	Quantity	Revenue
1965-66	56,534.000	50,745.75	752.527	1,137.66	8,231.000	5,673.00	65,517.527	57,556.41
1966-67	47,310.000	48,762.00	383.911	392.91	11,768.000	8,270.25	59,461.911	57,425.16
1967-68	55,365.000	42,000.00	1,369.520	966.26	15,663.000	10,875.00	72,397.520	53,841.26

At present, there are 11 lime-shell producers' co-operative societies in the Vembanad Lake area upto Cochin, six for black shells and five for white shells. The areas allotted to each society and other details are furnished in Tables 15 and 16. The figures presented in the Tables are from the records maintained by the societies. Though 572 and 351 licences were issued in 1968 for black and white lime-shell fishing respectively, only 331 and 257 fishermen were actually recorded as having engaged in black and white lime-shell fishing respectively (Tables 9 and 10).

The black shells collected by members of the societies are categorised as I, II and III qualities and are priced accordingly. The society at Muhamma paid during 1968, 49 paise per 20 Kgs for I quality, 41 paise per 20 Kgs for II quality and 37 Paise per 20 Kgs for III quality. This price is generally followed; however, the Society at Ariad paid as far back as in 1965, 52 paise, 47 paise and 38 paise for 20 kgs for the I, II and III qualities respectively. It is difficult to work out the real per capita income of the fishermen of these societies, since many unlicensed fishermen route their catch through the licensed fishermen of the societies.

The quantity of lime-shell handled by the 11 Co-operative societies are shown in Table 17.

There are two lime (kummaya) marketing co-operative societies in the region studied. They are the Kummaya Vyavasaya Co-operative Society Ltd., No. 2491, Kumarakom and the Kummaya Vyavasaya Co-operative Society Ltd., No. 2507, Pulincunnu. During 1968 the two societies together marketed 4,550 tonnes of lime (Table 18).

The problems of overfishing, fishing undersized clams, pollution and salt-water exclusion projects

(i) Over-fishing and fishing of undersized clams

Owing to over-fishing there is marked depletion of living clams in some of the beds, from where only white shells are collected at present. A cursory examination of the fishery will reveal that the average size of clam fished has gone down very much. Through unlicensed and indiscriminate fishing, the young and under-sized live clams are removed in large numbers. Near Ambalapuzha, large quantities of juvenile clams are collected and marketed, since their shells are more suitable for use as poultry grit. Fishing out the under-sized clams is uneconomical and may be detrimental for the propagation of the species.

(ii) Pollution

The main source of pollution of the live clam beds is the retting of the coconut husks in the shallow areas of the Lake. The extent of the effect of this pollution on the clams is not yet ascertained. The present report does not cover the area supposed to be polluted by the effluents of the industrial complex at Alwaye.

(iii) Salt-water exclusion projects

A large bridge-cum-bund is being constructed at Thanneermukkom across the Vembanad Lake, chiefly to check saline incursion from reaching the southern parts of the Lake, especially the Kuttanad rice fields (Fig. 1). On completion of the bund an extensive part of the Lake is expected to remain under freshwater conditions and it is doubtful whether the clams can reproduce and propagate their species in such a changed ecosystem. Observations on spatfall, analysis of plankton and examination of the gonads show that the clams may breed from January to July.

TABLE 15. Details of white lime-shell co-operative societies for 1965 to 1968

Name of society	Staff position		Pay of staff per annum	No. of licensed fishermen	Shell fished during the year	Value realised during the year		Average per capita net income during the year		Area allotted for each society	Remarks		
	Paid	Honorary				Rs.	P.	Rs.	P.			Rs.	P.
1965													
Lime-Shell Co-operative Society Ltd., No. 2065, Kainakary. (1)	6	2	5,962.00	65	6,543.740	78,523.68	1,208.06			Kainakary, Alleppey Villages in Ambalapuzha Taluk.			
Karapuram White Shell Vyavasaya Co-operative Society Ltd., No. 144, Muhamma. (2)	5	4	4,080.00	40	5,151.200	69,264.02	1,474.07			Ariad South and North, Thanner-mukkom South and North Villages in Shertallay Taluk.	Licences increased from 40 to 60 from September 1965.		
Cochin Lime Shell Co-operative Society Ltd., No. E. 79, Edscochin. (3)	—	—	—	—	—	—	—			Ernakulam District.	Not started working.		
White Lime-Shell Co-operative Society, No. A. 190, Mattathilbhagam. (4)	1	2	120.00	15	159.568	27,024.40	1,466.70			Mattathilbhagam Aroor, Panavally, Thyccattusery Villages in Shertallay Taluk.	Started from 16-2-1965.		
Lime-Shell Co-operative Society Ltd., No. 1782, Kumarakom. (5)	12	—	14,424.00	125	12,919.460	1,55,033.52	1,240.26			Vechoor in Vaikom Taluk, Kumarakom in Kottayam Tauk.			

[24]

TABLE 16. Details of black lime-shell co-operative societies of Vembanad Lake for 1965 to 1968

Sl. No.	Name of Society	Staff position		Pay of staff per annum	No. of licensed fishermen	Shell fished during the year	Value realised during the year	Average per capita net income during the year	Area allotted for each society	Remarks
		Paid	Honorary							
1	2	3	4	5	6	7	8	9	10	11
				Rs. P.		Tonne	Rs. P.	Rs. P.		
1965										
1.	Lime-Shell Co-operative Society, No. 2462, Ariad. (1)	1	9	1,248.00	146	2,677.980	56,208.65	316.50	Ariad North and South and Alleppey villages in Ambalapuzha Taluk.	
2.	Muhamma Lime-Shell Vyavasaya Co-operative Society, No. 2551, Muhamma. (2)	2	5	2,532.00	30	2,807.420	49,820.43	832.33	Thanneermukkom South and North and Kokkothamangalam villages and Shertallay Municipality.	Licences increased from 30 to 99 from April 1965.
3.	Kuthiathode Lime-Shell Vyavasaya Co-operative Society Ltd., No. A. 193, Eramallur (3)	—	—	—	—	—	—	—	Aroor, Vaduthala, Mattathilbhagam, Thuravoor North and South villages.	Not started fishing.
4.	Lime-Shell Co-operative Society Ltd., No. 239, Thyccattussery. (4)	—	—	—	—	—	—	—	Pallipuram, Thyccattussery Panavally and East Vayalar villages.	Not established in 1965.

				1966				
1.	6	2	7,012.00	65	6,567.640	99,417.63	1,529.50	
2.	5	4	3,463.85	60	5,796.320	1,18,723.22	1,979.55	
3.	—	—	—	—	—	—	—	Not started working.
4.	2	1	1,200.00	30	1,532.840	33,615.76	966.66	
5.	11	—	14,507.00	125	11,560.420	1,54,519.68	1,236.16	
				1967				
1.	6	2	9,045.00	65	7,041.060	1,18,306.89	1,764.34	New licences from 65 to 83 from April 1967.
2.	5	4	11,015.15	60	6,405.950	1,05,698.67	1,761.64	
3.	3	—	650.00	21	1,723.540	37,056.11	1,764.58	From March lime-shell fishing started.
4.	3	—	3,360.00	30	2,471.100	58,700.85	1,766.65	
5.	11	—	18,364.00	125	15,094.420	2,60,782.48	1,765.94	New licences from 125 to 157 from April 1967.
				1968				
1.	6	2	10,038.00	83	5,582.600	1,06,069.40	1,268.40	New licences from 83 to 108 from April 1968.
2.	5	4	11,015.15	60	4,726.900	99,935.73	1,665.60	
3.	3	—	3,000.00	21	832.120	19,387.52	923.22	
4.	3	—	3,720.00	30	2,297.560	53,552.16	1,600.00	New licences from 30 to 50 from September 1968.
5.	11	—	19,510.00	157	12,372.940	2,35,085.86	1,376.53	New licences from 157 to 204 from October 1968.

5.	Lime-Shell Co-operative Society Ltd., No. 3145, Vaikom. (5)	1	—	1,200.00	76	2,411.060	40,623.83	460.52	Vaikom, Naduvila, Vadakemury, Kula-sekharamangalam and Chembu villages.
6.	Vechoor Lime-Shell Co-operative Society Ltd., No. 2407, Vechoor. (6)	2	2	1,500.00	67	788.500	16,548.17	246.99	Vechoor village in Vaikom Taluk and Kumarakom village in Kottayam Taluk.
1966									
1.	(1)	1	9	1,542.00	156	2,922.780	65,400.97	412.73	
2.	(2)	3	5	3,787.00	99	2,834.420	55,089.65	556.15	
3.	(3)	—	—	—	—	—	—	—	Not started Fishing.
4.	(4)	3	—	440.00	30	1,119.800	30,829.83	833.33	Started working in April 1966.
5.	(5)	1	—	1,380.00	69	2,067.340	44,354.03	550.91	
6.	(6)	2	2	1,500.00	67	800.660	15,623.89	233.19	
1967									
1.	(1)	1	9	1,950.00	156	2,562.480	59,003.00	378.22	
2.	(2)	3	5	4,130.00	109	2,017.140	55,719.00	423.08	Licences increased from 99 to 109 in April 1967.
3.	(3)	—	—	—	15	13.300	349.05	23.81	Shell fishing from October 1967.
4.	(4)	3	—	2,880.00	30	2,001.160	45,753.26	1,256.76	Illicit Lime-shell fishermen were routing their catch through the members of the Society. The illicit collectors were given licences in 1968.
5.	(5)	1	—	1,620.00	77	199.934	54,256.74	623.50	
6.	(6)	2	2	1,920.00	67	643.280	15,474.56	230.96	

TABLE 16. *Details of black lime-shell co-operative societies of Vembanad Lake for 1965 to 1968—(Contd.)*

1	2	3	4	5	6	7	8	9	10	11
						1968				
1.	(1)	1	9	2,400.00	156	2,895.400	67,594.17	407.58		Licences increased from 156 to 211 from October 1968.
2.	(2)	3	5	4,128.00	109	1,719.880	36,752.66	337.09		Licences increased from 109 to 159 from April 1968, but the fishermen did not remit the licence fee to receive the licences.
3.	(3)	1	—	600.00	15	214.100	3,960.85	262.06		53 new licences issued in November 1968; fishing not started by new licensees in 1968.
4.	(4)	3	—	3,720.00	130	2,328.340	56,688.94	400.00		100 new licences from September 1968.
5.	(5)	1	—	1,620.00	95	2,444.160	44,247.17	431.57		
6.	(6)	2	2	2,160.00	67	493.680	12,102.06	171.42		New licences from 67 to 87 from October 1968; fishing by new licensees not started in 1968.

TABLE 18. Details of lime marketing co-operative societies for 1965 to 1968

Name of society	Paid staff	Pay of staff		Quantity of lime-shell burnt (Tonnes)	Remarks
		Rs.	P.		
<u>1965</u>					
Kummaya Vyavasaya Co-operative Society Ltd., No. 2491, Kumarakom. (1)	2	2,400.00		1,844.000	Source of lime-shell: Lime-Shell Co-operative Society, Kumarakom.
Kumaya Vyavasaya Co-operative Society Ltd., No. 2507, Pallincunnu. (2)	1	1,320.00		60.000	Do. Lime-Shell Co-operative Societies at Kumarakom, Muhamma and Kainakary.
<u>1966</u>					
(1)	2	2,520.00		1,770.000	
(2)	1	1,320.00		800.000	
<u>1967</u>					
(1)	2	2,580.00		1,946.000	
(2)	1	1,320.00		1,240.000	
<u>1968</u>					
(1)	2	2,700.00		1,930.000	112 members; of this, 80 are engaged in transporting lime in canoes to markets in different places.
(2)	2	1,760.00		2,620.000	88 members; of this, 81 are engaged in lime transportation in canoes to markets.

[20]

TABLE 17. *Quantity in Tonnes of lime-shell handled by the co-operative societies, 1965 to 1968*

Year	White shell	Black shell	Total
1965	24,773.968	8,684.960	33,458.928
1966	25,457.220	9,745.000	35,202.220
1967	32,736.070	7,437.294	40,173.364
1968	25,812.120	10,095.560	35,907.680

Whether the other possible repercussions of the conversion of south Vembanad Lake into a freshwater body has been debated is not known. The bund will check tides from reaching the south Vembanad Lake and this will in turn affect the natural drainage of the whole area touching the Lake, made possible by the low and high tides especially during the non-monsoon season. (Owing to the heavy inflow of water into the Lake during the monsoon, the tide is not appreciable in south Vembanad Lake). Also, freshwater conditions in the southern part of Vembanad Lake will favour the growth of weeds, mosquitoes, etc. which are now being controlled by the admixture of saline water during the summer months. The weeds are killed by increasing salinity and the mosquito menace is also under control during the summer months. With the advent of the bund, the growth and multiplication of weeds the year round, will affect the ecosystem and the animal communities including the clams.

CONSERVATION

The need for conservation

The biological source and the renewable nature of the lime-shell resource are largely being overlooked. The lime-shell resources are continued to be looked upon as a mere mineral resource. Depletion due to unplanned fishing, like the one described by Hornell (1910) in the case of the oyster fishery of Arcachon, has to be avoided in the clam fishery of the Vembanad Lake, and urgent measures will have to be taken for rehabilitating the already depleted clam beds of the Lake.

The establishment of Lime-Shell Research Station

The urgent need for conserving the fishery was recognised by the Department of Fisheries of Kerala and a scheme entitled 'Rehabilitation of the depleted clam beds of the Vembanad Lake' was taken up in 1964 by this Department with partial financial aid from the Indian Council of Agricultural Research, New Delhi. From April 1968 onwards the Station is solely financed by the Department of Fisheries of Kerala. The Station conducted investigations on the ecology, biology and fisheries of the clams of the Vembanad Lake with a view to suggesting to the Government, ways and means of conserving this economically important natural resource.

Prohibition of fishing under-sized clams and fishing during the breeding season

The fishing of under-sized clams is rampant throughout the Lake. But removal of under-sized clams, that is, clams below 1.9 cm (3/4 inch) in length, is specifically banned in the Kerala Lime-shells (Control) Act. A stricter enforcement of the Act is called for. The use of fishing baskets with about 2 cm square meshes is recommended, since this will allow the smaller clams to fall through while collecting and washing. The Lime-shell Act may have to be suitably amended to delegate powers to the licensing authorities for an effective control over the fishery.

Fishing implements detrimental to the living population of clams, like the 'Varandi' or the rake should be prohibited from use. As recommended by the Lime-Shell Research Station, a closed season for the fishery during the breeding season of the clams was declared by the Government in G.O. 47574/Fin. 3/67/DD dated 2-11-1967 of Development (Fisheries) Department. The clam beds at Vechoor, Chempu, Pallipuram, Thyccattussery, Aroor, Nedumbrakkad, Kokkothamangalam and North Ariad are thus protected against depletion.

Clam sanctuary

By the establishment of a clam sanctuary it is envisaged that in a congenial restricted natural habitat, unmolested by man, the clams can live, grow and propagate. As the sanctuary will be having a brood stock of clams under the best natural conditions, the clams will be producing large numbers of larvae, which by settling on the depleted clam beds to the south and north of the sanctuary will rehabilitate those overfished beds. The tidal currents will help in the dispersal of the larvae. Proposals for the establishment of a clam sanctuary at Chempu in the Lake have been submitted to the Government of Kerala by the Fisheries Department.

Clam farm cum hatchery

The idea behind the establishment of a clam farm cum hatchery is to control the physical and chemical conditions of the environment to give the clams the optimum conditions for reproduction and larval development. Only after experimental success in breeding the clams and rearing their larvae under controlled conditions is achieved, can the establishment of a clam farm be adopted as an effective counter-depletionary measure. This is rather an expensive venture and will have to be deferred for the present.

Transplantation

Transplantation is one of the commonly accepted measures for the propagation of bivalves and the connotation of the very word projects an idea of the measure to be undertaken. Tressler (1923) gives details of transplantation and culture of various molluscs practised in other countries. It may be pointed out that transplantation is more difficult with clams than with oysters since the clams do not have byssus threads and hence the spat do not attach themselves to collecting devices for easy collection and transportation. Larger clams will have to be collected and transplanted on depleted beds. This need be undertaken only as a last resort as the process is highly expensive.

CONCLUDING REMARKS

Suggestions for a judicious exploitation

Lime-shells occurring in the Vembanad Lake as sub-soil deposits have accumulated there over the centuries through the death of countless generations of clams. If these sub-fossil deposits are not removed over a few decades, there might occur loss due to erosion and leaching. Hence the need for fully exploiting the sub-fossil deposits of lime-shell in a planned way is stressed here. But the conservation of the living clams is urgently required for maintaining a sustained fishery.

The advisability of issuing fresh licences for the collection of black shells should be periodically examined. At present the lease of fishing right for white shell collection by mechanised means is granted by the Department of Geology. It is advisable that the areas allotted for mechanised fishing is restricted strictly to deeper areas of the Lake. This will obviate the usual bickerings between the local fishermen and the companies using dredgers for shell collection. It is equally important to see that the various companies are allotted small areas and to make sure that the deposits of lime-shell in these areas are completely exhausted, irrespective of the depths to which they may extend, before new areas are allotted. This will not only ensure complete utilisation of resource, but also will facilitate the repopulation of the area by living clams once the area is left unmolested after dredging. In course of time, this will result in the accretion of lime-shell deposits also. Mechanised fishing activity spread over wide areas for easy collection of the upper-most layer of the deposits, apart from not tapping the deepest strata of the deposits, will seriously disturb the settlement and growth of live clams.

Concern for the future

At present licences to the fishermen for the collection of whits and black shells are issued by the Fisheries Department and lease of fishing right by mechanised means is granted by the Geology Department of the State. It is understood that there is a proposal before the Government of Kerala to entrust the whole business of licensing or leasing the right of lime-shell collection with one of these Departments measures like the establishment of a clam sanctuary and the like that involve the least financial outlay should be taken up and the resources should be exploited in a judiciously planned way.

REFERENCES

- ANONYMOUS, 1948. A Survey of the lime-shell resources of Travancore. *Department of Research Report for the septennium 1939-46, Division of Marine Biology and Fisheries, University of Travancore, Trivandrum*, pp. 290-294.
- * BIJAWAT, H. C. AND S. L. SASTRY 1957. High Calcium Limestones of India. Published by Council of Scientific and Industrial Research, New Delhi.
- HORNELL, J. 1910. The practice of oyster culture at Arcachon and its lessons for India. *Madras Fisheries Bulletin*, 5 (2) : 1-90.
- . 1916. The utilisation of coral and shells for lime-burning in the Madras Presidency. *Ibid.*, 8 : 105-126.
- . 1917. A revision of the Indian species of *Meretrix*. *Rec. Indian Mus.*, 13 : 153-173.
- . 1918. The Edible Mollusca of the Madras Presidency. *Madras Fisheries Bulletin*, 11 : 1-57 (1917).
- . 1922. The Common Molluscs of South India. *Ibid.*, 14 : 97-215 (1921).
- KUNJU PANICKER, P. O. 1957. Notes on the progress of lime-shell industry on co-operative basis in Travancore-Cochin State and suggestions for improvement, pp. 1-85. Published by President, Kumarakom Lime-shell Co-operative Society Ltd., No. 1782, Kumarakom.
- LOGANATHAN, (Ed.) 1962. Techno-Economic Survey of Kerala. *National Council of Applied Economic Research, New Delhi*, pp. 103-105.
- * MACEDO, N. 1958. Lime Industry in India. *National Buildings Organisation, New Delhi*.
- * MENON, C. A. 1913. Cochin State Manual. Mangalodayam Company, Trichur, pp. 1-688.
- PRASHAD, B. 1921. XIV. Notes on Lamellibranchs in the Indian Museum. 3. The Genus *Villorita* Griffith and Pidgeon (= *Velorita*, Gray). *Rec. Indian Mus.*, 22 (2) : 111-119.
- PRESTON, H. B. 1916. Report on a collection of Molluscs from Cochin and Ennore backwaters. *Ibid.*, 12 (1) : 27-39.
- SEBASTIAN, M. J. 1970. The Clams and Mussels of Kerala—Prospects of a better and fuller utilisation by means of canning. *Seafood Export Journal*, 2 (4) : 25-30.
- SHETTY, H. P. C. 1963. A preliminary fishery survey of the Vembanad backwaters, Kerala Survey Report, No. 2, *Central Inland Fisheries Research Institute, Barrackpore, India*, pp. 1-24.
- TRESSLER, D. K. AND J. M. LEMON 1951. *Marine Products of Commerce*. Reinhold Publishing Corporation, New York. pp. 1-782.

* Original not consulted.