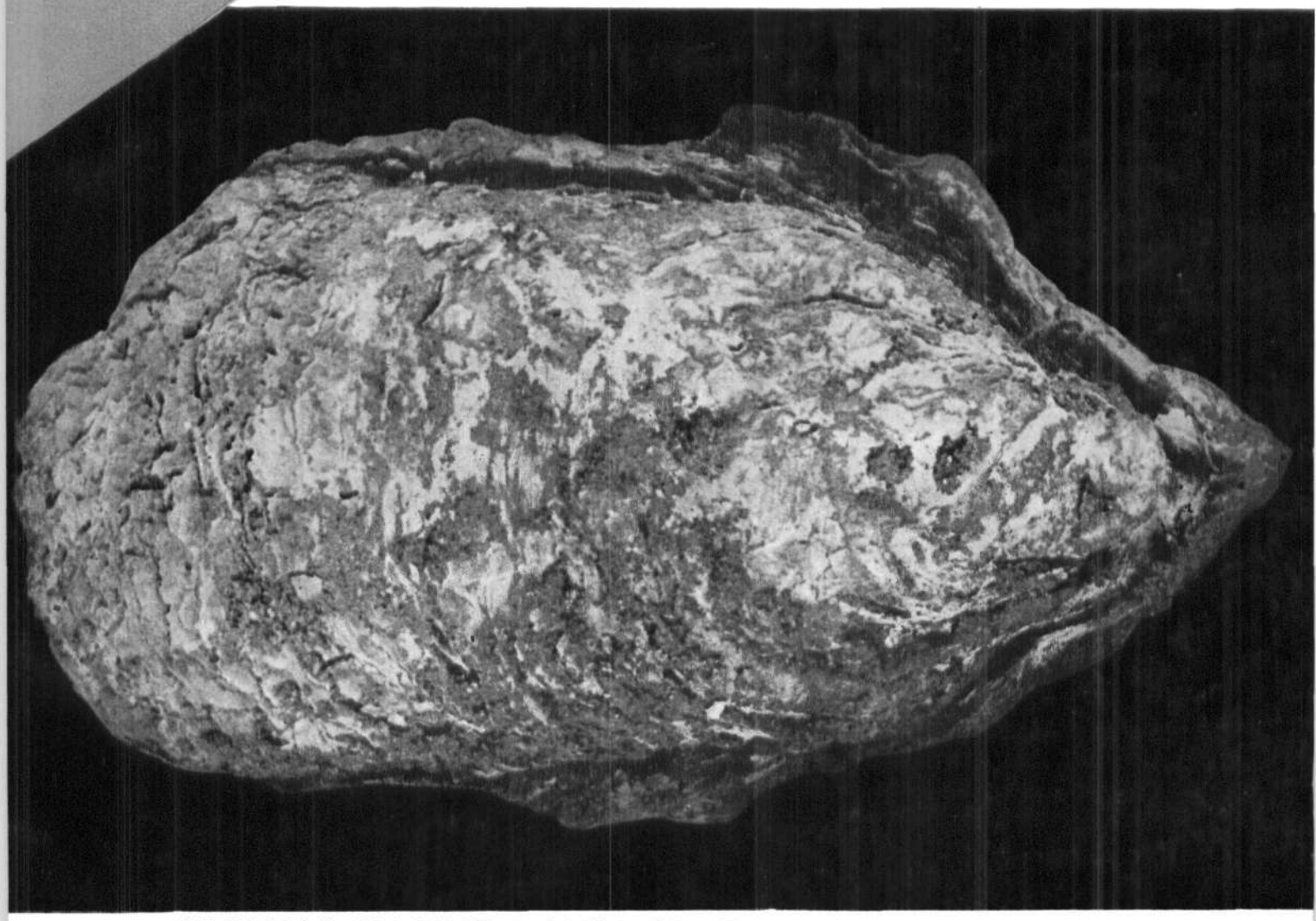
CMFRI
bulletin 38

JANUARY 1987

OYSTER CULTURE—STATUS AND PROSPECTS

Edited by : K. NAGAPPAN NAYAR AND S. MAHADEVAN



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P.B. No. 2704, Cochin 682 031, India

11

ECONOMICS OF OYSTER CULTURE

K. NAGAPPAN NAYAR[1], S. MAHADEVAN[1] AND P. MUTHIAH[1]

INTRODUCTION

Economic analysis of any system of aquaculture practice aids not only to improvise management practices but also ensures profitability. Attention on return on investment has been rightly emphasized by Mitchell and Usry (1967), Pillay (1973) and IPFC (1975) to show that well planned and properly managed aquaculture ventures compare very favourably with similar other food production industries. Hornell (1910) realising the edibility of the oyster meat and its nutritional value initiated efforts on oyster farming at Pulicat Lake and gave an approximate account of working expenses of a one ha. park. These estimates are not relevant to the present day cost but nevertheless provide an idea of the material inputs that have to go into the system. Blanco and Montalban (1955) have worked out the economics for one ha. oyster farm. Quayle (1971) and Humphries (1976) have given the production cost of oysters cultured by raft method and economics of tray culture respectively. Similarly Blanco (1972) has given the investment returns for oyster farms in Philippines. Koganezawa (1979) has stated that it is difficult to arrive at the production cost of oysters in Japan due to the wide range of culture methods and efficiency. Moreover, these enterprises are owner-operated. It is thus clear that for aquaculture, to become important in national economy the cost effectiveness is vital and it should be technologically practical and also fit into the legal and economic structure (Hanson, 1974). The technology of oyster farming experiments conducted at Tuticorin by 'rack' method has been explained by Mahadevan *et al.* (1980) and Nayar and Mahadevan (1983). Following this it was felt necessary to explain the economics of this system of oyster farming.

[1] *Present address :* CMFRI, Research Centre, Tuticorin-628 001.

THE FARM AND YIELD

Provision for an oyster farm with 90 racks for growing a stock of 500,000 oysters was made in the intertidal region of the Tuticorin Bay. Of this, a unit of 60 racks covering an area of 0.25 ha. was taken for model analysis. Each rack covered an area of 25 sq. m. with 20 trays accommodating, 4,000 oysters. The actual yield of oyster meat from this was 2,475 kg which works out to 9% of the total harvested stock.

COST STRUCTURE

The economic evaluation of 0.25 ha. oyster farm was calculated on this basis and presented in Table 1.

I. A. Initial investment :

(*a*) *Dinghy :* A fibreglass dinghy at a cost of Rs. 7,000 was used in transportation of farm materials to and from shore and farm area. The cost could be amortised over five years at Rs. 1,400 per year. If carefully handled the dinghy will be good for more number of years.

(*b*) *Rack :* For construction of a rack, 17 teak poles of 5-6 m length and 6-8 cm diameter were required. The cost of teak poles, tar coating, binding materials (coir and synthetic i.e. polypropylene ropes) and construction charges together amounted to Rs. 250 per rack. Each rack would serve for three years. Amortising the total cost for 60 racks (Rs. 15,000) yearly the annual cost worked out to Rs. 5,000.

(*c*) *Rearing trays :* 1,200 rearing trays of size 90 × 60 × 15 cm with synthetic webbing were good for three years, and at an initial cost of Rs. 40 per tray, the annual cost would be Rs. 16,000.

(*d*) *Box-type cages :* For initial rearing of spat, box-type cages of size 40 cm × 40 cm × 10 cm were used. The cost per tray was Rs. 25 with three years durability. The annual cost towards 800 cages would be Rs. 6,667. The rearing trays and cages together formed major portion (74.9%) of the annual capital cost.

(*e*) *Synthetic rope :* Synthetic rope used to suspend the box-type cages from the racks cost Rs. 833 annually.

II. Operational cost (O.C.) :

(*a*) *Seed :* For stocking the 1,200 trays in 60 racks, total seed required was 3 lakhs. The cost towards collecting the seed came to Rs. 6,000 accounting for 27.3% of operational cost.

(*b*) *Maintenance and repair :* Replacement and repair of racks and trays, forming 13.6% of the O.C. had cost Rs. 3,000.

Table 1. *Economic evaluation of oyster culture by rack method in* 0.25 *ha.*

Sl.No.	Items	Quantity	Initial cost Rs.	Annual depreciation Rs.	%
I. *A. Initial investment :*					
(*a*) Dinghy	..	1	7,000.00	1,400.00	4.6
(*b*) Racks	..	60	15,000.00	5,000.00	16.5
(*c*) Rearing trays	..	1,200	48,000.00	16,000.00	52.9
(*d*) Box-type cages	..	800	20,000.00	6,666.66	22.0
(*e*) Synthetic rope	..		2,500.00	833.33	2.8
(*f*) Farm accessaries	..		1,000.00	333.33	1.1
Total			93,500.00	30,233.32 or 30,233.00	99.9
I. B. Interest @ 12%	..		11,220.00	11,220.00	
			1,04,720.00	41,453.32	
II. *Operational Cost* :					
(*a*) Seed 3 lakhs	..			6,000.00	27.3
(*b*) Maintenance and repair	..			3,000.00	13.6
(*c*) Labour	..			8,000.00	36.3
(*d*) Predator eradication	..			2,000.00	9.0
(*e*) Harvesting	..			3,000.00	13.6
Total	..			22,000.00	99.8
III. Annual cost of racks and trays operational cost and			..	63,453.00	
IV. Gross income through sale of oysters @ Rs. 37/kg. for 2,475 kg of meat			..	91,575.00	
V. Net income			..	28,122.00	
Ratio to annual cost	..	44.3			
Ratio to Gross income	..	30.7			
Ratio to investment	..	30.1			

(*f*) *Farm accessories :* Farm accessories i.e., iron stand, hammers and scrappers etc. cost annually Rs. 333 forming 1.1% of the fixed cost.

Thus the initial cost came to Rs. 93,500 and the annual cost worked to Rs. 30,233. The cost towards the purification of oysters, salary of supervisory staff and rent of land were not included.

I. B. Interest :

Interst at the rate of 12% on investment worked out to Rs. 11,220.

(*c*) *Labour cost :* The annual labour cost incurred towards maintenance of rack and periodical cleaning of oyster cages was Rs. 8,000. This formed 36.3% of the O.C. During July to November when predation of stock by the gastropod *Cymatium cingulatum* was intensive, labour cost involved in eradication came to Rs. 2,000 forming 9% of O.C. Harvesting entire stock and subsequent cleaning cost came to Rs. 3,000. Thus the total labour cost formed 72.5% of annual O.C.

Ratio to Investment

The total annual production cost towards 2,475 kg of oyster meat came to Rs. 63,453. The objectives of oyster culture at Tuticorin were two-fold. One is to develop a suitable technology of farming oysters to marketable size and the other is to popularise oyster culture and establish a market for the oysters produced. Since this is altogether a new product for consumption by local people, steps were taken to distribute samples of shucked meat to public and different agencies to ascertain their opinion about the quality and palatability of the oyster meat. Major portion of harvested oyster meat was utilised for this extension work and also towards evolving suitable processing technology like smoking, deep freezing and canning. In an effort to popularise the oyster meat consumption amongst the public, a basic market price of Rs. 16 was arrived at although Rs. 37 per kg could be the actual worked out cost considering expenditure and inputs. While calculating the economics, the latter has been taken as the criterion. In order to popularise, oyster meat was sold locally at Rs. 16 per kg. Realising that the price could go up with popular demand in future years a price of Rs. 37 per kg of oyster meat was taken for calculating the ratio to investment. The sale of oyster meat at the rate of Rs. 37 would fetch Rs. 91,575. The net income could be Rs. 28,121. The break-even price of one kg of meat produced was Rs. 25.63. The break-even proudction would be 1,714 kg of oyster meat.

Ratio of net income to the annual cost works out to 44.3%. The ratio of net income to investment is 30.1% which is better than the return furnished by Blanco (1972) for Bacoor Bay oyster farm (20.5%) and slightly lower than the return from Binakayan Demonstration Farm, Philippines (38.48%).

Remarks

Gerhardsen (1979) remarks that the natural resources, labour and capital are the main factors affecting production from aquaculture. Regarding natural resources Hornell (1910, 1914, 1917, 1922), Rai (1928), Rao (1963), Alagarswami and Narasimham (1973) and Nayar and Mahadevan (1974) have drawn attention to the potentialities and availability of edible oysters all along the Indian coasts, particularly the east coast. Nayar and Mahadevan (1983) estimated that at least a considerable portion of 2 million ha. of backwaters and brackish waters area could be profitabily utilised for oyster culture along the east coast. For the present the requirement of seed for the above farming activities, can be easily procured from the intertidal open sea bay area following the 'tile' collection technique. It is fully recognised that seed collection dependant on natural resources has to be eliminated ultimately by developing a seed production technique through hatchery system. The Central Marine Fisheries Research Institute has taken note of this priority area for research and development devoting attention to achieve a breakthrough in hatchery production. Successful hatchery production of oyster spat has been achieved and the Tuticorin hatchery is at present in a position to ensure production of any number of oyster spat needed for large scale culture (Nayar *et al.*, 1984).

The aim of entrepreneurs will be to maximise income or to maximise return on investment. The return can be maximised by mechanisation at any desired level as Korringa (1976) observed that the return from mussel culture outgrew Dutch oyster industry because of mechanisation. Mechanisation can effectively reduce the labour cost which forms 72.5% of the operational cost.

Maximisation of income can also be achieved by effective prevention of predation since eradication of predators cost 9% of operational cost. Mackenzie (1970) calculated that $ 40 spent for chemicals used in eradication of predatory drills, increases the production cost of oysters. This is an area needing further research.

Production cost of oyster differs according to the culture method adopted and the scale of operation. Rabanal and Shang (1979) stated that the economic profitability of aquaculture can be improved, not only by increasing productivity, but also by reducing the production cost, and improving prices of the product. The production of rack and tray system can be increased two fold by adopting two tier system of arranging the trays one below the other unlike the present single file system (Nayar and Mahadevan, 1983). There is ample scope to reduce the cost by devising cheaper and suitable cages instead of the present synthetic netted iron frame trays and cages which cost 74.9% of the annual capital cost. A series of successful oyster culture experiments conducted here in 1985 using rens indicate the bright prospects of bringing down the cost on initial investment in regard to items (c) and (d) and on items (a) and (b) under O.C.

Preparation of the harvested oysters prior to sale in the market adds expenditure to the total cost. Especially in the culture of molluscs, the cost incurred on purification is an additional expense. If aquaculture is organised on co-operative basis, the purification system can be developed as a common facility thus reducing capital cost.

Towards obtaining high returns for the product, local demand for oysters has to be created by evolving better marketing strategy and creating market channels. Realising the potentiality of consumer demand from distant interior places and the market in foreign countries, steps for properly canning the oyster meat have been taken up by CMFRI in collaboration with Integrated Fisheries Project, Cochin.

Mariculture practices have to be classified as high-risk activities due to the enigmatic variations in the environmental parameters and their adverse impact on the culture operations by natural calamities, diseases, predation and pollution due to agricultural and industrial effluents. Crop insurance cover is one of the means for mitigating the possible losses. Although agricultural operations have been protected now by insurance cover it would take time for recognition in mariculture. In the meantime some suitable methods for evolving reasonable premia levels for aquaculture stocks can be formulated.

By blending sea farming with traditional fishing as suggested by Silas (1977) the traditional fishermen and their family members with a little training on seed collection and management of farm stock would greatly help to enhance oyster production and their earnings. 22.6% of operational cost of oysters can be reduced if their family members themselves can look after farm maintenance and predator eradication. As an experimental measure, fifteen fishermen families adopted oyster culture work under the transfer of technology programme on oyster culture and effectively managed 45 racks, which avocation yielded promising results and increased their annual income (Nayar *et al.*, 1979).

REFERENCES

ALAGARSWAMI, K. AND K. A. NARASIMHAM. 1973. Clams, cockle and oyster resources of the Indian coasts. *Proc. Symp. Living Resources of the Seas around India. Special Publication, CMFRI* : 648-658.

BLANCO, G. J. 1972. Economic trends of coastal aquaculture in the Philippines. In : *Coastal Aquaculture in the Indo-Pacific Region*, T. V. R. Pillay (Ed.), Fishing News Books Ltd. Farham, Surrey, England : 490-497.

BLANCO, G. J. AND H. R. MONTALBAN, 1955. Scheme of oyster farming in Philippines. *Agr. Ind. Life* 17 : 8 (46) : 48-50.

GERHARDSEN, G. N. 1979. Aquaculture and integrated rural development with special reference to economic factors. In : *Advances in Aquaculture*, T. V. R. Pillay and Wm. A. Dill (Eds.), Fishing News Books Ltd., Farham, Surrey, England : 10-22.

HANSON, J. A. 1974. A national mariculture program. In : *Open sea mariculture*, J. A. Hanson (Ed.), Hutchinson and Ross.

HORNELL, J. 1910. The practices of oyster culture at Arcachon (France) and its lessons for India. *Madras. Fish. Bull.*, **5** : 1-9.

HORNELL, J. 1916. A note on the edible oyster. *Madras Fish. Bull.* **8** : 1-10.

HORNELL, J. 1918. The edible Molluscs of the Madras Presidency, *Madras Fish. Bull.*, **11** : 1-51.

HORNELL, J. 1922. The Common Molluscs of South India. *Madras Fish. Bull.*, **14** : 97-215.

HUMPHRIES, M. 1976. The production and marketing of Tray-cultured raft oysters in British Columbia (unpublished report)

IPFC, 1975. Report on studies on the economics of aquaculture in the Indo-Pacific region.

KOGANEZAWA, A. 1979. The status of Pacific oyster culture in Japan. In : *Advances in Aquaculture*. T. V. R. Pillay and Wm. A. Dill (Eds.), Fishing News Books Ltd., England : 332-337.

KORRINGA, P. 1976. *Farming marine organisms low in the Food chain*. Elsevier, Amsterdam. 264 pp.

MACKENZIE, C. L. 1970. Oyste culture in Long Island Sound 1966-69. *Commercial Fish. Review*. January 1979 ; 27-40.

MAHADEVAN, S., K. NAGAPPAN NAYAR AND P. MUTHIAH. 1980. Oyster farming at Tuticorin. *Mar. Fish. Inform. Serv. T & E Ser.*, **26** : 1-3.

MITCHELL, E. G. AND M. J. USRY. 1967. Cat fish farming a profit opportunity for Mississipians. Jackson, Mississippi, *Mississippi Research and Development Centre*, pp. 83.

NAYAR, K. N. AND S. MAHADEVAN. 1974. III Edible Bivalves. Clams and others. In : The Commercial molluscs of India. *Bull. Cent. Mar. Fish. Res. Inst.* **25** : 40-53.

NAYAR, K. N. AND S. MAHADEVAN. 1983. Oyster Culture at Tuticorin. *Proc. Symp. Coastal Aquaculture* Pt. **2** : 427-435.

NAYAR, K. N., P. MUTHIAH AND M. E. RAJAPANDIAN. 1979. Oyster culture in Tuticorin. *Proc. Workshop. Trans. Coast. Aquaculture, CMFRI Spl. Publ.* **6** : 59-65.

NAYAR, K. N., M. E. RAJAPANDIAN, A. D. GANDHI AND C. P. GOPINATHAN, 1984. Larval rearing and production of spat of the oyster *Crassostrea madrasensis* (Preston) in an experimental hatchery. *Indian J. Fish* 31 (2) : 233-243.

PILLAY, T. V. R. 1973. The role of aquaculture in fishery development and management. *J. Fish. Res. Board Canada.* **30** (12) : 2202-17.

QUAYLE, D. B. 1978. Pacific Oyster raft culture in British Columbia. *Bull. Res. Bd. Canada.* 178.

RABANAL, H. R. AND Y. C. SHANG. 1979. The economics of various management tecniques for pond culture of finfish. In : *Advances in Aquaculture*. T. V. R. Pillay and Wm. A. Dill (Eds.), Fishing News Books Ltd., Farnham, Surrey, England : 224-235.

RAI, H. S. 1928. An account of the oyster industry in the Islands of Bombay and Salsette. *J. Bom. Nat. Hist. Soc.*, **33** (4) : 893-898.

RAO H. S. 1941. Indian Shellfish and their fisheries. *Sci. & Cult.*, **7** : 69-78.

RAO, K. V. 1963. Edible Molluscan shellfish of India. *Indian Fisheries Bull.*, **10** (3) : 23-27.

SILAS, E. G. 1977. Blending sea farming with traditional capture fisheries. *C.M.F.R.I. Newsletter* No. 6 : 1-2.