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FISHERY OF LIVE *SCYLLA SERRATA* (FORSKÅL) AT AZHICODE IN KERALA : ECONOMICS AND IMPLICATIONS

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ABSTRACT

Live mud crab *Scylla serrata* from India is being exported to Singapore and Malaysia. A fishery exists at Azhicode in Kerala. The season for its fishery is March – August with peak in May and the gear used is a ring net called *'Nanduvala'*. Estimated annual production here is about 70 tonnes. Hard crabs fetch a higher price than the soft ones. Investment being low, the return on investment is high and the daily earning per fisherman is Rs. 57. Crab farming, fattening and hardening soft ones could be tried at Azhicode to enhance production.

INTRODUCTION

FISHING by hand line having single or multiple hooks, hook and line, drag net, cast net, drift net and Chineese dip net for the mud crab *Scylla serrata* is in vogue in the backwaters of Kerala. Mud crab is a Malaysian favourite (Ferdouse, 1990) and the demand for live crabs from Singapore and Malaysia in the last couple of years resulted at Azhicode in the introduction of *Nanduvala*, which has the advantages of a higher catch with no damage. The crab resources and their fishery at various places in the country have been dealt with by Jones (1967), Datta (1973), Rao *et al.* (1973), Joel and Raj (1987) and Prasad *et al.* (1990). Recent reports on the *S. serrata* fishery of the Cochin Backwater is by Devasia and Balakrishnan (1985) and Sheeba Thariyan (1988). The present communication is on the fishery for live mud crabs at Azhicode with emphasis on economics, implications of fishery and management.

FISHERY

Azhicode, 30 km from Cochin, is the northernmost region of Vembanad Lake where a good fishery for mud crab exists. The crabs, it is believed, come out of their hidings to feed on fishes which enter the backwaters during high tide. The fishery for it, hence usually occurs at high tide. The gear used for the fishery at Azhicode is a ring net *Nanduvala*. It consists of a ring of 75 cm diameter made of 9 mm thick MS rod to which a nylon net of mesh size 3 cm is attached in such manner that the net sags a little when hung. Three, 2 mm thick nylon strings of 50 cm long tied to the ring form a bridle to which is fastened a 4 mm thick nylon rope of about 4 m long with a float of either preferably thermocol or 1 lt empty plastic jerry can at its free end. Two nylon strings are tied across the ring crossing each other at the centre. To each string, halfway from the centre, but on its either side is tied a 10 mm long nylon string of 2 mm thickness with its end made into a lasso in which the bait can be held. Bait used for crab fishery is the meat of eel caught by hand line using fish and prawn waste. The eel caught is skinned, cut into pieces, salted for a day and used. When eel is not available it is substituted by catfish head. For fishing, 10-15 baited *Nanduvala* are placed in a row one after

another each a few metres apart and left for half an hour or so. It is then lifted and the crab picked by one person, while the other handles the canoe. The crab is immediately tied with the chelae folded close to the body and kept in damp gunny bags. The *Nanduvala* is placed back at the same spot making good the bait lost, if the ground appears good. The canoe then moves to the next *Nanduvala* and fishing at a ground may last for 2 hrs after which the unit shifts to other areas. In case the catch at a ground is not good the unit may select a fresh ground immediately. Fishing lasts

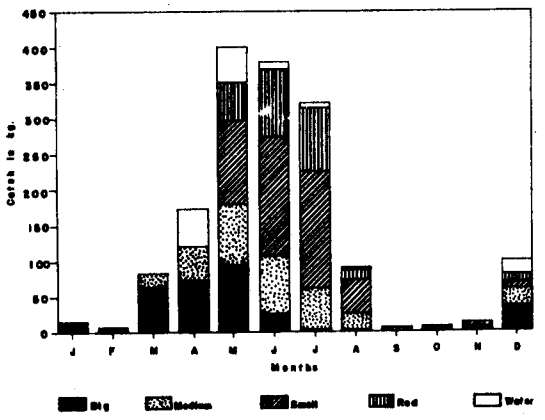

Fig. 1. Landings of *Scylla* spp. at Azhikode in 1990.

for 6-8 hrs and the catch without damage sorted out depending on the weight and moult stage is sold live to agents the same day. Hard crabs known as 'mud' are separated and graded as big (> 550 g), medium (350-550 g) and small (< 350 g). Crabs which are in the moult stages, ascertained by pressing the ventral side of the carapace are categorized as 'water'. Apart from *Scylla serrata* another variety *S. serrata serrata* is also caught, but categorized as 'red'. There is no size specification for the 'red' and 'water' groups. Securely tied crabs are transferred to barrel shaped wicker baskets tied tightly with coir ropes. A basket holds approximately 20-25 kg of crabs. From the collection centre at Pallipuram in Vypeen Island they are brought to Ernakulam and sent by train to Madras for airlifting to Singapore and Malaysia the next day. The crabs, it is reported reach live with minimum damage and mortality.

The fishing season starts in March and extends upto August with peak in May (Fig. 1). It may be observed that the small group of 'mud' dominate in the fishery during May-July, whereas the big and medium are dominant in March, April and December. The annual mean catch by a unit observed from 10 is 1,764 kg. On an average 40 units operate in the backwaters at Azhicode and an estimated annual exploitation is about 70 tonnes.

ECONOMICS

Data was collected from ten fishermen in 1990 on expenditure and income. A fishing unit normally consists of 2 fishermen. The income is divided equally between them as it generally is a family venture. There may be rare instances when a unit is operated by a single person. In such cases, the rings in a unit will be maximum only 7 or 8 in number. Also when family members cannot join a unit on a day, a fisherman from outside the family is engaged on equal share. This is done to avoid idling a unit especially at times of good catch.

The annual average expenditure in rupees for a unit consisting of 2 fishermen is as follows :

Cost of canoe		3,000
Cost of *Nanduvala* @ Rs. 50 for 10		500
Cost of hooks and nylon twine		100
Cost of oil and repairing of canoe		250
Miscellaneous		150
	Total	Rs. 4,000

Income

The big 'mud' fetches a high price. The other varieties such as 'water', 'red' and 'small' are less priced. Though these are rated together for pricing they are categorized separately for

export. The average income in rupees from sale of crabs from a unit is as follows :

Mud (big) @ Rs. 55/kg for 321.6 kg	17,688
Mud (medium) @ Rs. 22/kg for 518.7 kg	11,411
Mud (small) @ Rs. 10/kg for 515 kg	5,150
Water @ Rs. 10/kg for 142.7 kg	1,427
Red @ Rs. 10/kg for 266 kg	2,660
Total	Rs. 38,336

Profit

		Rs.
A.	Investment	4,000
	Total income	38,336
	Gross profit	34,336
	Earning/fisherman/day (assuming 300 working days a year)	57.23
	ROI	858.4
B.	Fixed cost (excluding cost of canoe)	1,000
	Imputed wages for 300 labour days @ Rs. 100/day	30,000
	Interst @ 14% on Rs. 4,000 invested	560
	Total	31,560
	Net profit	6,776
Profit investment ratio = $\frac{\text{Net profit} \times 100}{\text{Investment}}$		169.4%

DISCUSSION

The live crab export during 1988-89 was 412 t valued at Rs. 7.381 million when compared to 36 tonnes valued at Rs. 0.664 million during 1987-88 (Anon., 1989). There was no export of it in live condition prior to 1987-88. Subsequent to 1988-89, the export figure and prices increased to 619 t and Rs. 13.36 million in 1989-90 and 654 t and Rs. 16.04 million in 1990-91 (Anon., 1991 a). It is also noted here that the export of live crabs became higher in terms of both quantity and value than the frozen crab meat in 1988-89. *Nanduvala* is an efficient gear and the crab which enters cannot escape. On the other hand, the catch by line fishing is less as the crabs release the bait, drop down and escape before scooping when the line is drawn up to the surface. The dip net, drag net, drift net and cast net damage the crab; rendering it unsuitable for live export. Damaged ones from them, however, contribute to export of meat. But if by chance, any get damaged in *Nanduvala*, which is practically an impossibility, it is consumed locally as no agents for meat export is available at Azhicode.

Nanduvala is a non-selective gear. The catches by it will be of assorted grades. Shanmugham and Bensam (1980) at Tuticorin observed 3 distinct groups at 115, 155 and 185-195 mm CW in the fishery and opined that for improving the quantity and quality of the catches, capture of the smallest size group could be avoided. At Azhicode, the medium and small crabs constitute largely to the fishery (Fig. 1). Sheeba Thariyan (1988) in her studies at Cochin observed female *S. serrata* to attain maturity at 109 mm and *S. serrata serrata* at 90 mm size. Similarly Prasad and Neelakantan (1989) also observed *S. serrata* to attain maturity at 91-100 mm size group. Le Reste (1976) while describing the life cycle of *S. serrata* observed them in Madagascar to leave the estuary for mangroves at 100 mm sizes for mating. These sizes constitute the medium forming 29.4% of the annual catch from the backwaters at Azhicode and the maximum of which occurs during monsoon months. Monsoon months according to Devasia and Balakrishnan (1985) and Sheeba Thariyan (1988) being the period of maximum reproductive activity in Cochin area the fishery of such sizes which come under the mating group, in such level may have negative impact on the population.

The 'small' also forms the same percentage in the catches. Export of 'small' is not encouraged. Yet the agents accept them from

the fishermen for fear of losing a regular supplier of other larger sizes. The exploitation of 'small' reduces the fishery potential of the stock. Already self imposed regulation disallowing operation of *Nanduvala*, according to the fishermen, exists in the backwaters at Cochin. Overfishing of even permitted commercial sizes, Heasman and Fielder (1977) say adversely affects the fishery. It is therefore necessary to regulate the size and time of crab fishing in any area. Introduction of selective gear like the pot which retains only large size crabs trapped inside (Williams and Hill, 1982) may be tried as a possible measure to attain this goal. Where even legislations fail, management through extension education can be effective.

Another aspect that could be looked into for augmentation of stock is ranching. But this require hatcheries for large scale production of young ones. A system is already developed (Marichamy and Rajapackiam, 1984) at Tuticorin for mass rearing of mud crabs in coastal ponds with techniques simple and relevant for establishment of a hatchery. In Japan, modern technology is utilized to produce millions of juveniles for restocking and in Taiwan commercial hatcheries were being developed (Cowan, 1984). However, more research in this is necessary in India before commercial ranching is attempted, in the lines followed for *Neptunus pelagicus* and *Portunus trituberculatus* in Japan (Cowan, 1984; Pillay, 1990).

Crab culture in Thailand is essentially a simple 'crab fattening' exercise in which undersized crabs caught from the wild are fed on animal protein diets and grown in earthern ponds until they reach marketable size (Suresh, 1991). In Taiwan, the crab farming industry is differentiated into nursery, grow-out and fattening operations, while in Philippines crabs caught from the wild are reared at low density in intertidal ponds as a minor crop with prawns and milkfish (Cowan, 1984). Marichamy *et al.* (1986) conducted cage culture of *S. serrata* in Tuticorin Bay and envisaged the scope for extensive culture. Bensam (1986) also opines that it can be cultured in cages. A pilot project on fattening of undersized crabs may be initiated and economic feasibility demonstrated to the farmers for them to take up crab culture.

Under unfed conditions crabs are highly cannibalistic. Segregating them during culture in cages can prevent this. Also adequate feeding will reduce cannibalism. However, availability of seed in any culture work is a serious problem. Information on the seeds from the wild, with a few exceptions (Kathirvel, 1980; Chandrasekaran and Natarajan, 1987), are limited. If culture is to depend on stocking of seeds collected from the wild, more knowledge on their abundance in nature is necessary.

Hard crabs as indicated in economics fetch a high price than the soft moulted ones. Lavina (1977) observed the *S. serrata* to attain complete hardness in 72 hrs after ecdysis. In the following period, lasting for about 15-20 days, the crab takes food and mineralisation of the cuticle occurs (Babu and Manjulatha, 1991). Therefore the soft ones caught in the fishery may be maintained in the ponds until they become hard. In another 75-110 days of intermoult period, active feeding resulting in replacement of the water content by muscle protein and consequent increase in weight take place. In Philippines, intense feeding of mud crabs in cages has been found to increase its weight from 175 g to 300 g in just 10 to 15 days (Anon., 1991 b). Accoring to Babu and Manjulatha (1991) the late intermoult stage is the most suitable for harvest. At Azhicode, the soft crabs were being maintained in ponds by fishermen for about 3 weeks for hardening.

But it was discontinued on account of high cost on feeding them.

The economics worked out for live *S. serrata* fishery at Azhicode shows the earning per fisherman per day to be Rs. 57.23. This is slightly higher than the income of Rs. 52 a person gets from clam fishery at Azhicode (Nasser and Noble, 1991). But it is very low when compared to the daily earning of crab trappers in Malaysia and Singapore (Macintosh, 1982). The price obtained for a kilogram of crab at Azhicode is comparable to that obtained by crab farmers in Thailand (Suresh, 1991). But the investment at Azhicode being low the return obtained is quite high and it is highly paying for one's own employment. If wages are paid, the ROI considerably reduces, yet not become a loss.

Agbayani *et al.* (1990) observed the monoculture of *S. serrata* at Philippines to be profitable with ROI being highest at a stocking density of 5000/ha. Jameson *et al.* (1982) point out that culture of *S. serrata* in the brackishwater regions of Tuticorin, if attempted would be profitable. Bensam (1986) at Tuticorin calculated a production of 16.08 tonnes/ha/6 months and said that the mud crab could be cultured profitably yielding quite a good return at a recommended stocking density of 1,60,000 caged crabs per hectare. The stocking according to this is 16 crabs/m^2 as against the rate of 2-4 crabs/m^2 followed in Thailand (Suresh, 1990). Bensam's (1986) production figures arrived at by dividing one hectare area by the area of a plastic cage he used, is a miscalculation and exaggeration. In cage culture in Philippines, fishermen are reported (Anon., 1991 b) to get a market price of $ 5.80 per kg for an initial outlay of $ 0.38 per crab.

In USA, premoult blue crabs *(Callinectes sapidus)* captured from wild are held until they moult and the moulted crabs are sold as soft-shell crabs, which fetch higher prices in the market (Pillay, 1990). The market for export of the 'water' crabs in the moulted condition from Azhicode may therefore be explored. Crabs are said to be destructive in fish ponds as they make holes on the dikes and cause leakage. Pagcatipunan (1972) therefore opined that the most suitable places to culture crabs are underdeveloped fish pond with numerous high mounts and unsubmerged regions which the crab can use as shelter. Joseph Gilbert and Pillai (1986) found the soils of culture system located in the northern and north central parts of the Cochin backwater to be more fertile than the ponds in other regions. They attributed it to intense circulation of water by tidal action and large scale deposition of silt, clay and nutrients by the Periyar River. But there are ponds at other areas which are not productive due to poor water exchange. But they can easily be converted for crab farming for crabs cannot be maintained without intense artificial feeding.

Exporters in India and Sri Lanka depend only on Air India, Air Lanka and Malaysian Airlines System for transporting the mud crab to Malaysia as they face refusal from other airlines because of the messy traditional packing (Ferdouse, 1990). Due to insufficient direct flights during the peak seasons, the longer transhipment period increases chances of mortality. Vasudeo and Kewalramani (1960) observed that *S. serrata* packed in wooden boxes with wood-shavings soaked in seawater lived for 7 days. Proper packing acceptable to other airlines, therefore has to be developed.

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