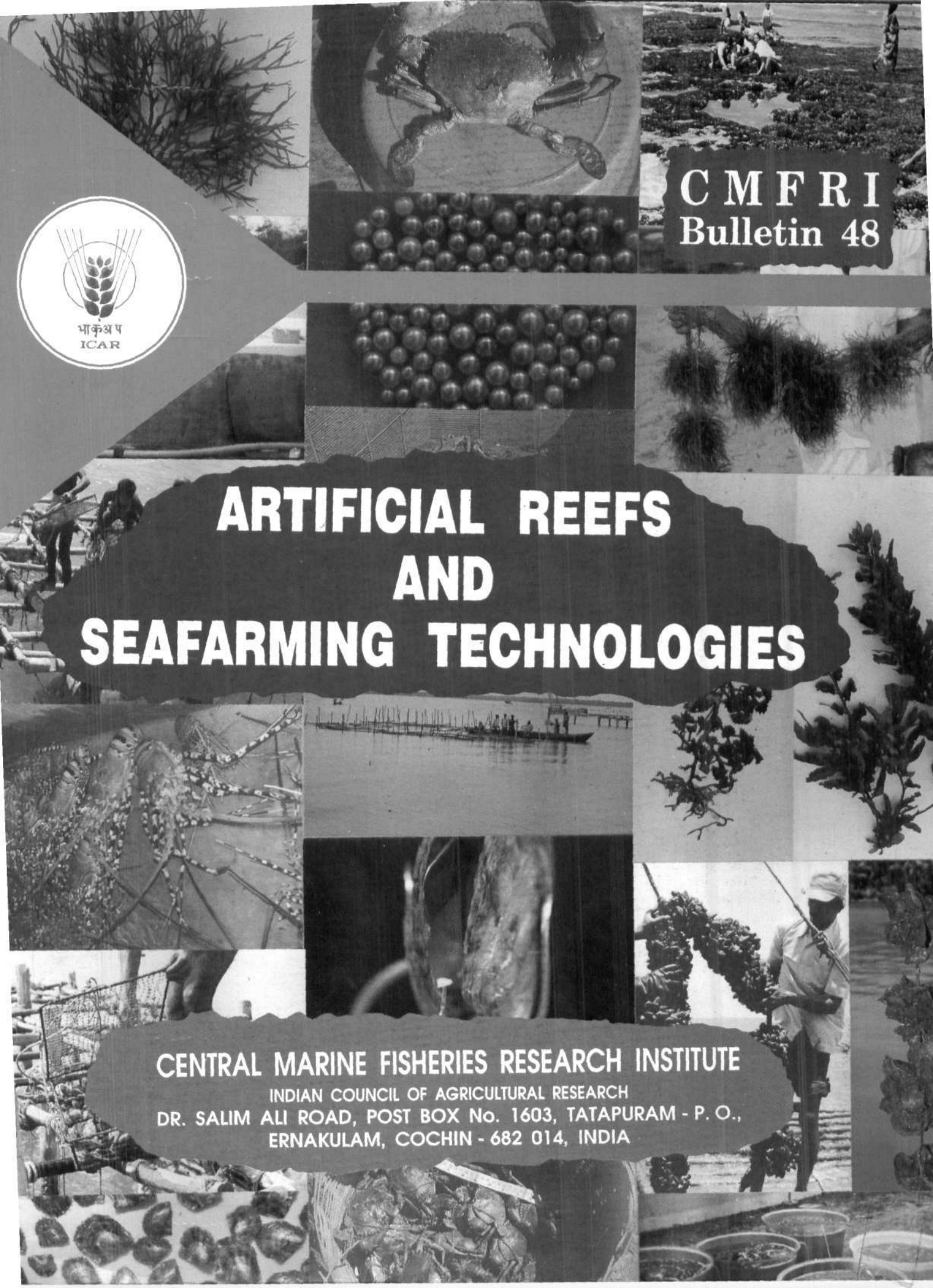

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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
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Dr. K. Rengarajan

Editor

January 1996

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CRAB CULTURE AND CRAB FATTENING

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Introduction

Among the commercially important brachyuran crabs, the species of the genus *Scylla*, which are commonly known as mud crabs, green crabs or mangrove crabs, are widely used for aquaculture purpose in the Indo-West Pacific region. In countries like Thailand, Malaysia, Indonesia, Philippines, Singapore and Taiwan, mud crab farming is practised on commercial scale, mainly by the artisanal sector. The farming methods followed and production trends in these countries have been reviewed in detail at the Regional Seminar on 'mud crab culture and trade in the Bay of Bengal region' at Surat Thani, Thailand organised by the Bay of Bengal Programme (BOBP) in 1991 (Anon., 1992). The enthusiasm for mud crab farming is ever on the increase throughout the Indo-Pacific region.

In India, the importance of live mud crabs as an export commodity has opened up great opportunities for crab farming. During the period 1989-'94, the country has exported live mud crabs to the tune of about 630 tonnes valued at Rs. 2.58 million on an average annually. The live crab export recorded a tremendous leap from 36 t in 1987-'88 to 725 t in 1993-'94. Among the maritime States, Tamil Nadu, Andhra Pradesh and Kerala have already taken up crab farming as an alternative source of income generation in the coastal rural sector. Efforts for mud crab farming in the other maritime States are also picking up in recent years.

Mud crabs

According to recent taxonomic studies on the Genus *Scylla*, the existence of atleast two distinct species of mud crabs, namely, *S. tranquebarica* (Fabricius) and *S. serrata* (Forskal) in the Indo-Pacific is established (Kathirvel and Srinivasagam, 1992). Of the two species, *S. tranquebarica* is considered to be synonymous with *S. oceanica*. *S. tranquebarica* attains a larger size than *S. serrata*. These two species are distinguished from colour markings, morphological characters such as spines on the outer border of the carpus of the cheliped, habitat preferences and behaviour. In *S. tranquebarica*, the outer margin of carpus of chelipeds bears two sharp spines, colour of upper surface of carapace light to dark green and all walking and swimming legs with polygonal markings. It is free living and rarely found in burrows. *S. serrata* has one spine on the outer border of the carpus of the cheliped, the other tooth being absent or blunt. Upper surface of carapace is greenish brown to ferrugenous brown in colour; polygonal markings absent on all legs except on the distal part of the swimming legs; lower surface of fixed finger of chelipeds dark to pinkish red in colour. It prefers to live in holes or burrows.

Distribution

Indo-Pacific in distribution, the mud crabs inhabit the marine as well as brackishwater environments. In India, both the species coexist in the inshore sea, estuaries, backwaters, coastal lakes and mangrove swamps of all maritime States on the main land and the creeks and bays of Andaman and Nicobar Islands. They prefer muddy or sandy bottom.

Biology

As in other members of Brachyura, the sexes are separate in mud crabs, the males growing to larger sizes than females. In *S. tranquebarica*, the male attains the maximum size of about 22 cm carapace width (CW) weighing about 2.5 kg and female about 20 cm CW weighing about 1.7 kg. In *S. serrata*, the maximum size attained by male is about 14 cm CW weighing about 1 kg and female about 13 cm weighing about 0.5 kg. Mud crabs are omnivorous and they feed on a wide

variety of food items such as shrimps, crabs, bivalve molluscs and fish. The females reach sexual maturity at a size of about 12 cm in *S. tranquebarica* and 8.5 cm in *S. serrata* in the brackishwater or sea. Both the species are continuous breeders, with peak breeding seasons which vary from place to place. Each animal spawns once in two months. After mating and spawning, the fertilized eggs are carried on the pleopods of female for about two weeks. The number of eggs thus carried by the incubating female varies from 0.5 to 0.9 million in *S. serrata* and 1.1 to 7.0 million in *S. tranquebarica*. The egg-bearing females ('berried crabs') migrate from estuarine areas to the inshore sea, mainly during the summer season. The eggs hatch out in the sea and undergo metamorphosis by passing through five zoeal stages and one megalopa stage before developing into the first crab stage. At megalopa stage they migrate to brackishwater areas and spread to different parts of the estuarine systems.

Farming

As mud crabs can tolerate wide range of salinities during their growing phase, brackishwater areas of all salinity gradients are used for crab farming. The most desirable ranges of water quality parameters are : salinity 10-34 ppt, temperature 23-30°C, dissolved oxygen above 3 ppm and pH 8.0-8.5. Commercial mud crab farming is done by two methods. In one method, juvenile crabs are grown to marketable size in earthern ponds for a period of 3-6 months and in the second method the medium sized or large sized crabs, preferably post-moult crabs (soft-shelled crabs or *water crabs*), are reared in cages, pens or ponds for about 20 to 30 days (or even shorter period) till the shells are hardened with additional gain in weight. The former method is generally referred to as "grow-out operation" and the latter "crab fattening".

Grow-out operation

Crab farming in earthern ponds is done either in monoculture or in polyculture with other organisms. Although extensive areas are used for this purpose in some countries, small ponds (0.3 to 0.5 ha) with sandy or sand-covered muddy bottom and a water depth of 1.5 m are ideal and easily manageable for crab farming. A sand bottom inhibits burrowing. Crabs are capable of climbing over the bunds, which is prevented by fixing overhanging fences on dykes. Fencing is done with materials like bamboo sticks, bamboo poles and knotless nets, asbestos sheets, fibreglass panels, etc. The height of the fencing ranges normally between 0.5-1.0 m above the dykes. As the crabs are highly cannibalistic especially on freshly moulted animals, 'refugee cages' made out of hollow bamboo pieces, cement pipes or stones are often placed inside the ponds to minimise mortality. Water exchange is through tidal water, the inflow and outflow of which is regulated through sluice gates. The sluice gates are provided with bamboo screens to prevent the escape of crabs. In regions where tidal influence is less, pumped-in sea water is used for crab farming as done for shrimp.

Pond preparation includes draining of water, baking in sunlight and liming. The seed crabs collected from the wild are stocked in the ponds after acclimatisation. In monoculture, the seed are stocked at the rate of 2 to 5/m^2 depending on size. In polyculture the stocking density is suitably reduced. The animals are fed with bivalve meat or trash fish at a daily ration of 5 to 10 % of body weight. The juvenile crabs of 3-4 cm CW attain marketable size of 200-300 g and 10-12 cm CW in a period of 5-6 months or larger ones of 100-200 g and 9-12 cm CW grown to marketable size of 400-600 g and 14-16 cm CW in 4-6 months. Harvest is done by draining the ponds and using scoop nets and ring nets with baits. Hooks are used to retrieve the crabs from burrows. Harvested crabs are marketed in dead or live condition. Live crabs are also restocked for further growth of fattening in appropriate culture systems.

In the East Asian countries, most of the grow-out operations are part of polyculture systems in which milkfish, penaeid prawns and seaweeds are also produced (Sivasubramaniam and Angell, 1992). In Taiwan, such farms vary in size from 1 to 200 ha. Individual rearing ponds are 0.2 - 1 ha and 1 to 4 ponds make up the average enterprise. Water is drawn from tidal channels in some farms, but many use saline ground-water which may be diluted with fresh well water to obtain the desired rearing salinity of 10-15 ppt. Dykes are protected with bamboo, brick or concrete panels. Stocking densities vary from

5000 to 10,000/ha. Snails at a feeding rate of 10 - 15 g/m²/day and trash fish at a rate of 4-5 g/m²/ day are given. In polyculture systems, milkfish are stocked at 1000-4000/ha. Crabs are stocked only during early spring and mid-summer. Market size is reached in 3-4 months during the summer and 5-6 months in the winter season, yielding a recovery of 5000-9000 crabs/ha depending on the culture system (whether mono or polyculture). Crabs with 8-9 CW are used for marketing.

In Philippines, mud crabs are only incidental harvests although some farmers take special measures to increase their yield. These include overhanging fences on dykes and soil mounds or tree stumps in the ponds for shelter. Seedlings are usually 2-3 cm CW and are stocked at only 1000/ha. With low level of management procedures the yield of crab averages only about 111 kg together with sizable quantities of milkfish and shrimp. The monoculture operations in Philippines yield 339 kg/ha.

Fattening

Crab fattening is essentially a holding operation during which post-moult or *water crabs* are kept for short periods until they 'flesh out', or immature female crabs are held until their gonads develop and fill the mantle cavity. This type of crab farming has become very popular throughout the Asian countries due to the increasing demand for gravid females and large size hard-shelled ones in seafood restaurants from Hong Kong to Indonesia. In countries like India, newly moulted crabs of sizes above 550 g and about 15 cm CW are obtained alive from commercial catches and subjected to fattening in ponds, cages or pens. The ponds used for this purpose are smaller in size (0.1-0.2 ha) with water holding capacity of 1 to 1.5 m depth. The fattening system has fencing, water exchange facility and other conditions described for the grow-out operations. The stocking density is normally 1 crab/1 to 3 m². The fattening period extends for 20-30 days by which time they 'flesh out' fully. The crabs are harvested after the shell becomes sufficiently hard and before next moulting takes place. After the completion of harvest, the ponds are prepared for the next cycle of fattening. Crab fattening/hardening is done profitably by repeated stocking and harvesting. In addition to fattening in ponds, cages made of arecanut palm splits in the size 3 x 3 x 1.5 m, with lid, are also used increasingly in the open backwaters in States like Kerala.

In Taiwan, crab fattening ponds are small, each ranging 50-600 m² in size. Most of the culture systems have 5-15 such ponds. They are provided with concrete dykes and water exchange is by tide or through pumping. Female crabs measuring 8-12 cm CW are stocked at the rate of 2-4/m² or 1/m² during summer. Feeding is done daily with trash fish upto 200 g per crab and live snail at 100 g/m². In Thailand, crab fattening in ponds and pens are very popular. Ponds are small averaging about 270 m², but an operator may have several such ponds. With a stocking size of about 415 g for the crab, the growing period extends for a month and six crops are taken a year. Crab fattening is considered to be very profitable in the Surat Thani area. In Indonesia, production of gravid females and fattening are practised besides growout operations from seed stock. Females over 150 g are cultured in floating bamboo cages, with 70-110 animals stocked in a 3 m³ cage. After one month of feeding with trash fish, 70-85 % of them develop ovaries. Fattening is done in ponds or pens and cages in lagoons. The fattening period is 3 or 4 weeks. Some fattening is done in small 0.09 m² compartments, each carrying 1 crab. Fattening ponds are 1000 m² and equipped with sluice gates, fencing and a central platform. The stocking rate for 150 g crab is 2/m² and the holding period is 3-4 weeks. Mortality ranges from 10 to 50 %. In Malaysia, floating cages of about 6 m³ with a depth of 1 m are used to culture. Netlon is commonly used for mesh. Crabs in size range 7.5-18.0 cm CW are stocked at 10/m². Chopped trash fish is given as food. The market size is 300 to 500 g, although the crabs may reach 1 kg in weight.

Economic considerations

Economic analyses of mud crab farming practised in most of the East Asian countries (Anon., 1992; Kathirvel, 1993; Viswakumar, 1993) and in India (Suseelan *et al.*, 1995) have established that crab culture is highly profitable when compared with other forms of aquaculture due to the increasing price of crabs in the international markets. Among the two types of culture, crab

fattening is considered to be more remunerative because of the fast turnover, low operating cost, high survival rate and good market demand for the end products. According to Kathirvel (1993), the initial cost for the development of 1 ha crab pond in Philippines is equivalent of about Rs. 25,000/-, while the running expenditure for one crop at Rs. 5000/ha stocking rate for 3 month rearing is the equivalent of about Rs. 24,000/-. The income realised in the first crop is Rs. 57,000/- and the net profit amounts to Rs. 33,000/- excluding the initial cost. Viswakumar (1993) reported that out of the capital investments required for construction of 1 ha farm, cost of pond construction formed about 59 % and perimeter fencing cost formed 28 %. Out of the operating cost, feed represented 37.4 %, labour 26.4 %, seed 10.7 %, depreciation 11.4 % and interest on capital, marketing, fertilizer and maintenance formed the rest. Taking into consideration of the major capital components and input requirements he worked out indicative economics of 1 ha farms, both for grow-out operation from baby crabs (2-3 cm CW) to market size (200 g weight) as well as for crab fattening during a year, which showed a profit of Rs. 27,000/- in the former and Rs. 83,500/- in the latter methods. Suseelan *et al.* (1995) more recently arrived at an annual net profit of Rs. 1,11,550/- for six crops of crab fattening in a 0.1 ha farm in Vypeen, Kerala.

Problems and prospects

When compared with shrimp farming which is now well established throughout the Indo-Pacific, culture of mud crab is only picking up in many countries especially those bordering the bay of Bengal. Even in the Southeast Asian countries where crab farming is traditionally practised, development of this sector is rather slow due to several inherent problems. One of the major constraints faced by the culturists is inadequate supply of stockable crabs as the only source for this at present is the wild stock in most of the countries where crab farming is attempted. It is, therefore, imperative that concerted efforts are needed to develop commercial hatchery for adequate and sustained supply of baby crabs to make mud crab farming an organised industry. As indiscriminate and excessive exploitation of crabs from the wild is bound to affect the natural population, mud crab farming may be popularised in a phased manner with less emphasis for large scale grow-out operations so that the pressure on wild stock can be minimised until the hatchery production of crab seed is established in the country.

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