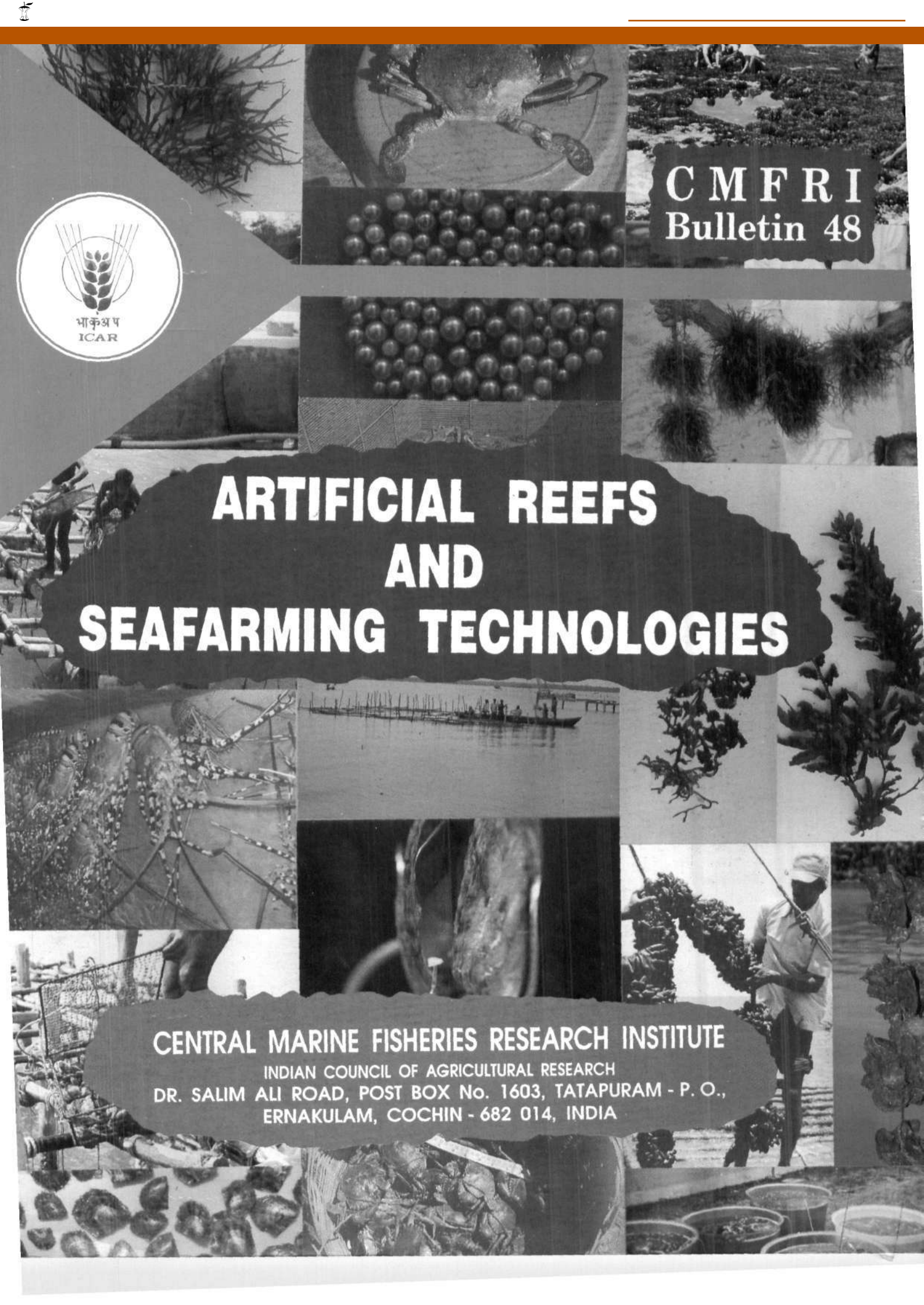
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Dr. K. Rengarajan

Editor

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MUDCRAB CULTURE AND HATCHERY

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Introduction

The capture, culture and trade of mudcrab are of increasing importance in the coastal areas of the Indo-Pacific region. Mudcrab is considered as a very expensive sea-food delicacy all-over the world. Widespread interest exists in crab fattening in the countries bordering Bay of Bengal. It is feared that the intensive and indiscriminate fishing of this marine crab and the absence of any management measures may cause a decline in the population. Its reproductive capacity is high. It is possible to culture them in specially designed coastal ponds, pens and cages. Experiments conducted in certain parts of brackishwater regions in India have shown high prospects of commercial culture. The availability of vast stretch of suitable land, tropical climate, local collection of cultivable species and the low cost labour, the potential for development of mudcrab farming in India are considered most favourable. Most of the countries including India have reported on the declining trend in mudcrab resources and stimulated aquaculture ventures in order to increase the production for export market. It is imperative to develop this valuable resource by proper management including the promotion of culture activities. Indiscriminate fishing of juvenile crabs are going on in most of the commercial fishing grounds. These juveniles can be used for further fattening in ponds. The Central Marine Fisheries Research Institute has made pioneering efforts in this aspect of study and accomplished a record of works both in field culture of mudcrab and production of seeds in hatchery system in the early years of 1980. This Institute plays a consultative role to develop and demonstrate new techniques to the interested entrepreneurs. A good number of shrimp farmers have converted their ponds suitably for crab culture and it is profitably practiced in Andhra Pradesh and Tamil Nadu.

Sources of seeds

Among the marine crabs, *Scylla serrata* and *S. oceanica* are the fast growing species and seeds are commonly available in shallow coastal waters, lagoons, brackishwater lakes, estuaries and inter-tidal swampy mangrove areas and become easily vulnerable to overfishing. *S. oceanica* (Pl. I A) is widely preferred as it grows to the biggest size. It is a free swimming animal and do not make holes in bunds or fences. *Portunus pelagicus* is also a cultivable species for farming in coastal ponds. Accidental entry of larvae of this species in shrimp farm has grown to marketable size and an additional production of 500 kg/ha in the same rearing period of four months have been realised in Tuticorin. Live mudcrabs are exported to Singapore and Hongkong and fetches better prices than the swimming crabs *Portunus* spp. The resourceful grounds and seasons for the collection of wild seeds have been identified and reported. Mudcrab culture depends to a large extent on wild seeds supply and thus becomes a limiting factor for the vast expansion of farming in coastal zones. However, a viable technology has been evolved for the production of crab seed in the hatchery at the Central Marine Fisheries Research Institute and the technology can be transferred on commercial scale production of crab seeds for the development of farming.

Methods of culture

Culture is a grow-out operation whereas fattening refers to the holding of growers or *water-crabs* for short duration to acquire maximum biological attributes so as to fetch a better price. This could be carried out in fenced ponds, pen or floating cages. Crab fattening is an advanced technology widely followed in Thailand, Taiwan, Malaysia and Indonesia. In India a good number of potential grounds adjacent to productive

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brackishwater lakes exists for the expansion of this profitable venture and envisage scope for the production in the near future.

Seed stock for crab fattening is collected from commercial fishing centres. The undersized crabs weighing less than 100 g and the newly moulted *water-crab* have a relatively low value in local markets. Such collections from indiscriminate/accidental fishing are gathered and grown further in cages for fattening. Compartmental cages made out of dealwood boxes or iron cages fabricated with nylon mesh were found suitable for fattening of advanced size crabs (Pl. I B, II A). Selective harvesting is arranged according to the size, growth and demand. Fattening of crab is profitable, because of the fast turnover, low operating cost, high survival rate due to control of cannibalism and migration, and good market demand for the end product in export trade. Crab fattening could be carried out on part time basis and needs relatively a low capital. Viable technology is available and the scope for development is promising.

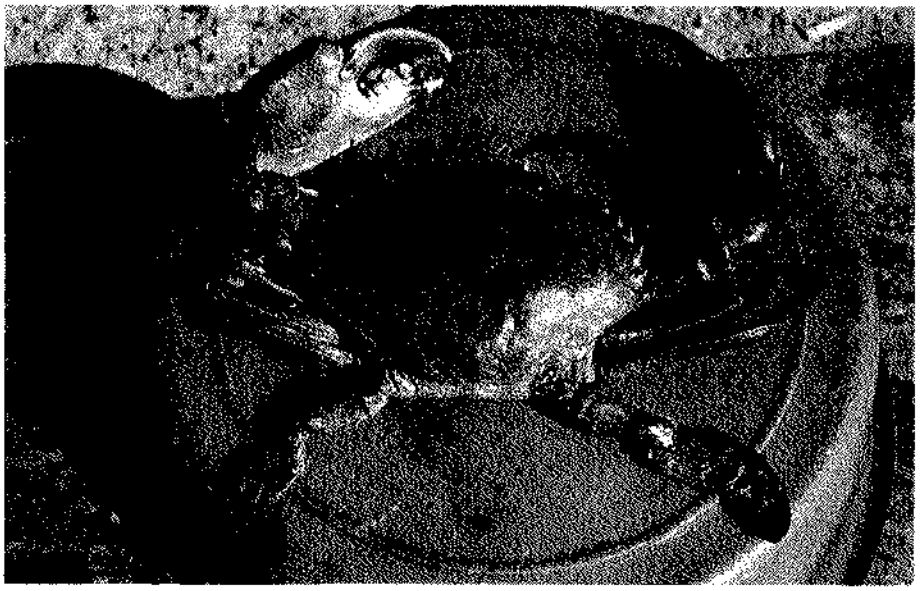
Production of gravid female crab

Mudcrab attains maturity at 90-100 mm carapace width. Females of 7 - 8 cm are gathered from commercial catches and stocked at 1 seed/ sq.m for fattening purpose. Fresh bivalve meat facilitates fast development of gonad. Much care is given to feed the stock intensively as high as to 20% of body weight. Salinity is maintained steadily and brackishwater medium in tidal areas are found suitable for operation. Loss of energy by frequent moulting is minimised in such media and the system promotes to gain weight. During fattening the sizewise growth is little, but the end product or the meat value in gravid females with fully developed gonads, command significantly higher prices. Production of gravid females under fattening method created a lucrative market in seafood restaurants in many Southeast Asian Countries. Such an attempt minimises the loss of natural stock of fully matured specimens from the wild and helps the management of stock resources. The holding could be considered almost a maturation process for the matted females. Gravid females should be harvested before they spawn. When male and female of matured size group are stocked together in a pond, that too in water with a salinity around 33 ppt, females may invariably spawn and become ovigerous or berried. Such crabs may not fetch any value in the export trade. Hence, the strategy is to rear the female in brackishwater media of low salinity or in compartmental cages separately without providing a chance to meet the male crab. In fattening process a maximum weight input of 75 to 100 g/ month is noticed in crabs of the size group of 9 -13 cm cw. This is the marketing size and crab weighs around 500 g. The trend of growth declines at this phase and so it is desirable to terminate the culture here. The period of culture in fattening system varies according to size at the time of stocking.

Farming techniques

Large scale culture of mudcrab is carried out in coastal ponds as well as by converting shrimp ponds. The intertidal mudflat in the edge of Tuticorin Bay with advantages of tidal range for water movement and circulation is developed into productive culture ponds. Fencing arrangements with palmyrah rachis on dikes are made to control the migration of crab from culture ponds (Pl. II B). Vegetative soil mounds were retained here and there to serve as natural shelter. In order to minimise the mortality of crabs particularly at the time of moulting by mighty predators, "refuge cages" made out of hollow bamboo pieces or stoneware pipes are placed at the floor of ponds and the system promoted the survival rate of the stock. Stocking density is maintained at 5000 - 10000/ha. Seeds are collected from the commercial catches of crab fishing centres such as Punnakayal and Palayakayal. Low cost trash fishes or fish offal are supplied at 10 - 15 % of body weight. Screened water is replenished by tidal exchange. Salinity in the range of 15 - 35 ppt, temperature in 23 - 30°C, oxygen more than 3 ppm and pH around 8.2 are the conducive environmental factors. However, even higher salinity in the range 35 - 45 ppt has never been a hindrance for the survival and growth of mudcrabs in coastal ponds at Tuticorin. The water depth is maintained at 1 m with adequate exchange of tidal fluctuations (Pl. III A).

The growth, survival and production rates differ according to the system of culture. Monoculture with single size stocking, monoculture with



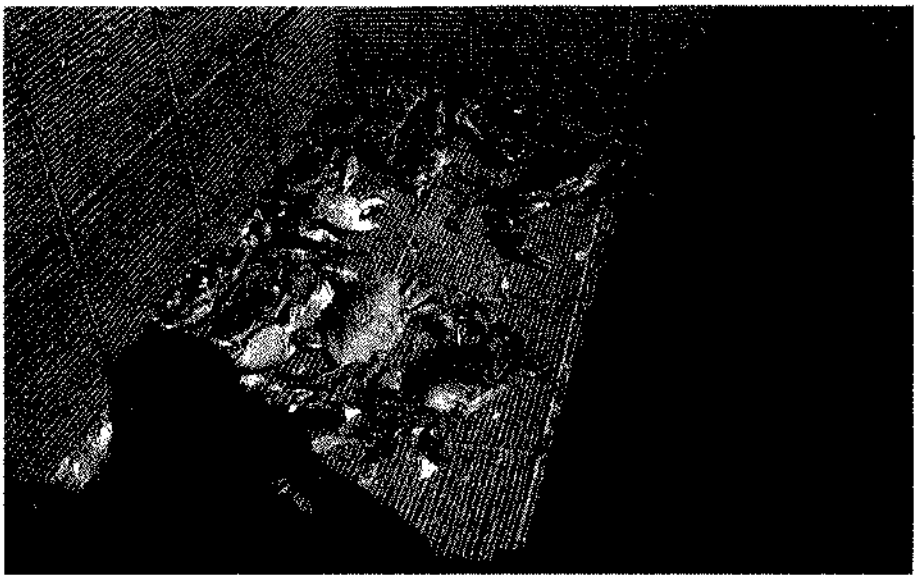
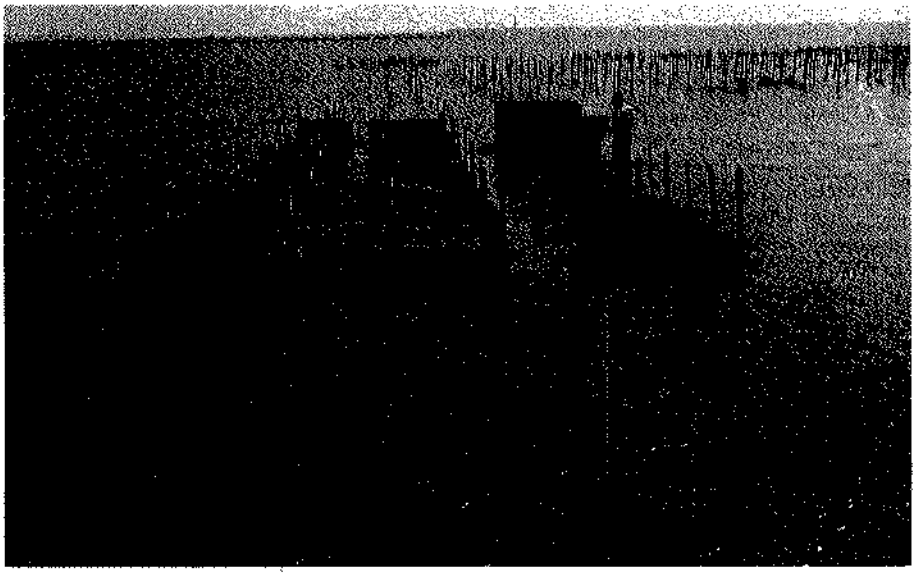


Plate I A. Mudcrab *Scylla oceanica* and B. Fattening of crabs in cages.



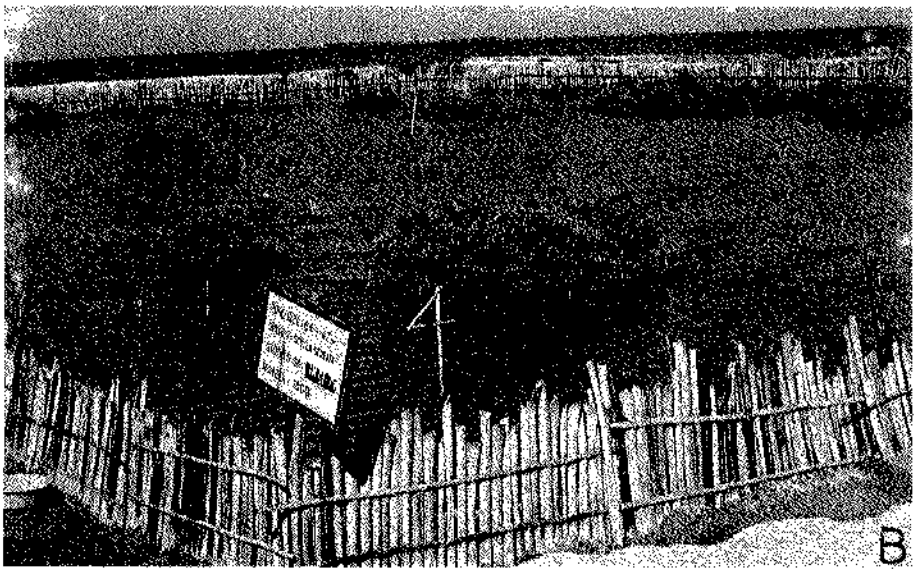


Plate II A. Collection of fattened crabs in iron-nylon meshed cages and B. Fenced, inter-tidal, coastal, crab culture pond.

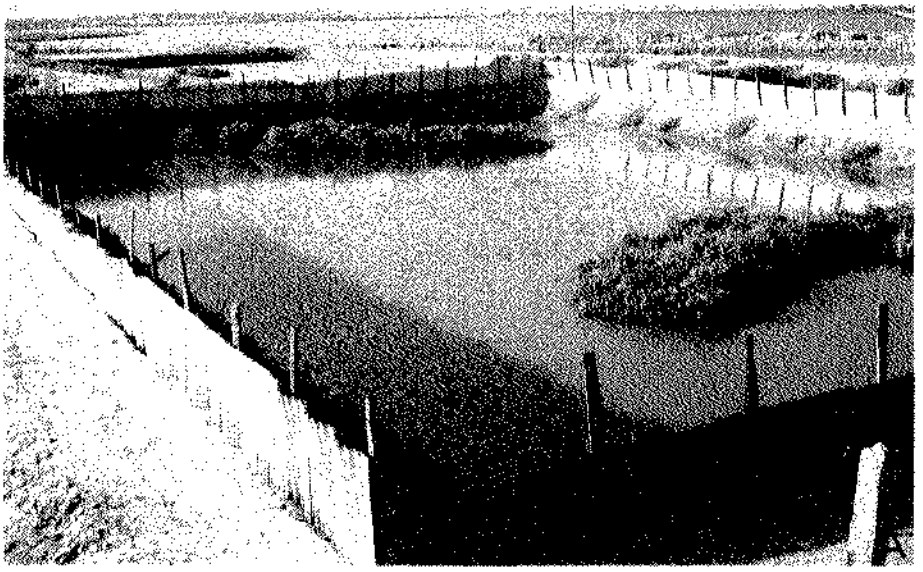
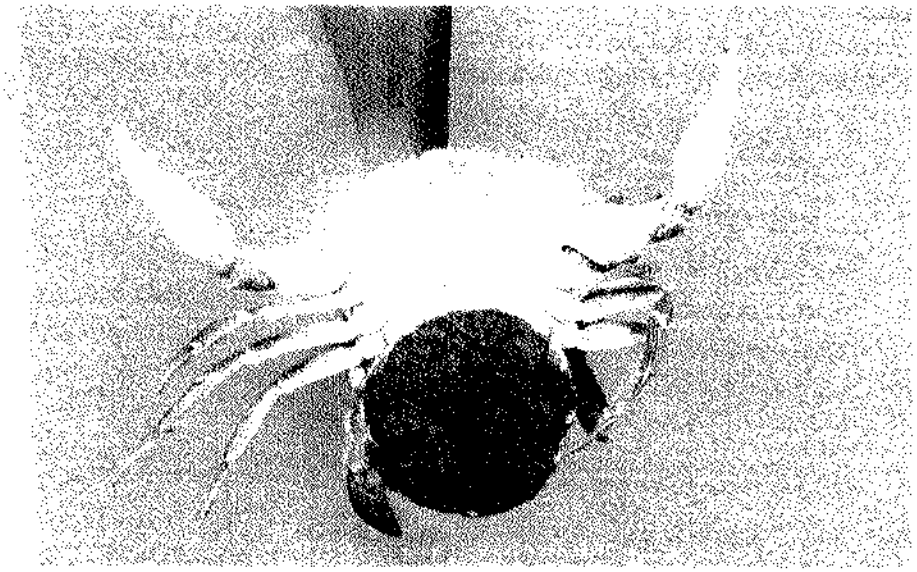


Plate III A. Crab culture pond fenced with light roof sheets and B. Part of selective harvested crabs.



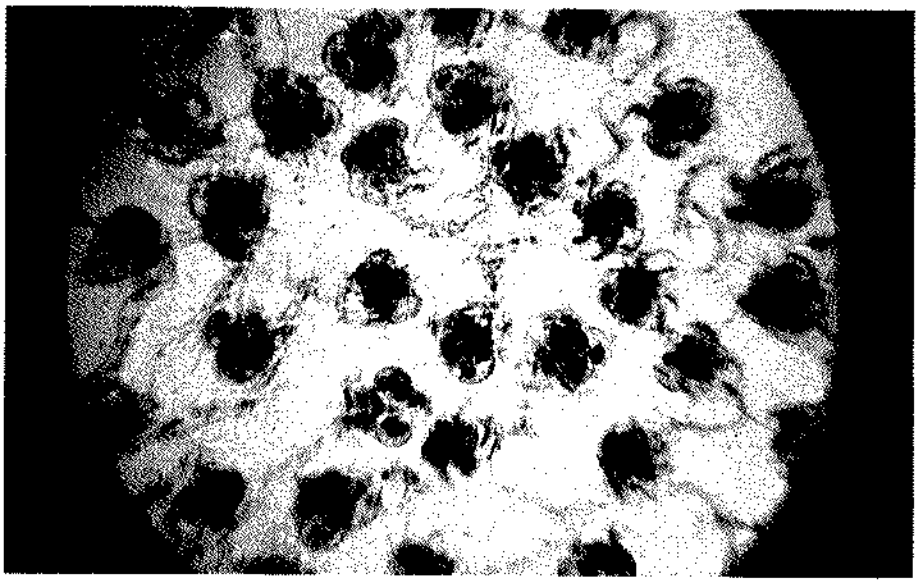


Plate IV A. Berried moderab under incubation and B. Newly hatched zoea I

multiple size stocking, polyculture with milkfish and mullets were experimented and attained encouraging production results in the range 2500 - 3000 kg/ha/crop. In polyculture system the unconsumed organic feed materials are decomposed and finally enriched the algal bloom in the culture site. This greenwater with "lab lab" and other algal matter becomes the natural food for milkfish and increased the production. Periodical sampling by cast net and hoopnet is arranged to assess the growth, survival and biomass to design the feeding dose, besides the biological studies. Selective harvesting by hoopnets with baits is preferred in multiple size stocking ponds as it enables the farmer to allow the undersized crabs to grow further. The survival is accounted at 30 - 45 % and envisaged the scope to increase this to 60 - 70 % by adopting management strategies such as frequent water exchange at 30 % of volume in ponds, intensive feeding and increase in shelters and niches in ponds. Total harvesting is arranged by draining the water completely during low tide and crabs are gathered individually by scoopnet. Marketing size crabs should be harvested around newmoon days only. Newly moulted crabs are released back to grow further. Loss of appendages results in the loss of value. Careful handling and arrest of chaelate legs by tying with fibre carefully are necessary before marketing them. The rate of growth varies from 12 - 17 mm/month. The weight input is accelerated in the range 70 - 100 g/month in the crabs of the size group 10 - 11 cm and above. This is the maturity size. Males grow faster than females. In brackishwater media the growth is still faster and the rearing period is shorter. The seed in the size 40 mm/8 g reaches the marketing size of 500 g in about 6 - 7 months and a seed of still advanced sizes (50 - 70 g) attain 400 - 500 g in 4 or 5 months (Pl. III B). In high saline environments it takes additional time to reach this size. *Chanos chanos* is the compatible fish and widely preferred in polyculture trials. It grows to 300 mm in 3 months and attains 700 g in 4 or 5 months. At the stocking density of 3000/ha and survival of 75%, the production potential is 1500 kg/ha and this additional income is realised with little input towards supplementary feed consisting a mixture of rice bran, soya powder, groundnut oil cake, etc. on alternate days. The algal matress of the pond bottom stands as the main nutritive feed for milkfish.

Brood stock development

In tropical waters, spawning occurs throughout the year. Matured crabs and spawner crabs in berried stages are available from the catches of inshore waters from the depth line 5 - 10 m off Kayalpatanam (Pl. IV A). The peak season for such occurrence is March to May and September to October coinciding the hot seasons. Spawners are safely transported in wet condition and can remain active out of seawater for about 6 to 8 hrs. Maturation of ovary and subsequent spawning takes place normally in deep sea, though it spends its life mostly in brackish coastal water zones. However, gonadal maturation and breeding is possible even in coastal ponds under the conducive salinity conditions of 33 - 36 ppt. Mudcrab matures at 100 mm cw when it is about 1 year old. Spawner crab could be developed even from the mating stage itself apart from wild collections. Berried crab reared in good laboratory conditions, may spawn more than once in a period of 5 - 6 months without copulatory ecdysis or further mating. In *Scylla*, there is multiple spawning within a single mature instar. Fecundity is 1.5 to 2 million eggs. Brackishwater is not suitable both for brood management and hatchery operations.

Culture of larvae

During the incubation period, the brood stock are fed with bivalve and crustacean meat for quicker development of ova. Active aeration, cutting of bright light in rearing tanks and adequate water change are the other essential requirements. The incubation period in laboratory conditions varied from 8 - 12 days and the influence of the temperature and salinity has been well recognised for the successful hatching of larvae. Higher the temperature shorter the period of incubation and vice-versa. Lower salinity is detrimental for larval rearing. The temperature at 28 - 31°C and the salinity around 32 ± 2 ppt are found most favourable for the release of viable larvae. Larvae of *Scylla* in tropical waters are considered to be more tolerant of high temperature and salinity than those from other regions. The zoea are liberated from eggs invariably in early morning hours and they are strongly photopositive (Pl. IV B). Mudcrab has a lengthy larval life. There are five zoeal stages taking

15 to 18 days and 1 megalopa stage lasting for 8 - 10 days which leads to first crab instar on 28th - 30th day. Diluted seawater with a salinity range of 21-27 ppt enabled the megalopa for quick metamorphosis into crab stage (Fig. 1). Filtered seawater free from contamination is provided in the hatchery by removing the dead larvae, exuvia, etc. The desired minimum size of the seed for stocking in the pond would be around 20 mm cw and the time taken in this nursery phase is 60 to 70 days. Besides this, water quality management, artificial seaweed are provided in rearing tanks so as to serve as shelters for megalopa which resulted in increased survival of stock. Megalopa are known for cannibalism and this strategy has minimised the loss of stock. Similarly, a sandy substratum is provided in rearing tanks for successful moulting of crab seed. Frequent moultings are observed when the seed stock is maintained at 21 - 27 ppt. Feeding frequency is increased to control the stock. Boiled clam meat or macerated shrimp meat are found to be the best feed at nursery phase.

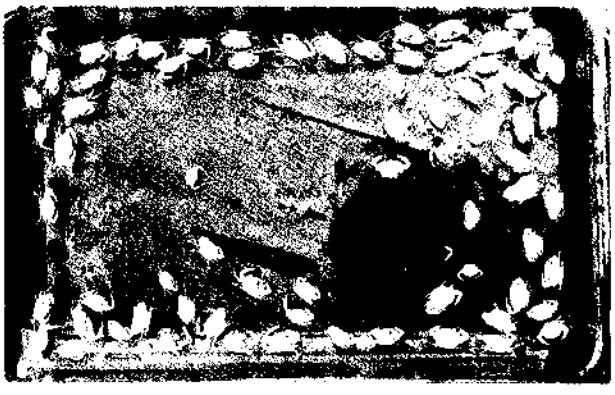


Fig. 1. Part of crab seeds produced in hatchery.

The success of larviculture largely depends upon the designing of the feeding regime. The marine rotifer *Brachionus plicatilis* raised in *Chlorella* culture is found as the best live-feed organism as it contains highly unsaturated fattyacids. *Chlorella* and rotifer cultures are maintained separately to meet the requirements in crab hatchery. A technology to run the *Chlorella* culture at a density of 2000 million cells/ml and rotifers at 70 - 100/ml has been evolved. Active larvae are segregated from the hatching tanks and stocked at 20 - 30/lt in rearing tanks of different volumes and managed as per the following feeding schedule.

Larval stage	Days	Feed
Zoea 1-2	1-8	*Skeletonema*, *Tetraselmis* and *Chlorella* 5000 cell/ml. Rotifer 5-10/ml. Egg yolk at later days.
Zoea 3-4	7-14	Rotifer 20-30/ml, *Artemia* nauplii 10-15/ml. Egg custard, fertilized bivalve eggs. BMC pellets 100 micron.
Zoea 5	15-18	*Artemia* nauplii 50/ml. Decapsulated embryo 20/ml. Minced clam meat. SUTIMAL pellets 150 - 300 micron.
Megalopa	19-30	Adult *Artemia*, copepods, macerated shrimp and clam meat.
Crab seed	28-50	Shrimp meat, copepods, clam and squid meal.

There is ample scope to increase the present rate of survival and production of seed from 15-25% to 60%. High protein micro pellet feed introduced in Japan and Malaysia and similar nutritionally balanced supplementary diet will promote our efforts towards large scale production of crab seeds. Two to three lakh seeds can be attained per run of 2 months.

Suggestions and scopes

Intensive research is needed in the area of nutritional requirements of larvae and water quality managements both in hatchery and farming. Nursery phase rearing of very young seeds has to be improved to attain better survival of seeds. The influence of lunar phase on the moulting behaviour as well as loss or gain in weight in crab are to be studied. The nursery and breeding grounds along the coast have to be protected from exploitation. This will enable a better recruitment which can promote a sustainable yield in the fishery. Seed survey and suitable land survey are equally important for the development of crab farming. The cost economics of this venture has been worked out. With an average production of 2500 kg/ha/crop of 5-6 months, an income of 4-5 lakhs is aimed. Crab culture is more remunerative than shrimp farming and fast return is realised in fattening programmes. The results on the trend of growth and production are encouraging and envisage the scope for development of crab farming in our country. The available published information and the technology evolved

in C.M.F.R.Institute both for field culture of crabs and seed production in hatchery will support and promote this new area of mariculture and the farmers have already taken a lead. This Institute has chartered demonstration programmes for crab culture and framed the norms for consultancy services for the interested entrepreneurs. Soon this will occupy a prominent place in the mariculture scenario of India.

Further reading

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