Proceedings of the Summer Institute in Recent Advances in Finfish and Shellfish Nutrition

11 TO 30 MAY 1987

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
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COCHIN-682 031

Technical Paper - 2

SUMMER INSTITUTE IN

RECENT ADVANCES IN FINFISH AND SHELLFISH NUTRITION

11-30 May, 1987

PRESENT STATUS OF CRUSTACEAN CULTURE IN INDIA

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INTRODUCTION

The crustaceans that are cultured include the most familiar decapods - the prawns, lobsters and crabs, and the smaller, lower crustaceans such as anostracans, cladocerans and copepods. The former group, due to their greater food value and economical importance, has attracted considerable attention for culture in the confined and manageable water bodies. Among them, the prawns in consideration of their demand, the state of art of culture and the developmental emphasis are most important and occupy the foremost place in the culture fisheries of India. Although the culture of lobsters and crabs has been attempted in the country since the past decade, the total effort involved both in research and development has been limited, and consequently, the technology of their culture is still in an experimental stage. The lower crustaceans cultured at present are mainly used as live food organisms for rearing larval and post-larval stages of finfishes and shellfishes. An attempt is made here to present the information on the status of culture of different crustaceans, constraints encountered and prospects available.

PRAWN CULTURE

The penaeids belonging to the genera Penaeus and Metapenaeus and carideans of the genera Macrobrachium and

Palaemon constitute the important groups of prawns involved in the culture fisheries of India. While the penaeid prawns form the principal component of the production in the aquaculture in the brackish water, Macrobrachium is mainly farmed in the fresh water regimes and in the paddy fields in the rainy season.

Prawn farming in the brackish water practised at present in India can be broadly classified into three categories on the basis of the prevailing farming systems.

1. Paddy cultivation during rainy season (June-September) followed by prawn farming in the fair season (October-April) in the low lying earthern fields adjacent to estuaries and backwaters - this system is principally concentrated in Central Kerala, along the northern coastal waters of Karnataka, Goa and to certain extent in West Bengal.

2. Prawn farming in relatively larger and deeper earthern fields throughout the year as seen in certain areas of Central Kerala and in the large 'Bheries' of West Bengal.

3. Prawn farming in the fields eradicated of undesirable organisms and prepared appropriately before stocking, stocking with species that grow fast and command good price and demand, and growing them to marketable size with supplementary feeding and water supply management as practised by progressive farmers and entrepreneurs in several regions of the country in recent times.

In the former two categories, the basic technology of prawn farming is similar. The stocking of the field is accomplished by the seed brought in by the incoming tide. The seed thus entering the field is allowed to grow for a short period by feeding on the natural food available in

the field and the stock is harvested periodically. The present prawn farming system in the country by and large follows this practice. However, due to the indiscriminate and uncontrolled stocking of seed that come along with the tide, short time allowed to grow the seed before harvesting and since no eradication or control of predatory and competitive species in the field is involved, the quality and quantity of production from these farming systems are found to be low. On the other hand, in the improved system, the yield as well as the quality of prawns harvested are of higher unit value, and consequently, this system is now rapidly spreading and gaining importance in the country.

The precise extent of area involved in each of the above categories of farming systems and the total production realised are not available. The total estuarine and brackish water area, the extent of suitable area available for prawn culture as surveyed at present, the total area under prawn farming in the country and the total prawn production from this source are estimated differently by different agencies. On the basis of the available data, information on these aspects, and the important species of penaeid prawns cultivated in different maritime states are given in Table 1. The total area utilised at present for prawn farming in the country is estimated at 42,653 ha and the total prawn production for this area as 21,119 t.

Following the awareness of the importance of prawn farming as well as the priority assigned for its development in the national and state fisheries programmes, several surveys, investigations, field experiments on the culture of prawns, information on the biological and physical inputs required to improve the system and the production, and hatchery techniques to meet the seed requirements have been endeavoured by different R & D agencies at different regions

of the country during the past 10 years. From the information available, the following observations are made.

1. In all the maritime states, there is an increasing awareness of the role of prawn farming as a definite means for augmenting production both among development promotion agencies and fish farmers.

2. Base-line information on the growth under captivity and on the availability and abundance of seed of candidate species of prawns in different estuaries and backwaters of the states are now available. The data gathered on seed resources have shown that adequate quantities of seed could be collected from the natural source for immediate culture purpose.

3. However, as often fish farmers fail to procure the seed as and when required for culture and since continued collection of seed in large quantities from nature would affect the capture fisheries, the need for establishment of hatcheries has been realised. The technique for hatchery production of seed of penaeid prawns is now available in the country. Following this, two commercial hatcheries, the Regional Shrimp Hatchery at Azhikode near Cochin belonging to the Government of Kerala and the other one at Kovalam, near Madras belonging to M/s. Hindustan Livers Ltd are now producing and supplying the seed. Besides, the commercial hatchery established recently at Asangoan in Thane District in Maharashtra has also started producing the seed. Hatcheries are also being established in Orissa, Andhra Pradesh, Tamil Nadu, Kerala and Karnataka by the Marine Products Export Development Authority and the State agencies.

4. Although there are vast potential brackish water resource, information on the sites suitable for aquaculture in different States is meagre.

5. The rate of production of prawns/fishes in the traditional practice is comparable to those obtained in experimental/semi-commercial monoculture or polyculture of selected species of prawns and fishes. However, in the former, the yield is composed of mainly smaller species of prawns, relatively smaller size of the larger species and consequently, the unit value realised is comparatively less. On the other hand, in the culture of selected species of prawns, the unit production per ha is found to be over 500 kg for culture duration of 3-4 months.

6. Base-line information on the economics of selected species culture of prawns is meagre and those available are found to differ from State to State and from operation to operation. This is due to the type of culture operation followed, farm size and its location, species selected for culture, facilities available and skill of management. Nevertheless, due to the higher unit value realised for the production in the farming of selected species, the rate of net profit is found to be about 3-5 times more over those obtained from traditional culture.

7. In the traditional farming practice followed in the country no supplementary feeding is given to the stocked prawns. Most of the experimental culture carried out have been mainly using ground nut oil cake, rice or wheat bran and fish meal or prawn head powder at the rate of 2 to 10% body weight of the stocked population. There is very little information on the use of pellet feed in the grow-out system.

8. Although increasing information on pond ecology relating to factors such as the physico-chemical parameters of pond water, soil characteristics and biological productivity are being gathered, the effects of fertilisers and manurial treatments in the tide-fed ponds are little understood. Most of the fertilizers used at present are inorganic fertilisers.

9. The techniques of brood stock maintenance and seed production of Macrobrachium rosenbergii have been developed. Although the young prawns grow well in the earthern ponds to reach a size of 200 to 250 mm during an year, the production is found to be influenced by the pond substratum, size of the pond, size-stocking density relationship, water quality, supplementary feeding and managerial skill. With different culture strategies the production is found to vary from 39.5 kg to 1929 kg/ha during a growth period varying from 90 to 150 days. The larval development of M. malcolmsonii and M. idella has been studied. Natural seed grounds of these species have been located at several regions. Field experiments on the culture of M. malcolmsonii have shown a production rate of 285-300 kg/ha/yr.

10. To provide a strong research support for the accelerated development of brackish water culture fisheries including prawn culture in the country, the Indian Council of Agricultural Research has recently established a new Institute, namely, Central Institute of Brackishwater Aquaculture. This is in addition to the active research programmes progressing at the Central Marine Fisheries Research Institute, Central Institute of Fisheries Education and at Agricultural Universities having fisheries Faculty. On the development front, all the maritime states and Union Territories have assigned priority for the development of prawn culture and have drawn up developmental projects for

implementation during the Seventh Five Year Plan period. The Union Ministry of Agriculture during the Seventh Five Year Plan period has proposed to develop 10,000 ha of brackish water area at an estimated cost of Rs. 30 crores. Besides, the Marine Export Development Authority has programmes to develop 2,200 ha during the Seventh Plan under its direct assistance apart from various other assistance to small, medium and large farmers. The Authority has also scheme to set up hatcheries, extending financial assistance and building up of technical manpower. The other Institution involved in the development of the sector are the Central Institute of Coastal Engineering for Fisheries, Indian Institute of Technology, Kharagpur and the regional Bay of Bengal Programme executed by the Food and Agricultural Organisation of the United Nations.

To achieve promising production of prawns through aquaculture it is essential to make available in adequate quantities the inputs such as suitable physical environment, a suitable economic environment, an equitable regulatory environment, incentives, land, water, capital, labour, seed, feed and fertilisers, tools and equipments, trained personnel management, market and information (research, extension and demonstration) at proper time. Thus the choice of suitable location; type of farming system to be taken up including the design of the farm, its type, size and lay-out; species to be taken up for farming; availability of seed; size of seed to be stocked; rate of stocking in the grow-out ponds; availability of suitable feed in adequate quantity and quality; water management; diseases, parasites, predators and competitors affecting the farmed prawns; physical damages caused by storms, cyclones and heavy rain fall; availability of finance to establish farms and corollary infrastructures; availability of trained personnel to execute and manage the culture projects and skilled labourers

to operate the system, and market avenue influence the production front. Besides, the policies, guidelines and priority assigned to the sector, land and water use strategies, economic strength of the society, interest and acceptance of the venture, structure of the organisation and local conventions also limit/promote the production. Nevertheless, given the proper management and a climate, bringing in the resources, technologies, finance and the skill available with us, there is little doubt that this country would be one of the major prawn producing nations in the world through aquaculture.

LOBSTER CULTURE

Although the lobsters are considered as epicurean gourmet, concerted efforts on their culture in India were initiated only ten years ago. Of the six species of the shallow water spiny lobsters available in the country, Panulirus homarus and P. ornatus are the species studied to understand their breeding, larval development and growth in captivity. Isolated experiments carried out prior to 1970 on the breeding of berried P. homarus under uncontrolled conditions and rearing of the phyllosoma larvae gave only limited success. Later, the puerulii that migrate into the coastal waters were collected by special collectors and reared in the laboratory. The results of these experiments showed that the lobsters of 35 mm carapace length grew to 57-58 mm carapace length in about 15 months and attained marketable size in 18 months. Further, during this period of growth, both males and females attained maturity, mated and subsequently, the females spawned releasing the eggs on to their pleopods. The eggs in the pleopods on further development hatched out into free swimming larvae. Although successful breeding of lobsters under controlled conditions is possible, larval rearing through different phyllosoma

stages which number IX stages and require a duration of 4 to 6 months has not so far been achieved.

Following the encouraging results of growth of puerulii in captivity, experiments were carried out to study the growth and breeding of eyestalk ablated lobsters. Fast rate of growth of eyestalk ablated lobsters, ranging from 1.45 to 2.5 g per day as against 0.35 g/day in the normal lobsters was recorded in the experiments. It was also found that the eyestalk ablated lobsters attained 180 to 200 g size during 5-6 months and 400 g in about 9-month period. Further, studies on this aspect are in progress. The main constraints in developing a viable technology of large-scale rearing of phyllosoma larvae are the long duration of larval life, and inadequate knowledge on the appropriate and suitable food on which they could be fed and reared.

CRAB CULTURE

The important species of crabs of India suitable for culture are Scylla serrata, Portunus (Portunus) sanguinolentus, Portunus (Portunus) pelagicus and Charybdis (Charybdis) cruciata. S. serrata grows to a size of 150-200 mm across carapace. It is available in the estuaries and brackish-waters and could withstand wide range of salinity variation. P (P) sanguinolentus grows to a maximum size of 150 mm across carapace and commonly occurs in the inshore sea and brackishwater regions. It breeds during February-April. P. pelagicus occurring all along the coast attains a size of 180 mm across carapace. It breeds from September to March. C. (C) cruciata, like P. (P) sanguinolentus grows to a size of 150 mm across carapace.

Because of larger size and demand, Scylla serrata has attracted more attention to culture than the other

species. Ovigerous crabs have been successfully maintained in the laboratory through the incubation period of eggs and subsequently spawned releasing about 2 million zoea larvae. The mother crabs were maintained in the medium having 32± 2°/₀₀ salinity at 26-30°C. They were fed with bivalves. The incubation period of eggs was found to be varying from 8 to 13 days. The larval development passes through five zoea stages, each of 3 to 4 days duration, and one megalopa stage. The megalopa stage lasts for about 8 to 11 days when it moults to the young crab stage. Thus, the entire larval and megalopa development completes within about 28 to 30 days. The larvae were reared by feeding with Chlorella and rotifers and the later stages with Artemia naupiii.

Experimental field culture of S. serrata has been carried out in cages and in earthern ponds. In the cage culture, basket type of cage made of split cane, box type made out of soft wood and metal framed cages were tried. The results of the experiments show that the crabs grow at relatively faster rate of 11-15 mm across carapace per month till they reach a size of 110 mm and thereafter, the growth rate slows down to 5-6 mm across carapace per month. They attain a size of 145-160 mm (400-500 g) in about 9 months. They are fed with trash fish, crushed bivalves and fish waste. It is also found that metal framed cage is preferred than other types of cages used in the experiment.

In ponds, the crabs are cultured along with milkfish and mullets. The seed crabs of 28 g size is found to grow to 600 g during a period of 8 to 11 months. The production rate is found to be 494 to 690 kg/ha.

Although these preliminary investigations have indicated encouraging results, large-scale culture of crabs requires further perfection of seed production technology,

development of suitable feed and techno-economic information on field culture.

CULTURE OF LOWER CRUSTACEANS AS LIVE FOOD ORGANISMS

Among the live food organisms used for rearing the larval and post-larval stages of finfishes and shellfishes, the brine shrimp Artemia salina is the most important one. The technology of their culture in out door containers have been developed. The preadults and adults cultured in plastic pools are fed with ground nut oil cake soaked in water. Artemia is also successfully reared in out door tanks in open sun light by manuring the medium with pig manure to maintain Chlorella bloom. Besides, the methods for decapsulation of cysts and separation of the hatched nauplii from the hatching debris are also developed.

The cladocerans of the genera Daphnia, Moina and Alona, are also mass cultured for feeding the finfish and shellfish larvae. Moina is reared in 2-ton capacity plastic lined out door pools containing tap water fertilised with ground nut oil cake, urea and superphosphate in various proportion and inoculated with a starter culture of Chlorella. As the Chlorella bloom develops, Moina is introduced. Multiplying rapidly they reach a concentration of 30,000 t - 40,000 units/lit within 7-9 days. Technologies of their culture with direct use of fertilizers, harvesting and storage are also developed.

The culture of Daphnia with brewer's yeast has shown that they multiply to the order of 12,650 to 15,000 units/ lit in seven day period.

Results of the culture experiments on the freshwater copepods and harpacticoid copepods have indicated the feasibility of their large scale culture under controlled conditions, and their utilisation for feeding the fish larvae. The technology of culture of these lower crustaceans as live food has thus greatly helped in the successful rearing of several finfish and shellfish larvae and post-larvae in the country.

Table 1. Estimated estuarine/brackish water area, extent of potential area found suitable for aquaculture as per the survey so far conducted (1985), area found suitable for prawn culture according to the survey so far conducted (1985), average production rate of prawns, estimated total production of prawns and important species cultured in different maritime States of India.

State/ Uts	Estimated estuarine/ brackish water area (million ha)	Potential area suitable for aquaculture (1985) (ha)	Area found suitable for prawn culture (1985)(ha)	Area utilised at present for prawn culture (1985)(ha)	Average production rate (kg/ha/yr)	Estimated total production of prawns (E)	Important species cultured
West Bengal	0.405	INA	INA	25,000	550	13750.0	1,2,4,5,7,8, 10,11
Orissa	0.299	31618	15,333	1,450	400	580.0	1,2,5,11
Andhra Pradesh	0.200	64000	17,000	560	500	280.0	1,2,5,10,11
Tamil Nadu	0.080	56000	16,000	95	300	28.5	1,2,4,5,7
Pondicherry	0.0008	INA	INA	68	250	17.0	1,2
Kerala	0.243	122000	11,473	7,400	600	4440.0	1,2,5,6,7,10
Karnataka	0.008	INA	INA	4,800	300	1440.0	2,3,5,6,7
Goa	0.019	INA	INA	1,300	300	390.0	2,3,5,6,7
Maharashtra	0.081	INA	14,455	1,820	80	145.6	3,5,7
Gujarat	0.376	INA	1,935	160	300	48.0	2,3,5,8,9
Total	1.7118			42,653		21119.1	

INA - Information not available

1. Penaeus monodon; 2. P. indicus; 3. P. merguiensis; 4. P. semisulcatus; 5. Metapenaeus monoceros; 6. M. dobsoni; 7. M. affinis; 8. M. brevicornis; 9. M. kutchensis; 10. Macrobrachium rosenbergii; 11. M. malcolmsonii