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Evaluation of the seed production and grow out culture of blue swimming crab *Portunus pelagicus* (Linnaeus, 1758) in India

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The demand for crabs is more for their delicacy. In view of developing protocol for seed production, nursery rearing and grow-out culture of *P. pelagicus,* experiments were conducted on the same aspects. Two larval rearing experiments, one at 50 larvae/l density and the other at 100 larvae/l density were conducted to assess the impact of stocking density on survival. Higher survival (10.3 ± 5.76%) from $Zoea_1$ to first crab instar was recorded at lower density than ($P < 0.05$) that (1.8 ± 0.91%) of higher density. A nursery rearing experiment (250 first crab instars/t), conducted to measure survival, yielded low survival (8.6 ± 0.91 %) after 15 days due to cannibalism despite provision of shelter and feed ad libitum. The grow-out culture performed in a 0.06 ha earthen pond by stocking first crab instars directly (2.6 first crab instars/m^2), to assess survival and growth, yielded 784 kg/ha on day 135 with 32.0% survival and Food Conversion Ratio (FCR) of 1.8. Crab attained commercial size (116 mm CW/112 g. wt.) as well as maturity after 5 months (20 days larval rearing + 134 days grow-out). After 135 days live crabs from grow-out can be shifted to recirculation system to produce soft shell crabs that have demand and fetch higher price than that of hard shell crab, to make the crab culture venture economical. The present study is a significant development in bringing out, *P. pelagicus* as a potential species for aquaculture.

[**Key words:** Hatchery produced first crab instars, nursery rearing, grow-out culture, shrimp feed, soft-shell crab and *Portunus pelagicus*]

Introduction

The All India Coordinated Research Project on Brackish water Fish Farming, developed technologies for finfish (milk fish and mullets) and shrimp[1]. However, the farming of shrimp is being practised in brackish water due to lucrative export returns. In 2004, the total value of the Indian aquaculture production was US $ 2936 millions, of which shrimp from brackish water accounted for 24.35% (US $ 715 millions)[2]. Shrimp *Penaeus monodon,* is the most widely cultured species in brackish water due to its fast growth and compatibility to wide range of salinity[1]. However, shrimp culture is encountering setbacks since 1995 due to consistent persistence of White Spot Syndrome Virus (WSSV), and shrimp farmers are uncertain of their returns due to frequent crop failures[3]. To ensure sustainability, industry needs diversification of resource and crab farming could be the alternate resource with potential species such as the mud crabs, *Scylla tranquebarica* (Fabricius, 1798), *Scylla serrata* (Forskal) and the blue swimming crab *Portunus pelagicus* (Linnaeus, 1758).

Demand for crabs in the internal market as well as in the export market is more for their delicacy. The Indian annual marine crab landings ranged from 20,000 to 48,380 *t* during 1975-2003 to which the blue swimming crab *P. pelagicus*[4] contributed about 30%. *Portunus pelagicus* occurs all along the Indian coast, supporting the fishery substantially along the southeast coast throughout the year. Earlier attempts made were on larval rearing[5,6], on seed production[7] and to describe larval stages based on the hatchery-reared larvae[8] besides studying moulting pattern and growth in tank conditions[9,10]. However, intensive efforts were made to standardise the protocol for seed production[11,12] of *P. pelagicus,* rearing up to F_4 generation through inbreeding (Maheswarudu, *et al.*, unpublished data). The results of the experiment on seed production and the evaluation of nursery and

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grow-out culture of *P. pelagicus* are dealt with in this paper.

Materials and methods

Larval rearing

The present study was carried out in the shrimp hatchery and marine fish farm. Two larval rearing experiments with similar design were made in succession. Six berried females (yolked eggs), three for first experiment and the other three for second experiment, collected from trawl net operations in the Palk Bay (9° 20-25′ N; 79° 5-10′ E) were transferred into 40 litre polythene cans with aeration, and transported to the hatchery. Upon arriving at the hatchery, berried females were maintained in 5 *t* capacity circular flat bottom fibreglass tank with diffused aeration by feeding them with clam meat to satiation. About 50% of water exchange was provided daily, and the leftover food material as well as the faeces was siphoned out. When the berry turned to dark green colour, each female was transferred to it capacity flat bottom oval shape tank (serially numbered) for hatching. Total number of hatched Zoeae$_1$ in each tank was estimated by taking three sub samples (2 litres each) after thoroughly mixing the water to ensure uniform distribution of zoeae in the tank, counting the zoeae in all three sub samples and raising the count to the total tank volume. Active Zoeae$_1$ (Z_1) were used for larval rearing experiments. In the first experiment Zoeae$_1$ (50 larvae/l) were stocked in three fibreglass tanks (1 *t* capacity, serially numbered). Zoeae$_1$ that hatched from individual brooder were stocked to the larval rearing tank, which bore the same number of the hatching tank to avoid bias. Similarly, for the second experiment, Zoeae$_1$ were stocked in three fibreglass tanks (1 t) at density of 100 larvae/l. Zoeae hatched on the same day from all the brooders in both the experiments. Larval rearing tanks were placed on elevated platform in the peripheral area of the hatchery shed that was open on all four sides, and with transparent roof. In both the experiments Zoeae$_1$ were reared up to first crab instar by following similar feeding pattern. Juveniles (<100 µm size) of the rotifer *Brachionus rotundiformis* were found to be suitable diet for Zoea$_1$ of *S. tranquebarica*[13]. Therefore, in both the experiments Zoea$_1$ to Zoea$_4$ were fed with rotifers (*Brachionus rotundiformis* and *B. plicatilis*), increasing their size from <100 µm to 350 µm. Zoeae$_1$ were fed with juveniles of *B. rotundiformis* (that passed through 100 µm sieve) at the concentration of 20 no/ml, and Zoea$_2$ with adults of *B. rotundiformis* (<220 µm, that were retained in 100 µm sieve) at concentration of 25 no/ml. Zoea$_3$ and Zoea$_4$ were provided with *B. plicatilis* (<350 µm) at concentration of 25 no/ml. Megalopae were fed with *Artemia* (OSI, PRO 80) nauplii (<500 µm) without enrichment, at concentration of 1-2 no/ml and with 'crumbled' shrimp feed (<200 µm) at the rate of 1.3 mg/larva/day. *Chlorella* sp was also maintained in the larval rearing tanks at concentration of 14×10^4 no/ml to facilitate feed for rotifers. The larval stages were determined according to Josileen & Menon[8]. Survival rate at each larval stage was recorded by following the method adopted for the estimation of total Zoeae$_1$ hatched out from each brooder. Settled and gravity sand filtered seawater that passed through 1 µm filter bags was used for entire hatchery operations including the live feed development[14,15]. In larval rearing, daily 30% of water exchange was provided, using respective size sieve to avoid exit of rotifer and zoeae. All the rearing tanks were provided with diffused aeration constantly. Ambient temperature (at 10.00 hrs and 16.00 hrs) and salinity (at 10.00 hrs) in all the rearing tanks were recorded daily. Temperature range was 24-27°C and salinity range was 31-32 ppt during larval rearing. Larval rearing was carried out under natural photoperiod. After 20 days, first crab instars were recovered from all the tanks for computation of survival rates. To determine the significant differences between survival rates of two density trials a repeated measure ANOVA was used. ANOVA single factor analysis was performed to assess the effect of brooder on survival rate of larvae.

Nursery rearing

Nursery rearing was conducted in an outdoor facility under shade. Three circular fibreglass tanks (5 t) were stocked each with 1, 250 first crab instars (0.25 first crab instars/l) and rearing was carried out with diffused aeration. The first crab instars that were produced from the brooder No.2 (Table 1) in the first larval rearing experiment were stocked randomly in three nursery-rearing tanks. Each tank was provided with about 10 bunches of seaweeds with a spread of 0.36 m^2 for providing shelter to the first crab instars. They were fed with prawn meat + egg custard for seven days, four times a day 15 g. each time initially, and subsequently with chopped clam meat 15 g. each

Table 1—Carapace width and weight of brooder, number of zoeae hatched per brooder, number of zoeae stocked and survival rate at each larval stage during larval rearing of *Portunus pelagicus*

S. No.	Brooder size (CW in mm/ Wt. in g.)	No. of Zoeae hatched	No. of Zoeae stocked in 1 t tank	Survival at each stage (%)					No. of first crab instars recovered
				Z_2	Z_3	Z_4	Megalopa	first crab stage	
Experiment-1									
1	160/250	15,84,000	50, 000	70.0	56.0	40.0	21.0	5.3	2, 670
2	143/240	10,25,000	50, 000	90.4	80.4	71.2	50.8	16.6	8, 280
3	149/200	5,52,000	50, 000	80.3	70.0	58.0	42.5	9.0	4, 500
Experiment-2									
4	143/150	1,24,000	1,00, 000	68.5	46.0	22.0	2.2	0.8	827
5	123/115	5,32,400	1,00, 000	70.5	55.0	27.8	7.6	2.6	2, 560
6	162/225	10,06,000	1,00, 000	69.8	54.6	26.4	6.3	2.0	2, 036

time. The left over food material and faeces were siphoned out daily. Every alternate day, about 30% of water exchange was provided. After 15 days all the crablets from each tank were recovered for the estimation of their survival rate, and carapace width (mm) of 30 crablets from each tank was recorded for the estimation of growth. Temperature and salinity were recorded daily. The range for salinity and temperature was 32-33 ppt and 27.0-29.0°C respectively.

Grow- out culture

For grow - out culture 1, 550 first crab instars, those produced from the brooder No. 5 (Table 1) in the second larval rearing experiment, were stocked in a 0.06 ha earthen pond (2.6 no/m^2). Ten days before stocking, to boost production of phytoplankton and zooplankton in the pond, inorganic manures such as urea and super phosphate were applied in the ratio of 100 kg/ha and 50 kg/ha respectively. During the culture period the first crab instars/crablets/crabs were fed with shrimp feeds No. 1-6 (C.P. Aquaculture Private Limited), gradually increasing the size of the feed as the crab showed progress in growth. Details of feed and feeding schedule followed during the grow-out culture are given in Table 2. However, after 60 days the shrimp feed was coated daily with a mixture of vitamin C (5 g/kg), ultramin (10 g/kg), fish oil (5 ml/kg) and chick egg (1 no/kg) and kept for drying under shade at least 3 hours before feeding. Initially feed was given twice a day, and after 60 days feeding at night (2100 hrs) was also initiated by introducing check tray (2 × 2 feet net with frame to assess the feeding rate) to keep the 2% of feed of each time for observation. After 1 hr the check tray was observed to assess the feed consumption for further increase or decrease on the following day. Crab behaviour while feeding from the check tray during night hours was observed under torchlight without causing much disturbance to the crab. Water depth in the pond was maintained at 0.7-1.0 m up to 60 days and there after 70% water exchange was provided once every week. Ambient water parameters such as salinity, temperature, *p*H and dissolved oxygen were recorded at fortnightly intervals. The ranges of salinity and temperature were 28 to 39 ppt and 25.2 to 28.5°C, respectively. Temperature and salinity rose gradually during the period of culture due to change in season i.e. winter to summer and due to evaporation of culture medium at higher temperature respectively. *p*H and dissolved oxygen ranges were 8.2 - 8.8 and 3.9 - 4.1 ml/l, respectively.

Sampling for growth was done once in a month; dragging the bag net in the middle of the pond by holding the net both sides in the peripheral region of the pond to avoid crab bite. About 25-30 crabs for each sampling were collected, segregated sexwise and measurements (carapace width in mm and weight in g.) were recorded. After 90 days, during water exchange, burnt lime (400 kg/ha) was applied to the feeding area to arrest the degradation of pond bottom by enhancing the oxidization of hydrogen sulphide that accumulates from the decomposition of unconsumed feed and faecal matter. On day 135, water in the pond was drained out to collect all the crabs for estimation of survival rate. Harvested crabs were segregated sexwise, length (Carapace width)-weight measurements were recorded and *t*-Test was applied to evaluate the differential growth between sexes. Total feed given over the 135 days was summed up to work out Food Conversion Ratio

Table 2—Size and type of the feed, composition of the feed, feeding schedule adopted and total quantity of feed consumed during different periods of grow out culture of *Portunus pelagicus*

Duration of culture (days)	Feed No., size and type	Composition of feed			Quantity of feed given (g/day)			Total feed consumed (kg)
		Protein (%)	Fat (%)	Fiber (%)	0600 hrs	1600 hrs	2100 hrs	
1-15	1 0.42 mm-Fine Crumble	42	5	4	50	50	---	1.5
16-30	2 0.89 mm-Crumble	41	5	4	50	50	---	1.5
31-45	4s 1.8×3.5 mm-Pellet	40	5	4	100	100	---	3.0
46-60	4s 1.8×3.5 mm-Pellet	40	5	4	200	200	---	6.0
61-75	6 2.3×4-5 mm-Pellet	38	5	4	250	250	250	11.25
76-90	6 2.3×4-5 mm-Pellet	38	5	4	300	300	300	13.5
91-105	6 2.3×4-5 mm-Pellet	38	5	4	350	350	350	15.75
106-120	6 2.3×4-5 mm-Pellet	38	5	4	350	350	350	15.75
121-135	6 2.3×4-5 mm-Pellet	38	5	4	400	400	400	18.0
Total feed consumed								86.25

(FCR) at the harvest. FCR was calculated by following the formula:

FCR = Total quantity of feed consumed (kg)/Total weight of harvested crabs (kg)

Total cost of the production was arrived by summing up the cost of feed, the cost of feed additives, the cost of inorganic manure and burnt lime, and the expenditure on diesel for pumping the seawater.

Results

Larval rearing

Number of zoeae hatched from brooder ranged from 827 Zoea$_1$ (g. body wt.)$^{-1}$ to 6336 Zoea$_1$ (g. body wt.)^1. Total larval rearing period from Zoea$_1$ to first crab instar was 20 days; duration for zoeal stages was 15 days ranging 3-5 days for each stage; and for Megalopa it was 5 days. Stage wise survival rate for all six larval rearing trials is presented in Table 1 and mean survival rate at each stage of larvae of two density trials is shown in Fig. 1. The survival during zoeal stages gradually declined with development (Fig. 1). The difference in survival between two density trials was significant ($P < 0.05$). Higher survival (10.3 ± 5.76%) from Z_1 to first crab instar was recorded at lower density than at higher density (1.8 ± 0.91%). Effect of brooder on larval survival rate was not significant ($P > 0.05$).

Nursery rearing

Despite the provision of shelter and fed to satiation heavy cannibalism was observed among the first crab instars during nursery rearing, resulting in the low survival rate (8.6 ± 0.91%). The first crab instars progressed in growth from 3 mm CW to 12.13 ± 0.85 mm CW in 15 days.

Grow-out culture

Size as well as quantum of the feed increased as crab increased in growth. Check tray observations during night hours revealed that crabs that lost chelipeds consume feed using maxillipeds as well as lowering their mouths close to pellets. Regeneration of limbs was also noticed in those that lost their limbs. Check tray observations also revealed that crabs struggled to pick up the pellets with chelipeds as the size of the pellet is below the requirement for larger crabs from 60th day onwards.

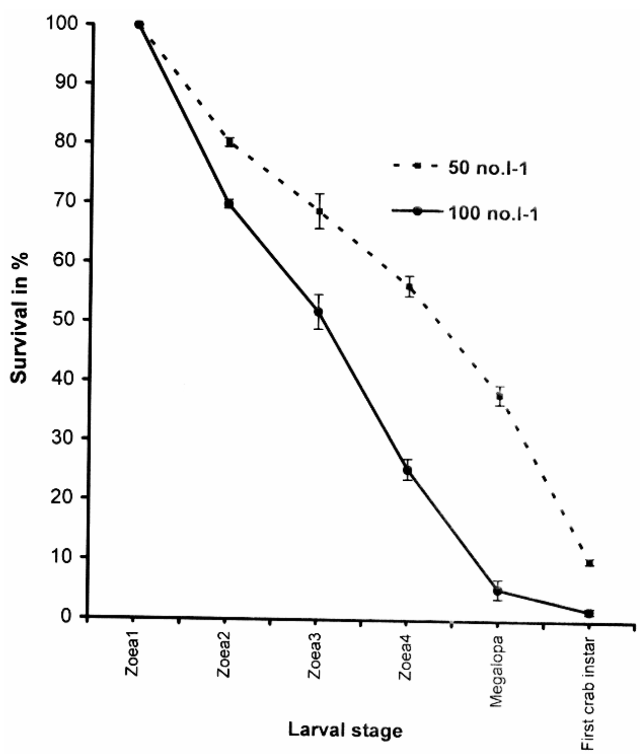

Fig. 1—Mean survival (± SE) at each larval stage of two density trials of larval rearing of blue swimming crab, *Portunus pelagicus*.

Growth performance of *P. pelagicus,* both sexwise and pooled, is given in Table 3. During the first 60 days, growth rate per day (pooled) in carapace width was higher than that of weight but it declined subsequently, whereas the increase in weight continued up to 90 days and thereafter proportional weight increase was less. After 135 days the crab attained commercial weight of around 112 g. ranges between 95-135 g. (Table 3). Growth between sexes did not differ up to 60 days, but there after differential growth was observed, males growing faster than females, and statistically significant at the harvestable size (P < 0.05). Gains in weight (P < 0.001) and carapace width (P < 0.05) were more in males than in females.

Out of 1,550 first crab instars stocked, 496 were harvested resulting in 32.0% survival on the day 135. Of those 496 crabs, 50.6% were females and 49.4% were males. Among the 251 females, five (1.9%) were in berried condition and seventy five (30%) underwent pubertal moult (change of the triangular abdomen to an oval shape), indicating that this progeny matured in the pond at the age of 5 months (20 days larval rearing + 134 days grow-out). Average size of berried female was 121.2 ± 6.7 mm CW/133.0 ± 23.3 g. wt. Harvested crabs weighed 46.925 kg. of which 53.6% was formed by males and 46.4% by females. As males registered fast growth in weight (P <0.001), their contribution to the production was more than that of females. Thus production rate was 784 kg/ha at a stocking density of 2.6 first crab instars/m^2 with FCR 1.8.

Table 3—Carapace width and weight of male, female and pooled for sexes of blue swimming crab, *Portunus pelagicus* during grow-out culture for a period of 135 days

Parameter	At stocking	Duration of culture (days)				
		30	60	90	120	135
Male						
Carapace width (mm)	---	---	88.0 ± 9.2	104.7 ± 9.0	114.1 ± 6.3	117.6 ± 8.2
Weight (g)	---	---	37.4 ± 14.6	75.0 ± 15	99.4 ± 11.8	120.6 ± 22.8
Female						
Carapace width (mm)	---	---	83.5 ± 10.0	103.0 ± 5.7	110.4 ± 6.7	114.4 ± 8.4
Weight (g)	---	---	32.4 ± 13.0	72.5 ± 10.6	88.9 ± 14.9	103.1 ± 23.4
Pooled						
Carapace width (mm)	3	21.6 ± 6.4	84.8 ± 9.7^n	104.6 ± 9.1^n	112.2 ± 6.6^n	116.0 ± 8.4^s
Weight (g)	0.007	1.1	33.9 ± 13.3^n	74.0 ± 11.9^n	93.8 ± 14.2^n	111.8 ± 24.6^s

n = Not significant (P > 0.05) between sexes; s = Significant (P < 0.05) between sexes

Total cost of the production, arrived at by summing up the cost of feed (Rs. 3,880), the cost of feed additives (Rs. 760), the cost of inorganic manure and burnt lime (Rs.162), and the expenditure on diesel (Rs.1,500) was Rs. 6,302 excluding the cost of seed and the expenditure incurred on farm labourer. The resultant unit cost of production (Rs. 134/kg) against the unit price of harvested crab, (Rs. 150/kg) shows that profit is nil if the cost of seed and the expenditure on labourer are included.

Discussion

The present study shows the possibility of seed production in the hatchery during a period of 20 days and their subsequent culture in grow- out pond up to marketable size within a period of 135 days.

In the present study the protocol that described for larval rearing is an established technique and currently first crab instars of *P .pelagicus* are being produced and sea ranched by following this protocol under a research project. Williams & Primavera[16] concluded in their review on tropical protunid species, that priority in research should be geared towards full development and technology verification for mass-producing juveniles for pond culture and stock enhancement of *P. pelagicus*. As *P. pelagicus* is supporting the fishery at certain centres all along the Indian coast, stock enhancement programme could be taken up by producing seed on large scale in the hatchery and sea ranching them at selected sites that are suitable for establishing ranch fisheries along the Indian coast.

The results of the two larval rearing experiments, demonstrate that survival is high initially and it gradually declined, may be due to deficiency in nourishments for subsequent larval stages. By feeding enriched rotifer and *Artemia* nauplii with N-3 Highly Unsaturated Fatty Acids (n-3 HUFA) right from the Zoea$_3$ onwards, to strengthen the Zoeae and to obtain optimum growth and higher survival was achieved in the swimming crab *Portunus trituberculatus* and mud crab[17-19]. Survival from Megalopa to first crab instar was improved for the mud crab, *Scylla serrata* by feeding with enriched *Artemia* nauplii[20]. Experiments conducted on mud crab larval rearing in Philippines also revealed that combination diet of *Artemia* nauplii and rotifer gave high survival rather than feeding either of these two diets alone[21]. In similar way survival may be increased from Zoea$_1$ to first crab instar of *Portunus pelagicus* by adoption of either enrichment of rotifer (Z_3 to Z_4) and *Artemia* nauplii (Megalopa) with N-3 Highly Unsaturated Fatty Acids or by addition of *Artemia* nauplii along with the rotifer from Zoea$_3$ onwards[22,23]. Recently, protocol for larval reaing of *P. pelagicus* was reported in Australia[24], disinfecting first the berried female in a static formalin bath (concentration 50 ul/l) followed by high stocking rate (500 larvae/l) and high feeding regime (rotifers at 20-40 no/ml and *Artemia* nauplii at 1-5 no/ml). But, survival from Zoea$_1$ to first crab instar was not reported for higher stocking rates.

In the nursery rearing, despite the provision of food to satiation and shelter with bunches of seaweeds, heavy cannibalism that took place is due to the more exposure of crablets to each other. As burrowing habits develop from first crab instar onwards (Maheswarudu, *et al.*, unpublished data), cannibalism could be reduced to some extent by providing sand substratum that would facilitate the crablets to burrow during resting/relaxing time. Furthermore, the addition of other forms of substrate may also reduce cannibalism. For example, dark clay paving stones provided 'edge space' for crabs to back up against, without impeding visibility from above which reduced aggressive behaviour of cannibals, and increased time spent resting in the shelter in early juvenile blue swimming crabs[25].

A salinity range of 20-35 ppt is suitable for culture of early juvenile *P. pelagicus*[24] to obtain higher survival and growth, and the isosmotic point is at 38 ppt. The successful rearing of blue swimming crab from first crab instar to maturity stage in grow-out culture of the present study may be due to prevalence of salinity in the optimum range (28 to 39 ppt) during culture period.

The result of the grow-out culture shows that *P. pelagicus* can be cultured to obtain crab of commercial size with 32% survival after 135 days. Experimental culture on mud crabs in grow-out ponds yielded 494-1,116 kg/ha/7-10 months with a survival rate 28-32%[26]. The rate of production and survival in the present study are comparable with those of mud crabs. Experiments conducted on grow out culture of *P. monodon* and *P. semisulcatus* also revealed that shrimp attains commercial size after 135-145 days in similar farming conditions[27].

The recorded survival for *P. pelagicus* in grow-out culture is low compared to that of shrimps *P. monodon* and *P. semisulcatus* reported from experiments (80-90% survival) conducted simultaneously in the same farm[27]. The factors that contribute for low survival of crabs are "Moult Death Syndrome" (death associated with moult)[24] as well as cannibalism[25]. While MDS may have occurred in the ponds, cannibalism may be higher contributing factor to mortalities as during feeding observations, the chelipeds on crabs were lost, indicating aggressive behaviour. By keeping shelter devises such as stone ware, pipes of 15 cm diameter and 45 cm length and worn-out tyres on the pond bottom, as suggested to reduce cannibalism in mud crab culture, may improve survival[26].

In grow-out culture, differential growth (Carapace width as well as weight) between sexes was observed from 60th day onwards, males growing faster than females. Similar result was reported on this species earlier[10]. The earlier study on growth of this species in tank conditions, feeding the animals with clam meat, squid meat and shrimp meat, has revealed that crab attains carapace width of 100 mm in four months[10]. Whereas in the present study, crab attained same size in three months, indicating faster growth in the pond may be due to prevalence of higher temperature as well as provision of formulated diet with feed additives.

In grow-out culture, feed that was developed originally for black tiger shrimp (*Penaeus monodon*) was adopted. Check tray observations, as crabs struggled to pick up the pellets with chellipeds, have revealed that the size of the pellet is below the requirement for larger crabs from 60th day onwards. Laboratory studies are needed to formulate suitable species-specific feeds having specific pellet-diameter to promote the feed utilisation effectively. Thus wasting of feed can be reduced resulting in better FCR.

Experiments that were conducted on grow out culture of *Penaeus monodon* and *P. semisulcatus*, simultaneously, in the same farm with the same brand feed, resulted in FCR 1.8 and 1.9 respectively[27]. The FCR that resulted in the present study (1.8) is quite comparable with that of shrimp. Since shrimp fetches higher price (Rs. 250-450 /kg) for harvested size compared to that of blue swimming crab (Rs.150 /kg), shrimp farming is economically viable. FCR in the present study indicates that 62% of production cost goes towards the cost of feed, while the profit is negligible. However, soft-shelled crabs have great demand in USA, offering the price much higher (approximately 3 times) than that of hard-shelled crabs[28]. By shifting 135 day old live crabs from grow-out to shedding system soft shell crabs could be produced to turn the crab culture into a profitable venture[28-30]. Results of the ongoing studies on *P. pelagicus* to induce the moulting process by using DNA microarray technology are encouraging, and it is easier to produce soft shell crab in captivity by achieving synchronous moulting (Source: Aquaculture News, 20, 2002, Department of Primary industries and fisheries, Queensland, Australia). As *P. pelagicus* is a potential species for soft shell crab production, development of viable grow-out technology is indispensable for which further studies are required.

In India, shrimp culture industry, the major contributor for export market, is facing set back due to repeated occurrence of White Spot Syndrome Virus in the widely cultured species, *P. monodon*[3] since 1995. Crab farming in parts of shrimp culture area could be an alternate measure to sustain the industry. As blue swimming crab avoids coming out of water to escape unlike mud crab, adoption of this species for culture in these ponds is easier because fencing around the pond periphery is not required[26]. Adoption of *P. pelagicus* for culture in all sea based shrimp ponds where salinity range prevails within the optimum limits of blue swimming crab (20-35 ppt) could be recommended for raising live crabs and soft shell crabs could be produced subsequently in the recirculated waters in the hatchery sheds.

Maturity being attained by the crab in grow-out pond is noteworthy as it facilitates easy way for captive broodstock development through selective breeding programme[3], which is vital requisite to any potential candidate for aquaculture. In *P. pelagicus* male attains maturity earlier than female[10]. In present study, at the harvest, about 32% of female population attained maturity, indicating that all the matured females were impregnated by the siblings. Precautions should be taken to avoid escapees from this impregnated stock to mix with the wild population, as this would impact the gene pool of this species in the wild.

Thus, the present study shows the possibility of seed production of *Portunus pelagicus* in the hatchery with a maximum survival of 16.5%. In the seed production, high survival at initial zoeal stages and its gradual decline at subsequent larval stages call for further investigations to find out the remedy for deficiency in nourishments for succeeding larval stages. Despite the provision of seaweeds as shelter and feed at libitum, low survival in nursery rearing is due to heavy cannibalism, which may be redressed by finding the appropriate shelters. The results of the grow-out culture, yielding 784 kg/ha with 32.0% survival and 1.8 FCR, shows the possibility of this species as a potential candidate for aquaculture. Since this species is suitable for culture[24] in a salinity range of 20-35 ppt, scope for adoption of this species for culture in coastal sea based shrimp ponds is more. The high cost of production, resulted due to low survival in grow-out culture, advises to opt for soft shell crab production that has demand and fetch higher price, to make the crab culture venture economical. Crab attaining maturity in the grow-out pond, shows the lenience of this species for genetic enhancement through selective breeding in captivity, which is essential for any potential candidate for aquaculture.

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