J. Sylhet Agril. Univ. 1(2):259-264, 2014 **Research Article** **ISSN: 2308-1597**

EFFICACY OF FORMULATED FEEDS FOR NURSERY REARING OF *PENAEUS MONODON* (FABRICIUS) IN SUSPENDED NYLON NET ENCLOSURE IN BRACKISHWATER POND

M S Islam*[1], M M Rahman[2], M H Rashid[3], R Akter[4] and K K U Ahmed[4]

[1] *Department of Coastal and Marine Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh*
[2] *Flood Plain Sub-Station, Bangladesh Fisheries Research Institute, Santahar, Bogra, Bangladesh*
[3] *Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh*
[4] *Shrimp Research Station, Bangladesh Fisheries Research Institute, Bagerhat-9300, Bangladesh*

Abstract

An experiment was carried out at 12 suspended nylon net enclosures (hapa) installed in earthen pond with a view to develop a low cost formulated diet for rearing of *Penaeus monodon* post larvae (PL) for a period of 40 days starting from 28 April to 7 June 2013. Three experimental diets with a protein level of 40% were formulated using locally available feed ingredients. These diets were categorized into 3 treatments *viz.*, T_1 (diet-1), T_2 (diet-2) and T_3 (diet-3). T_4 (control) was the commercial diet and each treatment had three replicates. *P. monodon* PL (ABW 0.005g) were stocked in each hapa at the rate of 500 PL m^{-2}. PL of nine hapas were fed with formulated diets in three times daily at the rate of 100% of the total biomass in 1st week, 50% in next consecutive 3 week and 20% for the rest of the days. In another 3 hapas, commercial diet was supplemented for PL according to same system. Observed water quality parameters were found to be within suitable ranges for PL of *P. monodon*. Significantly higher ($P<0.05$) weight (0.433 g) of shrimp PL was found in T_3 (diet-3) than those of T_1 (0.312 g), T_2 (0.356 g) and T_4 (0.393 g). Food conversion ratio (FCR) was achieved lower in T_3 (1.70) compared to T_1 (1.89), T_2 (1.84) and T_4 (1.77), respectively. The highest survival was also obtained in T_3 (73.4%) followed by T_4 (69.6%), T_2 (65.7%) and T_1 (62.8%). Therefore, the findings of the present study reveals that diet-3 containing fish meal 32%, soya bean meal 32%, mustard oil cake 20%, rice polish 5%, wheat bran 6%, wheat flour 4% and vitamin as well as minerals 1% may be recommended for post larvae rearing of *P. monodon* in pond conditions.

Keywords: *Penaeus monodon* post larvae, growth, survival, feed conversion ratio, hapa

Introduction

Shrimp farming is currently the main income generating activity of the people of South-western region of Bangladesh. With the rapid expansion of shrimp farming in last two decades, demand of post larvae (PL) in recent times throughout the country has reached around 1,500 million, which may increase with further expansion of farming area and its intensification. At present, shrimp hatcheries contributing only about 15% of total demand though it is facing numerous constraints and rest bulk portion are collected from natural sources (Khondoker, 2009). Most of the shrimp farm owners in the South-west region are largely dependent on natural PL. A large number of natural and hatchery produced PL are died after stocking in the *gher* (Coastal shrimp pond) owing to non-availability of suitable quality nursery feed.

Quality 'bagda' nursery feed is an essential prerequisite for its successful nursing as well as farming. Like other crustaceans, *Penaeus monodon* requires highly nutritious food for growth and survival in the early stages of its life cycle. Artificial feed is a reliable alternative and may be used as a substitute or supplement to live feed. However, there is a shortage of quality supplemental shrimp feed in Bangladesh (Hussain, 1994; Hossain, 1995; Karim, 1995; Khan 1995). But now-a-days, huge amount of different nursery feeds such as pre-nursery, nursery, starter-1, starter-2, starter-3 are used for bagda nursing in the coastal region. Different types of shrimp feeds are also imported from Thailand, India and Taiwan. Maximum feed manufacturer do not maintain shelf-life (around three months) properly. It has been reported that stale feeds are supplied at the farm level, leading to adverse effects on shrimp farming (Karim and Aftabuzzaman, 1997). Consequently, most of the farmers totally rely on natural feed and their farms suffer from lower productivity. Feed is the highest cost oriented inputs in nursery management of shrimp and fin fish larvae, and aquaculture. So, the more will be effective use of low cost quality feed, survival and growth of PL fry^{-1}

***Corresponding author: M S Islam,** Department of Coastal and Marine Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh, e-mail: islamms2011@ yahoo.com.*

will be higher and cost of production will be less. It is more important in high density nursery system. Therefore, there is a immense need to develop a low cost and effective diet. Keeping these views in mind, the present study was carried out to develop artificial diets using locally available ingredients for post larvae of shrimp in relation to nutritional requirements and to determine the efficacy of formulated diets in the pond condition.

Materials and Methods

Study area

Twelve rectangular nylon net enclosures (2.0m x 2.0m x 1.0m dimension with 0.5 mm mesh size) were installed in an earthen pond of Shrimp Research Station, Bangladesh Fisheries Research Institute (BFRI), Bagerhat for the experiment. The central out let of the research ponds is directly connected with the tidal river through a canal. Depth of water in the enclosure (hapa) was maintained about 1.0 m and the beds of the hapas were slightly high from the bottom mud of the pond. The study was conducted for the period of 40 days from 28 April to 7 June 2013.

Collection of feed and feed ingredients

Samples of feed ingredients and commercial nursery feed were collected through survey from different markets of Bagerhat district. Collected samples were stored properly in the laboratory and analyzed these to know proximate composition.

Experimental design

The experiment was designed with four treatments like as T_1 (diet-1), T_2 (diet-2), T_3 (diet-3) and T_4 (commercial diet) with three replicates each (Table 1).

Table 1. Stocking density (PL m^{-2}) of each replication hapa of four treatments

Treatments	Replications	Stocking density (PL m^{-2})
T_1 (diet-1)	3	500
T_2 (diet-2)	3	500
T_3 (diet-3)	3	500
T_4 (control, commercial diet)	3	500

Feed formulation

Three diets (iso-proteineus) were formulated to contain 40% crude protein on dry matter basis (Table 2). Feeds were prepared using locally available low cost feed ingredients such as seeds, mustard oil cake and soya bean meal. Soya bean meal was selected to partial replacement of fish meal protein in the diet for the formulation of shrimp nursery feed. Pearson's square method was followed during formulation of feed and then adjusted it by trial and error method. Four locally available feed ingredients like rice polish, wheat bran, wheat flour and vitamin as well as minerals premix were used as common ingredients for the formulation of these diets. Formulated feeds were analyzed for proximate composition to check the accuracy of formulation. The experimental feeds were palletized and then crashed and graded to match with the required food particles size (fine powder).

Pond preparation

Pond was prepared through drying and liming the bottom soil with agricultural lime @ 250 kg ha^{-1}. Tidal water was entered into the pond up to a depth of 1.2 m and water was treated with chlorinated bleaching powder @ 20 ppm. Then pond fertilized with urea @ 2.5 ppm, TSP @ 3.5 ppm, muriate of potash (MP) @ 0.6 ppm and molasses @ 30 kg ha^{-1}.

Installation of suspended net (hapa)

Twelve rectangular nylon net hapas of $4m^3$ were installed in the pond with bamboo frame and each hapa having one feeding tray for using PL feed. Dried coconut leaves (1 $hapa^{-1}$) were used within the enclosure as shelter of PL and to keep water cool. Depth of water within the hapa was always maintained 1.0 m.

PL stocking

Same aged and uniform sized of 0.005g post larvae were purchased from local market. Before stocking, shrimp PL were carefully acclimatized to pond water and stocked @ 500 no. m^{-2} in each hapa.

Feeding of PL

Shrimp PL were fed with formulated diets and commercial Mega nursery feed (control). The basic guide line used in estimating the amount of feed to be given to the larvae was 100—20% of the total biomass at three times in a day. Depending on the actual food consumption, quantity of feed was also adjusted daily by checking the feeding tray.

Table 2. Formulation (%) and proximate composition (% dry weight basis) of the formulated nursery feeds for shrimp post larvae

Ingredients	Diet-1	Diet-2	Diet-3	Diet-4
sh meal	45	45	32	
Dhyancha seeds	40	-	-	
Soya bean meal	-	25	32	
Mustard oil cake	-	-	20	Commercial Feed
Rice polish	5	12.5	5	
Wheat bran	5	12.5	6	
Wheat flour	4	4	4	
Vitamin & minerals premix	1	1	1	
Proximate analysis (%)				
Crude protein	40	40	40	40.01
Crude lipid	6.18	6.23	7.10	6.68
Ash	12.0	13.2	12.4	7.00
Moisture	8.10	8.09	8.10	8.04

Growth measurement

Weekly sampling was done to measure the growth of *P. monodon* PL and to adjust the feed rations. Growth was recorded with electrical balance (OHAUSH digital electrical balance, Model PA 214, USA) by weight. PL behavior was regularly observed especially after providing feed, early in the morning and in the evening to determine their conditions (movement, infection, discolorations, pigmentation, diseases and accumulation at the bottom of hapa).

Water quality monitoring

Physico-chemical parameters of water such as temperature, pH, dissolved oxygen (DO), salinity, ammonia, total alkalinity and transparency were recorded at 7 days intervals at 09-10 am in each sampling. Water salinity was measured using portable refractometer (ATAGO, Hand-Held Refractometer, Japan). pH of the pond water was recorded using pH meter (manufactured by Hanna Instrumental Company, Japan). Dissolved oxygen was measured using DO meter (YSI digital DO meter, Model 58). Water temperature was measured *in situ* using a standard centigrade thermometer. Total alkalinity was measured by titrimetric method. Transparency was recorded using Secchi disc.

Analytical method and analysis of data

Formulated feed and feed ingredients were analyzed to determine of crude protein, crude lipid, ash and moisture following AOAC methods. Specific growth rate (SGR), food conversion ratio (FCR) and survival (%) were calculated as follows:

SGR (%/day): {Ln (final body weight)—Ln (initial body weight) × 100}/cultured period (day)

FCR: Feed consumed (g dry weight)/Live weight gain (g wet weight)

Survival (%): (Final number – Initial number) × 100

For statistical analysis of growth performance, survival and feed utilization data, one way analysis of variance (ANOVA) and DMRT (Duncan's Multiple Range Test) were performed using SPSS (Statistical Package for Social Science, version-14) software. Significance was assigned at 5% level of significance..

Results and Discussion

Water quality parameters of the experimental hapa like temperature, pH, salinity, dissolved oxygen (DO), total alkalinity and ammonia were measured and are furnished in Table 3. Temperature of water was ranged between 27.6 and 30.8^{0}C during rearing period of shrimp PL and found to be more or less similar to the observation of Bashar *et al*. (2012) and Khan *et al*. (2004), who recorded temperature ranges from 28.5 to 31.5^{0}C and 30.7 to 31.0^{0}C, respectively in rearing of *Macrobrachium rosenbergii* PL in cemented tank and *P. monodon* PL at different densities

in brackishwater pond. Average temperature of water in four treatments was found in optimum range for shrimp nursing. Dissolved oxygen varied from 4.4 to 4.8 mg l^{-1}, which was within the recommended ranges for shrimp culture (FAO, 2002).

Table 3. Water quality parameters (mean ± SD with range) as recorded from the hapa's water during the experimental period

Parameters	Treatments			
	T_1 (Diet-1)	T_2 (Diet-2)	T_3 (Diet-3)	T_4 (Diet-4)
Temperature (^{0}C)	28.6±1.2 (27.6~30.6)	28.7±1.1 (27.6~30.7)	28.6±1.3 (27.6~30.6)	28.7±1.5 (27.6~30.8)
pH	7.9 (7.9~8.0)	8.0 (7.9~8.1)	8.0 (7.9~8.1)	8.0 (7.9~8.1)
Salinity (ppt)	2.8±1.6 (1.2~4.3)	2.7±1.7 (1.2~4.2)	2.8±1.6 (1.2~4.4)	2.7±1.7 (1.2~4.2)
Dissolved oxygen (mg l^{-1})	4.5±0.19 (4.4~4.7)	4.5±0.19 (4.4~4.7)	4.6±0.19 (4.4~4.8)	4.6±0.19 (4.4~4.8)
Total alkalinity (mg l^{-1})	78±3.42 (72.3~83.6)	78±3.43 (72.3~83.6)	79±3.51 (72.3~84.7)	79±3.55 (72.3~84.6)
NH_4-N (mg l^{-1})	0.027±0.020 (0.021~0.033)	0.027±0.022 (0.021~0.033)	0.026±0.026 (0.021~0.032)	0.028±0.025 (0.021~0.035)

Values of water pH varied from 7.9 to 8.1 in all treatments was more or less similar to findings of Soundarapandian and Gunalan (2008) and Faruque (2006), who recorded pH of 7.5—8.5 and 7.8—9.0, respectively for *P. monodon* culture. FAO (2002) stated that the optimum range of pH 7.0—8.5 should be maintained for maximum growth and production of shrimp. Shrimp PL were stocked at a salinity level of 1.2 ppt, which was gradually increased upto a level of 4.4 ppt at the end of culture period due to subsequent adding of river water with pond water during tidal periods in every full and new moon. Salinity is the most considerable factor for shrimp culture. Salinity ranging from 5.0 to 32.0 ppt is favourable for shrimp culture (Predalumpaburt and Chaiyakam, 1994). In the present trial, salinity gradually increased but had no negative effect on growth and health condition of shrimp. Observed salinity was strongly supported by the findings of Saha *et al*. (1999), who recorded salinity ranges from 0.19 to 6.39 ppt in semi-intensive culture of *P. monodon* in West Bengal of India. Under farm conditions, the ammonia level should be less than 0.1 mg l^{-1} (NACA, 1998). The level of ammonia in all treatments was 0.021 to 0.035 mg l^{-1}, which was so far below than the critical level (>0.1 mg l^{-1}). But higher level of ammonia (0.035 mg l^{-1}) was observed in control treatment than the diet treatments. This was mainly due to wastage of excess feed in the control hapa.

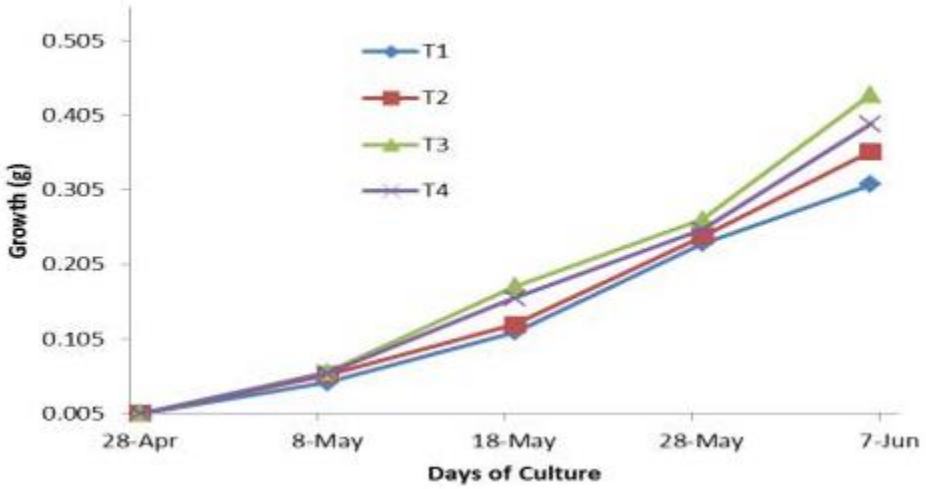

Fig. 1. Growth rate of shrimp PL under four treatments

Growth, survival and FCR of *P. monodon* PL are presented in Table 4. Growth of shrimp PL in all the treatments increased throughout the culture period. There was no significant difference in initial weight of shrimp PL. The highest mean final weight was recorded in T_3 (0.433 g) and the lowest in T_1 (0.312 g) (Fig. 1). Significantly higher ($P<0.05$) final weight of juvenile was found in T_3 than those of T_1 (0.312 g), T_2 (0.356 g) and T_4 (0.393 g). Higher

growth obtained in T_3 was mainly due to required feed ingredients used properly in the treatment (diet-3). Average final weight of juvenile recorded in present study was higher than that of Islam and Alam (2008), who reported an average final weight of 0.084 g with 0.007g of initial weight for 18 days rearing of PL in the earthen pond applying supplementary feed. Rodriguez *et al*. (1993) also reported that the final weight of shrimp juvenile was 0.260 g for 30 days rearing in the pond, which was lower than the present findings. Specific growth rate (SGR) values of shrimp in four treatments were not significantly different (P>0.05). The observed SGR (4.4-4.8) of all the treatments was agreed with the findings of Goda *et al*. (2010), who recorded the SGR of 4.53 using formulated different dietary protein levels diet containing 35% CP at 4 times a day for prawn PL in small scale hapa in the Fish Research Station, National Institute of Oceanography and Fisheries (NIOF), Cairo, Egypt.

Table 4. Growth, weight and survival (mean±SD) of shrimp (*Penaeus monodon*) PL in four treatments during the experimental period

Particulars	Treatments			
	T_1 (Diet-1)	T_2 (Diet-2)	T_3 (Diet-3)	T_4 (Diet-4)
Stocking density (nos. m^{-2})	500	500	500	500
Initial weight (g)	0.005±0.1	0.005±0.2	0.005±0.1	0.005±0.1
Final weight (g)	0.312 ± 0.01^{d}	0.356 ± 0.01^{c}	0.433 ± 0.04^{a}	0.393 ± 0.03^{b}
Specific growth rate (% $days^{-1}$)	4.4±0.3	4.6±0.2	4.8±0.4	4.7±0.2
FCR	1.89±0.2	1.84±0.4	1.70±0.3	1.77±0.5
Survival (%)	62.8 ± 1.7^{c}	65.7 ± 0.9^{b}	73.4 ± 1.0^{a}	69.6 ± 1.2^{ab}

Figures with different superscript in the same row differ significantly (p<0.05).

After 40 days of rearing, the survival rate of juvenile was 62.8%, 65.7%, 73.4% and 69.6% in T_1, T_2, T_3 and T_4, respectively (Table 4). Higher survival of shrimp juvenile was obtained in T_3 than that of control (69.6%) (T_4). The overall survival rates of shrimp in all treatment was lower than the observation of Alam e*t al*. (1997), who reported the survival rate of 84% for freshwater prawn in hapa-net nursery with the stocking density of 250 m^{-2}. Dayal *et al*. (2011) found that survival rate of *Penaeus monodon* PL was 83.67% and 86.67% after 45 days rearing in net cages using formulated diet 5 (15% fish meal, 10% sunflower cake and 75% common ingredients) and diet 3 (20% fish meal, 5% sunflower cake and 75% common ingredients), respectively in the lagoon of Muttukadu Experimental Station of Central Institute of Brackishwater Aquaculture, Chennai, India, which was higher compared to the present findings. Khan *et al*. (2004) recorded the survival rate of shrimp of 68.40% at a stocking density of 200 m^{-2} for 35 days rearing in brackishwater pond complex of BFRI, Paikgacha, Khulna, which coincides the present study. Mortalities of shrimp PL ranged from 26.6 to 37.2 % might be associated with heavy shower, oxygen depletion, turbidity of water, cannibalism and sudden fluctuation of temperature, salinity and pH during the nursing period. However, the survival rate of shrimp was much higher than Islam and Alam (2008) and Goda *et al*. (2010), who reported that the survival rate of juvenile was 57.76% in pond nursery system after 30 days rearing and 40% in small scale hapa, respectively.

A low feed conversion ratio (FCR) is an indicator of better food utilization efficiency of formulated feed. FCR was found lower in T_3 (1.70) than those of T_1 (1.89), T_2 (1.84) and T_4 (1.77), respectively. FCR values of the present study were more or less similar with the findings of ADB/NACA (1998) and Tacon (2002), who reported average FCR of 1.8 (Thailand), 1.9 (Indonesia), 2.0 (India), 2.3 (China) and 2.5 (Vietnam). The FCR obtained from this study was higher than the finding of Dayal *et al*. (2011), who recorded FCR of 1.48 from net cages using formulated diet 3 but observed FCR was almost similar to the FCR of 1.72 obtained using formulated diet 5 in the net cages by Dayal *et al*. (2011). Islam and Alam (2008) observed that the FCR (1.90-1.92) recorded in the pond complex of Brackishwater Station, BFRI, Khulna was higher than that of present findings. Lower protein content of formulated diet and poor feed management might be the cause of higher FCR value.

Results from this study implied that diet-3 (T_3) showed significantly higher growth, survival, specific growth rate (SGR) and lower FCR values than that of diet-1 (T_1), diet-2 (T_2) and diet-4 (T_4). In this study, *dhayncha* seed soaked (*Sesbania spp*) was used in diet-1and diet-2 as a good protein source in place of soya bean meal and mustard oil cake for minimizing production cost as well as higher growth of post larvae. But it showed lower growth performance and survival than diet-3. It is assumed from the results of this study that *dhayncha* seed may content anti-nutritional factors which are responsible for lower growth of PL. Therefore, from the results of the study it may be suggested that for higher growth, survival and lower FCR, diet-3 may be recommended for post larvae rearing of *P. monodon* in pond conditions.

References

ADB/NACA. 1998. Aquaculture sustainability and the environment. Report on a regional study and workshop on aquaculture sustainability and the environment. Asian Development Bank and Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand. 491p.

Alam M J, Hoq M E, Jahan D A and Mazid M A. 1997. Nursery rearing of *Macrobrachium rosenbergii* (de Man) using hapa-nets: effects of stocking density. Bangladesh J. Fish. Res. 1(1):09-16.

AOAC (Association of Official Analytical Chemists). 1990. Official Methods of Analysis Vol. I & II, 15th edition, Kenneth, H.(ed.) Anlington, Virginia, USA. 1298p.

Bashar M A, Khan M H, Rashid M H, Rahman M M and Ahmed K K U. 2012. Growth, survival and stress of *Macrobrachium rossenbergii* larvae at different stocking densities in cemented tank under hatchery condition. J. Agro. Enviro.. 6(1):143-147.

Boyd C E. 1988. Water quality management for pond fish culture. Elsvier, New York. pp.5-120.

Cruz P S. 1997. Aquaculture feed and fertilizer resource Atlas of the Philippines. *FAO Fish Tech. Pap.* No. 366, FAO, Rome. 259p.

Dayal J S, Rajaram V, Ambasankar K and Ali S A. 2011. Sunflower oil cake as a replacement for fish meal in feeds of tiger shrimp, *Penaeus monodon* reared in tanks and in net cages. Indian J. Geo-Marine Sci. 40(3):460-470.

Faruque A M O. 2006. Development of database on feed resources and small-scale shrimp farming practices in Khulna region and formulation of low cost shrimp feed. Ph. D. Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. pp.120-134.

FAO (Food and Agriculture Organization). 2002. Farming freshwater prawns. FAO Fisheries Technical paper 428, Rome. pp.11-68.

Goda A M A S, Wafaa M I A-H, Omar E A, El-Bermawey N M and Hebalah S M A. 2010. Influence of different dietary protein levels and feeding frequencies on growth performance and feed utilization of the giant freshwater prawn, *Macrobrachium rosenbergii* with the nile tilapia, *Oreochromus niloticus* in polyculture. Egypt J. Aquat. Biol & Fish. 14(2):53-67.

Hossain M M. 1995. Lagsai Projucti Prougue Upakulya Chingri Chash Unnayan. Fisheries Fortnight, 1995. Department of Fisheries, Ministry of Livestock and Fisheries, Government of Bangladesh. pp.50-52.

Hussain M M. 1994. Status of development of the fishery and seafood processing industry in Bangladesh. *In:* Sustainable development of marine fisheries resources in Bangladesh. Fisheries Research Institute, Mymenshingh. pp.25-130.

Islam M L and Alam M J. 2008. Impact of in-pond nursery of shrimp *Penaeus monodon* (Fab.) post larvae on the survival rate and production under modified improved cultures system. Progress. Agric. 19(2):167-175.

Karim M. 1995. Some aspects of shrimp culture development and management. A paper presented at a seminar on the occasion of Fish Fortnight 1995, Dhaka August 29. 15p.

Karim M and Aftabuzzaman A. 1997. Brackish and marine water aquaculture: potential, constraints and management needs for sustainable development. *In*: Report of the National Workshop on Fisheries Resources Development and Management in Bangladesh, BOBP/REP/74, Bay of Bengal Programme, 91, St. Mary's Road, Chennai 600 018, India. 65p.

Khan A N M S M. 1995. Shrimp Report on Bangldesh. *In:* Rosenberry, B. (ed.), World Shrimp Farming. Annual Report, San Diego, Shrimp News International. 46p.

Khan M S A, Alam M J, Rahman M F and Shah M M R. 2004. Optimization of stocking densities of *Penaeus monodon* post larvae in brackishwater pond. Bangladesh J. Zool. 32(1):101-107.

Khondaker H R. 2009. Prawn hatchery development in Bangladesh: problems and potentials. National workshop on freshwater prawn farming in Bangladesh: Technologies for suitable production and quality control. Dhaka, Bangladesh. 11p.

NACA. 1998. The environmental management of coastal aquaculture. A study of shrimp culture in Southern Thailand. Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand. 169p.

Predalumpaburt Y and Chaiyakam K. 1994. Impacts of shrimp farm effluent on water qualities. Technical Paper No. **7**, NACA. 39p.

Rodriguez E M, Fukumoto S and Ticar R B. 1993. Nursery rearing of *Penaeus monodon* (Fabricius) using suspended (hapa) net enclosures installed in a pond. Aquaculture, 112(1):107-111.

Tacon A G J. 2002. Thematic review of feeds and feed management practices in shrimp aquaculture. Report prepared under the World Bank, NACA and FAO consortium, 69p.

Saha S B, Bhattacharrya S B and Choudhury A. 1999. Production potential of *Penaeus monodon* (Fab.) in low saline environment. J. Aqua. Trop. 14(4):319- 325.

Soundarapandian P and Gunalan B. 2008. Recent technology for the survival and production of tiger shrimp *Penaeus monodon* along south-east cost of India. International J. Zool. Res. 4(1): 21-27.