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Impact of stocking density on growth and survival rate of mud crab (*Scylla serrata* Froskal)

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Abstract

A 10-weeks culture trial of mud crab, *Scylla serrata* in brackishwater earthen pond was conducted in different stocking densities. The aim of the experiment was to identify a suitable stocking density for optimum production. There were three treatment as 5000 crablings/ha, 10000 crablings/ha and 15000 crablings/ha of each with three replications. The initial mean weight of crablings were same (5.5 ± 0.13 g). The experimental month was June '95 to August '95. The size of each pond was 500 m^2. To maintain a good water quality water was exchanged in every spring tide. The salinity during the experiment were 2-18 ppt. Prepared feed of about 32% protein consisting fish meal, MOC, rice bran and wheat flour was used at 5% of their body weight. In terms of production, survival rate, growth and carapace width, the stocking density having 10000/ha showed the best ($P<0.05$) performance followed by 5000/ha and 15000/ha.

Key words : *S. serrata*, Stocking density

Introduction

Bangladesh has a coast line of about 480 km and about 628,780 ha of potential mangrove tidal flats (Mac-Nac 1974), where capture and culture of mud crab can be undertaken profitably. Many rivers and tributaries terminating in the Bay have formed an intricate network of cross-channels and creeks in Bangladesh's estuarine area. Mahmood (1977) reported 16 crab species of the coast of Bangladesh. In spite of having a culture favour brackishwater environment a crab fishery has not yet been established in Bangladesh. Literature suggests that the optimum range for better growth of mud crab is 15 - 30 ppt, and for larval rearing the salinity should above 17 ppt. And the year round occurrence of the larvae in Mathamuhury estuary even at a very low salinity (2ppt) was reported by Ahmed (1991).

Mud crab as a good export item in live condition from Bangladesh has been growing higher demand in world market day by day. In view of the gradual increasing importance of the commodity study was carried out for the

development of culture technology of mud crab at different stocking densities in the brackishwater environment of Bangladesh.

Materials and methods

The experiment was conducted in the brackishwater ponds of Fisheries Research Institute at Paikgacha, Khulna and continued for 70 days. The experimental conditions are given in Table 1. After construction of dykes and gates, the ponds were allowed for sun drying for 15 days. All the ponds were fenced by bamboo slits at about 0.5m deep in the soil to prevent escaping and burrowing of crab. Lime was applied at a rate 125 kg/ha in all the ponds followed by application of cowdung at a rate of 500 kg/ha after 7 days of liming and the ponds were filled by tidal water of Kapotakhya river.

Table 1. Experimental conditions of mud crab (*Scylla serrata)*

Conditions	Recorded data
Experimental period	70 Days
Water source	Kapotakhya river
Experimental months	June-August
Water depth	0.8-0.6M
Water exchange	50%/spring tide
Feeding frequency	5% body weight/day
Pond size	500 sqm
Treatment	Three stocking density
T_1	5000 crabling/ha
T_2	10000 crabling/ha
T_3	15000 crabling/ha
Range of water temperature	29-33^{0}C
Salinity range	2-18 ppt
pH range	8.4-8.6
Dissolved oxygen range	5.6-6.5 ppm

Crablings collected from natural source by trapping, baiting and netting during shrimp seed collection. There were three treatments having three replications of each such as stocking density of 5000/ha crablings (T_1), 10000 crablings/ha (T_2) and 15000 crablings/ha(T_3) respectively. Crablings were acclimated to the laboratory condition for 7 days prior to stock in the experimental ponds.

Formulated feed prepared by fish meal, mustard oil cake, rice bran and wheat flour were fed twice daily at 12 hourly intervals between 06:00 and 18:00 hours at a rate of 5% body weight per day for all treatments. Ingredients of feed and proximate composition are given in Table 2.

Table 2. Formulation and nutritional value of feed used during the experimental period

Composition of ingredients	Proximate composition of ingredients					
	Dry matter	Protein	Fat	Ash	CF	NFE
Fish meal	89.04	56.00	16.00	28.00	-	-
Mustard oil cake	90.14	35.35	16.81	6.36	13.40	8.04
Rice bran	92.45	11.88	10.45	5.40	27.85	44.42
Wheat flour	92.14	12.48	1.32	2.11	2.14	81.95
Percent of nutrient		32.29	12.19	11.81	10.02	33.69

Water exchange by at least 50% was done during the high tides of new and full moon throughout the experimental period. Sampling for growth performance and water quality parameters were done weekly. Specific growth rate, food conversion ratio (FCR), carapace width of crab, total production and survival rate were calculated following the guide lines of European Inland Fisheries Advisory Commission (1980). All crabs were harvested by complete drain out of the pond water. Comparison of treatment means was carried out using one-way analysis of variance (ANOVA) and Duncan's Multiple Range Test ($P<0.05$).

Results

The growth responses and production in three different stocking densities are presented in Table 3 and 4 respectively.

Table 3. Growth responses of *Scylla serrata* crablings at different stocking density over the 70 days experimental period

Treat ments	Mean body weight (g)										
	Culture period (Week)										
	Initial	1	2	3	4	5	6	7	8	9	10
T_1	5.5	8.6	14.5	25.8	36.4	46.2	55.7	68.5	82.1	98.3	113.13
T_2	5.4	8.7	14.0	24.4	35.4	39.0	51.6	63.2	76.4	80.4	93.0
T_3	5.5	8.5	14.1	24.0	32.6	37.1	44.0	53.2	61.7	70.3	73.0

Table 4. Growth, production and survival rate of mud crab during the experimental period

Parameters	Treatments			
	T_1	T_2	T_3	SE ±
Initial weight (g)	5.50	5.40	5.50	0.13
Final weight (g)	113.13[a]	93.0[b]	73.00	2.14
Weight gain (g)	107.63	87.60[b]	67.50[c]	3.66
Specific growth rate (%)	1.88	1.77[b]	1.75[b]	0.03
Initial carapace width (cm)	4.0[a]	2.30[a]	2.40[a]	0.20
Final carapace width (cm)	5.50[a]	5.30[a]	5.00	0.17
Food conversion ratio	2.56[a]	2.18[b]	2.87[a]	0.17
Survival rate (%)	28	31	31	
Production (Kg/ha)	158.4[b]	288.7[a]	338.3[a]	11.1

Figures in the same column with same letters are not significant different (P>0.05)

Differences in the initial weights of the crablings used in three treatment were insignificant but at termination of the experiment the performance differed significantly (P<0.05). Growth was more or less similar in the first two weeks, but from the third week a variation in the growth was appeared which was more prominent from the fourth week (Table 3). The best production was recorded in T_3 (338.25 kg/ha) followed by the T_2 (288.7 kh/ha) and T_1 (158.37 kg/ha) respectively. The survival rate of T_3 and T_2 were (31%) same. The performance of specific growth rate was best in T_1 (1.88) followed by T_2 (1.77) and T_3 (1.75) respectively. The change of carapace width during the experiment were homogenous. Though apparently there were slight variation of final carapace width but there were no significant different among three treatments. The lowest weight gain was found in T_3 (67.5 g) followed by T_2 (87.6 g) and T_1 (107.625 g). The food performance in T_2 was best (FCR 2.18) than other two treatments.

Water quality parameters was monitored from each pond throughout the experimental period. The temperature range from 29-33^{0}C, pH 8.4-8.6, salinity 2-18 ppt, dissolved oxygen 5.6-6.5 ppm and transparency 32-40 cm.

Discussion

Although the apparent production of crab in T_3 was highest but not statistically significant different from T_2. The lowest value of food conversion ratio found in T_2 among three treatment indicate low production cost in stocking density having 10000/ha. The same carapace width also confirm the same market price of harvested crab in all treatments. In terms of carapace size the present study reveals, that stocking density having 5000/ha have the highest carapace size which is supported by the finding of Balioao and Gerochi (1981) where author showed relation between highest average carapace size and percentage of survival, so positive impact of low stocking density on carapace size has been assumed by low stocking density. Total production of crab having stocking density of 15000/ha was found higher than 10000/ha, without any significant variation. Higher production obtained from stocking density of 10000/ha than 5000/ha suggest the best stocking density among three treatment which is supported by the statement of Fuad and Hanafi (1991). Chaiyakam and Parnichsuka (1977) also studied the relation among the stocking density, survival rate and production of mud crab. They found survival rate of 57% with a yield of 171.68 kg/rai while stocked with 1 individual/m^2, the survival rate was found low (30%) with increase in yield (224.16 kg per rai). This studies confirmed the present findings. However, the overall total production of crabs in all treatments were found low than recorded by Chaiyakam and Parnichsuka (1977 and 1978), Bensam (1980), Lapie and Librero (1979) which may be due to low feeding rate and short culture period. Although the survival rate of crab in present study were low but was similar to the findings after Raphae (1972). The low survival may in cause low salinity in the last three weeks of the experimental period.

Conclusions

Considering the average weight gain, total production and survival rate of crab, it may be concluded from this experiment that optimum stocking density for the culture of mud crab equal to or greater 1000/ha. More growth trial with longer culture period may be carried out to support of the present results in mono and polyculture of mud crab.

References

Ahmed, M.K., 1991. *Mud crab- a potential aqua-resource of Bangladesh. In*: The mud crab - a report on the seminar convened in Surat Thani, Thailand, 5-8 November 1991. BOBP/REP, **51**: 95-102.

Arshadullah, M.D., 1976. Industrial processing of crab *Scylla serrata* (Forskal) (Decopoda Brachyura) of the Karnaphully estuary, Chittagong, Bangladesh. *M. Sc. Thesis.* Dept. of Mar. Biol., Univ. of Chittagong.

Balio, D.D., E.M. Rodriguez, D.D. Gerochi, 1981. Culture of the mud crab, *Scylla serrata* (Forskal) at different stocking densities in brackishwater ponds. Quarterly Research Report. SEAFDEC Aquaculture Department, **5**(1): 10-14.

Bensam, P., 1980. *Culture experiment on the crab Scylla serrata* (Forskal) *at Tuticorin to assess growth and production. In*: Symposium on Coastal Aquaculture, Cochin, India, 12-18 January 1980. Abstracts. Cochin, Marine Biological Association of India. 97 pp.

Bhuyian, A.L. and N.G Das, 1976. Preliminary study on the taxonomy of crabs (Crustacea Brachyura) of the northeastern part of the Bay of Bengal. Symp. P. Ist Bangla. Conf. 48 pp.

Chong, L.P., 1993. INFOFISH International. **3/93**: 46-49.

Chaiyakam, K., P. Parnichsuka, 1977. Experiments on rearing of mud crab, *Scylla serrata* (Forskal) in bamboo pens. Annual Report–Songkhla Fisheries Station. Department of Fisheries: 91-98.

Chaiyakam, K., P. Parnichsuka. 1977. Experiments on rearing of mud crab, *Scylla serrata* (Forskal) in brackishwater pond and cement pond. Annual Report.– Songkhla Fisheries Station. Department of Fisheries: 72-89. (in Thai).

Cholik, F. and A. Hanafi, 1991. *A review of the status of the mud crab (Scylla sp.) fishery and culture in Indonesia. In*: The mud crab - a report on the seminar convened in Surat Thani, Thailand, 5-8 November 1991. BOBP/REP, **51**: 13-27.

Duncan, D.B., 1995. Multiple range and multiple F-tests. *Biometrics*, **11**: 1-42.

Islam, J., 1977. Brachyura of the Karnafally estuary and north-east part of the Bay of Bengal with special reference to the biology of *Scylla serrata*. *M. Sc. Thesis.* Dept of Mar. Biol., Univ. of Chittagong. 160 pp.

Lapie, L.P., A.R. Librero, 1979. Crab farming in the Philippines: a socio–economic study. Los Banson, Laguna, SEAFDOC-PCARR Research Programme. Research paper series. Socio–economic Survey of the Aquaculture Industry in the Philippines no. 21: 56 pp.

Lijauco, M.M., O.Q. Prospero, E.M. Rodriguez, 1980. Polyculture of milkfish (*Chanos chanos*) and mud crab (*Scylla serrata*) at two stocking densities. Quarterly Research Report. SEAFDEC Aquaculture Department, **4**(4): 19-23.

Mac-Nac, 1974. Mangrove Forest and Fisheries. FAO/UNDP/IOPC/Dev. 74/34: 35 pp.

Mahmood, N., 1977. Crustacean fauna of the Bay of Bengal of the coast of Bangladesh. Paper presented at the Biological Workshop organized by National Commission for UNESCO. 6 pp.

Raphel, Y.I., 1972. *Preliminary report on the brackishwater pond culture of Scylla serrata (Forskal) in Ceylon. In*: Coastal Aquaculture in the Indo-Pacific Region (ed. T.V.R. Pillay). West Bfleet, Fishing News (Books). p.395. (Abstract only)

Sivasubramaniam, K. and C. Angell, 1991. *A review of the culture, marketing and resources of the mud crab (Scylla serrata) in the Bay of Bengal region. In:* The mud crab- a report on the seminar convinced in Surat Thani, *In*: Thailand, 5-8 November 1991. BOBP/REP, **51**: 5-12.

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