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Fecundity of Thai Sarpunti (*Puntius gonionotus*), nursing and rearing of its fry in some BAU ponds in Bangladesh

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Abstract: An experiment was carried out to know the fecundity, gonadosomatic index (GSI) and growth of Thai sharpunti fry under nursing and rearing system for the period from February to August, 2007. For establishment of relationship between fecundity, body weight, gonad weight, fish size and GSI (%), 10 fishes were randomly selected. The average fecundity of each brood fish was 3704, and average gonad weight, fish weight and gonadosomatic index (%) was 10.39g, 139.75g, and 7.49% respectively. Four days old spawn hatching of *P. gonionotus* were reared for 4 weeks in four ponds of 85m^2 at stocking of 4 and 6 million/ha. Supplementary feed of rice: mustard oil cake 1:1 in twice was provided daily at a rate of 3 kg /million spawn for the first seven days and was increased by 2 kg/million every week thereafter. Growth of fry was observed and recorded survival rate was 66.5% and 56% at stocking densities of 4.0 and 6.0 million/ha respectively. Stocking at 6.0 million/ha appears to be the most efficient strategy for nursing. In rearing condition of Thai sharpunti, the growth, survival rate, gross and net yields were tested under two rearing techniques i.e. feed supply technique and fertilizer supply technique. The ponds were stocked at rate of 35,000 fingerlings/ha. Comparatively high survival rate (90%) was recorded in the supplementary feeding pond than the fertilized pond (82%). With respect to growth, highest net increase and percentage of increase both in length (10.66 cm & 300.28%) and weight (92.95 g & 827.7 %) were recorded in the supplementary feeding pond than the fertilized pond. Similar to growth rate, highest gross (3807.37 kg/ ha/ 5 months) and net (2886.2 kg/ ha/ 5 months) yields of fish wee recorded in the supplementary feeding pond than the fertilized pond.
Key words: Fecundity, *Puntius gonionotus*, nursing, rearing, growth

Introduction

Thai sharpunti (*Puntius gonionotus*) is one of the most important herbivorus species that commercially cultivated in freshwater pond in Thailand. It feeds mainly on soft aquatic vegetation, plants grass and algae. This species is well known in South East Asia and is culture in Indonesia, Vietnuam and Sri Lanka (Tantong et al. 1980). It can survive in brackish water at salinities of more the 7.0 ppt and grows to table size within as three to four months (Gupta and Rab, 1994). It normally spawns in flood and running waters.

The knowledge of fish fecundity has much relevance in fish population studies, commercial potentials, culture and management practices. Fecundity is usually studied in fishes to establish relationship with length, weight and age (Ibrahim *et al*. 1968), to provide relative index of density dependent factors affecting the population size for reporting the various stocks and races of population. It is also studied to develop numerical relationship between egg production and recruitment (Beverton and Holt, 1957). Though a plenty of information is available on the fecundity of different fish species. There is lack of distinct information about the fecundity of Thai sarpunti, *Puntius gonionotus* in Bangladesh. So, it is necessary to study clearly for scientific fish culture.

On the other hand, stocking densities and management measures practiced by nursery and rearing pond operators in Bangladesh are not based on scientific knowledge, resulting in poor growth and survival of fry. BFRI under its Freshwater station, Mymensingh has initiated a research program on the conservation of fish biodiversity and has successfully developed a package of technology of culture techniques of Thai sharpunti (*P. gonionotus*) and has also been developed as the first step to initiate their conservation. In Bangladesh, till now, we are culturing Indian major carps, rohu *(Labeo rohita)* catla *(Catla catla)* and mirgala *(Cirrhina mrigala)* by traditional way in our household ponds. Culture of exotic fishes like silver carp, grass carp, big-head carp and common carp in combination with above mentioned indigenous species is of quite recent origin. However, Thai silver barb is suitable for culture in ponds due to its faster growth, high market price etc. This fish was found to grow very well on supplemental feed (Hussain *et al.* 1987). All the vital functions of fish like feeding, digestion, assimilation, growth responses to stimuli and reproduction are dependent on water quality. Considering the above facts, the present study was designed to find out the fecundity of the *Puntius gonionotus* and develop an appropriate technique for nursing and rearing of Thai sharpunti fry in Bangladesh.

Materials and Methods

Study period: The present study was conducted in the Field Laboratory of the Faculty of Fisheries in Bangladesh Agricultural University, Mymensingh. The experiment was done in research ponds in the field laboratory. The experiment was conducted to study the fecundity, nursing by using feed and rearing the fry in the pond under fertilized and feeding conditions for a period of 7 months (1st February to 30th August, 2007).

Study area: The experiment was conducted in four ponds having 85 m^2 and the depth of the water varied from 1 to 1.5 m during the experimental period. The pond was numbered serially as ponds number I, II, III, and IV for the convenient of the study. The main sources of water supplied in the ponds were rain water and deep tube well water.

Pond preparation: Prior to initiation of the experiment the ponds were cleared from vegetation dried, limed (250 kg/ha) and manured with cowdung at the rate of 2500 kg/ha, urea and triple superphosphate were also applied to the pond at the rate of 25 kg and 37.5 kg/ha, respectively after filling the ponds with water.

Collection of brood fish and stocking in pond: The brood fish of *P. gonionotus* were collected from Bangladesh Agricultural University Fish Farm. The fishes were brought to the research site in buckets and acclimatized before releasing in the ponds. The collected brood fishes were 3 months old averaging 135.75 g in weight and 14.00 cm in length. Ten fishes were used for the study.

Management of brood fish pond: After stocking, the fishes were fed once a day in the morning at about 10 am at 10% of body weight. The feed consisted of 60% wheat bran, 30% Mustard oil cake, and 10% flour. The feed was given in the

form of balls i.e. dough form. Water from the near by deep tube well was supplied to the brood fish pond and required to maintain a water depth of 1.5 m.

Estimation of the fecundity: Fecundity was taken accurately because it varies for the size and age of the fishes. Gravimetric method was applied in the present studies as described by Dewan and Doha (1979) and Shafi *et al.* (1974). On the other hand, the two lobes of the ovary of *P. gonionotus* are connected along their dorsal surfaces by a thin mesentery from which they are suspended in the abdominal cavity. Two lobes are elongated and found to be of the same size. The anterior parts of the ovary are more or less triangular. A well known method which is frequently applied to determine the pawning frequency of fishes and crustaceans. GSI was calculated by following formula:

$$GSI\% = \frac{\text{Weight of Gonad}}{\text{Weight of fish}} \times 100$$

And fecundity was estimated by using following formula:

$$F = \frac{N \times \text{Gonad weight}}{\text{Sample weight}} \times 100$$

Where, F is the fecundity and N is the number of eggs in the sample.

Nursing and rearing experiment: Four days old Thai sharpunti (*P. gonionotus*) spawns were stocked (6 million/ha and 8 million/ha in different four ponds) in earlier morning having the average length of spawn was 3.61 mm and weight 0.22 g with two treatments. The experiments were carried out for four week. After one month the survival rate, length and weight of *P. gonionotus* was estimated. When the size of *P. gonionotus* was 3.1 cm in length and 9.93 g in weight after 28 days rearing then the fish was stocked in fertilized and feeding ponds for rearing experiment. The stocking density of both ponds was 35000/ha for five months fries rearing under two treatments. In one treatment (T_1), the fishes were fed with rice bran and mustard oil cake 1:1 as supplementary feed. In another treatment (T_2), organic and inorganic fertilizers were applied weekly in pond III and pond IV at the rate of 10 kg/ha urea 14 kg/ha TSP and 705 kg/ha cowdung. The feed was prepared by mixing the finely powdered mustard oil cake and rice bran in the ratio 1:1 and feed at the rate of 5% body weight in treatment (T_1) and in treatment (T_2).

Water quality parameters: Temperature, dissolved oxygen (DO) and pH of water in each pond under each treatment were recorded on sampling dates. Temperature was recorded by using a Celsius thermometer, transparency was measured by secchi disk, DO was measured by a digital DO meter (Multi 340i/set, Germany) total alkalinity was measured by and pH was measured by a portable digital pH meter (MICRO-TEMP, pH 500).

Estimation of Growth

For estimation of growth, following parameters were used:

Weight gain = Mean final fish weight -Mean initial fish weight

$$\text{Weight gain (\%)} = \frac{\text{Mean final fish wt. - Mean initial fish}}{\text{Mean initial fish}} \times 100$$

$$\text{Survival rate (\%)} = \frac{\text{No. of harvested fish}}{\text{No. of stocked fish}} \times 100$$

Statistical analysis: For the statistical analysis of the data, one-way ANOVA and DMRT were done by using the SPSS (Statistical Package for Social Science) version-10.0. Significance was assigned the 0.5% level. Duncan's Multiple Range Test (DMRT) was used to tests the results of multiple rangers for comparisons of averages.

Results and Discussion

Fecundity: For showing relationship between the fecundity, gonad weight, body weight and GSI (%) 10 fishes were randomly selected. Among the 10 fishes, we found highest GSI (%) was 9.09 and lowest was 5.05. In case of fecundity, the highest value was 4.416×10^3 and lowest value was 2.775×10^3 which has shown in Table 1. From the experiment it was clear that body weight or body size did not influence the fecundity. But gonad weight is directly related with fecundity. If gonad weight was high, then fecundity was high and if gonad weight was low then the fecundity was also low. The fecundity of brood fish is decreased day by day. In case of GSI%, it was clear that if gonad weight was high the GSI % was high. From the present study it was clear that there was no great change in the GSI%. GSI% is changed in monthly variation. In breeding season the gonado-somatic index is high and it may be 0 in odd breeding season. Mustafa *et al.* (1982) stated that, the fecundity of *P. sarana* ranged from 18,925 to 78,925 inhabiting a beel in Tangail, Bangladesh. Karim and Hossain (1972) observed that the relationship between fecundity and body weight was polynomial in case of *Puntius* sp.

Table 1. Body weight, gonad weight and GSI (%) of randomly selected fishes

Sl. No.	Body weight (x 10)g	Gonad weight (g)	GSI (%)	Gonad weight (g)	GSI (%)	Fecundity (x 103)
1	12.23	110	8.99	7.5	7.88	2.775
2	12.65	10.9	8.61	7.9	9.09	2.828
3	13.12	10.7	8.15	10.4	8.15	3.640
4	13.19	10.4	7.88	10.0	6.93	3.700
5	13.42	7.9	5.38	10.9	7.99	3.815
6	14.08	12.8	9.09	11.0	8.61	3.850
7	14.76	11.8	7.99	10.9	5.88	3.869
8	14.84	7.5	5.05	10.7	6.34	3.905
9	15.71	0.9	6.93	11.8	5.05	4..248
10	15.75	10.0	6.34	12.8	8.99	4.416

Table 2. Growth in length (mm) and survival (%) of Thai Sharpunti fry after 4 weeks of nursing under, two stocking densities under, two stocking densities under two treatments

Treatment	Replication	Initial length (mm)	Final length (mm)	Average final length (mm)	Survival (%)	Average Survival (%)
T_1	T_I	3.61	33.50	32 .65	68.00	66.5
	T_{II}	3.61	31.80		65 00	
T_2	T_{III}	3.61	30.20	30.40	37.00	56.00
	T_{IV}	3.61	30.20		55.00	

Table 3. Growth in weight (g) and survival (%) of Thai Sharpunti after 4 weeks of nursing under two stocking densities under two treatments

Treatment	Replication	Initial wt. (mg)	Final wt. (mg)	Average final wt. (mg)	Survival (%)	Average survival
T_1	P_I	0.55	9950	10070	68.00	66.5
	P_{II}	0.55	10200		65.00	
T_2	P_{III}	0.55	9700	9800	57.00	56.00
	P_{IV}	0.55	9900		55.00	

Table 4. Water quality characteristics of pond water stocked with Thai Sharpunti under two treatments

Treatments	Stocking density (million/ha)	Water temperature. (^{0}C)	Transparency (cm)	Dissolved oxygen (mg/L)	pH
T_1	4 million/ha	29-31	30-34	2.4-4.7	7.4-7.7
T_2	6 million/ha	30.1-31.5	32-35	2.1-4.3	7.1-7.9

Table 5. Growth rate of fishes by net increase and percentage of increase in weight during the period of study

Treatment	Pond no.	Fortnightly average values in weight (gm)										During the period of study	
		15 April	30 April	15 May	30 May	15 June	30 June	15 July	30 July	15 August	30 August	Net increase	% of increases
Feeding	P_I	90.86	40.66	34.35	22.78	23.09	13.68	3.38	11.82	13.24	9.67	86.55	794.06
	P_{II}	103.86	43.60	39.27	18.72	24.35	14.12	12.37	12.76	10.76	9.91	99.35	959.90
Average		97.36	42.13	36.81	20.75	23.72	13.9	7.875	12.29	12	9.79	92.95	827.7
Fertilizer	P_{III}	57.76	41.53	29.39	21.48	19.16	14.02	15.55	8.76	7.19	6.94	67.3	580.17
	P_{IV}	86.54	40.21	31.62	17.60	18.53	15.63	15.77	5.39	8.66	7.58	67.9	652.8
Average		72.15	40.87	30.505	19.54	18.84	14.82	15.66	7.075	7.925	7.26	67.6	614.54

Table. 6. Growth rate of fishes by net increase and percentage of increase in length during the period of study

Treatment	Pond no.	Fortnightly average values in length (cm)										During the period of study	
		15 April	30 April	15 May	30 May	15 June	30 June	15 July	30 July	15 August	30 August	Net increase	% of increases
Feeding	P_I	26.02	23.91	17.54	16.41	14.10	11.21	2.02	13.86	9.56	7.14	9.85	269.86
	P_{ll}	50.72	21.15	19.04	14.66	11.62	9.37	10.47	10.34	7.03	8.67	11.48	332.75
Average		38.37	22.53	18.29	15.53	12.86	10.29	6.24	12.1	8.29	7.90	10.66	300.28
Fertilizer	P_{Ill}	24.35	7.52	7.01	3.27	3.17	4.61	4.41	4.22	16.21	3 .48	5.3	135.85
	P_{IV}	21.62	11.11	12.00	8.92	6.55	6.15	4.34	5.55	I 5 .78	2.56	5.3	176.66
Average		22 98	9.3 I	9.50	6.09	4.86	5.38	4.37	4.885	I5.99	3.02	5.3	139.47

Growth of larvae during nursing: The initial length and weight of spawn stocked in all the ponds was the same 3.61 mm and 0.55 mg. It is evident from the data that the fry attained a size of 33.50 to 31.80 mm (average 32. 65 mm) in length and 9950 to 10200 mg in weight (average 10070 mg) in ponds with lowest stocking density of 4 million/ha, while the fry attained size of 30.20 to 30.20 mm (average 30.40 mm) in length and 9700 to 9900 mg (average 9800 mg) in weight in ponds with 6 million/ha. This indicates higher growth in length and weight at lower stocking density of 4 million/ha. Growth gradually decreased with increase in stocking density (Table 2 & 3) indicates that the treatment I show highest average length and weight followed by treatments II. The average survival of fry in different ponds is presented in (Table 5 & 6). The highest survival (65 to 68.00% with an average of 66.5%) was obtained from ponds stocked at 4.0 million spawn/ha while the lowest survival in ponds stocked at 6 million/ha was (55 to 57% with an average of 56%). This indicates that the survival of spawn decrease with increase in stocking density. Saha *et al.* (1989) found 76% survival of rohu spawns after 21 days when reared at 1.25 million/ha.

Water quality parameters during nursing: Water temperature, pH, dissolved oxygen and transparency in different ponds are presented in Table 4. Water temperature ranged from 29^0C to 31.5^0C in different ponds. Dissolved oxygen was relatively lower (2.1-4.7 mg/L) in morning hours in the ponds with higher stocking density as compared to ponds with lower stocking density (2.4-4.7 mg/L). Saha *et al.* (1988) observed a similar phenomenon. Secchi disc transparency was relatively higher (30-35 cm) in ponds stocked at 6.0 million/ha. During the study period, pH water in different ponds was in the range of 7.1-7.9 which is characteristic of good quality water.

Growth rate of fishes during rearing: During the period of study the net increase in length and weight of *P. gonionotus* recorded in the supplementary feeding ponds were 9.85 cm and 86.55 g in pond no. I and 11.48 cm and 99.35 g in pond no. 11 with average values were 10.66 cm and 92.95 g respectively (Table 5 & 6). In fertilized ponds the net increase in length and weight of the fish were found to be 5.3 cm and 67.3 g and 5.3 cm and 69.3 g in pond III & IV respectively and the average values recorded were 5.3 cm and 67.6 g. By percentage of increase in supplementary feeding ponds the fish was found to attain 270% in length and 794% in weight in pond I and 333 % in length and 960% in weight in pond II, and the average values of the same recorded were 300% and 828% in length and weight respectively. Karim (1989) also recorded highest growth rate of this fish in supplementary feeding ponds than the fertilized ones.

Survival rate: At the end of the experiment the survival rate of fish for each pond was estimated separately and the values so far recorded have been shown in Table 8. The survival rate recorded in feeding ponds (T_1) were 88% and 92% in ponds no. I and II respectively with average value of 90%. Whereas the value of the same recorded in fertilized ponds (T_1) were 79% and 85% in pond III & IV respectively with average value 82%. The survival rates (93.33% & 94%) recorded by Karim (1989) were almost closed to the survival rate recorded in the present study.

Yield: Gross and net yields of fish under fertilized and feeding conditions were estimated on the basis of survival rate and average weight gained by the fish and the results obtained were presented in Table 7. Between the two treatments highest yield of fish (gross and net) was recorded in the treatment T_1, where fishes were fed with supplementary feed. The gross and net yields of fish recorded in the feeding ponds were 3456.45 kg/ha and 2647.25 kg/ha in pond I, 4158.29 kg/ha and 3125.14 kg/ha in pond II. The gross and net yields of fish recorded in the fertilized ponds were 2454.25 kg/ha and 1536.25 kg/ha in pond III, 2647.48 kg/ha and 1723.65 kg/ha in pond IV. The average values of gross and net yields of fish recorded in the feeding ponds were 3807.37 kg/ha and 2886.2 kg/ha, the average values of gross and net yields of fish recorded in the fertilized ponds were 2550.87 kg/ha and 1629.95 kg/ha. Karim *et al.* (1989) and Kohinoor *et al.* (1993) also recorded higher yield of this fish with supplementary feeding. The yield recorded by Karim *et al.* (1989) were 645.79 kg/ha/5 months from the ponds feeding with rice bran only and 179.99 kg/ha/5 months in the fertilized ponds.

Table 7. Survival rate gross and net yield of *P. gonionotus* during *the* period of study

Treatment	Pond	Stocking rate/ha	Initial Survival weight(g) rate	Survival rate (%)	Gross -yield (kg/ha)	Net yield (kg/ha)
T_1	P_I	35000	819.28	88	3456.45	2647.25
(Feeding)	P_{II}	35000	894.52	92	4158.29	3125.14
Average		35000	856.9	90	3807.37	2886.2
T_2	P_{III}	35000	705.25	79	2454.25	1536.25
(Fertilizer)	P_{IV}	35000	785.45	85	2647.48	1723.65
Average		35000	745.35	82	2550.87	1629.95

Water quality parameters during rearing: The studied water quality parameters were presented in Table 8. During rearing experiment, water temperature was found vary from 28 to 31.1 ^{0}C and 28 to 30.7 ^{0}C in treatment 1 and 2 respectively. Mollah and Haque (1978) reported water temperature ranged from 26.00 to 32.44°C in the pond of BAU campus Mymensingh. The highest and lowest transparency was found in April and May respectively. Mollah and Haque (1978) recorded the transparency to be 91.50 to 127.0 cm in pond culture system. The highest and lowest dissolved oxygen found in the month of August and March respectively. Hasan (1998) recorded DO to be from 1.1 to 6.87 mg/L during the experiment from the ponds of BAU campus. The highest and lowest pH were found in the

month of July and May respectively. According to Swingle (1968), pH value of 6.5 to 9.0 is suitable for pond fish culture. The highest and lowest $N0_3$-N were found in the month of August and April respectively Hasan (1998) recorded nitrate range from 0.09 to 4.0 mg/L. The above results mostly agreed with the present study.

Table 8. The mean values (± SD) and range of water quality parameters in two treatments during the rearing period

Parameters	Treatment -1		Treatment -2	
	P_I*	P_{II}*	P_{III}*	P_{IV}*
Temperature (°C)	30.17±0.965 [28.3-31.3]	29.63±0.853 [29-30.8]	29.209±1.13 [28-31]	29.009f0.9924 [28-30.7]
Transparency (cm)	32.209±2.4664 [29-35.4]	32.4364±2.4664 [30-36.5]	34.109±1.9414 [30-36.5]	34.05±1.619 [31.5-36]
DO (mg/L)	5.1818±0.4916 [4.6-5.9]	5.3273±0.4429 [4.8-5.9]	5.47273±0.40023 [4.8-5.9]	5.5091±0.378 [4.8-5.9]
pH	6.45455±0.64709 [5.6-7.5]	6.3636±0.6772 [5.6-7.5]	6.5±0.467 16-7.5]	6.736±0.568 [6-7.5]
N03-N g/L)	0.1±0.08 [0.01-0.25]	0.102±0.071 [0.02-0.21]	0.0951{).067 10.01-0.231	0.095±0.064 [0.01-0.25]

*(Mean±se and Range)

However, the highest growth rate and yield of this were obtained with supplementary feeding than the fertilization only. It can be concluded that the fish may be the best grown under supplementary feeding condition for maximizing its yield. The present level of yield of this fish might be increased to great extent by rearing it under highest stocking densities with relatively improved supplementary feeding.

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