



Effect of different stocking densities on growth and survival of *Nandus nandus* fry in earthen pond

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Abstract

20 days old fry were reared for 45 days with three stocking densities having three replications to know the effect of densities on growth and survival of *Nandus nandus* fry in earthen pond. Experiment was designed with three stocking densities such as $T_1 = 80$ nos/m², $T_2 = 100$ nos/m² and $T_3 = 120$ nos/m². Water quality criteria of experimental pond were suitable to fish culture. After 45 days rearing the ponds were harvested and percent weight gain obtained 380.38 ± 50.92 , 275.76 ± 40.37 and 237.50 ± 33.96 in T_1 , T_2 and T_3 respectively. Survival rate obtained 68, 62 and 55 in T_1 , T_2 and T_3 respectively. The present experiment was undertaken as lower stocking densities showed higher growth rate and survival %.

Keywords: *Nandus nandus* fry, stocking densities

Introduction

Nandus nandus is an indigenous vulnerable and small food fish in Bangladesh. It can survive both in fresh and brackish water. This fish is favourite to consumers because of its delicious taste and therefore have a great demand fetching high price in the market. Successful technology culture will help to culture this fish in shallow waters like rice fields that would play substantial role in the overall nutrition of the people of Bangladesh, especially the poor and lower middle class rural people of Bangladesh (Das and Zamal *et al.*, 2000) [7]. Stocking density is an important parameter in culture operation, since it has direct effect on growth and hence on production (Backiel and le cren, 1978) [5]. It is an established fact that growth rate progressively increases as the stocking density decreases and vice-versa. Stocking densities and management measures practiced by pond operators in Bangladesh are not based on scientific knowledge, thus resulting in poor growth and survival of fry. To obtain maximum economic returns it would be necessary to stock the ponds at right stocking densities for optimum growth. Moreover International union for Conservation of nature (IUCN, 2000) [9] has enlisted mottled nandus (*N. nandus*) in their red list of threatened fishes of Bangladesh as a vulnerable taxon. So successful *Nandus nandus* culture is needed in our country to escape this species from extinction. Determination of optimum density for *Nandus nandus* culture is also essential for economic profit. The present study is intended to determine the optimum stocking for the culture of *Nandus nandus*.

Materials and Methods

20 days old fry having 2.1 ± 0.24 cm length & 0.52 g weight were carefully reared for 45 days with different stocking densities to know the effect of densities on growth and survival of *Nandus nandus* fry in flood plain sub- station

Santahar, Bogra. The fish were acclimated 3 days before starting the experiment. There were three treatments with three replications. They were designated as $T_1 = 80$ nos/m², $T_2 = 100$ nos/m², $T_3 = 120$ nos/m². Nine ponds (each 5 decimal) were prepared by drying, excavation and liming @ 1 kg /decimal and urea, TSP & cow dung @ 0.100kg, 0.075kg & 8kg/decimal. Before starting the experiment ponds were drained to eradicate all fishes and ponds were encircled with nylon net. Pond embankment was also repaired. To produce zooplankton mustered oil cake, cow dung, flour was provided before stocking of fry. Fry were fed with fine rice bran (25%) mustered oil cake (25%) and fish meal (50%) or brand nursery feed @ 6%-12% of estimated body weight, Tubifex and small fishes at the same daily ration. The ponds were sampled fortnightly by using nylon net to determine growth rate as well as feed adjustment. Water temperature, pH, ammonia, and nitrate nitrogen were routinely monitored. After 45 days of rearing all fish were harvested through seine netting and drying. During harvesting fishes were counted and weighed from each pond to assess the survival rate and production. The data obtained from the experiment were analyzed by DMRT (Duncan's Multiple Range Test) with one-way analysis of variance (ANOVA). For each sample the survival rate, % weight gain & specific growth rate were determined by the following formula.

a) Percent weight gain (%)

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

b) Specific growth rate (% per day)

$$\text{SGR (\% per day)} = \frac{\ln W_2 - \ln W_1}{T_2 - T_1} \times 100$$

Where, W_1 = Initial live body weight (g) at time T_1 (day)
 W_2 = Final live body weight (g) at time T_2 (day)

Results and Discussion

Table 1: Mean (\pm se) values of Growth and survival rate of *Nandus nandus* fry in different stocking densities

Treatment	Stocking Weight (gm)	Final weight (gm)	Weight Gain gm	% Weight Gain	Specific Growth Rate	Survival Rate %
T ₁ =80	0.52	2.49 \pm 0.26 ^a	1.97 \pm 0.27 ^a	380.38 \pm 50.92 ^a	3.38 \pm 0.015 ^a	68
T ₂ =100	0.52	1.95 \pm 0.20 ^b	1.43 \pm 0.21 ^b	275.76 \pm 40.37 ^b	2.94 \pm 0.009 ^b	62
T ₃ =120	0.52	1.75 \pm 0.18 ^c	1.25 \pm 0.17 ^c	237.50 \pm 33.96 ^c	2.69 \pm 0.006 ^c	55

* Figures with different superscript in the same column differ significantly

After 45 days rearing of *Nandus nandus* fry at different stocking densities, weight gain (1.97 ± 0.27 g) was highest in case of stocking density 80 nos/m² and followed by the stocking density 100/m² (1.43 ± 0.21 g) and 120/m² (1.25 ± 0.17 g) (Table 1). Survival rate 66 % was higher in case of stocking density 80 nos/m² and followed by the stocking density 100/m² (62%) and 120 nos/m² (55 %). Specific growth rate 3.38 was highest in case of stocking density 80 nos/m² among all treatments. Percentage weight gain was also higher (380%) in case of stocking density 80 nos/m² and followed by the (275%) stocking density 100/m² and (237 %) 120 nos/m² (Fig.2). This study showed that relatively higher stocking density causes proportional decrease in growth rate. In general weight gain appears to decrease as a function of biomass (standing stock) of fish when the population density exceeds the carrying capacity. Stocking density was an important parameter in fish culture operations, since it had direct effect on growth and survival and hence on production (Bakiel and Le Cren 1978) was similar to present study. Kohinoor *et al.*, (2004) [1] found that highest survival 89% and highest growth was obtained in treatment-1, where the stocking density was 40,000/h. The lowest survival 79% and lowest growth was obtained in treatment-3, where the density was 60,000/ha. The result revealed that higher survival rate and weight was found at lower stocking density was similar to the present experiment. Mollah *et al.* (2011) [14] concluded that *Barbonymus gonionotus* highest final weight obtained from 80/decimal stocking density and lowest final weight obtained from 120 /decimal stocking density which more or less agreed with results of the present study. It was an established fact that growth rate progressively increases as the stocking density decreases and vice-versa. This was because a relatively less number of fish of similar size in a pond could get more space, food and dissolve oxygen etc. (Brett *et al.*, 1974 and Weatherly, 1976) [6, 21]. In carp culture there is a positive correlation between pond size and growth (Ameen *et al.* 1986) [4] which might be true for the present study. Shigur *et al.*, (1974) [19] obtained 71% survival when stocking at 6-7.5million/ha carp spawn. Tripathi *et al.*, (1979) [20] stocked ruhu spawn at an average rate of 10.21 million/ha obtained 80.73% survival rate. K. J. Rana., (1992) [11] reported *Oreochromis niloticus* achieved 1668.40 mg weight from 2 fry/l stocking density and 1270.35mg weight achieved from 5 fry/l stocking density was similar to the present study. G.S Haylor *et al.*,(1991) [8] reported that in case of *Clarias*

gariiepinus stocking density 50fry/l obtained 90% survival and stocking density 100fry/l obtained 91% was disagreed to the present research. It was occurred due to species variation. Shahabuddin *et al.*, (1998) obtained maximum survival of 73.3% of ruhu spawn after 21 days at 3 million/ha. This was reason for species variation, size difference, duration of rearing, water quality parameters, and Diseases mortality. Karim *et al.*, 1988 [10] reported *Barbonymus gonionotus* grew fast at high stocking densities was disagreed with the result of present study. It may be occurred due to species variation.

Figs. 1 represent the growth in length of *Nandus nandus* fry respectively at different times of the experimental period. Length (Fig. 1) and weight gain (Fig. 2) of the fish increased with the low stocking densities of *Nandus nandus* fry in all treatments T₁, T₂, and T₃.

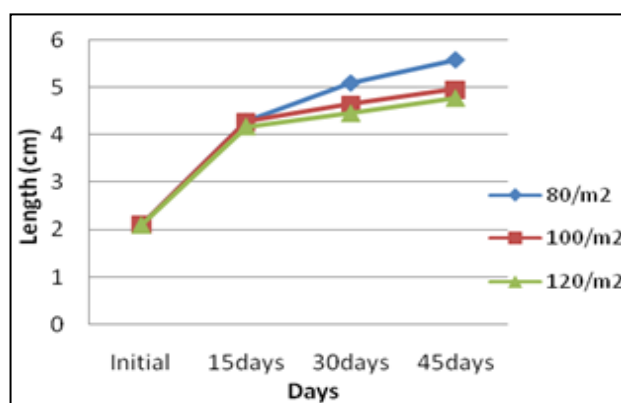


Fig 1: The length (mm) with time of *Nandus nandus* fry at different stocking densities.

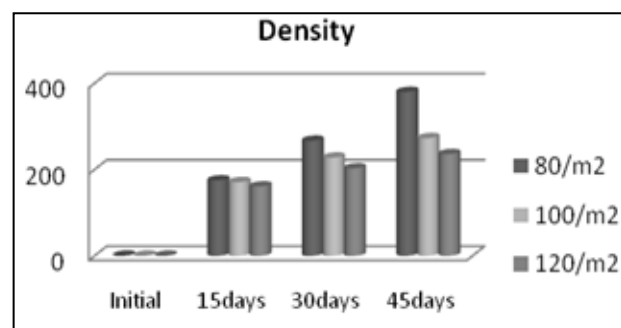


Fig 2: Effect of % weight gain of *Nandus nandus* fry at different stocking densities.

Table 2: Water quality criteria of experimental pond stocked with *Nandus nandus* at variable densities.

Experimental pond	Dissolve oxygen (mg/L)	Temperature °C	Total Alkalinity	pH	Ammonia mg/l	Nitrate nitrogen mg/l
T ₁ =80	7.0-8.2	28.2-29.2	160-168	7.90-8.5	0.043-0.07	1.65-1.77
T ₂ =100	6.5-7.69	28.0-29.1	161-165	7.7-8.10	0.051-0.08	1.7-1.75
T ₃ =120	5.70-6.56	28.23-29.3	159-166	7.6-8.02	0.065-0.09	1.67-1.70

Water quality parameters were not significantly difference. Dissolve oxygen was increased with the decreasing stocking densities. The lower level of dissolve oxygen might be reason of reduced growth. Ahmed *et al.* (1991) ^[3] also observed a decreased growth rate of *clarias gariepinus* fry under reduced oxygen level. Temperature was almost same in all experimental ponds. pH was higher in lower stocked pond. Ammonia also lowers in case of lower stocked pond. Nitrate nitrogen was also lowers in lower stocked pond among all experimental ponds.

The values of water temperature are more or less similar to that reported by Paul (1998) ^[16] and Kohinoor *et al.*, (2000) ^[13]. The pH in all pond water was alkaline throughout the experimental period. Different authors have reported a wide variation in pH from 6.7 to 8.3 (Hossain *et al.*, 1997) and 7.18 to 7.24 (Kohinoor *et al.*, 1998) ^[12] in fertilized fish ponds and found the ranges productive. The ranges and mean value of pH recorded in present study are alkaline which is indicating the productive nature of the fertilized ponds.

Dissolve oxygen is the most important factor for all aquatic organisms except anaerobic bacteria. Dissolve oxygen concentration more than 3.5 mg/l in pond waters reported by several researchers Martyshew, (1983) ^[15], Rahman 2000 and Kohinoor 2000) ^[13] was similar to the present study. Dissolve oxygen content were relatively lower (2-4 ppm) at the morning hours in ponds with higher stocking density, as compared to the ponds with lower stocking density (3.0-5 ppm) which was also observed by Saha *et al.*, (1998) ^[17] was agreed with the present experiment.

Although well growth and survival at high stocking densities will not only results in high profitability but also reduce area of ponds required for culture of fish, moreover almost all species achieved higher growth in low stocking density. Well growth & survival rate of *Nandus nandus* fry would be found in low stocking density. In the experiment, it was clear that survival rate, Growth and Dissolve oxygen were inversely related with the higher stocking densities of *Nandus nandus* fry. In the experiment pH, Temperature, Nitrate nitrogen, Total alkalinity and Ammonia were satisfactory to fish culture. All experimental ponds of the present research were productive according to (Alikunhi 1957) ^[2].

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