J. Agrofor. Environ. 5 (1): 117-120, 2011 ISSN 1995-6983

Effect of nursing methods on survival of Common carp, *Cyprinus carpio* Lin. Spawn

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Abstract: An experiment was conducted to observe the predatory effect on the survival of common carp spawn at Modati village of Birgonj Thana under Dinajpur district during March to April 2001. The experiment was conducted with five treatments each with four replications. The treatments consisted different methods to protect common carp spawn from the predators were: T_1. ditches fenced by polyethylene, T_2 - ditches fenced by bana, T_3 - hapa made by polyester cloth, T_4- hapa made by fine mesh net and T_5- (control)- open where no fence or hapa were used. Lime and organic fertilizer (cowdung) were applied in each treatment equally. In all the treatments, 15000 number of common carp spawn were stocked in each replicate on 04 March 2001 and fish fry were harvested from all the treatments on 02 April 2001. During the study period water quality parameters such as temperature and pH were monitored and found almost similar in all the treatments and were within the favourable range for fish seed production. Significant presence of predators was observed in T_5 compared to other treatments. In addition survival rate also found significantly higher ($P<0.0$ 1) in T_3 (57.5%) compared to other treatments. Whereas average length (of individual fry) and weight (of 1000 fry) were significantly higher ($P<O.0$l) in T_5 as sufficient food and space were available because of massive predation compared to other treatments. The findings of those treatments where spawn protecting technique adopted were significantly better. This result indicates that predation has a significant effect on the survival of common carp spawn.

Key word: *Cyprinus carpio*, Predator, Polyethylene, Bana, Hapa

Introduction

In fresh water aquaculture major culturable fish species of Bangladesh are carps like rohu (*Labeo rohita*), catla (*Catla catla*), mrigal (*Cirrhinus mrigala*) and common carp (*Cyprinus carpio*) etc. The common carp (*Cyprinus carpio*) is on a worldwide basis, one of the most extensively cultivated of all fish species. There exists an excellent opportunity in Bangladesh to flourish aquaculture by culturing *Cyprinus carpio* (Rahman, 1985). Considering the aquaculture potential of *Cyprinus carpio,* it was introduced in Bangladesh from Nepal in 1979 (Rahman, 1985). Locally it is called "carpio". It grows fast at high stocking densities (Jhingran, 1982). It may reach marketable size in five months and it is also ideal for culturing in seasonal ponds (NADP, 1996). It is well known that common carp in ponds lay eggs in water hyacinths and other submerged substrate during breeding period. Use and setting of water hyacinth in pond is a common practice. But, for getting better results farmers are now improving this concept day by day. In this connection, farmers pay more attention on selection of brood fish pond and water hyacinth, collection and setting them in pond for creating environment for breeding purpose of common carp. Though initially they get good results with egg collection and hatching of eggs, ultimately all their efforts fail because of their existing nursing method which results in high mortality of spawn. Traditionally farmers use small ditches for hatching of eggs. They do not pay any attention to the natural predation of hatchlings by natural enemies like backswimmer, frogs, different insect larvae etc. It is fact that fish eggs, hatchlings and fry stages are very much sensitive for fish culture. So hatchery operators of our country do not expect above 80% survival even in the intensive and controlled environment for fish seed production.

Backswimmer is a common predator for larvae from of carps which can easily penetrate its tactile organ in the yolk sac of spawn and the frog can easily catch the slow moving spawn. But, during this weaning stage spawns start searching for food and moves fast. This fast moving behaviour ensures escape from their predators. This result indicates more abundance of predators at the time of early hatched-out spawn. So there might be a probability of high mortality during the first 2 to 3 weeks after hatching. After that time they can easily save themselves from their predators. Farm manager and hatchery operators are of the opinion that mortality occurs significantly during first 2 to 3 weeks after hatching. So protection of spawns from predation in the early hatching period (up to four weeks) by any means may enhance the survival of fish seed. In this regard, fencing by any means around the nursing area or using of hapa technique could be easier means to increase the survival of common carp spawn to a significant level (Lakshmanan, 1969).

There is no information about the mortality of common carp spawn in extensive method by natural predation and no attempts so far have been made to study such factors. So, the present study is undertaken to find out the ways for increasing survival of common carp spawn at farmer level and to test the effectiveness of different fencing material in relation to the survival of common carp spawns.

Materials and Methods

The present study was conducted for a period of 30 days from 4th March to 2nd April 2001 at Modati village of Birgonj Thana under Dinajpur district. Eight hapa and eight ditches, each with 3 m length, 1 m width and 1 m depth were used to conduct the experiment. Hapa made of both polyester cloth and fine mesh net, was set in a 25 decimal pond. Ditches were situated near the side of the pond. Five treatments were used in the present experiment each with four replications. Ditches fenced by polyethylene and bamboo were designated as treatment-1 and 2 respectively. Hapa made of polyester cloth and fine mesh net was designated as trealment-3 and 4. Ditches, which were not surrounded by any means, designated as treatment-5 (control).

Before releasing of common carp spawn the ditches were treated with lime at a rate of 1 Kg/decimal. After liming ditches were enclosed with polyethylene sheet in a way that its wall would be 2 feet high from the land surface and half feet deep into the soil. Then all the ditches were filled up with water through polyethylene pipe. Water depth was

maintained up to 0.75 m. After filling with water, the ditches water was kept undisturbed for one night in order to let the clay particles settle down. In case of bana surrounded ditch, at first ditches of size 3x 1x 1 m were dug and then the ditches were treated with lime. After that the ditches were surrounded by bamboo made bana so that its wall would be 2 feet high from land surface and half feet deep into the soil. The ditches were then filled with water up to the level of 0.75 m and water of the ditches was kept undisturbed for one night. All the ditches were fertilized with organic fertilizer i.e. cow dung. Cow dung was applied evenly to ditches after one day of water filling. Cow dung was applied to produce natural food for spawn at a rate of 40 Kg/dec.

After preparation, hapas were set in a 25 decimal pond in such a way so that depths of water remained O.75m. Hapas were prepared with fine mesh net of size 3 x 1 x 1 m. Then set in the same pond where the polyester made hapas were set. Common carp spawns were collected from the adjacent farmers pond of Modati village under Dinajpur district where natural spawning of common carp is a popular and beneficial practice to the farmers now a days. During winter season most of the farmers become engaged with this activity. After five days of organic manuring spawns were stocked 15000 in each replicate. During the study period the water level was checked every two days interval so that it was not ring down quickly. Water was supplied by polyethylene pipe in all the ditches. For feeding of common carp spawn fine rice bran was applied into the ditches and hapas from next day of stocking as supplementary feed everyday in the morning and evening. A small quantity of rice bran was applied as powder form, which usually formed a thin layer over the water surface. After seven days of stocking, soaked mustard oilcake was mixed with rice bran in the ratio 1:1 and applied it as liquid form in the morning and evening into the ditch and hapa until completion of the experiment. Water hyacinth was used in the ditches to keep the water cool and for shelter of spawn. Water temperature was recorded at 3 days interval; while pH was recorded weekly basis through out the experimental period. Temperature was recorded at 8 AM, and 5 P.M. Presence of different types of predators was observed in different treatments on weekly basis and the number of predators in per square meter were recorded. At the end of the experiment fry were harvested and then counted their number individually. The growth in each treatment were recorded by measuring weight of 1000 fish seed and measuring length (cm) of individual spawn (50 from each replicate). The survival rate of common carp fry for each treatment and replication were calculated. Data were analyzed in Randomized Complete Block Design (RCBD) single factor. Duncan's Multiple Range Test (Duncan, 1955) was done in order to determine the variations in survival rate and growth of common carp fry among the treatments.

Results and Discussion

In Bangladesh, very few reports are available on the effect of nursing method on survival of common carp but research work like; effect of predation on the survival of common carp is very rare. In the present study an attempt has been made in this aspect. Water quality determines to a great extent the success or failure of a fish cultural operation. A favourable range of water quality parameters is the pre-requisite for good environmental condition that effect the survival of common carp spawn. Various water quality parameters were observed during the study period. The water temperatures were more or less similar in all the treatments. However, the water temperature of the experimental ditches and hapas increased gradually towards the end of the experiment. The range of water temperature were found 16.3-28.6, 16.2- 28.5, 16.2-28.4, 16.1-28.3 and 16.2-28.8 in T_1, T_2, T_3, T_4 and T_5 treatments, respectively (Table l). The maximum temperature 28.6 was recorded in T_1 on March 31.

Table 1. Water temperature (^{0}C) in 5 different treatments during experimental period

Monitoring	Time	Treatments				
		T_1	T_2	T_3	T_4	T_5
March 04, 01	M	16.3	16.2	16.2	16.1	16.2
	E	23.2	23.1	22.9	22.9	23.2
March 07, 01	M	16.8	16.8	16.6	16.6	16.7
	E	23.7	23.5	23.2	23.1	23.6
March 10, 01	M	17.2	17.1	17.2	17.2	17.1
	E	24.1	24.1	23.8	23.8	24.1
March 13, 01	M	17.6	17.5	17.4	17.3	17.6
	E	24.4	24.3	24.1	24.1	24.3
March 16, 01	M	18.4	18.2	18.2	18.1	18.3
	E	25.4	25.3	24.9	24.8	25.4
March 19, 01	M	18.8	18.7	18.5	18.4	18.6
	E	25.8	25.6	25.2	25.2	25.7
March 22, 01	M	19.6	19.6	19.4	19.3	19.5
	E	26.7	26.5	26.3	26.1	26.7
March 25, 01	M	19.9	19.8	19.7	19.7	19.8
	E	27.2	27.1	26.9	26.7	27.1
March 28, 01	M	20.3	20.1	20.1	19.9	20.3
	E	27.2	27.1	26.8	26.7	27.1
March 31, 01	M	20.6	20.4	20.3	20.2	20.5
	E	28.6	28.5	28.4	28.3	28.4

Note: M – Morning at 8.00 am, E – Afternoon at 5.00 pm.

On the other hand, the minimum temperature 16.1 was found in T_4 on March 04. Above temperature was favourable for successful growth of spawn. Mookherjee *et al.* (1946) reported that Catla juveniles could thrive well in temperature ranges of 18-37°C, while temperature above 39.5°C and below 16.7 °C was found to be fatal. Jagannathan (1947) reported that 26.5 °C temperature was optimum for survival of Catla. Basu (1951) reported that temperature has a distinct effect on oxygen utilization by the spawn and for 10°C raising temperature oxygen utilization is double. pH is one of the most important factor which regulates the productivity of water body. The pH values of experimental plots were near about neutral (Table 2). During the study period the pH values were found to range from 7.4 to 7.7 in all the treatments. Basu (1951) reported that larvae could tolerate a pH range of 6-9. Saha and Choudhury (1956) stated that water having a pH 7.0-8.5 and minimum dissolved oxygen of 4 mg/l was found congenial for survival. Survival period decreases at a water pH of 8.8 and above. Pi1lay (1990) reported that the most suitable pH of water for aquaculture farms is considered to lie in the range 6.7-8.6 and values above or below this inhibits growth and production.

Table 2. pH value of different treatments during study period

Treatments	Date				
	04-03-01	11-03-01	18-03-01	25-03-01	01-04-01
T_1	7.4	7.7	7.7	7.6	7.7
T_2	7.7	7.6	7.6	7.7	7.7
T_3	7.5	7.6	7.6	7.7	7.6
T_4	7.5	7.5	7.6	7.6	7.6
T_5	7.7	7.7	7.7	7.5	7.7

Table 3. Status of different predators observed per sq. meter area in individual treatment plot

Monitoring date	Treatments					
	Predators	T_1	T_2	T_3	T_4	T_5
March 04, 01	Back Swimmer	0	0	0	0	0
	Frog	0	0	0	0	0
March 11, 01	Back Swimmer	3	5	0	0	47
	Frog	0	0	0	0	3
March 18, 01	Back Swimmer	1	3	0	0	29
	Frog	0	0	0	0	2
March 25, 01	Back Swimmer	1	1	0	0	11
	Frog	0	0	0	0	1
April 01, 01	Back Swimmer	1	0	0	0	8
	Frog	0	0	0	0	1

Presence of predators: Presence of predators is an important factor that influences the spawn survival and growth. Because predators may directly prey on the fish spawn stocked and indirectly they compete with spawn for their food. Among these predators; insect larvae, waterbugs (e.g. *Nepa nibra Naucoris cimicoides*, *Ranatra linearis* and *Notonecta glauca*) notonectids etc. and amphibians like frogs are most important and these appear in large numbers during warm summers (Poe and Rieman, 1988). Banerji and Prasad (1974) observed that Cyclops becomes substantially harmful to the spawn of *Anabas testudineu*s causing 100% mortality within 12 hrs. in a concentration of 1500 number per litre of water. The size of 7 mm attained in about 10 days were non vulnerable to the attack of *Cyclops*. Islam and Elahi (1993) reported that tadpoles and water snakes (*Natrix tessellata*) prey on fry. In the present study, presence of two types of predators like notonectids (back swimmer) and frogs were observed and their maximum number was recorded (back swimmer-47 and frog-3) in treatment 5 on March 11, 2001 and the number gradually decreased towards the end of the experiment (Table 3). The reasons behind this decreasing tendency might be associated with the nature of free moving nature of the fish spawn compared its increasing age. At the same time comparatively less number of predators were recorded in treatment 1 (back swimmer-3) and treatment 2 (back swimmer-5) on March 11, 2001 and

in this case the number also gradually decreased towards the end of the experiment.

Survival rate of common carp: The average survival rate of T_1, T_2, T_3, T_4 and T_5 was 55.25, 56.75, 57.5, 52 and 16.5 %, respectively. Probably due to the lack of water movement the average survival rate were lowest in T_4 among the treatments where predator protecting techniques applied. Survival rate lies between 52.0 to 56.35 % in different treatment but the rate of survival rate is only 16.5 % in open condition. Maximum survival rate was found in T_3. However, there was no significant (P>O.01) differences between the survival rate in T_1, T_2, T_3 and T_4 because of protection from predators which is in agreement with the findings of Alikunhi (1952) who observed that in absence of predators with abundance of zooplankton it was possible to obtain 100% survival of Catla fry. Ahmed *et al.* (1996) observed 46 % survival rate of catla fry in nursery. On the other hand, the lowest survival was observed in T_5 (16 which shows significant (P<0.O1) difference due to non-protection of predators. Ahmed (1983) reported that up to 84.0 % mortality of common carp spawn in carp spawning ponds was due to frog predation in Uganda. Ahmed *et al.* (1977) studied on predatory propensities of larvae (*Orthetrum sabina*) with the spawn of common carp under laboratory condition and found that the satiation time was about 40 minutes and it took 85 seconds to consume a prey. Lakshmanan (1969) observed that *Cyclops* in density of 0.17 ml/lit of water could destroy 25% of major carps spawn within 24 hours.

Growth performance of common carp fry: The weight gained by 1000 spawn was determined only at the end of the experiment. Considering the weight of 1000 spawn in different treatment the maximum weight was recorded in T_5 (141.0 g). Ahmed (1983) reported that sufficient food and enough space for easy movement might have led to the maximum growth. On the other hand presence of higher number of spawn in other treatments might have resulted in the lower weight gain of fry. This result is significantly (P<0.O1) higher than in other treatments (Duncan, 1955). This result was followed by T_3 (135 .0 g). On the other hand the lowest growth was observed in T_1 (121.0 g) and T_2 (123.0 g), which was close to that of T_4 (129.0 g). However, the overall result was close to the findings of Jhingran (1982) who reported that the carp spawn of 25.4 to 37.8mm weighed 0.15 to 0.75g.

Length of individual spawn: Maximum length was found in 15 (2.15 cm) at the end of study. More food and enough space for easy movement accelerated the growth (in terms of length) of individual spawn. This result was significantly (P<O.O1) higher compare to other treatments. Length of fry in T_3 (2.07) and T_4 (were very close to each other. Minimum length was observed in T_1 (1.91 cm). Length of individual fry in T_2 (2.00 cm) was followed by T_1. However, the overall result was close to the findings of Jhingran (1982) who found that carp spawn of 25.4 to 37.8mm length weighed 0.15 to 0.75g. Natural spawning of common carp is becoming a profitable and popular enterprise to the farmers but absence of proper protection technique from predators causing massive moralities of spawn, whereas adopting a protection technique can reduce the mortality to a significant level. So, when farmers are capable to use these techniques they could be easily benefited by increasing the survival rate of common carp spawn. However, more research works need to be carried out before a final conclusion is made.

References

Ahmed, G.U., Islam, M.M., Absar, M.N., Azim, M.E. and Uddin, M.M. 1996. Evaluation of natural and artificial feeds on the growth of African Catfish (*Clarias gariepinus*) larvae. *J. Asiat. Soc.* Bangladesh (Sci.). 23 (2): 205-213.

Ahmed, K., Hussain, M.A., Huda, N. and Abdullah, M. 1977. Nutritional Survey of rural Bangladesh. *Inst. Nutr. Food Sci*., Dhaka Univ. 66 pp.

Ahmed, K.K. 1983. Induced Breeding of Indian major carps, Chinese carps and catfish. Tech. Pap. 1. Fresh water, Res. Sta. Chandpur. 44-52 pp.

Alikunhi, K. H. 1952. Fish culture in India. *Fm. Bull. India Coun. Agric. Res*., 20:144 pp.

Banerji, S.R. and Prasad, S.1974. Observations on reproduction and survival of *Anabas testudineu*s (Bloch) in Bihar region. *J. Inland Fish. Soc.* India., 6: 6-17.

Basu, S.P. 1951. A study of the ecology and bionomics of Indian carps (*Catla catla*) (Ham.), *Labeo rohita* (Ham.), *Cirrhinus mrigala* (Ham.) cultured in sewage irrigated fish farm near Calcutta Proc. *Indian. Sci. Congr*. 37(3): 253-254.

Duncan, D. B. 1955. Multiple Range and Multiple F-tests. Biometrics. 11:1-42.

Islam, M S. and Elahi, K.Q. 1993. Small-Scale marine fishing in Bangladesh: A Socio-economic analysis. Bureau of Socio-cconomic Research and Training. Bangladesh Agricultural University, Mymensingh.

Jagannathan, N. 1947. A note on the collection, conditioning and transport of fingerlings of Catla in Madras presidency. *J. Bombay. Nat. His*. Soc. 47: 315-9.

Jhingran, V.G. 1982. *Fish and Fisheries of India*. Hindustan publishing corporation (India), Jawahar Nagar, Delhi, India. 666 pp.

Lakshmanan, M. A. V. 1969. On carp mortality due to *Cyclops* attack. *J. Bombay Nat. Hist. Soc.* 66(2): 391-392.

Mukherjee, H. K., Ganguly, D. N. and Sengupta, S.N. 1946. The optimum range of temperature of water for fingerlings of major carps of India. *Sci. Cult.* 11:383-385.

NADP, 1996. Aquaculture Manual for literate and semi-literate Fish Farmers (in Bengali). Northwest Aquaculture Development Project, Parbatipur, Dinajpur. 80 p.

Pillay, T.V.R. 1990. *Aquaculture principles and practices.* The University Press, Cambridge. 223 pp.

Poe, T.P. and Rieman, B.E. 1988. Predation by resident fish on Juvenile Salmonids in John Day Reservoir. Final report, 1983-1986: Final report of research. Rep. V.S. Dep. Energy. 384 pp.

Rahman, A.K.A. 1985. Inlroduction of Exotic Fishes in Bangladesh. Fisheries Research and Training Center, Chandpur. 15 pp.

Saha, K.C. and Choudhury, N.K. 1956. Studies on the mortality in spawn and fry of Indian major carps during transportation. *Indian. J. Fish.* 3(1): 119-126.