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EARLY AND BETTER MATURITY IN CARP BROOD STOCK WITH CONROL OF ENVIRONMENT AND FEEDING

A.GHOSH AND P.K.ROY
Inland Fisheries Training Centre of Central Institute of Fisheries Education, Barrackpore-743 101, West Bengal.

ABSTRACT

Availability of carp breeders in their prim state of maturity is a major constraint in hypophysation. Experiments conducted in a fish farm at Naihati, West Bengal, for two consecutive years, 1983-84 and 1984-85, clearly prove that by manipulation of environmental parameters such as metabolites, dissolved oxygen, running water conditions, as also of stock densities and quality and quantity of feed, *Catla catla, Hypophythalmichthys molitrix, Labeo rohita, Cirrhina mrigala* and *Ctenopharyngodon idella* can be made to attain better maturity and spawning stage much earlier than normal i.e. even in summer months and the entire stock spawned during the period from March to September. Percentage of successful breeding, quantities of eggs realeased and fertilised in relation to the body weight of all the species, were also found to be more in comparison to the brood stock raised through the conventional methods.

INTRODUCTION

The success of hypophysation depends largely on proper gonadal maturation of the brood stock in ponds, at proper time, in the breeding season of carps, which is generally restricted to the monsson months.

In India, the general practice is to collect healthy brood fishes 2-4 years old, weighing 1-4 kg and keep them in healthy conditions by feeding oil cake and rice bran at the rate of 1-2% of their body weight for a few months prior to breeding season. The stocking rate of brood fish in ponds maintained as 1000- 2000 kg per ha of water area. This general practice often leads to improper and late maturity of fishes, resulting in partial breedings, early resorption of gonads and non-utilization of favourable elimatic conditions for carp breeding for want of properly matured brood stock.

During recent years in West Bengal, some effective methods are being followed by the farmers to bring early and better maturity of carp brood stock, through manipulation of stock densities, regulation of feeding, reduction of metabolite load and increase of oxygen content of water through water exchange etc.

In an effort to standardise this technology of induced maturity, a research project was taken up in a private fish seed farm at Naihati for two consecutive years. The results of the experiments prove, that by variations of the stock densities during autumn, winter, spring and summer months, with regulation of feeding schedule, water management and periodical nettings for conditioning, early and better maturity of the broad stock of *Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Cirrhina mrigala* and *Ctenopharyngodon idella* could be brought about.

MATERIAL AND METHODS

The experiments were conducted in the private owned 'Fish Culture Centre' at Naihati, West Bengal, for two consecutive years 1983-84 and 1984-85.

Altogether eight ponds were used for the experiments on rearing of potential carp brood stock. Pond Nos. 1-6 were used for rearing with special treatments, whereas No.7 and No.8 used as control, in which general conventional method of brood fish management was followed. Out of the six ponds for special treatment, Nos. 1-3 with 2209 Sq.meter, 3500 Sq.meter and

8680 Sq.meter areas respectively were used throughout the period of experiments, and Nos.4-6 with 2209 Sq.meter, 3300 Sq.meter and 8600 Sq.meter areas respectively were used during specific periods, for thinning of the stock and sex-wise seggregation. The two control ponds, (Nos.7-8), were of 2200 sq.meter and 8600 Sq.meters areas respectively. The average depth of all eight ponds ranged between 2 to 2.5 meters, with bottom silt of about 90-180 mm. Atleast 1.5 meters depth of water was maintained in all the ponds throughout the experiments, excepting when specifically required to increase the temperature of water in experimental ponds.

Pre stocking preparation

All the ponds (experimental and control) were treated with lime at the rate of 3 kg per 100 m^2 of water area, seven days before fertilisation with raw cattle dung at the rate of 5 kg per 100 m^2. Ponds were fertilised 15 days before stocking with potential brood stock. The bottom of all the ponds were thoroughly disturbed for removal of accumulated gases, if any, five days before stocking.

Stocking

Mixed stocking of potential brood fishes (2+age group) of *Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Cirrhina mrigala* and *Ctenopharyngodon idella* at a ratio of Catla - 12, Silver carp - 8, Rohu - 36, Mrigala - 36, Grass carp - 8 were done in three experimental (Nos. 1-3) and two control ponds (Nos. 7-8) in the month of September, in both the years 1983 and 1984. Stock density @ 2000 kg/ha was maintained initially in all the three experimental ponds and permanently in two control ponds. Average individual body weight was *Catla catla* - 2 kg, *Hypophthalmichthys molitrix* - 1.5 kg, *Labeo rohita* - 1 kg, *Cirrhina mrigala* - 1 kg and *Ctenopharyngodon idella* - 1.5 kg.

Post stocking management : Experimental ponds

First phase (September to first week of December -13-14 weeks - Autumn)

A stock density @ 2000 kg / ha were maintained in three ponds (Nos.1-3) Daily feeding started after five days of stocking with cheap boiled rice @ 10% of total stock weight (excluding that of Grass carp), with mixture of powdered dry fish at 3 : 1 ratio by weight (rice : dried fish). *C.idella* were fed with *Hydrilla,* which was always made available @ 20%- 25% of the total stock weight of that fish, in the ponds. Periodical fertilisation with raw cattle dung at the rate of 2 kg/100m^2/fortnight was also resorted to.

Second phase (Second week of December to end of January - 7 weeks - Winter)

The stock densities were reduced to 1000 kg/ha by transferring the fishes to other three experimental ponds viz. Nos. 4-6. The feeding rate was also reduced to 5% of stock weight in each of the six ponds. Periodical fertilization of water was completely stopped. On those days, when the water temperature was very low (22°C or below), feeding was not done. At an interval of 2-3 days a mild water current was created lasting 2-3 hours in all the six ponds by introduction of fresh water from outside and allowing the old water to flow out through the overflow outlets, thus reducing the metabolite load. Weekly nettings for exercise and conditioning of the fishes were done. When the water temperature continued to be very low for prolonged periods, the depth of water in all the six ponds were kept reduced to increase the water temperature.

Third phase (February 3-4 weeks - Spring)

The stock densities were raised to about 2000 kg. /ha by transfering the entire stock to pond nos.1-3. During this period, the water temperature gradually started increasing. The reduced feeding schedule as followed during the second phase, was continued with periodical exchange of water and nettings. No fertilization was done.

Fourth phase (From the begining of March to end of breeding period).

The stock densities were reduced to 1000 kg /ha by using all the six ponds and through sexwise seggregation. A daily feeding schedule as during the first phase was followed. Periodical water exchange and netting operations were also done.

Post stocking management : Control ponds.

. Stock density at the rate of 2000 kg / ha was maintained throughout, from September to the spawing period. No water exchange and netting were done. Periodical fertilisation with Raw Cattle Dung @ 2 kg/100 m^2/ fortnight was done. Daily feding was done with a mixture of rice bran and oil cake in 1:1 ratio @ 2% of the total body weight of the stock, throughout the period. Soft aquatic weeds were made available for *Ctenopharyngodon idella*. In the event of formation of an algal bloom, feeding was suspended.

RESULTS

When the fish were found matured, breeding operations were done in circular breeding pools, seperately for the stock from experimental ponds and from control ponds. Spawner : milter ratio for each operation was 2:3 by number.

Table I and II indicate the following results of breeding regarding the spawners managed in experimental ponds and control ponds for two consecutives seasons,

Catla catla

In both the seasons, brood fishes were avilable in their mature state from the month of April, both in expeirmental and control ponds. From experimental ponds, mature brood fishes were available upto September, but none were available after August from the control ponds. The peak breeding period of the species was observed to be between May and July. The percentage of maturity of spawners from experimental ponds was 95%, while that from control ponds was 70% . 76% of the spawners from experimental ponds bred successfully, in comparision to 50% from control ponds. Quantity of eggs released were 4.0 to 6.5 l/kg body wt. from experimental ponds and 1.3 to 6.0 l/kg body wt. from control ponds. Fertilisation of eggs varied between 60 and 99% for the spawners of experimental ponds, and between 50 and 70% for those from control ponds.

Hypophthalmichthys molitrix

In experimental ponds, the brood stock were ready from March and continued to remain in ready state upto July in 1984, and August in 1985. In control ponds they were ready from April and continued upto July, during both the seasons. The peak breeding period of the species was between April and July. From the experimental ponds 66% to 78% fishes reached maturity and from the control ponds, 53% to 61% . 81% to 84% spawners of experimental ponds bred successfully, in comparison to 59% to 63% from control ponds. Quantity of eggs released per kg body weight of spawners varied between 3.5 l to 5.25 l from experimental ponds in comparision to 3.05 l to 4 l from control ponds. Fertilization rate varied between 60 and 98% for the spawners of experimental ponds, while it was between 52 to 70% for those from the control ponds.

Labeo rohita

In the experimental ponds, mature brood fishes were available from April and continued to be available upto September, whereas in control ponds they were ready from May and continued to remain in ready state upto August, during both the seasons. The peak breeding period of the species was from April to September for brood stock of experimental ponds and from May to August for control ponds. The percentage of mature spawners from experimental ponds was 92%, while that from control ponds was 70%. 83 to 89% spawners

Table I : Showing *monthwise maturity (M) and successful breeding (B) of spawners raised under special treatement in experimental ponds and under conventional methods in Control ponds.*

Species	Year	Experimental ponds														Control ponds													
		March		April		May		June		July		Aug		Sept.		March		April		May		June		July		Aug.		Sept.	
		M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B	M	B
Catla catla	1984	-	-	12	8	20	18	18	15	30	28	22	14	10	3	-	-	10	7	10	3	15	11	22	10	10	2	-	-
	1985	-	-	10	8	21	18	16	15	35	31	21	10	12	5	-	-	11	4	11	6	12	8	15	8	12	5	-	-
Labeo rohita	1984	-	-	35	29	51	40	60	55	75	72	64	56	35	12	-	-	-	-	21	12	29	24	51	38	60	25	-	-
	1985	-	-	40	36	62	55	48	44	70	70	72	69	40	21	-	-	-	-	25	11	28	23	60	50	55	14	-	-
Cirrhina mrigala	1984	25	10	45	42	72	68	87	83	72	62	20	12	-	-	-	-	-	-	40	10	84	55	60	30	-	-	-	-
	1985	-	-	60	44	80	75	87	87	75	75	22	10	-	-	-	-	31	18	52	35	75	55	42	15	-	-	-	-
Hypophthalmichthys molitrix	1984	8	4	10	9	10	9	12	11	10	9	-	-	-	-	-	-	7	2	10	5	10	7	10	8	-	-	-	-
	1985	11	6	9	8	10	9	8	7	8	7	9	8	-	-	-	-	6	4	8	5	9	5	10	7	-	-	-	-
Ctenopharyngodon idella	1984	8	4	8	6	15	13	14	12	10	9	-	-	-	-	-	-	8	5	13	8	15	10	5	2	-	-	-	-
	1985	8	6	9	8	15	13	12	10	9	8	-	-	-	-	-	-	10	7	10	6	10	6	10	4	-	-	-	-

Table II : *Analysis of the results of breeding in respect of spawners raised under special treatment in Experimentsal ponds (EP) and under conventional methods in Control ponds (CP)*

	Details of spawner	Year	*Catla catla*		*Labeo rohita*		*Cirrhina mrigala*		*Hypophthalmichthys molitrix*		*Ctenopharyngodon idella*	
			E.P.	C.P.	E.P.	C.P.	E.P.	C.P.	E.P.	C.P.	E.P.	C.P.
1.	No. of spawner reared	1984	118.00	95.00	350.00	260.00	345.00	250.00	75.00	60.00	75.00	60.00
		1985	120.00	90.00	358.00	248.00	350.00	260.00	70.00	62.00	70.00	59.00
2.	No. of spawner matured	1984	112.00	67.00	320.00	161.00	321.00	184.00	50.00	37.00	55.00	41.00
		1985	115.00	61.00	332.00	168.00	324.00	200.00	55.00	33.00	53.00	40.00
3.	Percentage of maturity	1984	94.91	70.52	91.42	61.92	93.04	73.60	66.66	61.66	73.33	68.33
		1985	95.83	67.77	92.73	67.74	92.57	76.92	78.57	53.22	75.71	67.79
4.	No. of spawner bred successfully	1984	86.00	33.00	264.00	99.00	277.00	95.00	42.00	22.00	44.00	25.00
		1985	87.00	31.00	295.00	98.00	291.00	123.00	45.00	21.00	45.00	23.00
5.	Percentage of breeding success	1984	76.78	49.25	82.50	61.49	86.29	51.63	84.00	59.45	80.00	60.97
		1985	75.65	50.81	88.85	58.33	89.81	61.50	81.81	63.63	84.90	57.50
6.	Total body wt(kg) of spawner matured	1984	228.00	125.00	326.00	160.00	330.00	183.00	65.00	43.00	75.00	55.00
		1985	210.00	110.00	349.00	174.00	324.00	213.00	69.00	40.00	74.00	53.00
7.	Total body wt (kg) successfully bred	1984	174.00	62.00	268.00	99.00	281.00	95.00	51.25	26.10	59.00	33.00
		1985	164.00	55.00	309.00	105.00	293.00	126.00	51.00	25.75	62.00	30.00
8.	Weight wise percentage of breeding	1984	76.31	49.60	82.20	61.87	85.15	51.91	78.84	60.69	78.66	60.00
		1985	78.09	50.00	88.53	60.34	90.43	59.15	73.91	64.37	83.78	56.60
9.	Range of quantity of eggs (lit) per Kg.body wt. of spawner spawned	1984	4.0-6.5	1.3-5.0	6.15-9.0	5.0-7.02	3.54-7.02	4.2-5.03	4.0-5.20	3.5-4.0	3.0-4.0	2.0-3.33
		1985	4.5-6.5	4.0-6.0	7.04-9.06	5.07-7.03	4.5-7.2	4.03-5.11	3.5-5.25	3.05-3.84	3.09-4.0	2.30-3.57
10.	Range of percentage of fertilisation of eggs	1984	60.0-98.0	50.0-75.0	75.0-98.0	65.0-75.0	65.0-92.0	20.0-70	60.0-95.0	52.0-70.0	70.0-98.0	55.0-82.0
		1985	68.0-99.0	58.0-68.00	80.0-99.0	60.0-75.0	70.0-98.0	26.0-68.0	62.0-98.0	55.0-68.0	68.0-99.0	58.0-70.0
11.	Average percentage of fertilisation of eggs	1984	82.66	62.40	86.50	69.25	81.66	46.66	81.60	61.50	82.60	66.25
		1985	82.83	62.20	90.33	68.50	89.20	53.75	81.83	61.50	84.40	63.25

of experimental ponds bred successfully, in comparisons to 58 to 61% from control ponds. Quantity of eggs released per kg body weight of spawners was 6 l to 9 l from experimental ponds in comparison to 5 l to 7 l from control ponds. Fertilisation rate varied between 75 and 99% for spawners of experimental ponds, while it was between 60 and 75% for those from the control ponds.

Cirrhina mrigala

In experimental ponds, mature fishes were available from March in 1984 and from April in 1985, and continued to be available upto August in both the seasons. The peak breeding period of the species was between April and July. The percentage of maturity of spawners from experiment ponds was 93 while that of control ponds was 75. 85% to 90% of the spawners of experimental ponds bred successfully, in compariosn to 51% to 61% from control ponds. Quantity of egg released per kg body wt. of spawners reached upto 7.2 l from experimental ponds in comparison to 5.1 l from control ponds. Percentage of fertilization varied between 65 and 98 for spawners of experimental ponds, while it was between 20 and 70 for those from the control ponds.

Ctenopharyngodon idella

In the experimental ponds, the brood stock was ready from March and continued to be ready upto july; in the control ponds they were ready from April and continued to be ready upto July in both the seasons. The peak breeding period of the species was between April and July. The percentage of maturity of spawners from experimental ponds was 73 to 75 while that of the control ponds was 67 to 68. 80% to 85% spawners of experimental ponds bred successfully, in comparison to 57% to 61% from control ponds. Quantity of eggs released per kg body wt. of spawners was 3 l to 4 l from experimental ponds, in comparison to 2 l to 3.5 l from control ponds. Fertilization rate varied between 68% to 99% for the spawners of experimental ponds, and between 55% to 82% for those from the control ponds.

DISCUSSION

The first phase of management of the brood stock in experimental ponds were during the autumn season of the region, when the water was warmer during day times (20.5 to 30.5°C) and gradually dropped during night (19 to 29°C). High rate of feeding with protein rich feed were done daily alongwith periodical fertilisations of the water. Feeding between 12.00 and 14.00 resulted in better utilisation of the feed by the brood stock.

The second phase of management was during the winter season when the water temperature was low (21 to 25°C) and variations of temperature was not much during the days and nights. The fishes became sluggish and their natural appetite appeared reduced. Reduction of stock density with introduction of fresh water helped to reduce the metabolite load of water and consequently the repression effect on gonads of the brood stock. With mild water current, the stock was provided with riverine conditions to assist in better development of gonads. Reduction of water level during the days of very low water temperature, helped in raising the water temperature and consequently increased the appetite of the stock with inducement for better development of gonads. The reduction in feeding schedule was required to avoid pollulation of water resulting from low consumption of feed by fishes; the same was the case with fertilization. Periodical nettings provided exercise to the brood stock and their conditioning.

The third phase of management was during the spring when the water temperature started rising (29 to 29.5°C) and the natural appetite of the stock apparently improved. To prevent deposition of excess fat, the stock density was increased, and the reduced feeding schedule like that of second phase was continued. Periodical exchange of water as also nettings for reduction of metabolite load of water, creation of riverine conditions and to provide

exercise to the stock for their conditioning were done.

The fourth phase of management was at the time of brood stock attaining full maturity. Reduction of the stock density with sexwise seggregation at this stage helped in bringing better maturity. Increase in the feeding schedule provided better nourishment for gonads, as required at this stage.

The results of the study indicate that, in the experimental ponds in general *Catla catla, Hypophythalmichthys molitrix, Labeo rohita, Cirrhina mrigala and Ctenopharyngodon idella* through control of environment in ponds. The fishes studied viz., could be brought to spawning stage as earlier as in summer months and the entire stock spawned during the period from March to September. Percentage of successful breedings, quantities of eggs released and fertilised in relation to their body weight of all the five species were better in comparision to the brood stock raised through the conventional methods as followed in the control ponds.

The obervations suggest that the success of hypophysation depends largely on proper gonadal maturation of the brood stcok in ponds. In India, the general practice is to collect healthy brood fishes 2-3 years old, weighing 1-4 kg and stocking them at the rate of 1000 to 2000 kg/ha (Bhowmick, 1969 Barman, 1984). Artificial feed such as mustard oil cake or coconut oil cake and rice bran at the rate of 1 to 2% of the body weight of the stocked fish is given to ensure proper development of gonads (Bhowmick, 1969). Artificial feed comprising of 45% rice bran, 45% oil cake powder, plus 10% dry fish meal powder should be daily fed @ 2-3% body weight of breeders, untill a water-bloom appears in the pond (Barman, 1984). This general practice leads to improper and late maturity of fishes, resulting in partial breeding. Regulation of water column in brood ponds in February and March help to bring early and proper maturity (Natrajan, 1984)

Some effective methods were followed to bring early maturity through manipulation of stock densities, regulation of feeding to check development of algal bloom (Bhowmick, 1969), reduction of metabolite load and increase of oxygen content of water through water exchange (Chondar, 1986; Barman, 1984), which are highly beneficial for bringing brood stock to early and proper maturity.

In the experiments, for prestocking preparation, all the ponds were treated with lime @ of 300 kg / ha and a low dose of raw cattle dung of 500 kg/ha 15 days before stocking. Constant application of manures and provision of heavy supplementary feed act as repressive factors (Swingle, 1956). A high dose of raw cow dung @ 20,000 kg/ha and lime @ 200 kg/ha 7 days before stocking was suggested by Chondar, (1986). Lime @ 300 kg/ha and raw cow dung @ 7,500 kg/ha in the first dose followed by two more doses at an interval of one month at the rate of 3,750 kg/ha was suggested by Barman, (1984).

In the post stocking management the stock density of approximately 2000 kg/ha were followed. Daily feeding were started after 5 days of stocking with cheap boiled rice at the rate of 10 percent of the total stock weight with mixture of powdered dry fish at 3:1 ratio by weight (rice : dried fish). Grass carps were fed with hydrilla at the rate of 20-25 percent of the total stock weight. Periodical fertilization with raw cow dung at the rate of 2 kg. per 100 Sq.metre fortnightly were also applied.

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