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Artificial production of fingerlings and its survival rate

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Abstract
The study reviews the aquaculture of Indian major carps, rohu (Labeo rohita), catla (Catla catla) and mrigal (Cirrhinus cirrhosus) with special reference to current feeding and feed management practices in Jatrapur (Nilam bazar), India. The study is based on a survey of three farmers from six fisheries in Nilambazar and also in its surrounding villages viz Jatrapur, Akbarpur, Kananpur etc. The study primarily focused on the rates of production of fingerlings of different categories, feed management practices associated with Indian major carp production, management practices that are used under poly culture conditions with other species-groups were also assessed. Artificial feeding is plasticized to increase the fish growth. Artificial foods commonly used are oil cakes, whole grain and rice bran etc. Azolla is preferred for fish food. Food supply was established on Phyto and Zooplanktons produced by frequent manuring and on artificial feeds in the demonstration ponds. Mixture of soaked rice bran and mustard oil cake was fed. Dough types feeds containing fresh (coagulated) blood or fish meal, mustard oil cake and wheat bran (Feed type II), and mixture of ground duckweed and the traditional feed ingredients, wheat bran and mustard oil cake (Feed type III) was used in other ponds.

Keywords: Carp, Induced breeding, Hypophysation, Seed production, Hatchling, Fingerling, Spawning and hatching, Eco – hatchery

Introduction
Fish enjoy a special consideration and place in human civilization. Its food value, gastronomy, culinary and nutrition brings it to the fore. Many fishes of fish rank in the category of "government par excellence". Several others are sought as luxury food in expensive restaurants. Apart from this, a sizable member of food fish species, both fresh and salt water are put in the category of excellent, very good and fair depending upon local, regional and national consideration of taste, preference and eating habits. However, fish receives greatest place in national dish of Angola, Portugal, Japan, Norway and Sweden. The growing realization of the importance of fish as food and its role might play a part of meeting the ever increasing global food problem in the context of the immense potential of resources has been instrumental in the initiation of development of fisheries in many countries where it never existed to any significance; as well as in encouraging in expansion of fisheries where it already existed.

Fisheries and agricultural practices have evolved rather parallel in the human civilization. Interest in fish eating dates back into the down of history. It is believed that hunting of fish was not uncommon in prehistoric times. However, when application of science to fishing industry was made in recent times, the position begun reversing. Off - shore fishing and fish keenly taken occurred when there was a sudden meat scarcity in the past world war – II period. In 20's, the discovery of vitamin A and D placed in extreme position because of the reevaluation, that fish are generally rich in them. Another great role of fishery industry lies in the evaluation of suffering of the above reasons the demand for fish has increased considerably.

For Indian major carp, breeding is seasonal (once in a year) coinciding with rain and flood, which offer greatest opportunity for survival and development of the progeny.

Thus natural food production is unable to meet the growing demand of fishes. To overcome the problem, induced breeding of fishes has been taken into account by adopting various modern techniques, viz. through pituitary hormone extract, hormone stimulating chemical "ovaprim, ovatide" etc. These practices are done particularly for major carp – both indigenous and exotic. Induced breeding technique offers following advantages to the fish farmers and enabling them to meet the market demand.

- The seeds obtained from induced breeding are always pure.
- The farmers can produce only the desired species.
- Seeds are free from spawns of other carnivorous fish.
- The collection of spawns will be more compared to the natural or artificial process of spawn collection.
- Transportation cost is minimum.

On seeing the need of induced breeding in fish production; Jatrapur (Nilam bazar) hatchery has been chosen for the assessment of rate of fingerling production per year, where Chinese circular hatchery is employed for large scale production of fingerlings through induced breeding.

Topography

The area of this town is maximum plain. There are also low lying areas and marshy or swampy land in Karimganj district.

Climate

High intensive precipitation rate is the most remarkable characteristic of the district climate. With an average annual rainfall of 300 cm, occurring mostly from April to September, the district faces severe flood many times a year. Being situated very near to the tropic of cancer (the district lies between 92^{O} 15' to 92^{O} 35' E longitude and 24^{O} 15' to 24^{O} 55' N latitude) and with a sea level altitude, the district experiences a warm and muggy climate.

Relative humidity does not fall below 75% on an average with a maximum of 95%. The maximum temperature recorded in July is 32℃ and with a minimum temperature recorded in January is about 10℃. The winter is short, usually begins from the last part of the month of November to the last part of the month of February of the year.

River System

Nilam bazar town consists of many villages. The river "Longai" serves as a remarkable source of water for irrigation of the fields, water supply and other household activities. This river also serves as a lifeline for fisheries, hatcheries and nurseries. Thus the river Longai is the only option for their needs.

Democratic Features

Growth of population – Nilambazar is a small town of Karimganj district. During the decades 1961- 71, the population of the district grown by 25% where as the population of Assam has found growing by 34.5%.

During the last two decades i.e. from 1981 – 2001, the population of the district have grown by 37.54% whereas the population of Assam have grown by 18.92%.

Density of population - The density of population of Karimganj district increases from 457 per sq. Km in 1991 to nearly 555 per sq. km in 2001. In the same time, the density of population of Assam was found increased from 286-340 individual per sq. km as per Indian statistical record (Anonymous, 1983). The density of population of Karimganj district increases from 317 per sq. km (1971) to 457 per sq. km (1991). In the same time, the density of population in Assam was found to increase from 286 - 340 individual per sq.km.

Sex ratio - The ratio of female to male in Karimganj district decreased during the decades 1991 – 2001. The ratio of male to female population was found increased from 944 to 946 per 1000 males (Anonymous, 1944).

Survey Procedure

The work was started on and from December 2016 and continued up to March 2017. The records were collected from various fishermen who were performing the practice. The data was collected separately for every fish farmer. After returning from the site, scrutiny of survey sheets was done.

Data Collection Areas

Researcher had gone through many fisheries in Nilambazar and also in its surrounding villages viz Jatrapur, Akbarpur, Kananpur etc. During this survey, it is found that the name of their fisheries, hatcheries and nurseries are named to their family members name such as Nizamuddin fishery, Abdul sukkar fisheries, Jalaluddin fisheries etc. In certain cases, the individual who are having more than 1or 2 fisheries, named them as pond – 1, pond – 2, pond – 3…..or fishery 1, fishery 2, fishery 3…..and the same is applied for nurseries and hatcheries.

Food

Artificial feeding is plasticized to increase the fish growth. Artificial foods commonly used are oil cakes, whole grain and rice bran etc. Azolla is preferred for fish food. Phytoplankton and zooplanktons called "Kholi", flour, rice, barn are used in the ratio 2:1:1.

Chemicals

Natural productivity of pond can be increased by using organic and inorganic fertilizers. Ammonium sulphate, Ammonium nitrate, Super phosphate is the common. Sometimes cow and pig dung are used to facilitate the growth of Phytoplankton and zooplanktons.

Biochemicals

Toximer is used for the removal of gases from the pond. For 1 bigha of fishery, about 20 kg of toximer is sprayed (worth Rs. 50/ kg). Soap and mustard oil paste is used generally for water purification.

Technique

Major carps are the best species for rearing in culture fishery. Amongst the major carps, rohu, mrigal, katla, calbasu etc are the common. Some exotic species like grass carp, silver carp, are also reared. Different types of ponds are constructed in larger areas in the need of proper culture fisheries. The type includes hatcheries, nursery tanks, rearing tanks, stocking ponds.

In Jatrapur, each and every pond is used preferable for fish rearing. For this prospect, the ponds are made suitable for rearing i.e. treatment of water, p^{H} maintenance, fish food, construction of Happa's etc. In view of the survey, it is observed that a Chinese circular hatchery or Chinese eco hatchery has been constructed by the community of Jatrapur.

Selection of Ponds

The fingerling production demonstration activities were carried out in seven ponds located at four government farms representing four administrative divisions. Location, water area, identification, number of ponds is assigned and number of production cycles is achieved. Though exact pond areas are given for convenience and uniformity, later stocking rates, production etc was converted to 1000 m^2. Fingering production technology applied in these ponds was based on the principle of semi intensive poly culture system and the

practice of Bangladeshi and Hungarian fish seed producers, but modified to an improved technology.

Pond Preparation

For pond preparation, residual fish, insects and their larvae etc were removed from the selected ponds by dewatering or by application of poisons (0.25 ppm phostoxin or 5.0 ppm Rotenone) or by repeated netting. Between the production cycles residual fish were also eliminated by the application of either of the above methods. A gap of at least 3 days was maintained between poisoning and liming. Quicklime (CaO) was spread on the bottom after dewatering the pond water. Empty ponds were partially replenished on the next day and dry poultry manure (in some cases, in addition to manure area and TSP) was spread on water.

Pond Maintanence

Unlike the traditional practice, fortnightly heavy fertilization (80 kg of cow dung, 2.25 kg of urea and 2.25 kg of triple super phosphate per 1000 m^2) and daily small quantities of manure and fertilizer were applied to maintain a rich plankton population as natural food for the fish (Table 1). Dry poultry drops were used in majority of ponds. Stomach contents of slaughtered ruminants were applied daily as manure in pond 5.2 and cow dung in pond 3.1. Making of deviation from other ponds, pond 4.1 was manured fortnightly in the corner like the traditional practice here. The pond bottom was raked daily to stir the upper layer of the mud to help release any trapped gases and to aerate the pond bottom.

Feed preparation and feeding

Food supply was established on Phyto and Zooplanktons produced by frequent manuring and on artificial feeds in the demonstration ponds. Mixture of soaked rice bran and mustard oil cake was fed. Dough types feeds containing fresh (coagulated) blood or fish meal, mustard oil cake and wheat bran (Feed type II), and mixture of ground duckweed and the traditional feed ingredients, wheat bran and mustard oil cake (Feed type III) was used in other ponds. But now all the feed ingredients (MOC, W/RB, CB, FM & DW) were mixed and administered together except for of pond 3.1 and 4.1 where cow dung was used. Table 1 presents summary of pond preparation maintenance.

Table 1: Pre and post stocking management details

pond and crop no.	Pond preparation						Pond maintenance			
	Seining	Dewatering	Poison	Lime	Manure	Fertilizer	Organic manure	Inorganic manure	Rumen contents	Other
				(kg/1000 m^2)			(kg/1000 m^2 /day)			(kg/1000 m^2 fortnightly)
1.1	+			17	104	-	1.6	-	-	-
2.1			+	13	110	-	1.0	0.02	-	-
3.1		+		24	244	2.6	1.5	0.1	-	-
4.1		+		24	244	2.6	-	-	-	Manure U + TPS 4.5
5.1		+		19	148	-	1.9	0.04	-	-
6.1		+		19	149	0.39	2.6	0.05	-	-
7.1			+	33	-	-	2.9	-	-	-
7.2			+	33	170	-	3.1	-	-	-
7.3			+	30	-	-	4.7	1.0	-	-
1.2		+		39	-	-	0.6	-	-	-
1.3			+	26	-	-	-	-	-	-
1.4			+	15	130	-	3.4	0.17	-	-
5.2		+		25	160	-	-	-	10	-
5.3		+		25	60	3.0	2.2	0.11	-	-
5.4			+	15	202	5.0	3.5	0.14	-	-

The dough types feed contained at least 1/3 of the feed wet component (cattle blood, ground duckweed or soaked wet mustard oil cake). However, depending on the supposed requirement of fingerling, availability of feed ingredients and accuracy of management, the ratio of feed ingredients were changed from time to time as it is shown in Table 2. Floating duckweed was given when grass carp fry were big enough to consume it. Feed was provided once in the morning and in the afternoon, in equal portions. Dough type feeds were administered on feeding trays made of poly ethylene sheet fixed on bamboo frame. Traditional feed applied in pond 4.1 was dispersed from along the dikes.

Table 2: feeding ratios in demonstration ponds (kg/1000m^2)

Pond	Period day	MOC	W/RB	CB	FM	GD	Total feed	FD	Daily feed	Daily duckweed	Av. % of body weight
1.1	7.0	16.5	1.1	8.0	-	-	25.6	8.6	3.7	1.2	19.3
Total percentage	20.0	82.5	13.2	26.0	-	47.2	168.9	41.5	8.4	2.1	20.2
	22.0	91.3	33.0	-	-	115.8	240.1	41.5	10.9	1.9	13.7
	49.0	190.3	47.3	34.0	-	163.0	434.6	-	-	-	-
		43.8	10.9	7.8	-	37.5	100.0	-	-	-	-
2.1	16.0	24.2	4.4	5.5	-	8.6	42.7	-	2.7	-	12.1
	12.0	18.7	2.2	2.5	-	14.3	37.7	15.7	3.1	1.3	6.6

Total percentage	23.0	50.6	24.8	-	-	54.3	129.7	28.6	5.6	1.2	7.1
	51.0	93.5	31.4	8.0	-	77.2	210.1	-	-	-	-
		40.0	10.0	10.0	-	40.0	100.0	-	-	-	-
3.1	25.0	22.0	6.6	-	5.6	-	4.2	-	1.4	-	7.7
Total percentage	25.0	33.0	11.0	-	11.6	55.8	111.4	131.6	4.5	5.3	7.9
	50.0	55.0	17.6	-	17.2	55.8	145.6	-	-	-	-
		37.8	12.1	-	11.8	38.3	100.0	-	-	-	-
4.1	25.0	12.1	9.6	-	-	-	21.7	-	0.9	-	4.9
Total percentage	25.0	20.9	45.1	-	-	-	66.0	128.7	2.6	51.1	5.4
	50.0	33.0	54.7	-	-	-	87.7	-	-	-	-
		37.6	62.4	-	-	-	100.0	-	-	-	-
5.1	7.0	5.5	-	-	2.8	25.7	34.0	-	4.9	-	21.4
Total percentage	16.0	24.2	-	-	12.4	108.7	145.3	-	9.1	-	16.1
	22.0	26.4	-	-	17.1	148.7	192.2	-	8.7	-	8.9
	45.0	56.1	-	-	32.3	283.1	371.5	-	-	-	-
		15.1	-	-	8.7	76.2	100.0	-	-	-	-
6.1	14.0	29.7	-	-	14.0	75.8	119.5	-	8.5	-	22.0
Total percentage	14.0	20.9	-	-	10.9	105.8	137.6	-	9.8	-	18.0
	22.0	44.0	-	-	17.1	195.9	257.0	-	11.7	-	15.1
	50.0	94.6	-	-	42.0	377.5	514.1	-	-	-	-
		18.4	-	-	8.2	73.4	100.0	-	-	-	-
7.1	7.0	4.0	4.0	-	-	11.4	19.4	-	2.8	-	27.6
Total percentage	20.0	59.4	39.6	-	-	100.1	199.1	-	10.0	-	21.6
	18.0	66.3	67.1	-	-	150.2	283.6	150.2	15.8	8.3	14.9
	45.0	29.7	110.7	-	-	261.7	502.1	-	-	-	-
		25.8	22.0	-	-	52.1	100.1	-	-	-	-
7.2	25.0	11.4	11.4	-	-	34.3	57.1	130.1	2.3	5.2	17.8
Total percentage	7.0	24.3	24.3	-	-	14.3	62.9	50.1	9.0	7.2	9.7
	32.0	35.7	35.7	-	-	48.6	120.0	-	-	-	-
		29.8	29.8	-	-	40.5	100.0	-	-	-	-
7.3	12.0	46.5	-	17.0	17.6	-	6.8	81.1	6.8	-	91.1
Total percentage	13.0	29.7	7.9	2.0	10.3	-	3.8	49.9	3.8	-	6.2
	7.0	58.4	19.8	18.0	10.3	-	15.2	106.5	15.2	-	16.0
	32.0	134.6	27.7	37.0	38.2	-	-	237.5	-	-	-
		56.7	11.7	15.6	16.1	-	-	100.0	-	-	-
1.2	18.0	4.6	2.3	-	-	4.3	11.2	15.7	0.6	0.9	2.3
Total percentage	18.0	9.9	5.1	-	-	10.0	25.0	27.2	1.4	1.5	2.4
	24.0	38.6	19.4	20.0	-	14.3	92.3	22.9	3.8	1.0	4.3
	60.0	53.1	26.8	20.0	-	28.6	128.5	-	-	-	-
		41.3	20.9	15.6	-	22.3	100.0	-	-	-	-
1.3	23.0	11.3	8.5	-	-	4.3	24.1	5.7	1.0	0.2	11.2
Total percentage	12.0	20.6	15.4	-	-	15.7	51.7	45.8	4.3	3.8	5.1
	35.0	31.9	23.9	-	-	20.0	75.8	-	-	-	-
		42.1	31.5	-	-	26.4	100.0	-	-	-	-
1.4	12.0	8.5	5.6	-	8.9	5.7	28.7	-	2.4	-	27.4
Total percentage	17.0	34.8	34.8	-	24.2	22.9	116.7	70.1	6.9	4.1	13.1
	29.0	43.3	40.4	-	33.1	28.6	145.4	70.1	-	-	-
		29.8	27.8	-	22.8	19.7	100.0	-	-	-	-
5.2	12.0	2.5	1.7	-	-	1.4	5.6	41.5	0.5	3.5	1.8
Total percentage	20.0	34.1	26.1	34.5	-	25.7	120.4	104.4	6.0	5.2	7.5
	13.0	28.3	18.5	22.5	-	15.7	85.0	45.8	6.5	3.5	3.1
	45.0	64.9	46.3	57.0	-	42.8	211.0	-	-	-	-
		30.8	21.9	27.0	-	20.3	100.0	-	-	-	-
5.3	13.0	6.2	4.1	6.0	-	2.9	19.2	-	1.5	-	8.1
Total percentage	15.0	19.1	12.7	10.5	-	8.6	50.9	55.8	3.4	3.7	4.8
	28.0	25.3	16.8	16.5	-	11.5	70.1	-	-	-	-
		36.1	24.0	23.5	-	16.4	100.0	-	-	-	-
5.4	9.0	20.8	12.2	-	-	-	33.0	-	3.7	-	25.4
Total percentage	20.0	88.4	50.6	-	-	-	139.0	52.9	7.0	2.6	7.7
	5.0	36.4	17.2	-	-	-	53.6	127.3	10.7	25.5	8.4
	34.0	145.6	80.0	-	-	-	225.6	-	-	-	-
		64.5	35.5	-	-	-	100.0	-	-	-	-

MOC = Mustard Oil Cake, W/Rb = Wheat Rice Bran, CB = Cattle Blood, FM = Fish Meal, GD = Ground Duckweed, FD = Floating Duckweed

Sampling and Harveting

Sampling was done frequently to monitor growth and health condition. At the end of about 5^{th} – 7^{th} week when the

fingerlings attained or exceeded 10 gram average individual weight, feeding was stopped and the ponds were harvested within 2 days.

ECO – hatchery – for carp seed production

The Commonly cultivated species – catla (catla, catla), rohu (Labeo rohita), marigal (cirrhinus mrigala), silver carp (Ctenopharyngodon idella) and common carp (cyprinus carpio) are considered to be the best cultural species of fishes in the inland water system. These fishes originally belong to riverine environment and when cultured in standing water bodies such as ponds and tanks, they attain maturity but normally do not breed under confined conditions. Special attempts are therefore made to breed them by artificially creating riverine conditions and stimulating their endocrine system. The technique of breeding fish by other than its natural course is known as INDUCED BREEDING. Induced breeding techniques have been developed for production of quality fish seed of cultural able varieties. It is one of the most dependable methods of producing pure seed of desired species of fish. Further this technique has helped to produce fish seed in those areas where natural collection of fish seed was not possible.

Method of induced breeding: hypophysation – The technique of breeding the fish by administering pituitary gland extract injection is known as Induced Breeding: Hypo physation. The pituitary gland secretes several hormones of which Gonadotropin is the most important for breeding. The increasing demand of fish pituitaries have now been solved to some extent by the introduction of HCG, now readily available in the market. The HCG is now increasingly becoming popular due to its low cost. A mixture of HCG and pituitary hormone extract in definite proportion are employed successfully for breeding fish.

Collection of pituitary gland

Glands are collected from ripe fish by removing the upper part of the skull (scalp), the brain is exposed which is then cut from the posterior end and lifted up interiorly. As soon as the brain is lifted the gland can be seen located in the cavity covered by a thin portion, is carefully picked up with the help of tweezers and kept immersed in a cavity block or a petri dish in absolute alcohol under cover.

Preservation and storage of puituitary glands

While exposing and removing the glands great care is taken to avoid any contact with water. It is most important because the hormone of the pituitary gland is soluble in water. There are three methods for preservation of pituitary glands:

1. Preservation in absolute alcohol
2. Preservation in acetone
3. Preservation by quick freezing.

Maintenance of Breeders

Farm raised breeders give better results. The breeders can also be collected from ponds and rivers. The best time for collection is from November till March. The optional rate of stocking may be 2000-2500 kg per hectare. Organic manure along with low dose of single super phosphate (17 to 20 kg per hectare) may be applied at fortnightly intervals in the pond where catla and silver scarp is stocked as major species. Pond/ tank stocked with grass carp as the major species need not be manured regularly. It may be fed with submerged aquatic vegetation during winter months and with grass on the advent of the spring (at the rate of 1-2% of the body weight) for acceleration of gonadial development. For other species feed prepared by mixing de oiled rice bran and oil cake at the rate of 1-2% of the body weight of fish stock is desired in the initial stages. Fish meal containing 30% protein could be a better substitute for oil cake at the later stage (advent of the spring). The mature male and female breeders are segregated and stocked sex wise in separate ponds about 1-2 months before their breeding session and their genetic conditions and stage of maturity are checked periodically.

Breeding Technique

After selection of brood fishes from the segregated brooder ponds they are kept in the hapas at fish farms or in fish seed hatcheries for about 6-7 hours for conditioning. After proper conditioning the individual brood fish is weighed in a hand net using a spring balance. The breeders are then ready to receive injection.

Determination of dosage for injection

Doses of pituitary gland extract are calculated on the basis of milligrams of pituitary gland per kilogram body weight of the recipient fish. Determination of proper dosages of pituitary gland alone or in combination with HCG depends only on the stage of sexual maturity of the breeders and also to some extent on the environmental (climatic) conditions. Spawning of carp may be obtained by administration of a single dose of 5-10 mg. of pituitary gland per kg body weight to the female breeders. It makes a low dose of 2 mg per kg body weight is usually given. Better results are however obtained by injecting a preliminary dose of 2-3 mg per kg body weight to the female fish alone and a second dose of 5-8 mg per kg body weight after an interval of 6 hours. The males receive only a single dose of 2-3 mg per kg body weight at the time of second injection to the female. Both the sexes are then put together in a definite ratio in circular spawning pool inside indoor hatchery.

Preparation of gland extract

Once proper dosages are determined, the quantity of glands required for injecting the breeders is calculated. The required quantity of glands is then taken out from vials, dried on a filter paper and macerated in a tissue homogenizer with a little distilled water or 0.3% common salt solution. The homogenized glands are then centrifuged and the supernatant liquid is decanted and diluted with the same solvent to a known volume. The following dilutions are recommended:

Weight of breeder preparatory dose

1.0 to 2.0 kg, 0.50 cc/fish - 0.75cc/fish
Above 2 kg, 0.75cc/fish - 1.50 cc/fish

Method of Injection

Intra muscular injection of fish pituitary extract is administered usually in the region of the caudal peduncle a little above or below the lateral line region or near the shoulder region. For injecting the fish, the needle is inserted under a scale, parallel to the body of the fish and then pierced into the muscles at an angle. A 2ml graduated hypodermic syringe is most convenient for injecting most of the fishes. The size of the needle depends upon the size of the breeder to be injected.

Breeding Environment

Success of spawning by hypophysation depends on the hydrological and climate conditions. Temperature is one of the most important factors. It has been observed that 25℃ to 28℃ is most conducive for breeding. However, spawning could be induced at or below this temperature range. The percentage of fertilization and hatching under uncontrolled conditions is not very satisfactory. Circulation of fresh water containing 5-9 mg per liter of oxygen promotes better success in spawning, higher fertilization of eggs and higher recovery of hatchlings from fertilized eggs.

Spawning and Hatching

Eco-hatchery – circular spawning pool

It is circular cement pool (8 meter in diameter) with 50 cubic meters of water holding capacity. The bottom of the pool slopes to the centre where there is an outlet pipe (10 cm diameter) leading to the incubation pond (egg collection chamber). The wall of the spawning pool is provided with diagonally fitted inlet pipes at an angle of 45^{O} for circulation of water creating artificial riverine conditions. After circular pool is filled with water, about 80 kg of females and 80 kg of males are released into the pool. When the breeders start coming up to the surface the valves are opened so that a circular current is created. The speed of water current is maintained at about 30 meters per minute. The yield of 10 million eggs per breeding operation is usually achieved.

ECO - Hatchery – Incubation Pool

As spawning goes on in the spawning pool, the fertilized eggs are led into the incubation pool (3 meter diameter – double walled circular pool, with inner wall of regular mesh permitting out flow of water) where water at a regulated speed enters through the duck mouth valves fitted on the floor of the outer chamber. The speed of the water is regulated @ 2.5litre/sec in the initial stage and then reduced to 2.0 liter/sec when movement of embryo inside the eggs starts. After hatching, the speed is again increased to 3.0 to 3.5 liter/sec and the hatchings are allowed to remain there for about 3 days till the yolk sac is absorbed.

Rearing of seed hatchings to fry/ fingerling stage:

Presently two techniques are practiced:

1. Rearing in earthen ponds at the fish farm
2. Two phased seed rearing: Phase one inside the hatchery building and phase two rearing in earthen pond at fish farm.

Rearing in earthen ponds at fish farm upto fry stage

From the hatchling receiving ponds (nursery ponds), the weeds are removed. Unwanted fishes are removed using mahua oil cake containing 4-6% saponin at the rate of 2000-2500 kg/ha meter. Lime is applied @ 250-300 kg per ha for neutralizing acidity and helping mineralization of organic matter. Manuring of ponds with cow dung @ 5000 kg/ha is done about 15 days before the anticipated date of stocking by broadcasting all over the pond. Aquatic insects are controlled. Suitability of water is tested and thereafter ponds are stocked with old spawn about 3-4 days usually in the morning hours. The moderate rate of stocking may be 25-30 lakhs/ha.

Supplementary Feed

A mixture of finely powered groundnut/ mustard oil cake and rice bran/ polish, in equal proportion by weight is supplied to the fry. Cobalt chloride or manganese sulphate (trace elements) @ 0.01% mg/day/spawn may be added to the feed. Addition of yeast increases survival of fry. Feed may be broadcast all over the pond commencing from the day of stocking. Feeding may be stopped one day earlier to the harvesting. The generally recommended feeding schedule is as under.

Table 3

Period	Rate of feeding per day	Approximate quantity per 1 lakh of spawn/ day
1^{st} to 5^{th} day	4 times the initial total weight of spawn stocked	0.56 kg
6^{st} to 12^{th} day	8 times the initial total weight of spawn stocked	1.12 kg
13^{st} to 14^{th} day	No feeding	

Harvesting of Fry

The fry in about 2 weeks time generally grows to 25-30 mm size. They are harvested with fine meshed (1.5 mm) drag net in the cool morning hours avoiding the cloudy days.

Chinese fish hatchery: A few tips

1. The location of a Chinese hatchery should ideally be on a sloping high land for economical construction. If sloping land is available the floor level of the spawn collection tank should be adjusted to the ground level for draining out water by gravity.
2. The level of eggs transfer outlet located at the centre of spawning tank should be about 10 cm, above the level of central overflow pipe at the top of the hatching task. This will enable complete transfer of eggs from the spawning tank to use outside the tanks.
3. Overflowing water from the hatching tank should not be passed on to the spawn collection tanks but should be put to use outside the tanks.
4. Separate fresh water supply lines should be installed from the overhead water tanks to each tank i.e. spawning tank, hatching tanks, and spawn collection tanks in order to ensure independent working of each.
5. Water spraying arrangements should be provided for aeration and oxygenation in the three tanks.
6. Egg transfer pipes should discharge the water along with eggs into the hatching tank in between the two walls of the hatching tank to avoid damage of eggs.
7. The walls of spawning tanks should be provided with water inlet pipes installed in a diagonal position to create a circular water flow during the spawning period.

Where water flow is insufficient for circulation, multiple chamber hatching pools with paddle wheels for circulation may be constructed.

Table 4: a. capital cost (ecohatchery)

Item	Cost (Rs)
1. Renovation of tank of 2 ha water spread area involving excavation up to 1 foot depth	30000
2. Circular breeding pool and hatching pool	
i. Breeding pool of 8 m diameter	30000
ii. 3 hatching pools of 3m diameter @ 15000 per pool	45000
3. Overhead tank of 5000 gallons capacity	50000
4. Shallow tube well 8'' X 6'' X 200'	25000
5. Pump set (5HP)	20000
6. Generator set with 10 KVA altimeter	50000
7. Guard shed and office room	25000
8. Brood stock – 5 tons	1,50,000
9. Contingent expenses for nets, equipments etc.	30000
4,55,000	

Table 5: b. recurring cost (i. cultural cost for 3 preparatory months)

Item	Cost (rs)
i. Feeding of brood stock @ 3% body weight for 5 tons of fish with 13500 kg artificial feed (150 kg X 3 months) @ Rs 3 per kg.	40500
ii. Salary of 2 guards cum labor @Rs 450 pm	37000
iii. Cost of netting 2 times in a month for 3 months	600
43800	

Table 6: II. cultural cost for 5 preparatory months

Item	Cost (rs)
i. Feeding of brood stock @ 1.5% body weight for 5 tons of fish with 11,250 kg artificial feed (75 kg X 30 days X 5 months) @ Rs 3 per kg.	33750
ii. Salary of 2 guards cum labor @Rs 450 per month for 5 months	54500
iii. Operation cost of electric pump/ generator on equal ratio @ Rs. 5.00 per hour for 5 hours daily (Rs 5 X 5 Hrs X 30 days X 5 months)	3750
iv. Additional labor cost for 5 months	36000
v. Misc. cost for pituitary glands, equipments, electricity etc.	19250
97250	

Table 7: III. Cultural cost for 4 posts - preparatory months

Item	Cost (rs)
i. Manuring, liming and fertilizing @Rs 450 /ha/month	3600
ii. Salary of 2 guards cum labor @Rs 450 /ha/month	3600
iii. Cost of periodical netting @ Rs. 50 per month	400
iv. Other expenses	300
7900	

Total recurring cost (I + II + III) = Rs 1, 48,900

Table 8: C. UNIT COST

i. Capital cost	Rs. 4,55,000
ii. Recurring cost	Rs. 1,48,900
Rs 6,03,900	

Table 9: Production (a. installed capacity)

Unit	Size	No.	Capacity
i. Spawning pool	8 m diameter	1	150 – 200 kg brood fish
ii. Hatching pools	3 m diameter	2	150 liters reutilized eggs per pool or 450 liters of fertilized eggs from 3 pools requiring 80 kg of female brood fish or 160 kg of total brood fish

Table 10: B. expected utilisation of inatalled capacity

1	Per batch requirement of female brood fish	80 kg
2	Per batch requirement of brood fish single (male or female)	160 kg
3	Total no. of hatchery runs @5 run/ month for 5 months	25 runs
4	Total requirement of brood fish in 5 months (160kg x 25 runs)	4000 kg
5	Requirement of breeder for 5 months operation (considering 90% of the broodfish will attain maturity) and 90% of the matured breeders would respond to hypophysation.	4940 kg
6	No. of spawn produced per kg body weight of female brood fish (considering @1.2 lakh per/ kg) female, 90% of fertilization, 80% hatching rate say 80000.	80000 nos.
7	vii. Spawn produced from female brood fish in a single run.	64 lakhs

C. Expected Income

I. Gross income/ run

1. From sale of 51.2 lakhs of major carp spawn (80% of Rs. 10,240 the produce) @ Rs. 200/lakh
2. From sale of 12.8 lakhs of exotic carp spawn (20% of Rs. 64000 the produce) @ Rs. 500/lakh

Rs 16,640

II. Gross Income/ Month Rs 83200
(Rs. 16640/- x5 runs)

III. Gross Income in 5 operative months Rs. 4,16,000

IV. Net income Rs 2,67,050

The fecundity may be as high as 2.0 lakhs/kg of body weight of female brood fish. However, an average rate of 1.2 lakhs/kg body weight is considered for purpose of economics.

Table 11: Financial analysis of ecohatchery

Particulars	Years				
	1	2	3	4	5
Capital cost	4.55	-	-	-	-
Recurring cost	1.49	1.49	1.49	1.49	1.49
Total	7.04	1.49	1.49	1.49	1.49
Income	2.08	4.16	4.16	4.16	4.16
Net income	-4.96	2.67	2.67	2.67	2.67
NPV of cost @15%	2.32				
NPV of benefits@ 15%	9.82				
NPV @ 15%	Rs 2.32 lakhs				
BCR	1.24:1				
IRR	40%				

From the results declared above, it could be concluded that higher production of fingerling per unit area is possible by applying modified management technology of proper stocking density, feeding and maturing and repeated use of water bodies.

Stocking

To produce 10 g (10 cm) size fingerling the stocking density should not exceed 14000 prenursed fry per 1000m^2, and the combination of species should not exceed 5000 grass carp, 7000 silver carp, 3000 mirror/common carp, 5000 catla and 3000 mrigal per 1000m^2. Above this stocking, the individual growth of tested species is hampered. But, if improved food containing cattle blood is applied (Table 12, feeding type B), the stocking may be increased.

Feeding

To produce 120-130 kg large size fingerling per 1000 m^2 per 35 days cycle about 150 kg feed and for those ponds where brass carp is reared about 100 kg additional duckweed are necessary (Table 12, feeding type A). If the production rate is higher, 200-300 kg/ 1000m^2, application of cattle blood from 20th days of rearing is essential (Table 12, feeding type B).

Table 12: (feeding schedule for carp fingerling production)
A. Feeding schedule for 120-130 kg production/ 1000m^2/ cycle

Period (day)	Ration (kg/1000m^2/day)	Mustard oil cake(kg)	Wheat bran (kg)	Duckweed (kg)
0-7	0	0	0	0
8-14	3	1.5	1.5	1
15-22	5	2.5	2.5	1-2
23-24	5	2.5	2.5	3-4
35-42	6	3	3	5-8

Table 13: B. Feeding schedule for 200-230 kg production/ 1000m^2

Period (day)	Ration kg/1000m^2/day	Mustard oil cake(kg)	Wheat bran (kg)	Cattle blood (kg)	Duckweed (kg)
0-7	0	0	0	0	0
8-14	3	1.5	1.5	0	1
15-22	5	2.5	2.5	0	1-2
23-24	7	2.5	2.5	2	3-4
35-42	10	3	3	4	5-8

Manuring and bottom treatment

Daily 5-10 kg organic manure/1000m^2 (chicken/ cattle manure or fresh rumen contents) is suggested to spread on the water surface of the ponds. Inorganic fertilizers are to be used when necessary. Daily raking of pond bottom is also recommended.

General Recommendations - From the present study it may be recommended that:

1. The improved management system of year round production of large size fingerlings (average size 10 cm/ 10 g) should be taken up by the government and transferred to both the public and private sectors through training and extension services.
2. Government should also try this technique in the fish seed multiplication farm and thereby improve the technology further.

Table 14: Survey Report (Month – 1)

Date of survey - 12-12-2016		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - abdur fishery		
Name of the owner - abdur jalal uddin		
Area of the farm - 3 – 5 bighas		
Types of the tanks available in the farm		
Types	NUMBER	AREA
Nursery	1	1.8 cubic meter
Hatcheries	2	540 cubic meter
Rearing	3	1085 cubic meter
Stocking	4	680 cubic meter

Table 15

S. no.	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	2,50,000	2,00,000	80%
2	Grass crap	-	-	-
3	Cirrhinus mrigala	3,75,000	3,30,500	88%
4	Catla catla	1,13,000	70,000	62%
5	Silver carp	90,000	65,000	72%
6	Japani rohu	1,50,000	1,20,000	80%

Table 16: Survey Report (Month – 1)

Date of survey - 19-12-2016		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - m/s k b & bably hatcheries		
Name of the owner - kudrat ali		
Area of the farm - 7 – 8 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	2	3.6 cubic meter
Hatcheries	3	750 cubic meter
Rearing	2	1134 cubic meter
Stocking	2	360 cubic meter

Table 17

S. no.	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Gabeo rohita	1,72,000	1,54,800	90%
2	Grass crap	1,53,000	1,36,170	89%
3	Cirrhinus mrigala	5,25,000	5,25,000	93%
4	Catla catla	99,000	86,130	87%
5	Silver carp	1,89,200	1,60,820	85%
6	Japani rohu	2,74,000	2,09,840	86%

Table 18: Survey Report (MONTH – 2)

Date of survey - 09-01-2017		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - nizam uddin fishery		
Name of the owner - hazi noor uddin		
Area of the farm - 4 – 5 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	2	2.6 cubic meter
Hatcheries	5	1350 cubic meter
Rearing	2	1134 cubic meter
Stocking	2	720 cubic meter

Table 19

S. No	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	1,40,000	1,26,000	90%
2	Grass crap	80,250	68,213	85
3	Cirrhinus mrigala	3,00,000	2,85,000	95%
4	Catla catla	60,000	42,000	70%
5	Silver carp	1,70,000	1,49,600	88%
6	Japani rohu	2,50,000	2,38,500	94%

Table 20: Survey report (month – 2)

Date of survey - 06-01-2017		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - abdur fishery		
Name of the owner - abdur jalal uddin		
Area of the farm - 3– 5 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	1	1.8 cubic meter
Hatcheries	2	540 cubic meter
Rearing	2	11085 cubic meter
Stocking	2	680 cubic meter

Table 21

S. no	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	2,15,800	1,90,095	87%
2	Grass crap	--	--	-
3	Cirrhinus mrigala	3,95,400	3,67,722	93%
4	Catla catla	82,500	68,475	83%
5	Silver carp	2,04,800	1,84,320	90%
6	Japani rohu	2,48,900	2,21,521	89%

Table 22: Survey report (month – 2)

Date of survey - 23-01-2017		
Place of surve - jatrapur, nilam bazar		
Name of the fish farm - m/s k b & bably hatcheries		
Name of the owner - kudrat ali		
Area of the farm - 7– 8 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	2	3.6 cubic meter
Hatcheries	3	750 cubic meter
Rearing	2	1134 cubic meter
Stocking	1	360 cubic meter

Table 23

S no.	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	1,20,000	1,06,000	88%
2	Grass crap	60,000	45000	75%
3	CIrrhinus mrigala	4,50,000	4,05,000	90%
4	Catla catla	80,000	56,000	70%
5	Silver carp	--	--	--
6	Japani rohu	2,45,000	1,96,000	80%

Table 24: Survey Report (Month – 3)

Date of surve - 13-02-2017		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - abdur fishery		
Name of the owner - abdur jalal uddin		
Area of the farm - 3– 5 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	1	1.8 cubic meter
Hatcheries	2	540 cubic meter
Rearing	2	1085 cubic meter
Stocking	2	680 cubic meter

Table 25

S. No	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	1,85,000	1,48,000	80%
2	Grass crap	--	--	--
3	Cirrhinus mrigala	4,75,000	3,90,000	82%
4	Catla catla	1,30,000	1,05,000	80%
5	Silver carp	1,25,000	95,000	76%
6	Japani rohu	2,45,000	2,15,000	87%

Table 26: Survey Report (Month – 3)

Date of survey - 06-02-2017		
Place of survey - jatrapur, nilam bazar		
Name of the fish farm - nizam uddin fishery		
Name of the owner - hazi noor uddin		
Area of the farm - 4– 5 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	2	2.6 cubic meter
Hatcheries	5	1350 cubic meter
Rearing	2	1134 cubic meter
Stocking	2	720 cubic meter

Table 27

S. No	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	1,75,000	1,40,000	80%
2	Grass crap	1,60,000	1,25,000	78%
3	Cirrhinus mrigala	4,75,000	4,27,500	90%
4	Catla catla	1,20,000	1,02,000	85%
5	Silver carp	2,50,000	1,75,000	70%
6	Japani rohu	3,00,000	2,50,000	83%

Table 28: Survey Report (Month – 3)

Date of survey- 20-02-2017		
Place of survey-jatrapur, nilam bazar		
Name of the fish farm - m/s k b & bably hatcheries		
Name of the owner - kudrat ali		
Area of the farm - 7– 8 bighas		
Types of the tanks available in the farm		
Types	Number	Area
Nursery	2	3.6 cubic meter
Hatcheries	3	750 cubic meter
Rearing	8	1134 cubic meter
Stocking	1	360 cubic meter

Table 29

S. no.	Name of the species	No. of eggs disposed	No. of fingerlings produced	Survival rate
1	Labeo rohita	2,00,000	1,76,000	88%
2	Grass crap	1,75,800	1,51,188	86%
3	Cirrhinus mrigala	4,17,800	3,80,198	91%
4	Catla catla	87,900	75,594	86%
5	Silver carp	1,92,900	1,63,965	85%
6	Japani rohu	2,37,000	2,08,560	88%

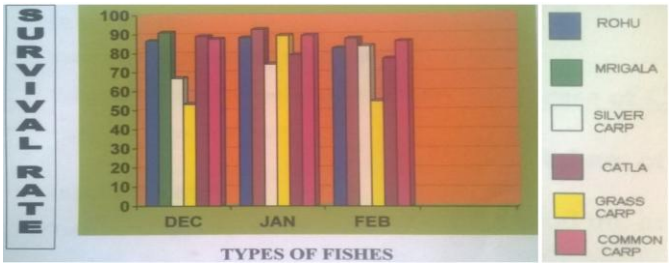

Fig 1: Bar diagram showing rates of production of fingerlings of different categories

Results - (showing total % of survival rate in different fishes)
In case of rohu:
Total no. of eggs disposed = 16,37,800, Total no. of fingerlings produced = 14,02,895
Therefore % of survival rate = 85%

In case of mrigal
Total no. of eggs disposed = 38,63,200, Total no. of fingerlings produced = 34,88,178
Therefore, % of survival rate = 90%
In case of catla:
Total no. of eggs disposed = 8,42,400,Total no. of fingerlings produced = 6,64,699
Therefore, % of survival rate = 78.9%
In case of grass carp:
Total no. of eggs disposed = 7,37,050, Total no. of fingerlings produced =6,20,611
Therefore, % of survival rate = 84%
In case of silver carp:
Total no. of eggs disposed = 14,68,900, Total no. of fingerlings produced = 11,32,805
Therefore, % of survival rate = 77.12%
In case of common carp:
Total no. of eggs disposed = 25,58,900, Total no. of fingerlings produced = 22,26,521
Therefore, % of survival rate = 87%

Conclusion
In case of Indian major carp, the survey report depicts that the

survival rate of fingerlings of Mrigal (Cirrhinus mrigala) is much higher as compared to Rohu (Labeo rohita) and Catla catla.

But in case of exotic carps, the survey report depicts that the survival rate of fingerlings of Common carp is much higher as compared to Silver carp and Grass carp. Thus, it may be concluded that breeding of Jatrapur, Nilambazar should be encouraged for large scale production of fishes to cope up with the growing demands of the population of Karimganj.

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