IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Breeding Response To Various Doses Of Ovaprim On Indian Major Carps – A Review

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ABSTRACT:

The aquatic environment provides a diverse range of food resources, including fish and other aquatic animals, that have been crucial for the sustenance of human societies for millennia. The fishing industry, which is an integral part of the broader fishery sector, provides not only food but also employment and economic benefits to many communities around the world. In particular, the fishery sector is an essential component of the food industry, as it provides a significant source of high-quality protein that is vital for human nutrition. Fish and other seafood are rich in essential nutrients such as omega-3 fatty acids, vitamins, and minerals, which are important for maintaining a healthy diet. Moreover, the fishery sector plays a vital role in addressing two of the most pressing challenges facing humanity: malnutrition and starvation. Malnutrition is a major problem in many parts of the world, especially in developing countries, where people often lack access to adequate sources of protein and other essential nutrients. By providing a reliable and sustainable source of protein, the fishery sector can help to alleviate malnutrition and improve the health of vulnerable populations. At the same time, the fishery sector also helps to address the problem of starvation by providing a source of food that is not only nutritious but also accessible and affordable. This is particularly important in regions where traditional agricultural practices are limited or unsustainable, such as in coastal areas or regions affected by climate change. Overall, the fishery sector is a critical component of the global food system, and its importance is likely to increase in the coming decades as the world's population continues to grow and demand for food increases.

Keywords: Aquaculture, malnutrition, starvation, minerals, vitamins, amino acids, *Catla catla, Labeo rohita, Cirrhinus mrigala*

INTRODUCTION

The aquatic environment is a host to a rich and varied variety of food resources. Since ancient times fishing provided food, employment and economic benefit to the mankind. Fishery sector is a very important component providing nutritious food to mankind on earth. This sector also enhances exports and contributes foreign exchange to Indian economy, generates employment opportunities. Fishery sector caters to the two major problems faced by mankind viz, malnutrition and starvation. Malnutrition is the biggest challenge it is mainly due to the deficiency of animal protein in the diet. Fish consists about 16-20 % protein which is higher than that in egg, milk, rice and wheat. Its nutritional value, palatable taste, presence of essential minerals, vitamins and essential amino acids gives it a higher buying preference. In 2013, globally fish provided 17 % of animal protein to the population FAO (2016) For the poor people in developed countries, whose main food is starch, fish even in small quantities supplement animal protein requirements Delgado C.L *et.al.*,(2003). Fish is considered as 'rich food for poor people'. It is an excellent source of food at an affordable price with high-quality protein content.

The average per capita annual consumption of fish and fish products in India was 2.85 Kg, providing 2.2 % of total protein consumption. Annual per capita consumption ranged from a high level in costal province of Kerala (22.7 Kg) to low level in northern province of Himachal Pradesh (0.03 Kg). The average per capita fish consumption in urban areas is 3.1 Kg while in rural areas it is 2.7Kg. Highest income groups consumed four times more protein from fish and fish products than lower income groups Needham and Funge-Smith (2014). Yearly requirement of long-chain omega-3 fatty acids of more than one billion people can be satisfied with carp fish alone it is significantly more than that available from all salmonids, marine fish etc Toppe (2013).

Population explosion has led to an ever increasing pressure on land resources and dwindling protein share from animals. Though fish farming is an age old practice, its importance has been realized due to the challenges faced by the humans to secure nutritious food for the ever growing population. Aquaculture has a high potential for generating employment to poor farmers and fisherman who once upon sustained on capture fisheries. Rapid advances in aquaculture has tremendously increased fish seed production, culturing and selling of fish as a result many farmers are trying their luck in fisheries sector.

The role of fishes is not limited as a food commodity but it can be seen in recreational and biological control sectors also. The fishery sector has now become highly industrialized to meet the demand from poultry, piggery and other agro- based industries. Fishes are very vulnerable to changes in aquatic environment and water is and easy medium for the disease spreading, one need to be very cautious and dedicated to solve the problems which creep on and off. Keeping abreast with all scientific improvements in the field and applying them judiciously will surely improve the status of the aqua farmer and also will be a boon for others.

Fisheries and aquaculture sector provides not only health but also wealth. Opportunities of employment in the sector has outpaced the world's population. Jobs and livelihood go hand in hand in this sector. Worldwide fish is the commodity traded by many countries. As it earns foreign exchange it is a valuable income source for developing countries and a life blood of many countries, which solely depend on them. In the last five decades a steady growth in global fish production has occurred. Food fish supply increased at an average annual rate of 3.2 percent exceeding the growth of world population which is at 1.6 %. Per capita fish consumption increased impressively on account of increase in population,hike in income, urbanization, increased fish production area and efficient marketing avenues FAO(2014).

Water plays a crucial role in agriculture and aquaculture sectors and thereby aiding in economic development of the country. Mighty rivers, their tributaries, rivulets and wet lands are a blessing to India Joshi (2010 **)**. The water spread area in India is about 4.5 million hectares. Of which inland aquaculture resources cover about 3 million hectares, this include 0.72 million hectares of natural lakes and 2 million hectares of constructed reservoirs. Freshwater source include lotic water bodies (rivers and streams) and lentic water bodies (ponds and lakes, the ground water, and the ecotonal water bodies). India is blessed with plenty of water resources in the form of numerous rivers, streams and associated wetlands. Indian states like Bihar, Assam, Telangana, A.P, West Bengal etc have good area under flood plain wetlands. In post-independence era in India large number of reservoirs have been commissioned with the primary objective of storing river water for irrigation and power generation. There is lot of potential for development of fisheries in these bodies. Globally fisheries and aquaculture provided livelihood to 56.6 million people in the primary sector in 2014 FAO (2016).

Fish culture in confined water area involves the practices of agriculture and animal husbandry. The fecundity of fishes is in no way comparable to other live stock.Primarily two types of aquaculture are practiced within the country where one is freshwater aquaculture and the other one is brackish water aquaculture. Freshwater aquaculture pertains to the breeding of freshwater fish like carp, catla, mrigal, rohu, freshwater prawn and freshwater ornamental fish farming. While brackish water aquaculture involves breeding of seawater fish such as grey mullet, sea bass, tiger shrimp and mud crabs.

Among the available fish species of world at least 20% of freshwater fish species are already extinct and in serious decline for reasons such as competition for water, alteration in habitat, pollution, effect of exotic species, and over exploitation for commercial usage Moyle and leidy (1992)

Record of 420 Indian fish species are found in Historia piscium published in oxford in 1686. Manuscript work of Petrus Artendi attempted the polynomial nomenclature for naming of fishes. J.G. Schneider reported 1519 fish species in his "M.E. Bnlochii System Icthylogiae" DR. Patrick Russel in 1803 published the figures and detailed descriptions of 200 fishes under the title "Descriptions and figures of two hundred fishes collected at Vizagapatam on the Coast of Coromandel " "A Journey from Madras through the countries of Mysore, Canara, and Malabar etc. " is a work published by Dr. Francis Buchanan in three volumes between 1805-1807 , in which he described three new species of fish. Dr. John McClelland published a memoir on Indian cyprinidae in 1839 in the second part of the 19th volume of Asiatic researchers (pp. 217-465). Dr. Albert C.L.G.Gunther reported 6843 species of fish and 1682 doubtful species in his monumental work "Catalogue of Fishes of the British Museum". Advancement in fisheries research have been made possible through the two research publications started by Dr. N.Annandale in 1907 viz. "Zoological Journal Records" and "Memoirs of Indian Museum".

World per capita food fish supply in 1960s was 9.9 kg and in 2009 it increased to 18.4 Kg.fish Import is satisfying the increased fish consumption demand in developed countries due to dwindling fish production locally FAO (2012).Whereas in developing countries people tend to consume locally and seasonally available fish Carps and tilapias have a much lower level of long –chain omega- 3 fatty acids when compared to salmon fish but still they are the good source of that.

Fish industry is playing a crucial role in providing proteineicious food, employment generation and foreign exchange earnings to the people and country. The statistical data regarding fish culture have been poorly organized in many countries. It is only through people who are who are closely related with production and marketing we could get the required data. In the fourth five year plan, special emphasis have been give to increase the fish feed availability and to improve the collection of fish production statistics. Like other industries status and growth of fish culture evaluation need raw statistics. The major review of the state of World fishery resources was produced by Food and Agriculture Organization Gulland (1971) and since then the FAO Fisheries department has been producing updates almost every two years, In order to help the farmers in gazing the scope of fishing in a country, measure of annual production and growth of fisheries is important. Through this one can evaluate the progress or lacunas in any fishing plan adopted and can improve it for better results. Knowledge about the ongoing technological advances and the fishing activity in an around country can open new avenues for the farming community. Reliable statistics of estimates of fish culture production and economics are required by public and private sector to prioritize their investment plans and be benefitted. Government can also make long term policies and improve the standards of fishing community. United National Food and Agricultural Organization has been vested with the responsibility of collection of fisheries statistics, so far. The recent development is the collection of statistics of fish culture independent of other fisheries production. In statistics number of fishermen in a country or a district or number of vessels or nets owned by them or production etc. are taken. Statistics in its modern connotation is called as body of methods for making wise decision in the face of uncertainties. The importance of statistics is it gives a clear and deducible idea of the information and help in planning.

As per the latest update of IUCN Red list of threatened species, People who are not living in wealthy countries depend on wild species for food as a result fresh water ecosystems are put under pressure and is leading to over exploitation of resources. Therefore steps for conservation of genetic resources were initiated in India. Due to ecological degradation and improper management of naturally available resources 20 percent of the fresh water fish species are already extinct or at the brink of extinction Moyle and Leidy(1992).

Fish is a renewable resource which is in decline. According to FAO estimates fisheries production of the whole world rose from 98 million tons in 1990 to 140 millions in 2007, this is an increase by 42 percent. for the same time period total world exports of fish raised from 33 million tons to 53 million tones, this is an increase by 60 percent. the share of trade in world fish production also increased from 34 percent to 38 percent from 1990 to 2007. for this time period though production and trade are rising the annual catches from oceans and fresh water bodies are around 90 million tones. this may be due to over exploitation of resources due to growing demand from exploding population

Carp culture India is the polyculture of three to six species of major carps. Of these three are Indian major carps namely Catla (*Catla catla*), Rohu (*Labeo rohita*), Mrigal (*Cirrhinus mrigala*), and three exotic carps viz. Silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*) and Common

carp (*Cyprinus carpio*).In India major carp fishes like *Catla catla, Labeo rohita,* and *Cirrhina mrigala* are chosen for pond culture because they can grow quickly in confined waters, non predatory food habits and general preference as food by the public.

Taxonomically, Carps belong to the family Cyprinidae Berg (1940) and order Cypriniformes. Members of this family are called as Cyprinids. Among the Indian families of fresh water fishes, cyprinidae is the largest, most dominant and highly priced. Two-thirds genera and species of cypriniformes belongs to cyprinids. This family has over 2,400 species in about 220 genera The family cyprinidae consists of the carps, the true minnows, and their relatives. It is commonly called the carp family or the minnow family.

Among Indian major carps rohu has the highest market value followed by catla and mrigal. The demand for catla and rohu are high because they growth rate is higher. Silver carp demand is low because of its poor keeping quality and less consumer interest. Common carp also has less demand, though it attains maturity within six months and has two breeding seasons it is not preferred because its uncontrolled breeding hampers the growth of other fishes and pond burrowing habit damage the walls of ponds, apart from this the chances of bursting belly during transportation fetches low price. The problem with grass carp is they consume most of the supplementary feed given at the cost of other fish due to their voracious feeding habit. Though it has good market value it is not very much preferred.

Carp fishes constitute the bulk of the world aquaculture production, with silver carp, grass carp and common carp occupying third, fourth and fifth places, respectively Crespi (2004). The widely cultivated Indian major carps, namely, *Labeo rohita, Catla catla and Cirrhinus mrigala*, contribute to over 90 % of the total Indian aquaculture production and 70-75 % of total fresh water production. The exotic carps, namely, silver carp *(Hypophthalmichthys molitrix); grass carp (Ctenopharyngodon idellus) and common carp (Cyprinus carpio*) form a second important group contributing to 25-30 % of this production along with catfishes FAO(2015)

India produces about 6.4 million metric tons of fish every year out of it 3.4 million metric tons comes from inland-sector. Fisheries sector provides employment to 14.0 million people in the country. Fisheries and agriculture sector contributes 1.07 and 5.15 percent of country's GDP respectively. (About Indian Fisheries, 2016).Carps contribute as much as 87% of the total aquaculture production Ayyappan (2009). Fisheries sector is contributing 0.5 percent of Telangana's Socio-economic outlook (2017).

With the ever increase in population, necessity of augmenting the production of fish through the development of more effective techniques for fish culture for supply of animal protein is the need of the hour. A major factor that constrains the speed and extent of development of fish farming is the inadequate supply of quality fish seed Nwokoye et al., (2007). Non-availability of quality fish seed is the major problem in the carp culture Naeem et al.,(2005a & b) and timely seed supply is one of the major constraint Radheyshyam (2010). To satisfy ever growing human consumption demands large scale cultivation of organisms which is successful only when the resource is renewable Harvey and Hoar (1979). Fishes are easily renewable but they are not infinite so they have to be managed properly to sustain the world population.

Description of the study area

Fish seed hatchery selected for studying the breeding performances of Indian major carps with Ovaprim is located in Hasnabad village, 5 km away from Jagtial district of Telangana state, India.

Telangana is the 29th state which came into existence on 2nd of June, 2014, with Hyderabad as a capital. It is in the in the Southern region of India. It is the twelfth largest state in India. Telangana is bordered by the states of Maharashtra to the north and north- west, Chhattisgarh to the north-east, Karnataka to the west, and Andhra Pradesh to the east and south. Telangana is spread across in an area of 1,14,840. The northern part of Telangana is mountanous and receives an average rainfall of 102 cm. It is situated on the Deccan plateau it is drained by two major rivers viz., the Godavari and the Krishna rivers. The two minor rivers which drain through the area are viz., the Bhima, the Manjira, the Musi. These rivers are fed by south-west and south-east monsoons. River Godavari, the sacred river of central India, is also named as Southern Ganges or Dakshin Ganga. The river moves into Telangana at Kandhakurthi in Nizamabad district the manjira, The Inspite of all this most of the land is in semi -arid condition. South-west monsoons from

June – September are the major reason and hope for rainfall in the state. In the northern Telangana the annual rainfall is between 900-1500 mm and 700 to 900 mm in southern Telangana.

Overview of the Fish Seed Hatchery

Breeding of carps in this hatchery is done utilizing continuous flow of water by gravity. This technique was developed in China. The advantages of this system are viz. a continuous flow of water can be maintained which simulates riverine environment, hatching is more effective because oxygenated water gets distributed evenly, eggs can be protected from being washed out with water by placing a plastic tube in the middle and a screen at the water outlet, water flow rate and water quality parameters can be easily accessed and maintained.

The components of this hatchery are :
1) Overhead tank
2) Spawning pool
3) Egg collection chamber
4) Hatching pool
5) Spawn collection chamber

Overhead Tank

An overhead tank is installed on the fish farm building. It has 10,000 litre capacity. It is supplied with water from a canal and also from a bore well. Water is passed through a sand filter to remove any impurities and is then pumped into the overhead tank which supplies water for spawning and incubation tanks continuously.

Breeding Pool

It is a circular tank made of cement. Its diameter is 21 '6" and 6' deep. It's bottom slopes towards centre at this central place a hole is there for water to go out. A plastic pipe is fitted in the centre for exit of exit. Any excess water flows through this pipe to the egg collection chamber. at the exterior opening of the outlet pipe a fine cloth is tied to stop eggs from escaping out. Two pipes are fitted vertically along the walls of the pool diagonally facing each other. These pipes have holes on one of their lateral side at regular intervals. This causes a circular water current simulating riverine conditions. On the brim of the tank a perforated circular iron pipe is fitted which causes a fine shower from them. this condition simulates rain fall. During this process atmospheric oxygen gets dissolved in water increasing the concentration of dissolved oxygen. A valve is used to control the speed of water.

Breeding pool

Egg Collection Chamber

Egg collection chamber is at a lower level to breeding chamber. It is square shaped house 6 x 6 x 3 feet.Using a PVC pipe eggs are drained from the breeding pool and collected in the egg collection chamber using a fine mesh cloth bag.The four corners of the cloth are held firmly in place. Eggs are then transferred to hatching pool using buckets of known volume.

Egg collection chamber

Hatching Pool

It is circular in shape. It has an outer chamber and an inner chamber. It is 3 metres in diameter. Eggs are poured with bucket in the outer compartments. Its inner chamber and outer chamber are separated with vertical pipes. These pipes are covered with a fine nylon cloth. Base of the nylon cloth is fastened tightly to inner compartment using a rubber tube, to avoid escape of eggs or spawn. In the outer chamber duck mouth pipes are arranged at regular intervals to create a circular water current. Swollen and water-hardened eggs are delicate, and cannot tolerate mechanical damage,due to this Indian carp's eggs are to be incubated artificially and carefully..In the center of inner chamber there is a hole for water to go out. A plastic pipe is vertically fitted in this hole at a level lower than the height of the nylon screen. This makes excess water to flow out and stops eggs or hatchling from escaping. At the same time a fine mesh cloth is placed at the opening of the water outlet to check any material from escaping.

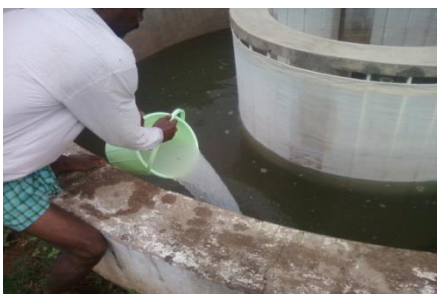
Hatching Pool

Spawn Collection Chamber

Spawn collection chamber located at a lower level to the hatching pool. Dimensions of this chamber are 6 x 6 x 3 feet. It is located at a lower level to the hatching pool The inlet PVC pipe is connected to the hatching pool and outlet pipe drains out excess water. A fine mesh cloth is used to collect spawn after three days.

Operations in this fish seed hatchery includes egg to spawn production for 3 days, spawn to fry nursing for 15-20 days, fry to fingerling rearing for 60-90 days and fingerling to yearling rearing for 8-9 months. Thus the carp seed may be categorised as spawn (6-8 mm size), fry (20-25 mm size), fingerlings (100-150 mm size) and yearlings (100-200 g weight).

Spawn Collection Chamber (2)



Transferring of fertilized eggs to hatching pool

***Catla catla* (Catla)**

Plate No: shows *Catla catla* breeder. Catla has fastest growth among indan major carps Catla attains sexual maturity at an average age of two years and an average weight of 2 kg. Catla breed during the monsoon season in rivers.. During the breeding season the dorsal surface of the pectoral fin of the males becomes rough and on applying gentle pressure on the belly milt oozes freely from the genital papilla. The female has a soft, round, bulging belly and a swollen, pinkish genital opening. In South Indian rivers, the breeding season is more fluctuant (May-October) and may occur twice a year. Male and Female breeders of 3 + age and weighing 3 kg are selected Bisht et.al (2013)

Systematic Position

Phylum : Chordata
Sub-Phylum:Vertebrata
Super class: Gnathostomata
Series:Pisces
Class: Teleostomi
Sub Class: Actinopterigii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Catla*
Species: *catla*

***Labeo rohita* (Rohu)**

Plate No: shows *Labeo rohita* breeder.During the breeding season the pectoral fins of mature males are rough on the dorsal surface, while those of females are smooth. The species breeds naturally in rivers, reservoirs, and in large lakes in which fluvial conditions are simulated. The breeding season generally coincides with the south-west monsoon i.e June-September. Male and Female breeders of 2 + age and weighing 2 kg are selected Bishtet.al (2013)

Systematic position

Phylum : Chordata
Sub-Phylum:Vertebrata
Super class: Gnathostomata
Series:Pisces
Class: Teleostomi
Sub Class: Actinopterigii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Labeo*
Species: *rohita*

***Cirrhinus mrigala* (Mrigal)**

Plate No: shows *Cirrhinus mrigala* breeder Sexual maturity is attained when it is about one year old (Hora and Pillay,1962) or two years old Khan (1934); Alikunhi (1957)depending on location. Hanumantha Rao (1971) reported first maturity of mrigal when the fish are more than two years old. Relative fecundity of mrigal ranges from 100 000 to 400 000 ova.kg-1 of female bodyweight In natural waters breeding occurs during the south-west monsoon season It spawns once an year (Qasim and Quyyum,1962) The breeding season generally coincides with the southwest monsoon i.e June-September. Male and Female breeders of 2 + age and weighing 2 kg are selected Bisht. A., et al (2013).

Systematic Position

Phylum : Chordata
Sub-Phylum:Vertebrata
Super class: Gnathostomata
Series:Pisces
Class: Teleostomi
Sub Class: Actinopterigii
Order: Cypriniformes
Family: Cyprinidae
Genus: *Cirrrhinus*
Species: *mrigala*

MATERIALS AND METHODS

Collection and maintenance of brood fish:

The brooders of *Catla catla, Labeo rohita* and *Cirrhinus mrigala* were collected from local rivers during March – May in 2012. The brooders were fed with supplementary feed mixture of rice bran and mustard oil cake daily in 1 : 1 ratio at the rate of 3-4 % of their body weight during March and April , later on it was reduced to 2 % till they are used for breeding. This is done to ensure proper growth and gonadal maturity Charula (2008)

Identification of male and female brooders:

At the time of breeding the male and female brood fishes were identified on the basis of their secondary sexual characters Jhingran and Pullin (1985). The ripe males were identified by roughness of the dorsal surface on the pectoral fin, which on the contrary was very smooth in the female. The roughness in pectoral fins was felt by touching the surface of fin close to the body. The mature male and female fishes were also distinguished from the shape of their body, condition of the vent and secretion of milt in males.

Male and female breeders were netted out with drag net and are put into the breeding pool for acclimatization. Water jets are released to simulate riverine conditions and fountains are also opened to give the rainy effect. Breeders are starved for 6-8 hours before beginning of breeding programme, to clean up their guts so that no release of fecal matter occurs while breeding.In the evening breeders are separated sex wise. Ratio of female to male selected for breeding is in the ratio of 1:1 by weight More et.al (2010)

Protocol of the experiment:

Experiments were carried out on three Indian major carps in the following way.Three doses of Ovaprim i.e, 0.3, 0.4 & 0.5 ml/kg body weight were injected to female breeders in replicates of four in the period of study from June to August, 2012. Male fishes are administered with only 0.2 ml/kg body weight Pandey and Singh (1997) The schedule of hormonal dose administered is given in Table No: 1

Table No 1 : Dosage of hormone administered to Indian major carps

Name of the fish	Dosage of Ovaprim administered to female breeder (ml/kg)			Dosage of Ovaprim administered to male breeder (ml/kg)
	Treatments			
	T1	T2	T3	T1, T2 and T3
Labeo rohita	0.3	0.4	0.5	0.2
Catla catla	0.3	0.4	0.5	0.2
Cirhinus mrigala	0.3	0.4	0.5	0.2

Administration of Ovaprim :

Glass syringes and non disposable needles are boiled to make them sterile. Brooders are netted out one by one and held in a cloth hapa to avoid wriggling movement and then injected with ovaprim.

There are several ways of administering ovaprim to carps viz. intracranial, intraperitoneal, and intramuscular. In this study only intra muscular injection is given in the dorsolateral region of both and female fish in a single dose Haniffa and Sridhar(2002) at the base of the caudal above the lateral line.. Later on injected brooders are released into the breeding pool.

Dosage of Ovaprim to be administered :

The brood fish are weighed and quantity of Ovaprim to be injected to male and female breeders is calculated as follows Nandeesha et.al (1991)

Quantity to be injected (ml) = Dosage of Ovaprim(ml) x Weight of brood fish (Kg)

Methods for assessing results :.

Detailed observation were done during June-August 2012 i.e during the south-west monsoons to know the dosage of ovaprim effective in inducing maximum breeding results in Indian major carps. Parameters recorded during the experiment are total number of eggs laid by spawners, average number of eggs laid $Kg^{-1,}$ number of fertilized eggs, number of hatchlings obtained, fertilization percentage and hatching percentage. Environmental parameters like water temperature, pH and dissolved oxygen were continuously monitored and recorded.

Estimation of breeding performance

Latency :

Latency is the time between injection of hormone and ovulation Montchowui et.al (2011) it is expressed in hours

Stripping:

When ovulation was observed females were hand stripped after drying the genital papilla with a paper towel and eggs were collected in a container, later stripping of male was done for collection of milt Chaudhuri et.al (1966), Naeem et.al (2005a). Eggs were gently mixed with milt with a quill. Fertilised eggs were rinsed three or four times with water and then transferred to a circular hatching pool.

Counting Of Eggs and Average Number of eggs Kg^{-1}

Number of eggs laid by fishes was measured using volumetric method More (2010). A beaker of known volume is taken and numbers of eggs were counted in triplicate and the average number of eggs per beaker was calculated. Total number of eggs per beaker was calculated using the following formula:

.

Total number of eggs laid = Average number of eggs in sample beaker x Number of beakers measured

The average number of eggs $Kg^{-}1$ was obtained by dividing total number of eggs obtained by total weight of female breeders

Fertilization percentage:

After 3 to 4 h of fertilization, the fertilized and unfertilized eggs can be distinguished. Fertilized eggs of Indian major carps are transparent, non adhesive, round in shape while unfertilized eggs are opaque. To estimate fertilisation percentage 2-3 samples of water hardened eggs were taken from the breeding pool

in random and number of fertilised eggs in each sample was counted and average value was determined More *et.al.*,(2010).

Fertilisation percentage is calculated using the following formula

$$\text{Fertilisation percentage} = \frac{\text{Average number of fertilised eggs}}{\text{Average number of eggs in a sample}} \times 100$$

Hatching percentage :

. Hatching percentage was calculated by taking sub sample of a uniform volume(5ml) from fertilised eggs and incubating them in a plastic tray filled with water which is used for egg incubation. Eggs were kept rotating by putting an aeration stone in one corner of the tray Charula (2008). Hatching percentage was estimated by the following formula Naeem(2013)

$$\text{Hatching percentage} = \frac{\text{Total number of hatchlings}}{\text{Total number of fertilized eggs}} \times 100$$

Water quality estimation:

Water quality is an important factor affecting fishes the most. So, the parameters selected for the present study are water temperature, pH and dissolved oxygen

Water temperature

Temperature of water was recorded by immersing the sensor of digital thermometer in the water of breeding pool. After the reading stabilized, temperature is noted down upto single decimal point in ^{o}C

pH

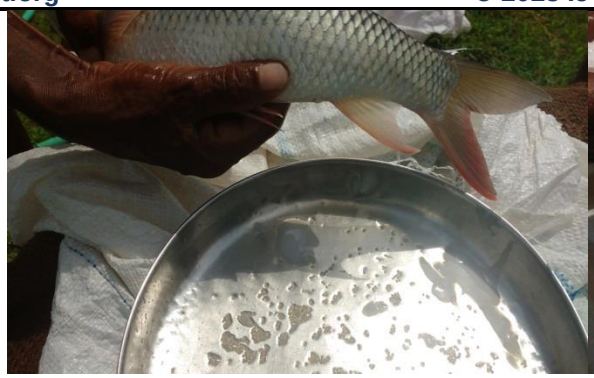
pH of the water was recorded using a digital pH meter (*Digital pH* Meter. *LI 120*)**.** Reading is noted down upto single decimal point

Dissolved oxygen

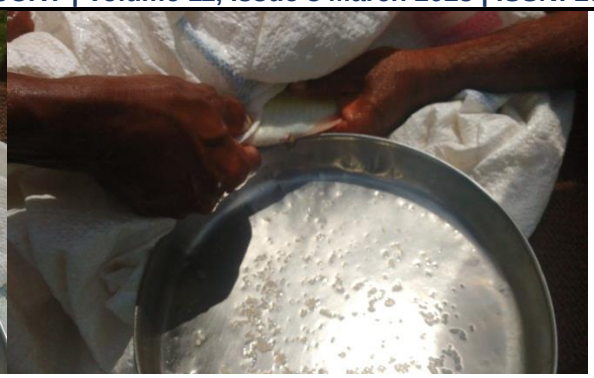
Estimation of dissolved oxygen was done by following modified Winkler's method APHA(1995) and recorded as mg/ l

Ovaprim injection

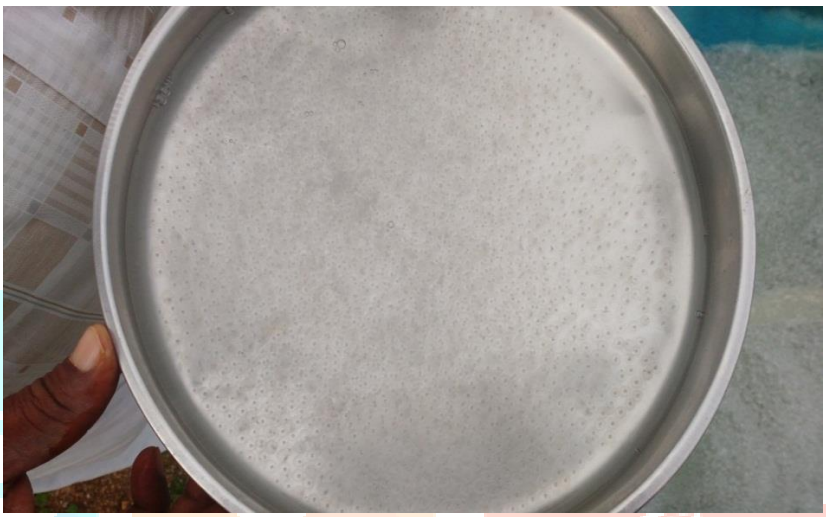
Milt from Breeder



Stripping of male milt



Stripping of Female eggs



Fertilized Eggs

Conclusion

The breeding response of Indian major carps, namely Catla catla, Labeo rohita, and Cirrhinus mrigala, to various doses of Ovaprim during the monsoon season can vary depending on several factors, such as the quality of brood stock, environmental conditions, and management practices. However, in general, Ovaprim is a synthetic hormone that is commonly used to induce spawning in fish, including Indian major carps. The most commonly used doses of Ovaprim for Indian major carps are 0.5 ml/kg body weight for females and 0.3 ml/kg body weight for males. These doses are usually administered through intramuscular injection, and the timing of the injection is critical to achieve successful spawning. Typically, the injection is given in the late afternoon, and spawning is induced early in the morning of the following day.

Studies have shown that higher doses of Ovaprim can result in higher fecundity and egg quality in Indian major carps. For example, a study conducted on Labeo rohita found that a dose of 0.6 ml/kg body weight resulted in significantly higher fecundity and hatching rate compared to lower doses. However, excessively high doses can have adverse effects on the fish, such as reduced survival rates and deformities in the fry. Overall, the breeding response of Indian major carps to Ovaprim during the monsoon season can be enhanced by using appropriate doses and timing of injection, good broodstock management, and optimal environmental conditions. i.e from June to August. Three doses of Ovaprim i.e 0.3,0.4 and 0.5 ml/kg body weight was tested under three treatments T1,T2,T3 respectively in four replicates each. The effectiveness of Ovaprim, containing salmon GnRH and dopamine inhibitor, in inducing breeding in Indian major carps is experimentally proven. A single dose of Ovaprim was enough in induction of breeding in these fish. *Catla catla, Cirrhinus mrigala* have shown good breeding results with 0.5 ml/Kg whereas *Labeo rohita* performed well with 0.4 ml/Kg Ovaprim. This present study clearly shows that the differences in Ovaprim requirements between the species of fish lies in the varied levels of dopamine activity in them Billard et al. (1984), Peter et al. (1986).

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