

## What is fish breeding?

- Fish breeding refers to the intentional process of producing offspring from selected parent fish with desirable traits, like size, color, and growth rate.
- Breeding of fish with pituitary gland (hypophysis) extract is termed as Hypophysation
- The pioneers of hypophysation of Indian major carps are H.L.Chaudhary and K.H.Alikunhi.

## Fish Seed

- Seed refers to the juvenile life stages of fish or specifically to fry.

## Fish Seed Size and Age

Fish Spawn 5-8mm 72-96 hours

Fish Fry 20-25 mm 15 days

Fish Fingerling 100mm 2-3 months



# FISH BREEDING

# Breeding of Major carps in Chinese Carp Hatchery/Eco Hatchery

There are two types of fish breeding:

## 1. Natural Fish Breeding:

Instinct breeding in natural environmental is known as natural fish breeding.

2. Artificial Breeding: A process by which seed are produced artificially. This is a technique in which breeding is done by hypophysation, when the condition is not favorable for natural spawning or large quantity of fry is needed.

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Chinese Carp Hatchery/Eco Hatchery is one of the method of artificial breeding.

## Synthetic spawning agents

- Synthetic spawning agents include Ovaprim, Ovotide, WOVA-FH etc and is very effective

## Injection of brooders

### Intra-muscular injection

Administered into the muscle on the caudal peduncle or behind the dorsal fin, but above the lateral line.

It is most effective, convenient, simple and less risky.



## Chinese hatchery

- Breeding and hatching devices of circular shape and are of Chinese origin are referred to as Chinese type of carp hatchery or eco-hatchery
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- Sets of brooders are formed, each consisting of 1 : 2 (female : male) ratio.
- The injected brooders are released in the breeding hapa.

### Structure:

It consist of :

1. Breeding tank
2. Hatching Tank

## Breeding tank

- These tanks are made of brick or concrete or FRP, circular and their diameter varies from 6 to 12 m with a depth of 1.0 – 2.0 m.
- The base of the tank is sloped towards the centre where the central outlet is located
- They are provided with water jets/inlets on the bottom or inner-surface of the tank so as to provide a circular motion of water which results in better spawning and hatching than hapa system.
- For the induced breeding of major carps, clean the breeding tank, fill it with clean water taken from a channel or well and release injected brooders up to 100 kg for spawning.
- Provide water shower on the tank to maintain temperature and increase oxygen content
- Maintain a water flow rate of 200-250 l per minute to create a riverine environment and stop water flow just before the fish starts spawning.
- After spawning, remove the brooders, disinfect them and transfer to a freshly prepared pond.
- Collect the developing eggs and incubate in the hatching tank.





## Hatching tank

- The hatching tank slightly smaller (3-6 m diameter and 1-1.5 m deep) and has two chambers, i.e. inner and outer chamber
- The outer chamber has 3-6 m diameter, whereas the inner chamber has 1-1.5 m.
- The bottom of the outer chamber is provided with 15-20 water jets/inlets, equidistant from each other, to provide circular motion and simulate riverine environment.
- The circular wall that separates the outer chamber from the inner chamber is covered with a nylon screen (mesh size 1/80)
- The nylon screen allows the water to flow from the outer chamber to the inner chamber and prevent the escape of eggs and hatchlings.
- The water comes out from the inner chamber through a centrally placed vertical pipe
- Maintain a water flow rate of 80-100 L per minute to provide a circular motion of water in the outer chamber

# Operation

- After cleaning tank and filling water, release about 7-10 lakh eggs/m<sup>3</sup> of water.
- Ensure that the eggs keep bobbing up and down throughout the incubation period.
- The water flow should be such that the eggs keep away from the screen and do not hit against the outer wall.
- Hatching period is temperature dependent and varies between 16 and 20 hours
- Allow the resultant hatchlings to remain in the hatching tank for 3-4 days after which they are sold or transferred to nursery pond.
- Sprinkle KMnO<sub>4</sub> solution intermittently on the water to reduce siltation and microbial load
- Suspend a few coir ropes in the water column to remove dead eggs and spawn which stick to the bristles
- Clean and disinfect the tank thoroughly with KMnO<sub>4</sub> solution (5 ppm) after every cycle.

## Examination of eggs:

- The fertilized (good) eggs are transparent with a clearly visible nucleus at the centre and look-like pearls.
- The unfertilized (bad) eggs are opaque white and the nucleus disintegrate within one hour



# Breeding Season

## Breeding Season

- They mature during May-June and some are found to remain mature till the end of August.
- The common carp attains maturity at 4-6 months of age and breed year-round in captivity.
- Induced breeding of carps starts with the onset of south-west monsoon, June.





# Nursery and Rearing Phase

India, carp culture is carried out in three phases (three-tier system) comprising:

1. Nursery phase (rearing three-day-old spawn to fry),
2. Rearing phase (rearing fry to fingerling stage) and
3. Grow out phase (rearing fingerlings to adult stage).

The nursery rearing involve nurturing of 72-96 hours old spawn which have just begun to eat and continues for a period of 15-20 days, during which they grow to fry of about 25-30 mm. These fry are further reared in another pond for a period of 2-3 months to raise the fingerlings of about 100 mm in size.





# TROUT CULTURE- COLD WATER FISHERIES





## Food and feeding



Adults feed on aquatic and terrestrial insects, molluscs, crustaceans, fish eggs, minnows and small fishes.

Juveniles are omnivorous.



## Habitat & Biology of Rainbow Trout

It is a hardy fish, easy to spawn, fast-growing, reaching 5-10 kg in 3 years

Tolerant to a wide range of environments and handling.

Large-scale fry production is possible as they prefer to feed on zooplankton.

It is anadromous as well as purely river or lake resident (spends entire life in river or lake).

Can tolerate temperature of 0-27°C, spawning and growth occur at 9-14°C.



## INTRODUCTION

Trout is a cold water fish  
Among trouts, the rainbow trout, is the most important species.

Trouts native to India are:  
snow trouts

Water Quality Requirement:

DO : near saturation

CO<sub>2</sub> : < 2 ppm

Temperature : 12-21 degree celcius

pH : 6.5-8.5

Alkalinity : 10-400 ppm (as CaCO<sub>3</sub>)



## BROOD STOCK DEVELOPMENT

RBT spawn during spring (January-May), but photoperiodic manipulation can advance or delay maturation and spawning which ensures year-round fry production.

It does not spawn naturally in captivity



Eggs are artificially obtained by spawning or stripping females.

Ripe/fully mature females (3-4 year-old) fish is preferred.

More number of females is required as fecundity is low.

Females produce up to 2,000 eggs /kg body weight.

Eggs are large (3-7 mm)

Sex ratio 1: 3 (male and female) are kept separately prior to spawning.

Females are slightly larger and have swollen abdomen

Males are slightly smaller and have round abdomen

Stripping and fertilization technique is well-developed





## STRIPPING

Dry method of fertilization is a common approach

No hormones are used for spawning in this species.

Eggs are stripped on to a clean basin and mixed with milt from more than one male to ensure better fertilization and reduce inbreeding.

Fertilized egg can be transported after 20 minutes and up to 48 hours after fertilization, but then not until the eyed-stage.

Exposure of fertilized eggs to direct sunlight should be avoided.

Eggs incubated undisturbed until the eyed-stage, in hatching troughs, vertical incubators or hatching jars.

Hatching and rearing troughs are 40-50 cm wide, 20 cm deep and up to 4 m in length.

Two layers of eggs are placed in wire baskets or screened trays.

Water flow rate is 3-4 l/minute.

As the eggs hatch, the fry drop through the mesh to a bottom trough.

Some times up to 16 trays are stacked one above the other.

Hatching period is 100 days at 3.9 degree celcius or 21 days at 14.4 degree celcius

Dead eggs are periodically removed to limit fungal attack.

Fugal infection is controlled using formalin (37% solution of formaldehyde) for 15 minutes

Hatching rate is up to 95%.

Yolk-sac absorption period lasts for 2-4 weeks.

After hatching, the trays are removed and trough water depth is maintained at 8-10 cm until swim-up stage

After yolk-sac absorption, the fry actively actively search for feed.



## **HATCHING**

# Fry rearing

Fry are traditionally reared in fiberglass concrete tanks.

Diameter of circular tank is 2 m or size of squarish tank is 2 m x 2 m, with 50-60 cm depth.

The drain is fixed in the centre of the tank and is protected by a mesh screen.



Fry are fed with specially prepared starter feeds using automatic feeders.

Feeding rate is 10% b.w. daily for 2-3 weeks using continuous feeders

Feed pellets contain fish meal (80%), fish oil and grains. Feed contains proteins (50%), fat (12-15%) and vitamins (A, D and E), minerals and pigments (astaxanthin and canthaxanthin).



# 'THE ARUNACHAL PRADESH FISHERIES ACT 2006'



provides laws for proper management, conservation and development of natural fisheries resources in the state of Arunachal Pradesh.

It states the following:

• Destruction of Fish by Explosives or by similar/ allied substances:

Punishable with imprisonment, for a term which may extend to two months, or with fine which may extend to two thousand rupees or with both.

• Destruction of fish by Poisoning Waters:

Punishable with imprisonment for a term which may extend to two months, or with fine which may extend to two thousand rupees or with both.

• Power to make rules

For prohibition of all the fishing as may be necessary and particularly during breeding season in any specified water for any specified period which may also be extended for further period



## Do's & Don't

❑ Stop killing of brood and juvenile fishes and observe closed season i.e. April to September to allow fish to breed.

❑ Discard all form of chemicals, electrocution. Pesticides, poison of plant origin to kill fishes.

❑ Do not use banned medicinal products such as malachite green, carbadox etc

❑ Don't culture banned fish species such as Thai Magur (Clarias gariepinus) and other invasive fish species which may endanger local species.

❑ Identify and declare some stretches of rivers, streams as sanctuaries and impose complete ban on any type of fishery activities in this protected zone round the year

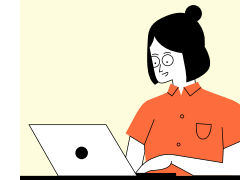
❑ Use recommended gear with regulated mesh size.

❑ Prevent/minimize polluting rivers and streams

❑ Stop catching of fish by diverting course of river/ stream followed by complete drying trapping.

**Formaldehyde** presence in fish and seafood occurs in two different ways, natural formation and illegally addition to extend shelf life.

**"Formaldehyde is not permitted for use in foods as per Food Safety and Standards Regulations 2011"**



What is formaldehyde? how is it related to formalin?

- Formaldehyde is a highly flammable, colourless gas with pungent and irritating odour .
- It is commonly used in industry for the manufacturing of plastic resins that can be used in wood, paper and textile industry.
- Formalin, which is a solution of about 37% formaldehyde, serves as disinfectant and preservative for household products.

## Why traders tend to adulterate fish with formalin?

- The underlying motive of using formalin on fish (either as a dip or through ice laced/or made with formalin as an ingredient) is:
  1. to extend the storage life of fresh or chilled fish
  2. to artificially improve the sensory attributes i.e. appearance, so as to give a facade of fresh fish.

## How to detect contaminated fish?

- Contaminated fish will be stiff, have rubbery meat, hard scales, red gills & clear eyes.
- It will not have the typical fish smell
- If the fish is tender it may not be formalin treated”
  - For further test, kits are available

## Why consuming formaldehyde or formalin can be bad for health?

- The International Agency for Research on Cancer (IARC) of WHO classifies formaldehyde as **"carcinogenic to humans"**
- Presence of formaldehyde in food at higher levels can lead to severe abdominal pain, vomiting, coma, renal injury and possible death. For food handlers, it can lead to sensory irritation of eye and lungs, dermatitis and asthma.

### Advice to consumers

- Wash fish thoroughly with running tap water, as formaldehyde is soluble in water and washing can aid the removal of formaldehyde, to a larger extent.
- Cook your fish thoroughly to an internal temperature of 75°C or above, as heat from cooking can also aid the removal of formaldehyde, because it is a volatile. Also, check the flesh to see whether it has turned opaque and can be separated easily.
- Consumers can check the fish for adulteration using rapid detection kit

# AWARENESS ON CONSERVATION OF FISHERIES & MISUSE OF FORMALIN IN FISHES



**" NATURAL RESOURCES SUPPORTING FISHERY IS OUR STATE WEALTH. WE MUST STRIVE TO PROTECT/CONSERVE THIS GOD GIFTED WEALTH FOR SUSTAINABILITY AND BETTER TOMORROW. "**



# COMMON FISH DISEASES AND THEIR MANAGEMENT



## Causes

- Most of disease outbreak is observed during fluctuation of temperature or changes in the environment.
- The common factors of disease are as followings:-
  - Changes in water quality such as: Temperature, Dissolved Oxygen, CO<sub>2</sub> PH, Transparency Turbidity etc.
  - Waste products make water polluted so that gill, skin, and mouth cavity become infected.
  - Excess use of organic matters and food produce harmful gases such as H<sub>2</sub> S, Ammonia, Methane, CO<sub>2</sub>, Which are responsible for fish disease.
  - Runoff water from agriculture field, flooded area and other ponds make polluted water.
  - Fluctuation in temperature and high stocking density may cause stress in fishes.
  - Over feeding may cause water pollution.

## Common symptoms of disease:

- Isolation from group, differences in behavior and swimming.
- Abnormal position, stop feeding or reject food intake.
- Changes in body physique, shape, colour i.e, discoloration of body.
- Accumulation of water or reddish fluid in the body and roots of fins.
- Stomach swollen, necrosis of gill, secretion more mucous.
- Body swelling followed by spots, abrasion, furunculosis, ulcer or wound with fungal infection.
- Sudden movement and jumping off the water, rubbing the body against rough surface, pond dykes, aquatic plants etc, improper respiration and movement.
- Movement on own axis, backward or forward tail down or head down, oblong, vertical or horizontal imbalanced body.

# Precaution and Treatment

*Prevention is better than cure!!!!!!*



**I .Disinfection of ponds and tanks:** Pond management is based on the application of 50-100kg bleaching powder per hectare during pond preparation. Quick lime is used @ 400-600kg/ h in new ponds and 500-800kg/ h in old ponds to eradicate microbes and pathogens. Fish stock can be treated with 5ppm formalin or 0.5-2.0% salt solution prior to stocking in the pond. 5kg  $\text{KMnO}_4$  and 5-liter formalin can be used in new ponds. 10kg  $\text{KMnO}_4$ , 10kg  $\text{CuSO}_4$  and 10 liter formalin can be used in old ponds.

**II. Eradication of diseased and dead fishes:** Diseased fish can be eradicated and treated till healthy condition. Dead fishes should be taken out from the pond and buried away from ponds and hatchery.

**III. Primary treatment:** This treatment is done with the help of  $\text{KMnO}_4$ , common salt solution, formalin and  $\text{CuSO}_4$ . Generally, 2-3% salt solution is used as bath treatment for 1-2 minutes.  $\text{KMnO}_4$  is @ 100-250ppm for 2-3 minutes as bath treatment. Netting is required twice a month or after 20 days. Water exchange up to 30cm should be done per month.

In severe infection different medicine or chemicals could be used according to the diagnosis of disease. Oxytetracycline antibiotics can be mixed with fish feed @ 50-60mg/100kg fish up to 15 days. Also an injection of streptomycin 25mg and penicillin 20,000IU can be given to valuable and costly fish more than 1kg body weight.

Bacterial Disease	Symptoms	Treatment
<b>Columnaris disease or “Cotton wool” disease</b>	Grey whitish spots appear on the head and fins, gills and lateral sides of body these spot become ulcerated with reddish colored periphery around the lesion.	Use KMnO <sub>4</sub> @ 203ppm in the fish pond bath the fish in 1-2ppm KMnO <sub>4</sub> solution . For bigger fish more than 1kg give injection of penicillin per kg body weight of fish . provide Nitrofurazone in fish feed @ 6.5kg/100kg fish/day.
<b>Bacterial Hemorrhagic septicemia (BHS)</b>	Accumulation of red fluid in body cavity ;other symptoms include destruction of liver cells, green or yellow coloration of liver, necrosis of skin and inflammation of the blood vessels. Exophthalmia (bulging eyes).	Use 2-3ppm KMnO <sub>4</sub> in the fish pond; use Terramycin @ 65-80mg/kg fish body weight up to 10 days. Give injection of streptomycin 25mg and penicillin 20000 IU per kg body weight of fish, only for bigger fish more than 1kg.
<b>Edwardsiellosis</b>	Removal of scales, causing skin lesions and damage of muscle tissues. Many gaseous wounds appear on the skin, causing bad smell.	Use Tetracycline or sulphonamide @ 8-12 mg/kg fish with fish feed. Provide bath treatment in 1:20,000 copper sulfates solution for 15 minutes. Put the fish in 0.04ppm iodine solution for 2 hrs. improve the water quality hygiene food and stocking density.
<b>Fin Rot or tail Rot</b>	Outer edges of fins become slightly cloudiness, and at advance stage of disease the tissues of fins and tail get necrosed and finally the tail and fins disappear.	Use long bath in acriflavine @ 10gm/100-liter water or sulfonamide @ 10gm/100-liter water; use dip treatment with emequil @ 10ml/100 liter for 24-48hrs. For bigger fish more than 1kg weight give injection of antibiotic kanamycin @ 20mg/kg body weight fish, disinfect the tanks, raceways with chlorine and copper sulfate (1:2000).
<b>Dropsy</b>	Gills become pale in colour, exophthalmia, anus become swelling with red coloration, bulging eyes and heavy tummy; fish swim near the surface or pond.	Disinfect the pond with slacked lime @ 100kg per hectare. Use Oxytetracyclin or Chloromycin @ 5mg per kg fish.

Fungal Disease	Symptoms	Treatment
<b>Saprolegniasis and Achlysis.</b>	Fins become frayed and provide the place for bacterial infection. The fungi penetrate into the muscle tissues.	Provide bath treatment of potassium permanganate @ 100g/100-liter water for 10 minutes. Provide dip treatment with Copper sulfate @ 100g/100liter water for 1 minute.
<b>Branchiomycosis</b>	Necrotic patches on the gills, together with false membrane formation made up of proliferation and adhesions of the gill epithelium	Disinfect the tanks and ponds with quick lime or calcium Cyanamid @ 2ppm after complete drying the pond or tank. Treat the fish with 3% salt solution and add copper sulfate @ 1-2ppm in the fish pond.
<b>Epizootic Ulcerative syndrome</b>	<u>The symptoms include large haemorrhagic cutaneous ulcers, epidermal degeneration and necrosis followed by sloughing of scales</u>	Provide bath treatment of fish with copper sulfate 2 100-200g/100 liter water. Spray 102kg copper sulfate per hectare. Apply slacked lime @ 400-600kg per hectarepond. Apply potassium permanganate @ 1-2kg per hectare. Apply Cifax @ 1 liter per hectare.

Parasitic Disease	Symptoms	Treatment
<b>Argulosis or fish louse</b>	Cornea of eyes become turbid due to blindness. These parasite attacks on skin causing inflamed and reddish areas. Secondary infection may be of bacterial hemorrhagic septicemia	Provide short bath in 40% formalin in 100 liter water for 30 minutes. Apply cleaner 2 1-1.5 liter per hectare pond.
<b>Lernaea (Anchorworms)</b>	Lernaea frequently attack almost all the species of major carps and sometimes cause large scale damage in nursery and rearing ponds.	Provide short bath in 40% formalin in 100 liter water for 30 minutes. Bath the fish in 3-4% salt solution for 2-3 minutes. Apply cleaner @ 1-1.5.liter per hectare pond.
<b>Myxosporidiosis</b>	First symptom rotatory movement and black coloration in the caudal region of the body moving on the surface of the water, the fish start this whirling movement when they swim.	Contaminated tanks must be disinfected with grease free calcium cyanamide 2 1 kg /m2.Apply slaked lime @ 80kg/ ha in the pond before stocking the fish and use bleaching powder for pretreatment.
<b>Dactylogrosis</b>	The edges of gills turn grayish in colour. Initially these worms attack on gill filaments but when they are present in large numbers, they become distributed in all over the body.	Provide short bath in 40% formalin I 100- liter water for 30 minutes.
<b>Gyrodactylosis</b>	These parasite attack on skin causing inflamed and radish areas. Flashing in common symptom. In severe condition the	Formalin bath treatment @ 25ppm; NaCl salt solution bath treatment @ 2-5%.



Columnaris



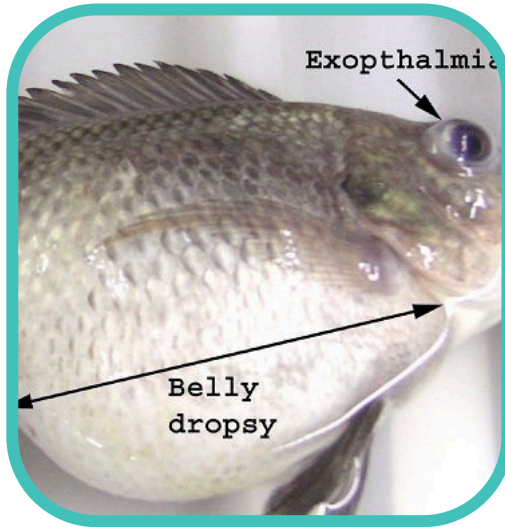
Bacterial Hemorrhagic septicemia



Edwardsiellosis



Fin Rot or tail Rot



Dropsy



Saprolegniasis



Ichthyosporidiasis



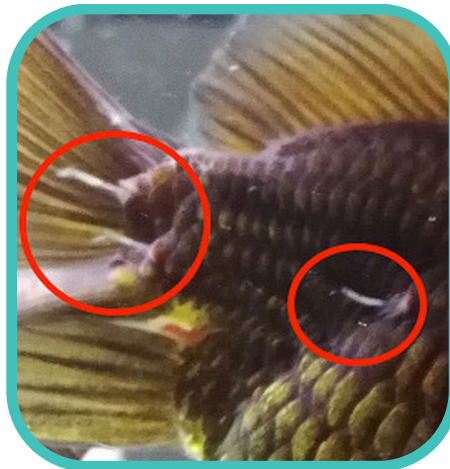
Branchiomycosis



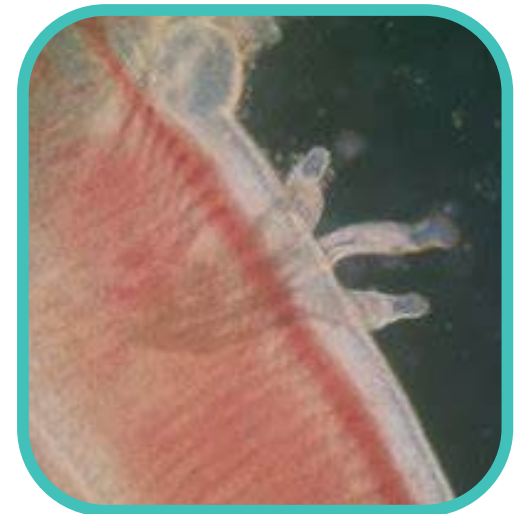
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Dactylogrosis

