

Management of fin fish Hatcheries:

 **Hatcheries:** are artificial or natural confinement where breeding, fish spawning, egg incubation, hatching & rearing to spawn stage are done.

- Presently, hatcheries account for the maximum share of India's fish seed production.
- The country's fish seed production which was only 211 million fry in 1964-65, increased to 20,700 million fry in 2008.
- A quantum jump in fish seed production from the 1980s is attributed mainly to the introduction of the technology of the Chinese type of carp hatchery and refinement of the technology of induced breeding, coupled with usage of ready-to-use fish spawning agents like **ovaprim**. However, India still faces shortage of quality fish seed.
- **West Bengal**, where inland fish culture and fish seed production is an age-old practice, continues to be ranked first in fish seed production and supply, far ahead of the 2nd ranked State i.e. Assam, where there is a great demand for freshwater fish.

Uses of Hatcheries:

1. In earlier days, fish hatchery was used as a facility for hatching of fish eggs collected from rivers and bundhs.
2. At that time, rivers and bundhs were the main sources of carp seed.
3. Over the years the development and refinement of the technique of **induced breeding** has been enlarged.
4. Hence more emphasis is being given to the hatchery proper for the large scale production of fish fry.
5. Details on the number of Indian major carp hatcheries (both public and private sector), spawn production, conversion rate from spawn to fry, type of hatchery, spawning agent used, etc. are presented below.
6. It is evident that the Chinese type of circular hatchery is the most widely used hatchery for large seed production all over the country.
7. Jar hatchery (glass or fiberglass) and double-walled hatching hapa are used for medium or small scale operation in some parts of the country.

8. Among the different fish spawning agents, **ovaprim**, a ready-to-use agent, has been the most popular hormone among fish hatchery operators.

Different types of fish hatcheries:

Hatchery proper

The evolution of fish (carp) hatchery systems in India was reported by Dwivedi and Zaidi (1983).

Several types of fish hatchery devices are found in India.

These range from the simplest hatching pits to the most modern.

1. Hatching pits:

- The earliest device of hatching carp eggs, used in bundh-type breeding system of Bengal, comprised pits.
- The dimensions of the pits vary according to the requirement, but pits of 3'x 2'x 1' are dug in multiple rows and their inner walls are plastered with mud.
- About 30,000-40,000 eggs can be kept for hatching in each pit.



2. Chittagong type hatchery pits:

- These are similar to hatching pits except that they are each provided with a double-walled (inner mosquito netting material and outer muslin cloth) cloth linings.
- The outer cloth is kept a few inches above the earthen bottom of the pits.

3. Earthen pot hatchery:

- This is one of the earliest types of hatchery used in association with bundh-type breeding system.
- It comprised earthen pots arranged at different levels one draining into the other kept at a lower level.
- This provides a flowing current of water, cooled by surface evaporation of the porous earthen pots in which the carp eggs are hatched.



4. Double-walled hatching hapa:

- The double-walled hatching hapa is one of the commonest devices to serve as an outdoor hatchery.
- Installable in a pond or in the margin of a river, up to 1,00,000 eggs can be hatched in the inner mosquito net wall of the hapa of the size 1.75m x 0.90m x 0.75m.
- The newly hatched hatchlings wriggle out through the round meshes of the inner wall and collect themselves in the outer whole cloth enclosure
- Larval survival is much higher when the hatching hapa is installed in a gently or fast flowing canal or a river because of superior exchange of water.

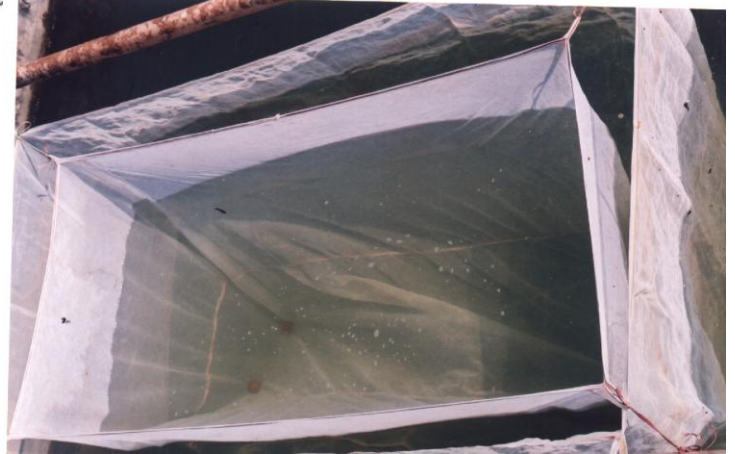
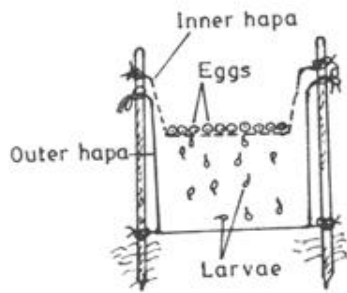
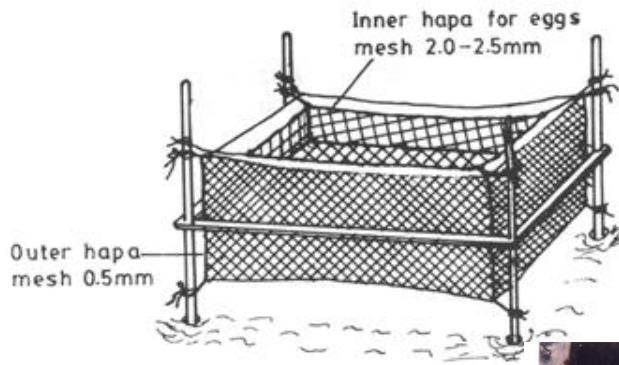


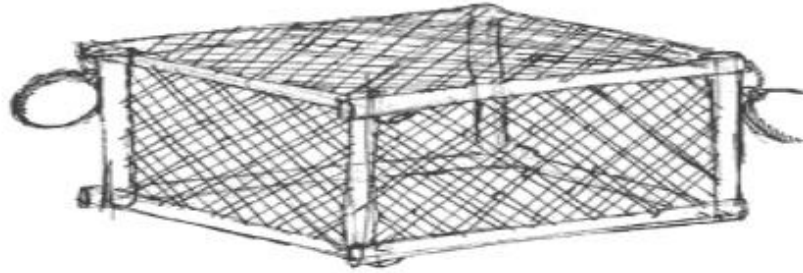
Figure : Doubled-walled hatching hapa consisting of inner (round-meshed mosquito cloth) and outer (nylon) hapas.

5. Floating hapa:

- Similar in principle to the double walled hatching hapa, a floating hapa is mounted on a wooden frame to which it is securely tied such that the whole unit drifts in water.
- The floating hapa has the advantage that it can be used on rocky substrates, often found in reservoirs

and can be towed to deeper water to obtain better exchange of water.

Floating Hapa



2.1×1.1×1.2 m fitted in frame of plastic pipe

- Outer- 2×1×1 m

- Inner- 1×0.5×0.5 m

- Capacity 75,000 to 1,00,000 eggs



6. Tub hatchery

- First introduced in the Madhya Pradesh State.
- This hatchery furnishes running water to hatch eggs in galvanized iron units with adjusted levels such that water flows by gravity through interconnecting siphons.
- Each tub (2.5' x 2.5' x 1.5') is fitted with double walled hapas and the eggs are constantly bathed in a gently flowing water current.



7. Cemented cistern hatchery

- Used at Nowgong dry bundh in Madhya Pradesh and is situated generally below the dam sites
- Each cement cistern (tank) commonly measures 2.4 x 1.6 x 0.45m.

- It has its own inlet, situated at different levels at the opposite ends of the cistern.
- They are often arranged in rows wherein water flows by gravity and each cistern can hatch about 3,00,000 eggs at a time.



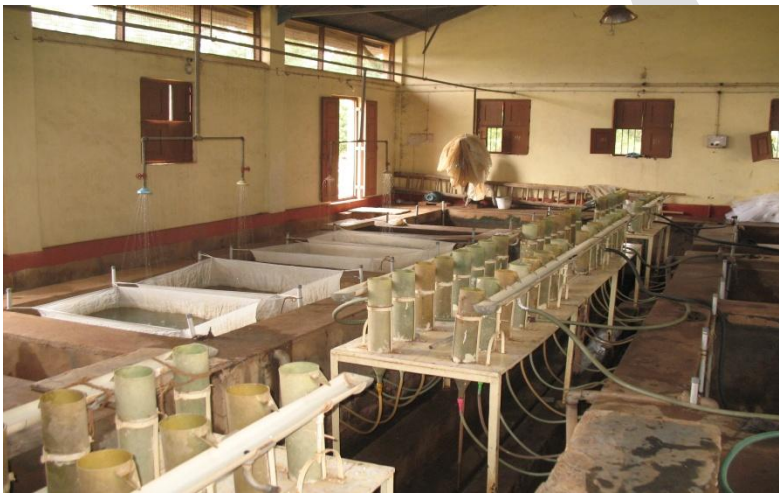
8. Glass jar hatchery:

- The credit of developing India's first transparent hatching device in which the developing eggs can be watched at eye level goes to Bhowmick.
- In this system, the hatching are automatically transferred to storage hapa/spawner, within the hatchery building itself.
- The main components of Bhowmick's glass jar hatchery are : an overhead tank, fish breeding tank,

incubation/hatching jars and a spawnery to hold the newly hatched spawn.

- The capacity of the overhead tank is 5,500 L and that of each of 20/40 hatching jars is 6.35 L.
- The spawnery comprises two cement tanks (1.8 x 0.9 x 0.9 m each) which can hold a nylon hapa measuring 1.65 x 0.8 x 1.0m, projected above the tank and hence deeper than the tank and has an overhead shower for spray.
- Each jar can accommodate 50,000 water hardened and swollen eggs at a time. The water flow rate maintained is 600-800 ml/minute for IMC.
- This was earlier a very successful system, but the hatchery jars are now obtained against orders only.





9. Transparent polythene jar hatchery:

- This hatchery is identical to Bhowmick's glass jar hatchery except that the breakable hatching jars are replaced by transparent polythene containers.
- Each jar is provided with an inlet pipe and an outlet pipe and escape of eggs from jars is further prevented by an inner mesquite netting container.

- Each jar has its water supply inlet pipe going down almost up to the jar bottom which is of concave type, in hatchery jars.
- The water on reaching the jar bottom is reflected upwards till it finds its exit located at the top of the jars.
- The water in a jar of this type develops greater churning and suspended eggs therein get better oxygenation.
- This is perhaps a superior system than the unidirectional flow pattern of Zoug jars





Figure : Indoor transparent jars, used for hatching major carp eggs.



Figure : outdoor fiberglass (translucent) jars, used for hatching major carp eggs

10. Galvanized iron jar hatchery:

- This hatchery resembles Bhowmick's glass jar hatchery except that the hatchery glass jars are replaced by galvanized iron jars.
- Each jar has a cylindrical portion (48.5 cm long and 23.0 cm diameter) and a top conical portion (19 cm long).
- The jars are filled on an angle iron framework which also accommodates a galvanized iron conduct (10 cm wide and 10 cm high) to carry the hatchlings from the jars to the spawnery.
- The water flow rate is 1 L/min/jar. The galvanized iron jar hatchery is cheaper than glass jar or polythene jar hatchery.



11. Shirgur's bin hatchery:

- This hatchery consists of a rectangular aluminum container (54'' x 16'' x 22'') provided with circulating water (243 L/min) in which are placed cylindrical egg vessels (12'' diameter and 12'' height).
- Each egg vessel can hold about 200,000 carp eggs at a time.

12. Hanging dip net hatchery:

- This hatchery comprises conical 1/16'' cloth dip nets (65 cm diameter at top and 46 cm diameter at bottom) provided with a 50mm brass spray head at the bottom of each dip net.
- Such dip nets are hung in hatching tanks of 3.3 x 1 x 1m.
- The water flow rate is 1-1.5 l /min during hatching and about 100,000 eggs can be hatched in each container.
- After hatching, the hatchlings pass through the meshes of the dip net and get collected in the tank where they are allowed to remain for 3 days before being transferred to nursery pond.
- Such units were installed in Orissa State.



Fig. Hanging dip net Hatchery

13. Circular cistern hatchery:

- This consists of a galvanized iron circular cistern (tank) of 1 m³ capacity with a series of inlet facets placed at 45° at a height of 5 cm from ground level such that when connected to water supply, water moves in a circular fashion.
- The overflowing water is allowed to leave the cistern from an outlet placed at the top by a monofilament 60 mesh/ linear inch.
- The hatchlings are left behind in the cistern till their transfer to nursery pond.



14. Chinese type of hatchery:

- To the Chinese goes the credit of developing the concept of circular breeding and hatching tanks in which water shows circular or centrifugal motion.
- Such hatcheries used for hatching carp eggs in India are of Chinese origin and they are called as the Chinese type of carp hatcheries.
- This system, within a small space, simulates some aspects of riverine environment and has proved itself a very successful method of breeding carps where commercial production of carp seed is required.
- In this system, the outlet lies in the middle of the circular tank guarded by a circular perforated structure or a sloping outlet.
- The principle of a hatching tank is similar to that of a breeding tank, excepting that the former is smaller

and normally has two chambers, giving the shape of a double doughnut to the hatching tank.

- The outlet lies in the middle of the circular tank guarded by a straight, circular perforated pipe which regulates water level in both the chambers.
- One wall of the double doughnut lies at the periphery and the other at the inner end surrounding the outlet.
- The water circulates between the two walls in a circular fashion, with the help of water jets/ inlets, placed at 45 degree from the bottom.
- It is where the eggs are hatched.



15. Low density polyethylene (LDPE) hatchery:

- S.N. Dwivedi, a former Director of Central Institute of Fisheries Education, Bombay was instrumental in introducing LDPE material in fish hatcheries.

This material, like moulded plastic, is made in one piece, has no joints or welds.

- This hatchery comprises overhead tanks, cooling tower and compressors. It combines breeding and hatching facilities.
- Each vertical hatching jar of capacity 40 L can hold 0.2-0.25 million developing eggs.



Chinese type of carp hatchery:

- Hatching and breeding devices of circular shape and are of Chinese origin are referred to as Chinese carp hatchery.
- A hatchery proper is the most essential component of the modern fish seed farm.
- It is here that fish are bred, eggs hatched and hatchlings produced.

- Further rearing can even be done outside, but according to the latest concepts of a hatchery, up to fingerling rearing is done in the hatchery or the fish seed farm.
- A modern hatchery which incorporates all the essential components and where ecological conditions are simulated is sometimes referred to as eco-hatchery.

The components of a hatchery proper are:

1. Ante-tank,
2. Fish breeding tanks,
3. Hatching tanks and
4. Larvae holding tank or spawnery.

1. Ante-tank:

- The purpose of these tanks is to temporarily hold selected broodfish and to acclimatize them prior to injection and they are normally located inside the hatchery building.
- The ante-tanks are normally twins - one each for female and male.
- A 200 m² (10m x 20m x 1.5m) ante- tank, divided into two identical twins of 5m x 20m can hold 25 sets

of broodfish comprising female to male in the ratio of 1:2 i.e. 75 specimens of fish.

- Besides holding broodfish for conditioning, the ante-tanks are also used, in modern hatcheries, for stocking fry or fingerlings prior to sale and also for treatment of diseased or infected fry, fingerling and broodfish.
- The ante-tank is generally a concrete structure.

2. Fish breeding tanks:

- Depending upon the system adopted, the same breeding tank can serve as a hatching as well as larval rearing tank for about 3 days after hatching.

3. The hatching tank:

- ❖ can itself serve as a larval rearing tank besides a hatching tank or can in turn lead to a **larval rearing tank**, where the larvae after yolk-sac absorption are given their first external larval food before being transferred to the outside nursery pond.

The merits:

1. The important merits of this system are that it stimulates some characteristics of a riverine habitat where the fish naturally belong.

2. Very efficient hatching (almost 100%).
3. It combines breeding, hatching and larval rearing.
4. It is suitable for commercial scale operation.

The demerits:

1. Requirement of water is high.
2. In many a hatchery water is in short supply.
3. A large breeding tank is ill- utilized for small scale breeding operations.
4. Concrete structures are expensive to install and once installed, subsequent modification becomes virtually impossible.

Infrastructure of eco – hatchery complex for carp seed production (Chinese type):

- For commercial success of fish hatcheries, infrastructural facilities are prerequisites.
- Due to lack of infrastructural facilities, realization of fish seed in nursery/rearing ponds is poor in many states.
- Modern carp eco-hatchery is the most appropriate system to produce seed of Indian major carps and exotic carps.

- It is an integrated one, with infrastructure for broodfish care, breeding tank, hatching/incubation tank, spawn and fry rearing, packing and marketing of seed, water supply system and buildings.



Figure : . Top view of a Chinese type of circular breeding tank, with an overhead shower(above & below).





Figure: Breeding cage prepared inside a breeding cage (below) and removal of spent brooders from the cage (above).





Figure : A view of a Chinese type of circular hatching tank, with the inner chamber covered with nylon netting(above) and a battery of circular hatching tanks in operation (below) .



Causes of mortality of fish eggs and spawn and their treatment:

- Improper production and delivery of seed to farmers or poor management of brood fish and fish seed by farmers once stocked, may lead to decline in fish production.

Some of the causes of mortality of fish eggs and spawn are:

1. Poor water quality.
2. Poor pond hygiene.
3. Presence of Pests.
4. Poor management of brood fish and seed.
5. Transportation stress.
6. Conditioning of fish seed.
7. Mortality of eggs and hatchlings.
8. Diseases and parasites.

1. Poor water quality:

- It is known that a lot of major carp eggs perish during incubation as a result of heavy siltation (particularly so during the first few weeks after the onset of monsoon), oxygen depletion, high hydrogen sulfide level, etc.

- This problem is all the more serious if reservoir water is taken directly to hatching tank.
- Similarly, newly hatched spawn also suffers from the above mentioned problems.
- High density of eggs and spawn also contributes to high mortality, particularly in Chinese type of carp hatchery where a large quantity of unfiltered water is used.
- Use of filtered water will greatly help reduce mortality of fish eggs and spawn.

2. Poor pond hygiene:

- Mass mortality of seed in carp nursery ponds is frequently encountered in Karnataka (Mohan and Shankar, 1995).
- Mortality of seed is attributed mainly to prevalence of protozoan parasites, particularly in ponds which are not dried properly prior to stocking.
- Pond drying followed by liming is known to considerably reduce mortality and improve seed quality.

3. Presence of Pests:

- The presence of fairly shrimp (*Streptocephalus* spp) in carp nurseries is known to hamper the growth and survival by competing with fry for food, space and oxygen.
- Presence of weed fishes in nursery pond leads to the production of stunted fingerlings.

4. Poor management of brood fish and seed:

- Competition among fish seed producers to meet demand some times leads to poor management of broodfish and fish seed may negatively affect seed quality.
- Substandard quality seed is frequently observed as a result of high stocking density in nurseries.
- Fish hatcheries in India are concerned more about the quantity rather than the quality of fish seed and produce them without following any selection norms.
- Consequently, the seed suffer from high rates of mortality, poor growth and are prone to diseases and parasites.

5. Transportation stress:

- During transportation fish seed is subjected to confined environment, higher metabolic load, stress, strain and exhaustion.
- As a result, the seed becomes susceptible to diseases and parasites.
- Chowdhury (1996) used scale loss and tail damage of carp after transportation as quality indicators.

6. Conditioning of fish seed:

- Conditioning is acclimatizing seed to a restricted environment prior to packing and transportation.
- During this period the seed is stocked at a very high stocking density in a hapa or a pond with running water, but without provision for food so that the weak seed dies and only the healthy fry survives.
- The seed that survives the 'stress test' only is selected for transport to a required destination. This type of conditioning of fish seed is commonly practiced in several States of India.

7. Mortality of eggs and hatchlings:

- Fish farmers in West Bengal at times encounter heavy mortality of eggs and hatchlings during incubation period.
- This has been found to be due to immature bursting of egg shells and release of premature hatchlings before the anticipated period of hatching. Such hatchlings either do not survive or suffer mortality at subsequent stages.
- To overcome this problem, fish farmers of the State have been using a solution which is a mixture of extract of catechu (*Acacia catechu*) and Myrobalan (*Myrobalus indica*).
- The plant extract enhances hatching period and prevents hatchlings from premature release due to the presence of tannin which helps harden the egg membrane (chorion).

8. Diseases and parasites:

- High stocking density, artificial feeding, water fertilization, etc. have become common husbandry

practices in carp nursery and rearing systems to optimize returns.

- These high density systems offer the ideal environment for disease outbreak because such systems have stressed host and virulent pathogen.
- Depending on the nature and severity, the disease may cause mass mortality of the affected population in a short time, produce protracted small scale mortality, reduce growth, make the larvae unsuitable for stocking.
- The need for adopting suitable health management measures to reduce the loss due to diseases is being increasingly felt by hatchery operators.