Different types of fish hatcheries – traditional doublewalled hapa

Hatcheries

- Account for the lion's share of India's fish seed production
- The country's fish seed production- 211 million fry (1964-65), increased to 17,000 million fry (2003)



Figure 13 : India's fish seed production statistics (from 1964-65 to 2003).

- A quantum jump from the 1980s due to introduction of 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
- West Bengal- ranked first in fish seed production and supply; Assam 2nd ranked

Hatchery proper

• India – seed revolution by Dwivedi and Zaidi (1983)

1. <u>Hatching pits</u>

- The earliest device of hatching carp eggs, used in bundh-type breeding system of Bengal, comprised pits. 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

- Similar to hatching pits but 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

- Comprised of earthen pots arranged at different levels one draining into the other kept at a lower level
- 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

- One of the commonest devices to serve as an outdoor hatchery
- Installable in a pond or in the margin of a river, up to 100,000 eggs can be hatched in the inner mosquito net wall of the hapa in the size1.75 x 0.75 x 0.90m
- The newly hatched hatchlings wriggle out through the round meshes of the inner wall and collect themselves in the outer whole cloth enclosur
- 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





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
- Advantage it can be used on rocky substrates, often found in reservoirs and can be towed to deeper water to obtain better exchange of water

6. Tub hatchery

- Introduced in the Madhya Pradesh State
- 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 bundhs in Madhya Pradesh and situated generally below the dam sites, each cemented cistern (tank) commonly measures 2.4 x 1.6 x 0.45m
- Inlet situated at different levels at the opposite ends of the cistern
- Arranged in rows wherein water flows by gravity and each cistern can hatch about 3,000,000 eggs at a time



8. Glass jar hatchery

- The credit goes to Bhowmick
- The hatching are automatically transferred to storage hapa spawnery, within the hatchery building itself
- The main components of Bhowmick's glass jar hatchery are : an overhead tank, fish breeding tank, incubation and hatching jars and a spawnery to hold the newly hatched spawn.



• The capacity of the overhead tank is 5,500 I and that of each of 20/40 hatching jars is 6.35 I

• 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



9. Transparent polythene jar hatchery

- 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 (Fig.).
- 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

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
- 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 dipnets are hung in hatchery tanks of 3.3 x 1x 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

13. Circular cistern hatchery

- 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

- Developed by Chinese
- Used for hatching carp eggs in India are of Chinese origin
- The system 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
- Here 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 space between the two walls is where water circulates in a circular fashion with the help of water jets/ inlets placed at 45° from the bottom and where the eggs are hatched.

15. Low density polythene (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 for aeration. It combines breeding and hatching facilities
- Each vertical hatching jar of capacity 40 L can hold 0.2-0.25 million developing eggs

- Due to intensification of carp culture- large scale production of fish fry- hence more emphasis is being given to the hatchery
- Chinese type of circular hatchery is the most widely used hatchery for large seed production all over the country
- Jar hatchery (glass or fiberglass) and double-walled hatching hapa are used for medium or small scale operation in some parts of the country
- Among the different fish spawning agents, ovaprim, a ready-to-use agent- most used

Table : Indian major carps (indicative spawn production)

State	Number of hatcheries	Spawn production (lakhs p.a.)	Spawn to fry conversion rate	Type of hatchery	Spawning agent used
Andhra Pradesh	20	55,000	30%	Jar/circular (Chinese type)	Pituitary extract/ ovaprim
Arunachala Pradesh	1	n.a.		Circular	n.a.
				Circular	Pituitary extract/ ovaprim
	4	3,300	<25%	Circular	Pituitary extract/ ovaprim
Gujarath	12	2,200	25%	Circular	Pituitary extract/ ovaprim
Haryana	21	5,150	25%	Hapa, circular, jar	Pituitary extract/ ovaprim
Karnataka	28	6,343	20%	Circular, jar, hapa	Pituitary extract, ovaprim, HCG, ovatide
Kerala	28	21,000	20%	Jar, circular,	Pituitary extract/ ovaprim
Madhya Pradesh	72	15,800	30%	Circular, bundhs	Ovaprim/ovatide

Maharastra	28	10,655	30%	Circular, hapa	Ovaprim/ovatide
Manipur	4	160	n.a.	Circular	Ovaprim, pituitary extract
Orissa	37	19,672	30%	Circular	Pituitary extract/ ovaprim,ovatide
	6	950	30%	Circular	Ovaprim,ovatide, pituitary extract
Rajasthan	19	6,550	n.a.	Circular	Ovaprim, ovatide, pituitary extract
Tamil Nadu	84	8,968	n.a.	Hapa, circular	Ovaprim, pituitary extract
Tripura	5	2,960			Ovaprim, pituitary extract
Uttar Prudish	45	11,970	Upto 50%	Circular	Ovaprim/pituitary extract, HCG
	30	33,600	Over 30%	Circular	Ovaprim, ovatide, pituitary extract, HCG
Total	420	342,918			

n.a.: data not available; data of Assam State not included in the totals;

* There are/appears to be more carp hatcheries, particulars of which could not be obtained.

State	Number of hatchery	Spawn production (lakhs p.a.)	Spawn to fry conversion rate	Type of hatchery
Mandhya	2	1	-	-
Prudish				
Orissa	1	-	-	Experimental
	1	-	-	Experimental
Total	4	1	-	-

Table : Magur (Clarias batrachus) hatcheries

 Table 7 : Trout hatcheries

State	Number of hatchery	Spawn production (lakhs p.a.)	Spawn to fry conversion rate
A r u n a c h a l Prudish	1	n.a.	n.a.
	3	6	n.a.
H i m a c h a l Prudish	4	30	n.a.
Tamil Nadu	1	n.a.	n.a.
Uttar prudish	3	1.30	n.a.
Total	12	37.30	

Source : *Fishing Chimes*, **19** (10 & 11) : 212-213.

State	Number of hatcheries	Spawn production (lakhsp.a.)	Spawn to fry conversion rate	Туре of hatchery	Spawning agent
	1	5	n.a.	Hatching trays	N a t u r a l (stripping)
Karnataka	1	10	n.a.	Hatching trays	Ovaprim,ov atide
Uttaranchal	2	n.a.	n.a.	Hatching trays	n.a.
	1	10	n.a	Circular	n.a.
Kerala	1	n.a	n.a.	Hatching trays	Ovaprim
Tamil Nadu	1	U n d e r construction	n.a.	n.a.	n.a.

Double-walled hatching hapa

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- 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

GLASS JAR HATCHERY

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

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



- Each jar has its water supply inlet pipe going down almost up to the jar bottom which is of concave type, in hatchery jars (Fig.)
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DIFFERENT TYPES OF FISH HATCHERIES - CHINESE TYPE OF CARP HATCHERY

- Chinese carp hatchery- chinese origin; circular shape
- Here fish are bred, eggs hatched and hatchlings produced
- 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 : (i) ante-tank, (ii) fish breeding tanks, (iii) hatching tanks and (iv) larvae holding tank or spawnery.

Ante-tank :

- The purpose temporarily hold selected broodfish and to acclimatize them prior to injection
- Are normally located inside the hatchery building.
- 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
- Also used for stocking fry or fingerlings prior to sale and also for treatment of diseased or infected fry, fingerling and broodfish
- Depending upon the system adopted, the same breeding tank can sub serve as a hatching as well as larval rearing tank for about 3 days after hatching
- The hatching tank can itself serve as a larval rearing tank

- The merits :
 - Stimulates some characteristics of a riverine habitat where the fish naturally belong
 - Very efficient hatching (almost100%)
 - Combines breeding, hatching and larval rearing and suitable for commercial scale operation
- The demerits :
 - Requirement of water is high
 - concrete structures are expensive to install and once installed, subsequent modification becomes virtually impossible

Infrastructure of eco – hatchery complex for carp seed production

- Important prerequisite
- Due to lack of infrastructural facilities, realization of fish seed in nursery/rearing ponds is poor
- 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



Figure: Breeding cage prepared inside a breeding cage (left) and removal of spent brooders from the cage (right)



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