

Shaping the future of Indian aquaculture: A path to captive catfish seed success

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Clarias batrachus fingerlings.

A major development in Indian aquaculture in the late 20th century was the shift from focusing solely on major carps to a more diverse range of species. Catfish have become a key part of this expansion. Their unique taste makes them a delicacy. They also fetch high prices due to their flavour, soft flesh, and fewer bones. Some species are sold live, which improves their market value.

Since the late 1980s, aquaculture in India has grown into an industry. Entrepreneurs now farm carps, catfish, and prawns. Recently, the Government of India identified catfish farming as a national priority and encouraged diversification. However, despite its potential, many fish farmers struggle to culture catfish due to a lack of stocking material. Relying on wild seed collection is not sustainable. Captive seed production is necessary to meet demand. This chapter provides an overview of induced breeding and rearing methods for key catfish species. It offers practical guidance for farmers in the Indian subcontinent to produce catfish seed.

The Asian catfish (*Clarias batrachus*), commonly known as magur, is an air-breathing fish well adapted to harsh environmental conditions. This tropical species is typically found in swamps, marshes, and stagnant water bodies across the Indian subcontinent. Due to its hardy nature and ability to breathe air, it can be cultured at high stocking densities. In recent years, magur farming has gained popularity and is recognised as a valuable species for aquaculture diversification.

Healthy brood fish are maintained on a formulated feed containing 30% protein, with periodic water exchange. This species reaches maturity at about one year. Brood fish weighing 100–150 g can be used for breeding. Males and females are distinguished by secondary sexual characteristics. Gravid females have a round, swollen abdomen and a reddish, circular vent, while males have an elongated, pointed genital papilla. Magur breeds naturally during the monsoon, from June to August.

Females are induced to spawn using synthetic hormones such as Ovaprim, Ovotide, or WOVA-FH at a dose of 1.0–1.5 ml/kg of body weight. Alternatively, they can be injected with conventional carp pituitary extract at 30 mg/kg of female body weight. Females are ready for stripping 16–17 hours after injection. The stripped eggs are fertilised using a sperm suspension prepared by macerating testes in a 0.9% sodium chloride solution.

The species has low fecundity, producing about 600 eggs per gram of ovary weight. A healthy female weighing 100–150 g can lay 6,000–7,000 eggs. The eggs are adhesive and light brown in colour.

The flow-through hatchery consists of a metallic stand or a cemented platform, supporting a row of small plastic tubs with a diameter of 12 cm and a height of 6 cm. Each tub can hold 1,500–2,000 eggs for hatching. Water is supplied from an overhead tank through a common pipe, with individual control taps for each tub. Each tub has an outlet positioned at a height of about 4 cm.

The ideal hatching temperature is 27–30°C, and hatching occurs within 24–26 hours. After hatching, the larvae are washed thoroughly to remove eggshells. The yolk sac is absorbed within 3–4 days. The hatchlings are then transferred to circular or rectangular fibre-reinforced plastic (FRP) or plastic containers for further rearing.

Once the yolk is absorbed, the larvae readily feed on live mixed zooplankton and *Artemia* nauplii. Those reared on *Artemia* exhibit better growth. At 9–10 days old, the larvae start accepting formulated feed, which is introduced gradually while reducing live feed. An optimal stocking density of 1,000–1,500 larvae per square metre, along with two-thirds water renewal, ensures the best survival rates during the first 2–3 weeks. By this stage, they grow to 30–40 mg.

The fry are then transferred to cement tanks for further rearing until they reach the fingerling stage. Providing shelters, feeding crumbled feed, and regular water exchange are essential management practices to ensure healthy fingerling production.

Heteropneustes fossilis

The catfish *Heteropneustes fossilis* (Bloch), commonly known as singhi, is not primarily piscivorous. In natural waters, its diet includes insects, ostracods, worms, algae, organic debris, and occasionally fish. Post-larvae feed on plankton. Singhi breeds in confined water bodies during the monsoon. Males and females reach sexual maturity at one year of age. No parental care has been reported.

Researchers have successfully induced breeding in singhi. Brood fish can be collected from the wild or reared in ponds on a diet containing 30–32% protein. Males and females are identified by the shape of the genital papilla, similar to *Clarias batrachus*. The dose for hypophysation varies from 60–200 mg of pituitary gland per kg of body weight, depending on female maturity. Some researchers have also reported successful breeding using synthetic or steroid hormones. Several inducing agents are effective, including:

- LHRHa and pimozide (50 µg + 5 mg/kg)



Heteropneustes fossilis fingerlings.

- Ovaprim (0.6–0.9 ml/kg)
- 17α-hydroxy-progesterone (8 mg/kg)
- 17α, 20β-dihydroprogesterone (2 mg/kg)

Stripped eggs are fertilised using sperm suspension, following the same method as in *C. batrachus*. Natural breeding is also possible without sacrificing the male. Both sexes of similar weight are injected with synthetic hormones such as Ovotide, Ovaprim, Gonopro, or Ova-FH. The dosage is 1 ml/kg for females and 0.5 ml/kg for males, administered in the evening. The injected brood pairs are released into tanks with a water shower. Fertilised eggs settle at the bottom and are collected the next morning for incubation.

Eggs have a diameter of 1.4–1.6 mm, and hatching occurs within 18–20 hours. The yolk sac is absorbed by the end of the third day, after which larvae begin feeding. Initially, larvae are fed boiled egg yolk, chopped or crushed molluscan meat, and mixed zooplankton. These feeds can be used alone or in combination to improve survival. After ten days, compound feed in dough form replaces live feed. The larvae are reared for 2–3 weeks before being stocked in outdoor tanks for fingerling production.

The fry are transferred to cement tanks with shelters, which satisfy the catfish's hiding behaviour. Crumbled feed containing 30–32% protein is provided near the shelters for easy access. Regular water exchange ensures good water quality. Well-fed fish reach a weight of 2–4 g within 2–3 months of rearing.

Wallago attu

Wallago attu, commonly known as the freshwater shark, belongs to the family Siluridae. It is a large catfish found in rivers, reservoirs, and connected water bodies across the Indian subcontinent. This species is known for its impressive growth, reaching up to 2 m in length and 45 kg in weight. It is highly carnivorous and predatory. Its rapid growth, elongated silvery appearance, and high nutritional value make it a promising species for aquaculture.

Wallago attu breeds once a year during the monsoon in flooded river margins and reservoirs. It has also been observed breeding in large tanks after heavy rains, when runoff water flows into the tanks. Several studies have reported successful induced breeding.

Induced spawning has been achieved using LHRHa and Buserelin acetate (Hoe 766 vet). The female is given 150 µg/kg of body weight as the first dose, followed by progesterone at 100 µg/kg after six hours. The male is injected with 50 µg/kg of Hoe 766 vet at the time of the second injection for the female. Spawning occurs 11–15 hours after hormone injection.

Hypophysation has also been successful, using 16 mg (administered as 4+12 mg or 6+10 mg) of carp pituitary extract per kg of body weight for females. Males receive 5–6 mg (2+3 mg or 3+3 mg) per kg of body weight, leading to ovulation 5–6 hours after the second injection. A study at ICAR-CIFA found that a single injection of Ovaprim at 0.3 ml/kg for males and 0.5 ml/kg for females also resulted in successful induced spawning. Males and females are ready for stripping 8–10 hours after injection.

The sticky eggs hatch after 18–20 hours of incubation. The hatchlings are free-swimming and display cannibalistic behaviour. They prey on smaller or similarly sized larvae by biting the head or tail and swimming with the prey in their mouths. High stocking densities increase cannibalism, while lower densities improve survival during indoor rearing.

Larvae can be reared on live zooplankton, molluscan meat, fish muscle, or goat liver, either individually or in combination. Regular segregation improves survival. Farmers often release fry into ponds where weed fish are abundant. These serve as live feed and satisfy the catfish's predatory instincts, allowing them to grow into fingerlings or juveniles.

***Ompok* spp.**

The genus *Ompok* includes *Ompok bimaculatus*, *O. pabo*, *O. pabda*, and *O. malabaricus*. These medium-sized catfish, belonging to the family Siluridae, are valued as food fish and have high consumer demand. However, limited research exists on their induced breeding and culture.

The first breeding and culture trials for *O. pabda* were conducted at the Kalyani Centre of ICAR-CIFA in West Bengal. Initial results showed that mature fish could be induced to spawn using carp pituitary extract or Ovaprim, either by stripping or natural hapa breeding. Spawning occurs 6–8 hours after injection. A higher dose of Ovaprim (3–4 ml/kg) improves egg release. Hatching takes place within 18–20 hours.

Ompok bimaculatus, commonly known as the buffer fish, can be induced to spawn in hatchery conditions. Mature fish weighing 200–300 g are given a single intramuscular injection of Ovaprim at 0.5 ml/kg for both males and females. Spawning occurs naturally in the hatchery 5–6 hours after injection, with high fertilisation rates. A female weighing 200–300 g produces 3,874–4,150 eggs. The eggs are small (1.22 mm in diameter) and hatch in 24–25 hours. Hatchlings measure 2.4–2.6 mm in length.



O. bimaculatus.

Larvae begin feeding on the fourth day. They can be fed boiled egg yolk or live feed. Mixed zooplankton, *Artemia* nauplii, and chironomid larvae are also effective. Larvae reach 40 mg in 20–25 days and are then transferred to small tanks or cement cisterns for fingerling production. At this stage, they readily accept formulated feed with fish meal as the primary ingredient. The fish grow to 3–5 g within 45–60 days.

Ompok malabaricus is another small catfish with aquaculture potential. It matures at a weight of 80–115 g and spawns during the monsoon. Spawning can be induced using various agents, including:

- Carp pituitary extract (90–110 mg/kg)
- Ovaprim or Ovatide (0.3–0.7 ml/kg)
- Human chorionic gonadotropin (HCG) (3,000–5,000 IU/kg)

The latency period for spawning is 6–12 hours. Fecundity ranges between 3,800 and 5,000 eggs per female. Captive rearing trials have used plankton soup, *Tubifex* worms, chironomid larvae, mosquito larvae, and earthworms as feed.

Mystus cavasius

Mystus cavasius is found in water bodies across Southeast Asia. It is a promising species for freshwater aquaculture diversification in the Indian subcontinent due to its high market demand and excellent taste. Brood fish can be raised in small ponds or cement tanks at a stocking density of 3–4 fish per cubic metre. This omnivorous species is fed a diet containing 30–35% protein at a rate of 2–3% of body weight to ensure healthy broodstock for seed production.

This catfish reaches sexual maturity within its first year and breeds during the monsoon. Brood fish weighing 50–100 g are ideal for captive breeding. Males are identified by their elongated genital papilla, while females have a swollen abdomen. *Mystus cavasius* is induced to spawn using synthetic hormones such as Ovatide, which is injected at a dose of 1.0–1.5 ml/kg of female body weight. Ovulated females are stripped 10–12 hours after injection. The testes



Mystus cavasius fingerlings.

from the male are macerated in a normal saline solution to prepare a sperm suspension, which is mixed with the stripped eggs for fertilisation.

Fecundity ranges from 10,000 to 22,000 eggs per female weighing 40–80 g. The sticky, fertilised eggs hatch within 24 hours at temperatures of 28–32°C. Both sexes can also be induced to spawn naturally in captivity when injected with the same hormone dosage. In such cases, a male-to-female ratio of 2:1 is maintained.

Hatchlings are tiny, transparent, and measure 3.0–3.3 mm in length. The yolk sac is absorbed within two days, after which the larvae begin external feeding. Live feeds such as mixed zooplankton, *Artemia* nauplii, and chopped *Tubifex* worms are preferred during early rearing. Since this species grows slowly, lower stocking densities and regular water replenishment are recommended.

At 10–12 days old, larvae are gradually weaned onto formulated feed. After two to three weeks, the fry are transferred to cement tanks, where they continue feeding on formulated diets until satiation. They reach a weight of 2–3 g within two to three months and are then ready for grow-out culture in ponds.

Rita chrysea

Rita chrysea is a medium-sized freshwater catfish belonging to the Bagridae family. It has a lead-grey body with a whitish ventral side and greyish bands on the dorsal side. This species is omnivorous and breeds during the monsoon. Brood fish weighing 50–60 g or more are suitable for induced breeding.

Only females are injected with a commercially available synthetic hormone, a combination of sGnRHa and domperidone, at a dose of 1 ml/kg of body weight. Stripping is carried out 13–15 hours after injection. The eggs are released in a mass resembling a grape cluster and measure 1.2–1.4 mm in diameter. A female weighing 90–120 g produces 10,000–13,000 eggs. Fertilisation is done using a sperm suspension prepared in the same way as for *Clarias batrachus*.

The fertilised eggs hatch within 22–24 hours. Hatchlings measure 3.5–4.3 mm in length and weigh 0.9–1.2 mg. The yolk sac is absorbed within 72 hours, after which the larvae require external feeding. Live mixed zooplankton and *Artemia* nauplii are the preferred feed at this stage.

Over three weeks, the larvae grow to 40–60 mg and exhibit hiding behaviour. The fry are transferred to outdoor tanks for fingerling production. A crumbled or dough-form compound feed containing 30–35% protein is placed near the shelter areas, as the fish tend to hide there. Oxygen depletion is commonly observed in the early morning during rearing. To prevent this, regular water renewal is necessary.

During the 2–3 month rearing period, the fish grow to 2–3 g, with a survival rate of 50–70%.

Horabagrus brachysoma

Horabagrus brachysoma is a medium-sized bagrid catfish found in the water bodies of the Western Ghats, India. It is commonly known as the Asian sun catfish or yellow catfish due to its yellowish body and two black blotches located just behind the operculum. This species is valued as an ornamental fish in its juvenile stage and as a food fish when fully grown.

Its ability to adapt to different environments, mature in captivity, accept a wide range of food, and grow well in confined water makes it a promising species for aquaculture. However, overfishing and the destruction of spawning grounds have led to a decline in wild populations, and it is now considered an endangered species. Captive breeding is essential both for conservation and to meet consumer demand.

The brood fish readily accept artificial pelleted feed. They are fed a pelleted diet containing 30% protein at a rate of 2% of body weight. Periodic sampling is necessary to monitor feeding rates and brood health. Regular water exchange in brood ponds is essential to maintain a clean environment and support maturation.

Males reach maturity in their first year, while females mature in their second year. At first maturity, females typically weigh 50–60 g, but only 40–50% respond to induced breeding. It is



Horabagrus brachysoma fingerlings.

best to avoid breeding first-maturity females. If the female's age is unknown, those weighing more than 80 g should be selected.

For induced breeding, females receive a single dose of Ovaprim or Ovotide (a mixture of sGnRHa and domperidone) at 1.5 ml/kg of body weight to stimulate final oocyte maturation and ovulation. Stripping is carried out 12–14 hours after injection. The female should be stripped when eggs flow freely in a semi-fluid state. If the eggs appear too liquid, stripping has been delayed, leading to reduced fertilisation and lower hatch rates.

A well-fed female of 100 g can produce 18,000–19,000 eggs. The milt from a single male is sufficient to fertilise the eggs of a female of the same weight. Fertilised eggs hatch within 24 hours at ambient temperatures.

Larvae are reared in fibreglass tanks inside the hatchery until the fry stage. Feeding them with zooplankton or *Artemia* nauplii improves survival compared to pond rearing. The fry are then transferred to cement tanks and fed crumbled feed until satiation. Water is exchanged as needed. During 2–3 months of rearing, the fry grow to 2–3 g and are then sold to farmers or used for grow-out culture.

Pangasius pangasius

Pangasius pangasius is primarily found in the river systems of the Indian subcontinent. It is a hardy fish that feeds on offal, gastropods, bivalves, and insects. It is often introduced into aquaculture ponds for biological control of molluscs. However, overexploitation has significantly reduced its natural population.

Limited research exists on its captive breeding. Recently, ICAR-CIFA successfully bred and reared this species in hatchery conditions, apart from a few attempts in Bangladesh. Males reach maturity at two years, while females require 3–4 years before they can be used for breeding. Proper brood care is crucial for successful induced spawning. Providing a suitable environment and feeding brood fish with a 30–32% protein diet are key management practices.

Brood fish weighing 1.5–2.0 kg are ideal for induced breeding. Synthetic hormones such as Ovaprim or Ovotide can be injected at a dose of 1.0–1.5 ml/kg of body weight to induce ovulation. Males exhibit free-flowing milt, and a single male of equal weight can fertilise the eggs of two females. This species has high fecundity, with over 100,000 eggs per kg of female body weight. The eggs are approximately 1 mm in diameter, sticky, and hatch within 22–24 hours.

The hatchlings are free-swimming, and their yolk sac is absorbed within three days. However, larvae exhibit cannibalism during early stages, leading to significant losses. To improve survival, larvae are fed live plankton, chironomid larvae, or *Artemia* nauplii. Within 15–20 days, they grow to 40 mg. The seed is then transferred to cement tanks or ponds for fingerling production. They readily accept floating feed and grow to 3–4 g within 5–6 weeks.



P. pangasius fingerlings.

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