

Hatchery Management Practices for Key Aquaculture Species: Asian Seabass, Milkfish, Mullet, Mussels, Clams, Pearl Oyster, and Edible Oyster

M. Santhosh Kumar¹, P.S. Prathib², A. Mariselvammurugan³ & M. Anbarasan⁴

¹M.F.Sc. Fisheries Extension Research Scholar, Central Institute of Fisheries Education, Panch Marg, Off. Yari Road, Versova, Andheri (West), Mumbai, Maharashtra, India.

²M.F.Sc. Aquaculture Research Scholar, Central Institute of Fisheries Education, Panch Marg, Off. Yari Road, Versova, Andheri (West), Mumbai, Maharashtra, India.

³M.F.Sc. Fish nutrition and feed technology Research Scholar, Kerala University of Ocean Studies, Panangad, Kerala, India.

⁴Assistant Professor, TNJFU Directorate of Sustainable Aquaculture, Thanjavur Centre for Sustainable Aquaculture, Thanjavur, Tamil Nadu, India.

SUMMARY

Aquaculture plays a crucial role in meeting the global demand for seafood, necessitating efficient hatchery management practices for various species. This article provides an in-depth overview of hatchery management techniques for Asian seabass (*Lates calcarifer*), milkfish (*Chanos chanos*), mullet (*Mugil cephalus*), mussels (*Perna viridis* and *Perna indica*), clams (various species), pearl oyster (*Pinctada* spp.), and edible oyster (*Crassostrea madrasensis*). Key aspects discussed include broodstock selection, induced breeding, spawning, hatching, and nursery management, offering valuable insights for optimizing production and ensuring sustainable aquaculture practices.

INTRODUCTION

Aquaculture has emerged as a significant contributor to the global seafood supply, providing an alternative to wild-caught fisheries and contributing to food security and economic development. Effective hatchery management is vital for the successful breeding, hatching, and rearing of various aquaculture species. This article focuses on the hatchery management practices for seven important species: Asian seabass (*Lates calcarifer*), milkfish (*Chanos chanos*), mullet (*Mugil cephalus*), mussels (*Perna viridis* and *Perna indica*), clams (multiple species), pearl oyster (*Pinctada* spp.), and edible oyster (*Crassostrea madrasensis*). Each species presents unique challenges and requirements, and understanding these can enhance production efficiency and sustainability in aquaculture operations.

Hatchery Management of Asian Seabass (*Lates calcarifer*):

Asian seabass, also known as barramundi, is found from the Persian Gulf to Southeast Asia and Australia. These predatory fish migrate from estuaries to freshwater rivers and are fed frozen fish like oil sardines and tilapia at 5% of their body weight daily to raise brood stock in captivity.

Brooder Selection: Asian seabass have separate sexes, but it is difficult to differentiate males from females externally. They first mature as males before turning into females after around three years. These fish can spawn multiple times, producing about 1 million eggs per kilogram of body weight in different batches. Males release milky milt when their bellies are pressed, while females have soft, round bellies, pinkish genital papilla, and release eggs when their bellies are pressed.

Induced Breeding: In captive breeding, pairs are formed with a ratio of 1 female to 2 males. Females with ova size greater than 0.45 mm and males releasing milt are selected. Spawning is induced using LHRHa hormone injections: 60-70 µg/kg for females and 30-35 µg/kg for males.

Spawning and Hatching: Spawning occurs spontaneously 30-36 hours after the injection. The fertilized eggs are round, floating, and about 0.78 mm in diameter. Hatching occurs 17 hours later, producing larvae 1.7 mm in length.

Nursery Management: Hatchlings are stocked in indoor FRP tanks of 10-ton capacity at 30 larvae per liter. They are first fed rotifers from the second day post-hatch (dph), followed by green algae, *Artemia nauplii* from the ninth dph, and artificial feed from the seventeenth dph. By the thirtieth dph, seabass fry reach 1.0-1.2 cm with an average survival rate of 40-45%. Due to their cannibalistic nature, frequent grading is required to maintain uniform size.



Injection of hormone; microscopic image of fertilized eggs; fry of seabass

Hatchery Management of Milkfish (*Chanos chanos*):

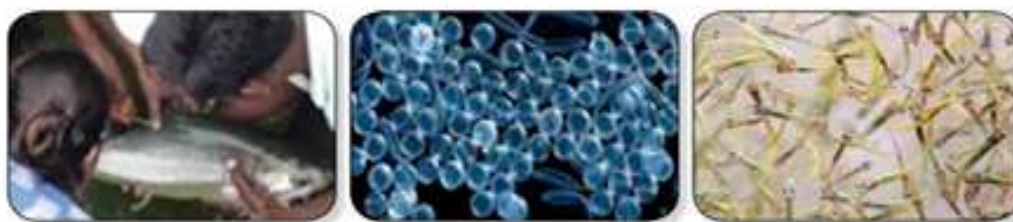
Milkfish are popular brackish water finfish for pond and pen farming, widely distributed in the Indo-Pacific region. They spawn twice a year, primarily from January to April and October to November in the wild. Under captivity, spawning can be extended from February to September with hormonal manipulation and seawater salinity maintained at 30-35%.

Brooder Selection: Milkfish show no distinct sexual dimorphism. Fully mature females have ova diameters of 650-680 μm , while males release white viscous milt when their bellies are pressed. Brooders weighing over 3 kg are raised in large tanks and fed floating brood diets for maturation in captivity.

Induced Breeding: Milkfish require combined hormone pellet implantation (LHRH-A + 17 α -Methyl Testosterone) at regular intervals for induced breeding.

Spawning and Hatching: Milkfish spawn intermittently, batch by batch. They produce 0.3-1.0 million eggs per kilogram of body weight. Fertilized eggs are slightly yellowish and measure 1.10-1.25 mm. Hatching occurs in 24-25 hours at water temperatures of 27.0-29.0°C, and newly hatched larvae measure 3.2-3.4 mm in length.

Nursery Management: Hatchlings are reared in semi-outdoor tanks at 10-15 larvae per liter. They are first fed rotifer *Brachionus plicatilis* from the second dph, followed by green algae. *Artemia nauplii* are introduced from the fourteenth dph, and artificial feed (200-300 μm) from the twentieth dph. By the thirtieth dph, the fry reach 1.5 cm with a survival rate of 40-45%.



Injection of hormone; microscopic image of fertilized eggs; fry milkfish

Hatchery Management of Grey Mullet (*Mugil cephalus*):

Grey mullets are found worldwide in coastal temperate and tropical waters. They are characterized by two separate dorsal fins, small triangular mouths, and the absence of a lateral line organ. They feed on detritus and have unusually muscular stomachs and a complex pharynx for digestion.

Brooder Selection: Grey mullet brooders can be procured from the wild or raised in ponds. Males mature between 250-300 mm, while females mature at 270-350 mm. A minimum fork length of 310 mm or three years of age is recommended for brood stock selection.

Induced Breeding: Females with the correct oocyte size are given hormonal therapy for final oocyte maturation and ovulation. The recommended hormonal therapy includes a priming dose of 20 mg/kg of carp pituitary homogenate and a resolving dose of LHRHa at 200 µg/kg after 24 hours.

Spawning and Hatching: After receiving the resolving dose, brood fish are kept in breeding tanks at a sex ratio of 2-3 males to 1 female. Spawning occurs 12-14 hours after the resolving dose. The eggs, about 880-900 µm in diameter, are collected and stocked into incubation tanks. The incubation period for mullet eggs is 28-30 hours at 26°C.

Nursery Management: Larval rearing takes 42-55 days, with optimal stocking density at 10-20 larvae per liter of water. They are fed with rotifers and phytoplankton. Larvae grow from 2.63 mm to 17.69 mm in 42 days.

Hatchery Management of Mussels:

Mussels attach themselves to hard surfaces using byssus threads. They are filter feeders, consuming plankton. The two important mussel species in India are the Green mussel (*Perna viridis*) and the Brown mussel (*Perna indica*).

Brooder Selection: Mussels reach sexual maturity within a year. Mature broodstock (6-7 cm) is collected from the wild, quarantined, and maintained in holding tanks. They are fed with *Isochrysis* sp. and *Chaetoceros* sp. at 5-6 million cells/ml.

Maturation and Spawning: Broodstock maturation occurs in FRP tanks with photoperiod adjustment and temperature control (20-26°C). Spawning is induced by increasing the temperature by 4-8°C. Mussels have a fecundity of 5-20 million, with a hatching rate of 95%.

Incubation: Fertilized eggs are incubated in glass or FRP tanks with gentle aeration. They undergo various developmental stages before becoming veliger larvae. The D-veliger larvae are transferred to larval-rearing tanks for further growth.

Hatchery Management of Clams:

Clams burrow into the substrate using a well-developed foot. They are found in shallow coastal waters and harvested for their meat and shells, which are used commercially.

Common species of clam along Indian coast :

- Black clam (*Villorita cyprinoides*)
- Short neck clam (*Paphia malabarica*)
- Blood clam (*Anadara granosa*)
- Yellow clam (*Meretrix casta*)
- Great clam (*Meretrix meretrix*)
- Baby clam (*Marcia opima*)

Brooder Selection: Black clams and short-neck clams reach sexual maturity in their first year. Mature clams are conditioned in tanks with unfiltered seawater and fed mixed microalgae.

Spawning and Fertilization: Spawning is induced by thermal stimulation or placing clams in a buffer solution of 9.0 pH. Fertilized eggs are reared in FRP tanks, developing into veliger larvae. The larvae are fed with *Isochrysis galbana* from day 2 onwards and settle as spat within 7-10 days.

Nursery Rearing: Nursery rearing of giant clams occurs in two phases: onshore tanks for nine months, followed by ocean nurseries. Juvenile clams grow to over 20 cm in length in 19 months.



Hatchery Management of Pearl Oyster:

Pearl oysters belong to the genus Pinctada. They produce valuable pearls and are found in tropical and subtropical seas. Six species are found along the Indian coast.

Six species of pearl oysters along Indian coastal water (FAO) :

- *Pinctada fucata* – Indian pearl oyster
- *Pinctada margaritifera* - Black lip pearl oyster
- *Pinctada chemnitzii* - Cape pearl oyster
- *Pinctada sugillata* - Fringed pearl oyster
- *Pinctada anomoides*
- *Pinctada atropurpure*

Brooder Selection: Brood oysters are kept in seawater at 25-28°C and fed mixed algae and corn flour. Spawning is induced by changing water temperature or pressure.

Induced Spawning: Spawning can be induced using thermal or chemical stimulation. Fertilization occurs externally, with eggs and sperm forming whitish masses in the water.

Nursery Management: Spat are reared in hatcheries for two months before being transferred to farms. They are stocked in velon screen net cages and fed mixed algae. Spat grow to 40-45 mm in 12 months.

Hatchery Management of Edible Oyster (*Crassostrea madrasensis*)

Edible oysters are highly nutritious and widely cultivated. They are rich in protein, fat, and minerals. The development of hatchery technology has boosted oyster farming.

Brooder Selection: Oysters selected for breeding are collected from areas with comparable salinity to the hatchery. They are conditioned to mature and spawn.

Spawning and Incubation: Spawning is induced by transferring oysters to seawater with a temperature of 34-35°C. Fertilized eggs are stocked in FRP tanks and aerated gently.

Nursery Management: Larvae are stocked at 5-10 per ml in treated seawater. They are fed mixed algae and undergo various developmental stages before attaching to a surface and metamorphosing into spat.

Stages	Days
D veliger	1-2
Umbo	3-14
Eyespot larvae	14-17
Pediveliger	17-19
Plantigrade	20-21
Spat settlement	24-29
Spat	30-60
Spat	60-90

CONCLUSION:

The hatchery management of Asian seabass, milkfish, mullet, mussels, clams, pearl oysters, and edible oysters involves a range of specialized techniques tailored to the biological and ecological needs of each species. Effective broodstock selection, precise induced breeding protocols, and meticulous nursery management are critical components of successful aquaculture operations. By adopting and refining these practices, aquaculture can continue to meet the increasing demand for seafood while promoting sustainability and economic viability.

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