

Empowering coastal tribal communities with hatchery-produced shell-attached Indian backwater oyster seeds

M.K. Anil^{1*}, P. Gomathi¹, O. Shalini¹, Krishnapriya¹ and A. P. Dineshbabu²

¹Vizhinjam Regional Centre of ICAR-Central Marine Fisheries Research Institute, Vizhinjam P.O., Thiruvananthapuram – 695521, Kerala

²ICAR-Central Marine Fisheries Research Institute, Kochi-682 018, Kerala

*E-mail: mkanil65@gmail.com

The production of attached spat is a crucial step in the aquaculture of *Crassostrea madrasensis* (*Magallana bilineata*), the Indian backwater oyster. Hatchery-produced oyster seed offers several advantages over wild-collected seed, making it the preferred choice for oyster farming worldwide. Hatchery-reared seed ensures uniform size, high survival rates, and disease-free stock, leading to better yield and predictable production cycles. Additionally, it helps conserve natural oyster beds by reducing overexploitation and supports selective breeding for improved growth and resilience. These oyster seeds were produced and supplied by the Vizhinjam Research Centre of ICAR-CMFRI for coastal tribal farmers of Maharashtra under the sponsorship and support of the Mangrove & Marine Biodiversity Conservation Foundation of Maharashtra. This initiative aims to enhance sustainable aquaculture practices, improve livelihood opportunities, and support the economic growth of tribal communities by providing high-quality hatchery-reared oyster seeds. Oyster farming is a significant global industry, valued at more than \$7 billion, with increasing demand in markets such as the USA, Europe, and Asia. Oysters are highly sought after for their nutritional benefits, including high protein content, essential minerals, and omega-3 fatty acids. The rising demand for sustainable seafood and the gourmet food market further contributes to the expansion of oyster farming. Additionally, oysters play a critical role in marine ecosystems by improving water quality and providing habitat for various marine species. Economically, oyster farming provides livelihood opportunities to rural coastal communities. It is a low-investment, non-fed aquaculture practice with minimal pollution and high returns, enabling small-scale farmers to generate sustainable income. With proper support, including hatchery-produced seed, rural farmers can

engage in profitable oyster cultivation, benefiting from both local and export markets. This report outlines the methodology adopted for attached oyster spat production, focusing on broodstock collection, spawning, larval rearing, spat attachment, and transportation.

Broodstock collection and spawning

Broodstock oysters were collected from Ashtamudi Lake, Kollam, Kerala, and transported to the ICAR-CMFRI hatchery on December 2, 2024. The oysters were strip-spawned and fertilized, producing 5 million D-shaped larvae with a size range of 60–75µm, which were stocked in FRP tanks for further rearing.

Larval rearing

The larvae were reared for 16 days until they developed a foot, indicating readiness for settlement at a size range of 200–320µm (average: 243.6µm). During this period, they were fed a diet of multi-species microalgae, including *Isochrysis galbana*, *Pavlova lutheri*, *Dicrateria* sp., and *Chaetoceros calcitrans*.

Selection of cultch material

The selection of appropriate cultch material is a crucial factor in the success of attached oyster production. Large and hard oyster shells provide a stable surface for larval attachment, while an irregular or rough surface enhances attachment and allows better water, air, and feed circulation. Conversely, small shells lack sufficient space for attachment, and old or

brittle shells cannot support the weight of growing oysters, leading to reduced attachment rates and profitability. Proper cultch material selection increases attachment percentage, improves growth rates, and enhances overall profitability.

Seasoning of oyster shells

The preparation of oyster shells for spat settlement involves several steps. First, the shells are sun-dried for 2–3 months (or use already seasoned shells), then drilled at the anterior hinge area of the shell. They are then brushed, washed, and scraped to remove dirt, mud, borers, and foulers. Once cleaned, the shells are transferred to seawater for seasoning, with water exchanged thrice a week until calcium carbonate bleaching stops and the water clears. Before transferring the larvae, the shells are washed thoroughly with seawater. They are then strung on 1.4 m ropes (4 mm thickness), with 20–25 shells per rope, and left for a week to allow biofilm formation before larval introduction.



Cleaned shell rens

Spat attachment methods

Two methods were used for placing oyster shells in the tank. The first method, vertical hanging, allows for better water circulation, enhances feed and oxygen availability, and simplifies cleaning, reducing the risk of contamination. The second method, horizontal spreading (using old net bags), allows for easy handling and movement but poses a risk of anoxic conditions if not properly maintained. To prevent oyster larvae from attaching to the tank sides, a plastic liner could be used before introducing the larvae. This facilitated oyster attachment to the designated cultch material. Oyster rens were hung vertically using

horizontal wooden sticks in the tank. A total of 6,500 oyster shells were cleaned, washed, and seasoned. One million larvae were evenly released into the tank.



Pouring ready to settle larvae

Feeding and water management

No water exchange was carried out for the first two days post-larval release. The larvae were fed a microalgae mixture consisting of *Isochrysis galbana*, *Chaetoceros* sp., *Pavlova* sp., and *Dicrateria* sp., with 60–120 L of microalgae supplied daily per million larvae. Water exchange was performed every alternate day, and larval attachment was monitored weekly. Larvae with well-developed foot structures attached within one to two days, and attached spat became visible to the naked eye after one week. The number of spat attached per shell ranged from two to twelve, with an average of 6.5 spat per shell. More than 95% of the shells had attached spat, indicating a high success rate and the overall health of the pediveliger larvae and spat attachment process.



Packing of attached spat in styrofoam boxes

Growth and transport

Ten days after larval release (26 days post-hatch, dph), the attached spat grew to an average size of 2.12 mm. By day 31 (47 dph), they reached 3.2 mm, and after 60 days of rearing (60 dph), the spat attained an average size of 8.5 mm. Styrofoam boxes measuring 74 × 54 cm were used for transportation, with each box accommodating 500 shells. The shells were arranged in five layers with seawater-soaked gunny bag pieces placed between the layers to maintain moisture. A total of 5,000 shells, containing an estimated 0.1 million spat, were packed. The boxes were sealed after providing a few holes for air circulation, labelled, and transported by train to Maharashtra. The 30-hour journey was successful, and the spat arrived safely for distribution among tribal self-help groups under the Mangrove & Marine Biodiversity Conservation Foundation of Maharashtra.

The successful implementation of attached oyster spat production ensures a reliable seed supply for aquaculture. The high survival rate and optimal growth conditions demonstrate the effectiveness of these



Transportation of the oyster spat

practices. If self-help groups or the Mangrove Cell provide minimal facilities, packed larvae can be supplied for remote-setting at the destination. This technique, widely practiced in the USA and Europe, significantly reduces transportation costs while ensuring successful oyster seed production.