

Demonstration of Mussel Farming in Karnataka: A Success Story

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Focal Points at a Glance: Spat settlement along the Karnataka coast occurs during September to November. The mussel fishing season in the region also begins from October. The dense attachment of mussel spats occurs along with adult mussels in the intertidal and subtidal areas, which can be productively utilised for farming, provided a considerable numbers of farmers are involved to establish and maintain the link between mussel fishers and mussel farmers. In this contribution the authors give an account of the demonstrations of mussel farming and their results.

Background

Aquaculture is an alternative to the currently stagnating fish production through capture fisheries. Bivalve shellfishes, mainly oysters, mussels and clams are promising candidate species for mariculture in India. Bivalves are filter feeders, filtering copious quantity of phytoplankton in water and converting it efficiently into delectable seafood. While being environment-friendly, the farming practice is simple and less capital intensive with no input cost on feed and feeding. Further, in comparison with the fish-meal/oil dependent marine finfish/ crustacean farming, the bivalve aquaculture crops are produced at lower trophic levels, the reason being that they naturally feed on plant materials.

Successful commercial aquaculture is a blend of scientific management practices and economics. The Central Marine Fisheries Research Institute (CMFRI) embarked on a programme for disseminating the technology of scientific bivalve farming in the coastal States of India. While emphasising on sustainable aquaculture promotion, this programme also focused on income and employment generation, women empowerment, quality improvement in post-harvest handling (depuration) and increase in the overall production of bivalves. Among the maritime States of the country, Karnataka is one of the ideal locations for the development of scientific mussel farming, primarily due to the availability of abundance of natural mussel seeds. Several training and demonstration

programmes were conducted by CMFRI for disseminating the technology in Karnataka with the involvement of local fishermen and aqua farmers at Surathkal, Mulki, Udyavara, Kaup, Uppunda, Byndoor and Karwar. The transfer of technology programmes helped in creating awareness about the mussel farming system. The initial efforts to popularise this practice were confronted by the regional challenges of under-developed local market demand, low farm-gate value and limited access to the markets in other States. The marginal increase in farm-gate value and increased demand for mussels encouraged in popularising the bivalve farming technology in the State. The successful harvest of cultured green mussel, *Perna viridis* from the estuarine mussel farms under the technical support of CMFRI in Kodikanyan, Udupi District of Karnataka in 2009, further demonstrated the immense scope for wider adoption of scientific mussel farming practices. The rack culture method advocated by CMFRI in estuarine area with continuous technical support right from the selection of site to harvest time ensured the success of bivalve culture taken up by aqua farmers in the region. The practice proved highly remunerative and has attracted attention of other fisherfolks to venture into mussel farming as a lucrative aquaculture enterprise.

The Initiative

The sheltered estuarine and protected coastal areas of Karnataka offer great opportunities for sustainable development of mariculture. Initially, mariculture

activities in the region were synonymous to shrimp farming in enclosed low-lying brackishwater systems along the coastal districts of Karnataka. When poor management of shrimp farming sector led to environmental issues and related disease problems, enterprising farmers were ready to accept alternate aquaculture practices. One such enterprising aqua farmer initiated the practice by venturing into commercial mussel farming in Sita estuary. This was a major step towards achieving a long-standing goal for establishing and expanding commercial mussel culture along Karnataka and increasing mussel production by Mariculture. An entrepreneur, originally a shrimp farmer, constructed the rack in the outlet of his existing shrimp (*Fenneropenaeus indicus*) farm for suspended farming of the green mussel, *Perna viridis* too. This had the added advantages of both product diversification as well as integration of shrimp farming (involving feed input) with extractive filter feeding bivalves that utilise the organic waste discharged from aquaculture activities.

Farming Method

The suspended "Rack and Rope" farming method, advocated by CMFRI for the shallow areas in protected bays, lagoons and estuaries was adopted for mussel farming. The racks for suspending the seeded ropes were installed near the discharge gate of the shrimp farm where a minimum water height of 150cm was available during low tide. Two racks were constructed as a square platform using

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bamboo and casuarina poles and these were fixed at 50cm above mean high tide level. Mussel seeds collected from natural beds were re-attached to Polypropylene / coir ropes and were suspended from the fixed rack for grow-out.

Grow-out period for the farming of marine mussels is for a period of seven months (during November-May), when conducive salinity prevails in the estuarine areas. Mussel seeds (spat) were collected from intertidal areas, where the young spat settle in abundance during the post-monsoon period. The rocky coastal stretches off Gangolli and Trasi are ideal locations near the farm site for gathering mussel spat in considerable quantity. The farmer (as mentioned earlier) engaged the local fishers and collected mussel spat during the lowest low-tide period and transported it to the farming sites.

The mussel spat collected were cleaned, segregated and packed in wet gunny bags for transportation to farming site during the cold hours of the day. The transported spats were kept submerged in the shallow part of the estuary by spreading them on used fishing nets. For seeding the mussel, coir rope of 22 mm diameter and 1 m length was used as grow-out ropes and mussel spats were wrapped using biodegradable cotton material. Seeding rate used was 0.75-1kg biomass per meter of rope. The seeded ropes were suspended vertically from the racks at 50 cm intervals, ensuring that the free end of seeded rope would remain 0.5 m above the bottom.

The selected farming area had moderate currents and good primary production which helped in continuous replenishment of the natural food availability. As no supplementary feeding or water exchange was required, the farm management was limited only to the maintenance of raft and periodic inspection of ropes used in farming for assessing the health conditions and growth rate of mussels.

The green mussel, at an average size of 22 mm at seeding in the farm, attained a size of 66.63 ± 5.35 mm in 150-160 days, registering a monthly growth rate of 8.2 mm. The mussel yield per meter length of the grow-out rope ranged from 6.8 to 9.2 kg.

Mussel Harvest

The harvesting of mussels was timed to be before the onset of monsoon so as to avoid the reduced saline phase during monsoon months at the farming site. The high saline phase, with salinity varying from 31 to 33 psu, prevailed at the farming site, for

a period of six to seven months, till the onset of monsoon in June. The harvesting was carried out in two phases, considering the market demand. Initially, the better sized mussels, approx 30 count shell-on per kg, were selectively collected from individual grow-out ropes, from the first week of May 2009. The quantity of mussels thus harvested was 450 kg. The final complete harvest was carried out during June 2009. This yielded 2,620 kg of shell-on mussels. The total shell-on weight of green mussel production achieved from the rafts over a period of five months was 3,070 kg. The mussel yield per meter length of the grow-out rope ranged from 6.8 to 9.2 kg.

Processing and Marketing

Declumping, debysing (removal of byssus from mussel) and grading was done manually by trained fisherwomen in a temporary handling facility near the farm, following hygienic practices. The mussels were graded and each grade was segregated for marketing. a) The larger sized mussels were sent to markets in the neighbouring State of Goa where they would fetch a premium price. b) The medium sized mussels were pre-processed for export. The mussels were washed, depurated and steamed for hot-shucking. One-half of the shell was removed manually and the half-shells on mussels were sold to M/s Aditya exports, Udupi for further processing and export. In the sea-food processing unit, the half-shells on mussels were washed, graded and packed in trays, glazed and wrapped before freezing. In each tray, 60-80 numbers of them were arranged in layers with the half-valve and meat facing up. The frozen half-shell-on mussels were exported to Kuwait.

Production and Profitability

About 3,070 kg of shell-on mussels were harvested from the farm of 142 sq. m. area, yielded a revenue of ₹50,000/- during 2008-09.

Mussel Harvest details from farm at Sita estuary

Yield/rope	8.10 \pm 0.42 kg/m
Count	25-30/kg
Survival	85.62 \pm 2.3 %
Mortality	14.38 \pm 2.3 %
Av. Nos./m of rope	202 \pm 10.4
Sales proceeds/ m rope (Gross)	₹709 (25 count)

Economics: Rack size 5mx 5m (100 ropes of 1 m) - Coir rope

A. Initial expenditure	.(₹)
I. Farming	6,736
II. Post-Harvest	4,000

B. Recurring Cost

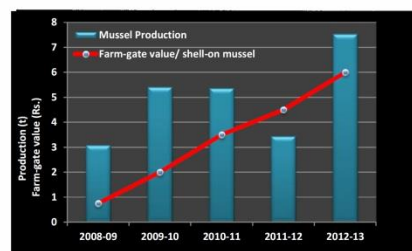
I. Farming & marketing	19,675
Total Expenditure (A + B)	30,411
Gross revenue (100 ropes)	70,910
Net revenue	40,499
Net revenue/ m rope	405

The Impact

a. Adoption of estuarine mussel farming practice: The commercial mussel farming initiatives in Sita Estuary under the technical guidance of CMFRI confirmed the commercial viability of this practice and the major impact of this successful operation had a wider acceptance and adoption of estuarine-mussel farming. The simple, minimal risk -oriented, less capital intensive and eco-friendly operation which was proven as a successful venture coupled with the growing demand for mussel had encouraged more of farmers to adopt mussel farming in Sita Estuary during the subsequent years. Mussel farming practice was initiated as a group farming activity in the estuary by 13 shrimp farmers during 2009-2010. Later, MPEDA (Karwar) extended financial support by providing an amount of Rs. 10,000/- for selected mussel-farming groups.

b. Harvesting plan for better remuneration: Interventions to maximise the profits from the mussel farming are underway. Presently the mussel harvesting is timed to coincide with the period (from March) when a higher percentage of edibility is attained by mussels so as to obtain better counts. This has resulted in selective harvesting and in supplying of larger sized mussels in small quantities from last week of March as direct retail sales of shell-on mussels in domestic marketing sector.

c. Towards more extensive operations-Open-sea farming: During 2010-11, apart from estuarine farming in racks, a mussel raft was also fabricated and moored by fishermen off Kaup for promoting mussel



Farmed mussel production in Karnataka during 2008-2013

farming along with aqua-tourism. Kaup beach with its Light house is a popular tourist spot in Udupi District. Private organisations also conduct regular water sporting activities for tourists. The floating mussel raft was placed 0.6 km off Kaup Light house beach where regular water rides and snorkeling activities are conducted. The mussel raft served as a floating platform for tourists engaged in water sporting activities.

Similarly, 'long-line' method of mussel farming was also carried out in open-sea off Byndoor with the participation of the local fishers. Nylon ropes each of 3m length were seeded with *P. viridis* seed at 1500 g/m during January 2011 at 6m depth.

d. Mussel production in Karnataka: Earlier, mussel production from the State was exclusively limited to the exploitation of traditional fishery of wild stocks. Initiation and expansion of mussel aquaculture in the State contributed to 'farmed mussel productions' (from 2008-09) (Fig. 1). The quantity of mussels from the farming activity surpassed 5t in 2009-10 period. The remarkable increase in farm gate value of the produce from less than a Rupee (Rs. 0.75) in 2008-09 to Rs. 5/shell-on mussel in 2012-13 encouraged continuity of farming of mussel.

Way Forward

The sheltered estuarine and protected coastal areas of Karnataka offer great opportunities for sustainable development of mussel farming in low-lying brackishwater enclosed systems. The timely availability of its good quality seed is the major pre-requisite to mussel aquaculture development. Mussel farming at present relies on the availability of wild seed from the natural mussel beds. Spat settlement along the Karnataka coast occurs during September to November. The mussel fishing season in the region also begins from October. The dense attachment of mussel spats occurs along with adult mussels in the intertidal and subtidal areas, which can be productively utilised for farming, provided a considerable numbers of farmers are involved to establish and maintain the link between mussel fishers and mussel farmers. It is imperative that the necessary guidelines and norms for leasing water bodies for mariculture activities including mussel farming are set by the local governing bodies by bringing together all stakeholders, including fishermen, the tourism industry, exporters and others for peaceful co-existence of potentially confrontational interests.



Fig 1: Rack fabricated near shrimp farm outlet



Fig 2: Mussel seeding

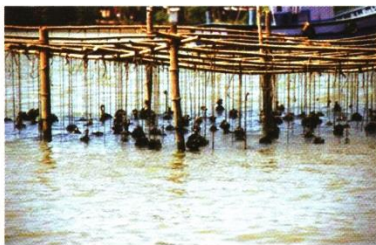


Fig 3: Seeded ropes in estuarine racks



Fig 4: Mussel racks in Uppunda estuary



Fig 5: Mussel racks in Sita estuary



Fig 6 :Mussel harvest-Sita estuary



Fig 7 :Half-shell mussel with meat packed in trays for export



Fig 8 : Raft fabrication-off Kaup



Fig 9 : Harvest from open-sea raft



Fig 10: Mussel ropes-off Kaup