

Green Mussel Farming in Andhra Pradesh

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An overview

Green mussels (*Perna viridis*) and brown mussels (*P. indica*) are highly productive filter-feeding bivalves that are well-suited for marine and estuarine aquaculture. Mussel farming has gained significant traction in Kerala, and similar potential exists along Andhra Pradesh's coast due to its rich estuarine systems, phytoplankton abundance, and calm coastal waters. Mussels are not only high in protein but also rich in omega-3 fatty acids, minerals, and essential vitamins. With proper training, infrastructure, and market support, mussel farming can provide livelihood diversification for fisherfolk and coastal communities in the state.



Green Mussel (*Perna viridis*)



Brown Mussel (*Perna indica*)

Green mussel (*Perna viridis*), a fast-growing and highly nutritious bivalve, is increasingly gaining attention as a promising candidate for coastal aquaculture in India. Along the Andhra Pradesh coast, where a unique blend of ecological richness and traditional fishing practices coexist, mussel farming holds vast potential for enhancing seafood production and improving coastal livelihoods. The state's extensive shoreline, nutrient-rich waters, and estuarine environments provide an ideal natural setting for mussel growth, while the growing consumer demand for affordable, protein-rich seafood creates strong market opportunities. By combining ecological suitability with socio-economic benefits, green mussel farming has the scope to emerge as a sustainable livelihood option for coastal communities in Andhra Pradesh.

Favourable factors:

Long Coastline

Andhra Pradesh is blessed with a coastline of approximately 1054 kilometers (Andhra Pradesh Maritime Policy, 2024), making it the second-longest coastline among Indian states. This extensive coastal stretch spans from Srikakulam in the north to Nellore in the south and encompasses a variety of estuarine, brackishwater, and marine ecosystems. Such a long coastal area provides abundant space and opportunity for promoting nearshore and offshore shellfish farming, particularly green mussel (*Perna viridis*), which thrives in shallow coastal waters. The diverse hydrography along this coastline allows site selection tailored to local environmental conditions, supporting both small-scale artisanal operations and large-scale commercial aquaculture ventures.

Biology and Reproduction

Mussels are fast-growing, with juveniles reaching market size of 80–90 mm in just 5–6 months. Growth depends on food availability, water quality, and space. Mature mussels are unisexual and easily distinguished by color – orange-red for females and creamy yellow for males. Spawning is prolonged from January to September, with peak activity during the pre-monsoon and monsoon months. Fertilization is external, and larvae settle as spat within 15–35 days. In Andhra Pradesh, areas like Kakinada and Krishna estuary offer ideal conditions for spat settlement, especially during late summer.



Perna viridis



Perna viridis (female and male)

Site Selection

Site selection is a key determinant of success in mussel farming. Estuarine zones with depths under 4 meters and minimal wave action are ideal for rack culture, while open sea locations with depths over 5 meters are suitable for raft or long-line farming. The salinity should remain between 27–35 ppt and water temperature between 26–32°C. High primary productivity, seen as chlorophyll concentration (17–40 µg/l), is necessary for mussel growth. In Andhra Pradesh, regions such as Bheemunipatnam, Uppada, and Kakinada backwaters have shown promising characteristics for large-scale mussel farming.

Suitable Water Conditions

The water quality along much of the Andhra Pradesh coast is naturally favourable for mussel culture. Salinity levels typically range from 27 to 35 parts per thousand (ppt), which is optimal for the growth and survival of green mussels. These bivalves also require temperature conditions between 26–32°C, which are commonly observed in the tropical marine waters of Andhra Pradesh throughout the year. Additionally, coastal waters here are plankton-rich, especially near estuarine outflows and upwelling zones, providing ample natural food for mussels, which are filter feeders. These environmental parameters collectively contribute to rapid growth rates, higher survival, and improved meat yield in cultured mussels.

Ideal Locations

Field surveys and initial culture trials conducted have identified the Visakhapatnam coast, Kakinada Bay, Uppada, Bheemunipatnam, and Pudimadaka as promising locations for green mussel farming. These areas are characterized by moderate wave action, good water quality, and, in some cases, naturally occurring rocky or hard-bottomed substrates that facilitate the settlement of spat. Where natural substrates are absent, the areas are suitable for the deployment of suspended rope or raft culture systems. These zones are also easily accessible by local fisherfolk, and many are located close to fishing villages or landing centres, which helps in post-harvest handling and transport.

Farming Techniques

Several farming methods can be adopted based on site conditions:

- ▶ **Rack Culture:** Best suited for estuarine regions; bamboo or casuarina poles form the frame, and seeded ropes are suspended vertically.



- ▶ **Raft Culture:** Effective in calm sea conditions; rafts supported by drums float on the surface, with ropes hanging vertically.



- ▶ **Long-Line Method:** Ideal for exposed sea areas; horizontal mainlines support multiple seeded ropes.
- ▶ **Horizontal Culture:** Ropes tied horizontally across vertical poles; commonly used in shallow estuaries.
- ▶ **Bouchot (Stake) Culture:** Mussel seed attached to vertical poles; proven effective in shallow estuarine waters like Bheemunipattanam.

Seeding and Grow-Out

Seeds are collected from healthy, pollutant-free subtidal zones. After cleaning and size grading (15–25 mm), seeds are wrapped around ropes using cotton netting or cloth. Within 2–3 days, mussels attach themselves to the rope using byssus threads. The seeded ropes are suspended such that the upper portions remain submerged even during low tide to prevent desiccation. Regular thinning is essential to avoid overcrowding, which leads to poor growth and slipping of mussels from the rope.



Farm Management

Proper maintenance of farm structures is vital for consistent yields. This includes checking for rope integrity, anchor security, and raft stability. Fouling organisms like barnacles and polychaetes must be removed periodically, as they compete with mussels for food and space. Mussel growth is faster in the upper water column due to higher plankton concentration. In Andhra Pradesh, extreme care is necessary during the monsoon to prevent losses due to salinity drops and increased siltation.



Harvest and Processing

Harvesting should be done just before the spawning season, typically April to June, when the meat content (condition index) is highest. Mussels are removed from ropes, cleaned using jet spray, and depurated in filtered seawater for 24 hours. After depuration, mussels can be sold live, shucked for fresh or steamed meat, or processed further into ready-to-eat products. Blanching in 5% salt solution for 5 minutes improves meat texture and shelf life.



Value Addition and Market Opportunities

Mussel meat is used in numerous value-added products such as frozen packs, seafood cocktails, vacuum-packed fried mussels, and condiments. In Andhra Pradesh, though the domestic demand is limited, there is strong market potential in neighbouring states and via exports through Chennai and Visakhapatnam ports. With growing awareness about health foods and sustainable protein sources, mussel products are in increasing demand in the UAE, Japan, Singapore, and Australia.



Marketing and Supply Chain

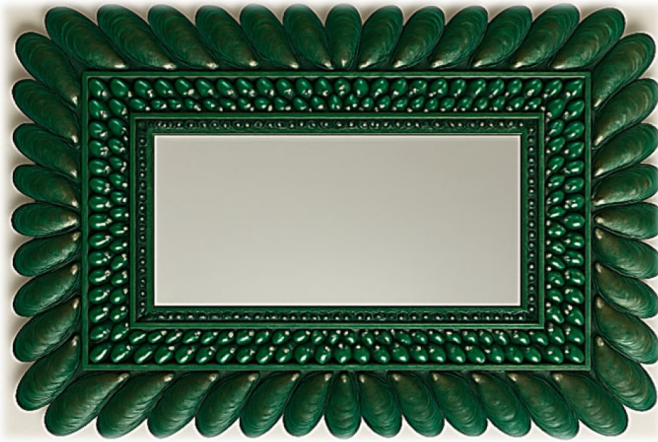
Green mussels are in increasing demand in domestic as well as export markets due to their nutritional profile, which includes high protein content, essential minerals like zinc and iron, and omega-3 fatty acids. They are also considered a delicacy in many coastal cuisines.

While the domestic market for green mussels in Andhra Pradesh is currently limited, the awareness about the nutritional value of these resources may increase domestic demand. There is a strong and growing demand from neighbouring states such as Kerala, Karnataka, Goa, Maharashtra, and Tamil Nadu, where mussels are widely consumed both in households and the hospitality sector. These states have an established culture of mussel consumption, and buyers from these regions frequently source mussels from other coastal states due to local shortages. In addition, there is significant export potential for green mussels, especially to Southeast Asian countries like Thailand, Malaysia, and Singapore, as well as to the Middle East, where Indian-origin seafood is in high demand. The Chennai port serves as a major gateway for exporting processed and frozen mussel products. With proper handling, cold chain infrastructure, and value addition (like meat extraction and IQF packing), mussel farming in Andhra Pradesh can be effectively linked to lucrative regional and international markets, thereby enhancing income and sustainability for coastal farmers.

Besides the edible part, green mussel shells also have market value. The cottage industry based on shells uses cleaned and polished mussel shells to create decorative and craft items such as mirrors, photo frames, jewelry boxes, earrings, bangles, and other ornaments. This offers an extra source of income and job opportunities, especially for women artisans and coastal self-help groups involved in shell craft. Therefore, green mussel farming not only supports the food industry but also boosts rural artisan sectors and waste-to-wealth circular economy initiatives, improving overall sustainability and socio-economic benefits.



Model Ornament
(Source: Pattnaik P., ICAR-CMFRI)



Interior Decoration Item



Ornaments

Livelihood Opportunity & Sustainability

Mussel farming offers a reliable and sustainable livelihood option for coastal communities, especially women and marginalized fishers. The low initial investment, short culture duration of 4–6 months, and minimal maintenance make it an attractive alternative to capture fisheries, which are increasingly uncertain due to overfishing and climate change. Mussel farming can be integrated with other livelihood activities and does not require land ownership. Moreover, mussels contribute to improving water quality by filtering excess nutrients and plankton, making them environmentally beneficial. When adopted in clusters, this activity can promote community-based aquaculture models, leading to economic empowerment and improved nutrition security.

Economics of Mussel Farming

A typical 5 × 5 m rack setup with 100 seeded ropes can yield about 800 kg of live mussels or 200 kg of shucked meat in 5–6 months. Total input cost ranges between 46,000– 50,000 depending on processing, with expected gross returns of 80,000. The net profit per cycle ranges from 29,000 to

34,000. With low investment and quick returns, mussel farming is a promising option for small-scale coastal farmers and SHGs.



Women Self-Help Group Harvesting Green Mussels

Challenges to Address:

Site-specific Suitability

Although the Andhra Pradesh coastline has immense potential, not all sites are uniformly suitable for mussel farming. Certain locations may be affected by strong wave action, seasonal sedimentation, pollution from urban or industrial discharge, or shipping traffic, which can hinder farming success. Site selection must be guided by scientific assessment of environmental parameters such as salinity, water current velocity, turbidity, and depth. It is essential to conduct pilot-scale trials before full-scale deployment of farms to avoid crop loss and ensure sustainability.

Seed Availability

One of the key bottlenecks in mussel farming is the availability of quality seed (spat). Currently, most mussel farms in India rely on wild spat collection during the natural spawning season, which is not always predictable or uniformly abundant. To overcome this, there is a pressing need for hatchery-based seed production technologies and standardized spat collection devices such as spat collectors and artificial substrates. Establishing mussel hatcheries or ensuring regular spat fall monitoring along the Andhra Pradesh coast can help in ensuring year-round seed supply and consistent farming activity.

Training and Awareness

Despite the proven success of mussel farming in other parts of India like Kerala, awareness levels among Andhra Pradesh fishers remain low. Many are unfamiliar with bivalve aquaculture techniques or hesitant to try new methods due to risk perception and lack of exposure. There is a need for capacity building programs, on-farm demonstrations, and exposure visits to successful

mussel farming sites. Training programs must also include post-harvest handling, value addition, hygiene, and basic bookkeeping to make the initiative economically viable and sustainable.

Regulatory Clearances

Green mussel farming in coastal waters may require clearances from Coastal Zone Management Authorities (CZMA) or Fisheries Departments, especially when implemented at commercial scale. Farmers often face bureaucratic delays and are unaware of the legal formalities involved. There is a need to streamline the regulatory process and provide guidance through one-stop service centres or community extension workers. Inclusion of mussel farming under central schemes like PMMSY (Pradhan Mantri Matsya Sampada Yojana) can help by offering subsidies, insurance, and access to institutional credit.

Technology Availability

The Central Marine Fisheries Research Institute (CMFRI) has played a pivotal role in developing and promoting mussel farming technology in India. Techniques such as rope culture, raft culture, and spat collection methods have been scientifically developed and successfully demonstrated at field level. The technology is cost-effective, simple, and scalable, making it ideal for adoption by traditional fisherfolk and women's Self Help Groups (SHGs). In Andhra Pradesh, CMFRI's Visakhapatnam Regional Centre has begun field trials and training programs to transfer this knowledge to end users. The technology requires minimal infrastructure and no feed inputs, making it economically attractive and environmentally sustainable.

Ecological Relevance in Andhra Pradesh

The east coast of Andhra Pradesh offers a favourable environment for sustainable mussel farming. The nutrient-rich waters of the Godavari and Krishna estuaries, combined with calm backwaters and minimal industrial pollution in selected zones, create an ideal ecosystem. Mussel farming can be integrated with seaweed cultivation or cage fish farming under IMTA, enhancing environmental benefits and economic efficiency. With institutional support and capacity building, mussel farming can become a vital part of Andhra Pradesh's blue economy strategy.