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A CASE STUDY ON INTENSIVE *LITOPENAEUS VANNAMEI* CULTURE PRACTICES IN ANDHRA PRADESH

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ABSTRACT

Intensive culture of Pacific white shrimp (*Litopenaeus vannamei*) has become an important component of coastal aquaculture in Andhra Pradesh, contributing to seafood production, employment and export earnings. The success of intensive shrimp farming depends on quality seed, appropriate stocking density, pond preparation, effective aeration, balanced feeding, water quality management and strict biosecurity. This case study examines commercial *L. vannamei* farming practices in Andhra Pradesh, with particular reference to a reported culture operation at Dugarajupatnam, SPSR Nellore district. The study involved four commercial ponds stocked at 50 post-larvae (PL)/m² and monitored over a 105-day culture period during the rainy season. Reported survival ranged from 88 to 95%, final average body weight from 15.92 to 16.74 g and feed conversion ratio (FCR) from 1.25 to 1.36. The findings demonstrate the importance of coordinated pond management, aeration, feeding and regular health monitoring under intensive culture conditions. The article also discusses production challenges and sustainable management practices relevant to shrimp farmers in Andhra Pradesh.

Keywords: *Litopenaeus vannamei*, Intensive Shrimp Culture, Biosecurity Management

INTRODUCTION

Shrimp aquaculture is one of the most economically important sectors of Indian coastal aquaculture. Among the commercially cultured shrimp species, Pacific white shrimp (*Litopenaeus vannamei*) has gained considerable importance because of its relatively fast growth, adaptability to a wide range of salinities and suitability for intensive farming systems. Its commercial cultivation has expanded significantly in Andhra Pradesh, particularly in coastal districts such as Nellore, Prakasam, Guntur, Krishna, West Godavari, East Godavari and Srikakulam. Andhra Pradesh

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has favourable conditions for shrimp farming, including extensive coastal areas, brackishwater resources, established hatchery networks, feed availability and access to processing and export markets. The adoption of improved pond management, formulated feeds, mechanical aeration and disease surveillance has further supported the development of commercial shrimp aquaculture. However, intensive shrimp production involves higher stocking densities, greater feed inputs and increased dependence on artificial aeration and water quality management. These conditions can increase organic matter accumulation, ammonia production, oxygen depletion and disease transmission when management is inadequate. Therefore, sustainable production requires an integrated approach combining good aquaculture practices, biosecurity and environmental monitoring.

STUDY AREA AND CASE STUDY BACKGROUND

The present case study draws on published observations from commercial *L. vannamei* culture ponds in Andhra Pradesh, particularly the Dugarajupatnam area of SPSR Nellore district. The regional case study reported by Ravuru and Mude (2026) examined four commercial ponds, each measuring approximately 0.4 ha, during the rainy-season culture period from June to October 2025. The culture operation was evaluated over 105 days, with particular attention to pond preparation, stocking, acclimatization, aeration, feeding, water management, shrimp growth, survival and economic performance. The study provides a practical example of intensive shrimp production under the coastal conditions of Andhra Pradesh. Its findings represent observations from four commercial ponds and should not be considered universal production benchmarks for all farms in the state.

POND PREPARATION AND MANAGEMENT

Pond preparation is a critical step in successful intensive shrimp farming. After harvesting, ponds are generally drained and allowed to dry to facilitate oxidation of accumulated organic matter and reduce the survival of undesirable organisms. Excessive black soil and organic sediments are removed, particularly from areas where anaerobic conditions and toxic gas accumulation may occur. The pond bottom is levelled and treated with suitable agricultural lime or other amendments according to soil and water characteristics. Reservoirs and inlet channels are also cleaned and prepared before filling. Water is preferably filtered through suitable screens to prevent the entry of unwanted fish, crabs and other potential disease carriers. In the Dugarajupatnam case study, pond preparation included drying, removal of accumulated black sediment, soil treatment and subsequent filling. The study also described the use of lime-based amendments before stocking. Such treatments should be based on soil and water testing rather than applied indiscriminately, because excessive liming or chemical treatment can adversely affect pond conditions.

SELECTION AND STOCKING OF QUALITY SEED

The selection of healthy and disease-screened post-larvae is essential for successful intensive shrimp culture. Farmers should procure specific pathogen-free (SPF) seed from hatcheries authorised by the Coastal Aquaculture Authority (CAA). Seed quality assessment should include information on larval development, swimming activity, size uniformity, stress tolerance and appropriate pathogen screening. In the Dugarajupatnam case study, PL10 post-larvae were stocked at a density of 50 PL/m². Before stocking, the seed was acclimatized gradually to pond temperature, salinity and pH to minimise environmental stress. Sudden changes in these parameters can cause osmotic stress, mortality and poor post-stocking performance. Stocking density should be selected according to pond infrastructure, water exchange capacity, aeration availability, farm experience and the ability to manage increasing biomass. Although intensive systems can support relatively high stocking densities, excessive stocking without adequate aeration and waste management can reduce survival and increase disease risk. CAA guidelines specify that the stocking density for *L. vannamei* should not exceed 60 shrimp/m² under the applicable culture guidelines.

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WATER QUALITY MANAGEMENT

Water quality is one of the most important determinants of shrimp growth, survival and feed utilisation. Intensive culture ponds receive substantial feed inputs, resulting in the accumulation of uneaten feed, faecal matter and other organic materials. Their decomposition can increase ammonia, nitrite and suspended solids, while reducing dissolved oxygen. Regular monitoring of dissolved oxygen, temperature, pH, salinity, alkalinity, ammonia and nitrite is therefore essential. Dissolved oxygen should receive particular attention during early morning hours, when oxygen concentrations are often at their lowest. Sudden changes in salinity and pH, particularly during the rainy season, can also affect shrimp feeding activity, moulting and growth. In coastal Andhra Pradesh, seasonal rainfall may cause fluctuations in salinity and pond water characteristics. Farmers should monitor rainfall-related changes and avoid sudden water exchange or chemical treatment without assessing pond conditions. Reservoir management, controlled water intake and proper sludge removal can help maintain a more stable culture environment.

AERATION AND OXYGEN MANAGEMENT

Mechanical aeration is essential in intensive *L. vannamei* culture because increasing shrimp biomass and feed inputs raise the demand for dissolved oxygen. Paddle-wheel aerators are commonly used to maintain oxygen availability and promote water circulation. Their positioning should encourage the movement of water and organic particles towards suitable collection or removal areas. In the Dugarajupatnam case study, paddle-wheel aerators were installed in the ponds, with aeration schedules adjusted according to culture requirements. The reported system used multiple aerators to maintain oxygen availability during the culture period. Aeration requirements should be increased as shrimp biomass increases, particularly during periods of high temperature, cloudy weather, heavy rainfall and elevated feeding activity. Backup generators and emergency aeration arrangements are important because power interruptions can result in rapid oxygen depletion and mass mortality in intensive ponds. Continuous attention to aerator condition, electrical safety and emergency preparedness is therefore essential.

FEED AND NUTRITIONAL MANAGEMENT

Feed management is a major determinant of production cost and water quality in intensive shrimp farming. Commercial pelleted feeds are formulated to meet the nutritional requirements of shrimp at different growth stages. The protein level, pellet size and feeding quantity should be adjusted according to shrimp size, biomass, water temperature and feeding response. In the Dugarajupatnam study, commercial feed containing approximately 35–42% crude protein was supplied four times daily. Feed consumption was monitored through routine observations and sampling. Feed trays can be used to assess feeding response and adjust the quantity offered. Overfeeding should be avoided because uneaten feed increases organic loading and contributes to deterioration of pond water quality. Feed quantity should be revised after periodic estimation of average body weight and standing biomass. A well-managed feeding programme improves growth, reduces feed wastage and supports a favourable FCR. The use of high-quality feed, proper storage and hygienic handling is equally important for maintaining nutritional value and reducing contamination risks.

GROWTH MONITORING AND PRODUCTION PERFORMANCE

Regular sampling provides information about shrimp growth, health and production performance. Cast-net sampling is commonly used to estimate average body weight, size variation, moulting condition and general health. Sampling should be conducted carefully to avoid excessive handling stress. In the Dugarajupatnam case study, shrimp sampling was initiated around 30 days of culture and subsequently conducted at approximately fortnightly intervals. The observations included average body weight, health condition, survival and feed utilisation. Such monitoring helps farmers revise feeding rates, assess biomass and determine suitable harvest schedules.

The reported performance of the four ponds is summarised below.

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Production parameter	Reported observation
Number of ponds	4
Pond area	0.4 ha each
Culture duration	105 days
Stocking density	50 PL/m²
Final average body weight	15.92–16.74 g
Survival rate	88–95%
Feed conversion ratio	1.25–1.36
Reported production per pond	2,348.45–3,013 kg

The results indicate that satisfactory growth and survival were achieved under the reported management conditions. Pond B2 recorded the lowest FCR, while Pond B4 achieved the highest production and net profit. These differences suggest that pond-level conditions and management efficiency can influence production outcomes even when farms follow broadly similar culture practices.

HEALTH MANAGEMENT AND BIOSECURITY

Disease outbreaks are among the major risks associated with intensive shrimp aquaculture. Viral diseases such as white spot syndrome virus (WSSV), infectious myonecrosis virus (IMNV) and other emerging pathogens can cause serious production losses. Bacterial infections, particularly those associated with *Vibrio* species, may also affect shrimp health and survival. Biosecurity should begin before stocking and continue throughout the culture cycle. Important measures include the use of screened water, certified seed, disinfection of equipment, controlled farm access, crab and bird exclusion, removal of dead or weak shrimp and appropriate disposal of farm waste. Regular observation of feeding activity, swimming behaviour, gut condition and external appearance can help identify early signs of disease. Research conducted in Ampalam, Srikakulam district, examined water quality and *Vibrio* loads in *P. vannamei* ponds and reported lower pathogenic bacterial loads in ponds receiving probiotic applications compared with untreated control ponds. This indicates the potential value of microbial management as part of an integrated health programme. However, probiotics should be selected carefully and used alongside sound pond management, not as substitutes for biosecurity or disease diagnosis.

SEASONAL CHALLENGES IN ANDHRA PRADESH

Shrimp farmers in Andhra Pradesh face several seasonal and environmental challenges. Heavy rainfall during the monsoon can cause sudden reductions in salinity, changes in pH and increased turbidity. These fluctuations may affect shrimp osmoregulation, feeding behaviour and moulting. High temperatures during summer can increase metabolic activity and oxygen demand, while prolonged cloudy weather may reduce photosynthetic oxygen production. Other challenges include disease outbreaks, rising feed costs, seed quality variations, electricity interruptions, water scarcity and fluctuations in market prices. Intensive farms are particularly vulnerable because high standing biomass increases the consequences of aeration failure or rapid water quality deterioration. A recent commercial study at Dugarajupatnam demonstrated that *L. vannamei* could be cultured during the rainy season under relatively high-salinity conditions when stocking, aeration, feeding and monitoring were managed systematically. Nevertheless, such outcomes depend on local water quality, pond design, seed quality and farm-level management.

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REGULATORY COMPLIANCE AND ENVIRONMENTAL SUSTAINABILITY

Sustainable shrimp farming requires compliance with national coastal aquaculture regulations. Farms must obtain the necessary registration and approvals from the Coastal Aquaculture Authority and follow applicable guidelines for seed procurement, stocking, biosecurity, effluent management and waste disposal. Effluent Treatment Systems (ETS) are particularly important in intensive shrimp culture. They help reduce suspended solids, organic matter and other pollutants before wastewater is discharged. Under the applicable CAA guidelines, an ETS is mandatory for *L. vannamei* farms following the specified stocking-density category of up to 60 shrimp/m². Farmers must follow the current requirements applicable to their farm and stocking density. The reuse of treated water, proper sludge management, efficient feed utilisation and reduced unnecessary water exchange can help minimise environmental impacts. Cluster-based farming with shared reservoirs, common treatment facilities and coordinated disease surveillance may further improve biosecurity and resource efficiency.

FUTURE PROSPECTS AND RECOMMENDATIONS

The future of intensive shrimp farming in Andhra Pradesh will depend on improved farm management, disease prevention and environmentally responsible production. Digital water quality sensors, automated feeders, real-time dissolved oxygen monitoring and mobile-based farm management applications can support timely decision-making. Early disease surveillance and improved diagnostic facilities are also necessary to minimise production losses. Farmers should adopt stocking densities according to pond carrying capacity rather than focusing only on maximum possible production. Regular soil and water testing, quality seed procurement, biomass-based feeding, adequate aeration and proper effluent treatment should form the foundation of intensive culture. Training programmes, farmer cooperatives and stronger technical support from research and extension institutions can further improve the adoption of scientific farming practices.

CONCLUSION

Intensive *Litopenaeus vannamei* culture has considerable potential to strengthen shrimp production and rural livelihoods in Andhra Pradesh. The Dugarajupatnam case study demonstrates that commercial ponds stocked at 50 PL/m² can achieve 88–95% survival and an FCR of 1.25–1.36 under the reported 105-day culture conditions. These results highlight the importance of proper pond preparation, quality seed, acclimatization, aeration, nutritional management and regular growth monitoring. However, intensive production also increases the risks associated with disease outbreaks, oxygen depletion, organic waste accumulation and seasonal water quality fluctuations. Therefore, long-term success will depend on the integration of scientific pond management, effective biosecurity, regulatory compliance and environmentally responsible practices. A shift towards efficient, data-driven and sustainable shrimp farming can strengthen the competitiveness of Andhra Pradesh's shrimp aquaculture sector.

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