Asian J Biol Life Sci., 2026; 15(3):757-762.
https://ajbls.com

Research Article

Growth Performance and Survival of White Shrimp Using Bore Water During the Rainy Season, Alakapuram, Andhra Pradesh

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ABSTRACT

Background: Pacific white shrimp (*Litopenaeus vannamei*) farming under bore water conditions has become an effective alternative in regions with limited access to brackish water. Evaluating shrimp growth performance and survival during the rainy season is essential for improving production efficiency in intensive aquaculture systems. **Materials and Methods:** The study was conducted in four intensive culture ponds (A1, A2, B1, and B2), each measuring 0.4 ha, located in Alakapuram village, Bapatla District, Andhra Pradesh, India. PL10 *L. vannamei* (Sy Aqua strain) seed was procured from Sri Manjunadha Hatcheries, supplied by a CAA-certified hatchery in SPSR Nellore District. Shrimp were stocked at a density of 25 post-larvae m^{-2} in all ponds. Survival rates recorded at harvest were 76%, 70%, 53%, and 65% for ponds A1, A2, B1, and B2, respectively. A commercial feed containing 35-42% crude protein was provided four times daily. Water quality parameters were monitored every two weeks at 7:00 a.m. from June to October. **Results:** The final mean body weights were 31.25, 33.33, 31.25, and 31.05 g in ponds A1, A2, B1, and B2, respectively. The average daily growth (ADG) was 0.27 g day^{-1} in all ponds. Production yields were 1,987, 1,890, 1,431, and 2,018 kg, while feed consumption was 3,500, 3,100, 1,900, and 2,900 kg for A1, A2, B1, and B2, respectively. Feed conversion ratios (FCR) were 1.76, 1.64, 1.32, and 1.44, with the culture period lasting 113 days. Higher survival rates were associated with greater production, indicating the importance of effective pond management under bore water conditions. **Conclusion:** Intensive culture of *L. vannamei* using bore water during the rainy season supported satisfactory growth, feed utilization, and production. The findings demonstrate that bore water can serve as a suitable alternative culture medium for intensive shrimp farming in Andhra Pradesh when appropriate management practices are followed.

Keywords: Dissolved oxygen, Growth, Litopenaeus vannamei, Survival.

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Received: 09-07-2026;
Revised: 13-08-2026;
Accepted: 26-10-2026.

INTRODUCTION

Aquaculture is one of the fastest-growing food-producing sectors globally, with shrimp farming-particularly of *Litopenaeus vannamei* (Pacific white leg shrimp)-playing a significant role in meeting the rising global demand for seafood. However, intensive shrimp culture systems often face serious challenges such as deterioration in water quality, accumulation of organic waste, disease outbreaks, and reduced feed efficiency (FAO 2022; Kumar *et al.*, 2018). The rapid expansion of aquaculture as a means of meeting global seafood demand has necessitated the development of sustainable and environmentally responsible production practices. Among the various species cultured worldwide, *Litopenaeus vannamei* (Pacific white shrimp) has emerged as one of the most economically important species due to its fast growth rate, tolerance to high stocking densities, and adaptability to a wide range of salinities (Gamberoni *et al.*, 2025).

In the global seafood market, shrimp has gained huge demand among the consumers because of its high nutritional value and favorable ingredient in many intercontinental cuisines. Due to rich protein content and low caloric value, shrimp has become a popular food among health conscious individuals (Dayal *et al.*, 2013). The species' rapid growth rate and high production efficiency have made it a cornerstone of modern aquaculture operations, with global production reaching unprecedented levels (Tian *et al.*, 2024). Culture of the Pacific white shrimp *Penaeus vannamei* in low salinity waters are faced with the challenge of rearing animals in less than ideal environments. With the rapid development of the shrimp industry, the demand for shrimp feed is increasing. In shrimp aquaculture, feed costs can be as high as 50 to 60% of the total cost. (Krishna *et al.*, 2015). *L. vannamei* is mostly grown in the Western Hemisphere. It is native to Mexico's

OPEN ACCESS

Manuscript TECHNOMEDIA

DOI: 10.5530/ajbls.20260010

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Eastern Pacific coast as well as Central and South America (Briggs *et al.*, 2004). The industry's output has grown by almost 600% since 1990 (Ahmed and Turchini, 2021).

MATERIALS AND METHODS

The current investigation was carried out over the summer in coastal areas. The Alakapuram village in the Bapatla district is where the cultural ponds first appeared (Figure 1). The Sri Manjunatha hatchery from SPSR Nellore District, Andhra Pradesh, provided the Sy aqua seed used in the study. The months of June through October are when the prawn culture takes place. Bore water cultivation and rectangular ponds. The ponds' density, survival, growth, productivity, and water quality characteristics were also investigated. The larvae are fed four times a day, at 6am, 10am, 2pm, and 6pm. The feed pellet, starter, grower, finisher, and feed types No. 1, No. 2, 2P, 2SP, 3P, 3SP, 4S, and 4M with 35-42% protein were employed in the artificial diet. Seed costs 0.35 rupees each piece, while feed purchase costs Rs 85 per kilogram (Figure 2).

Statistical Analysis

To ascertain whether there are notable variations between ponds in terms of growth performance, survival, production, feed conversion ratio, and economic characteristics, the experimental data can be examined using one-way Analysis of Variance ANOVA.

RESULTS

Over the course of a 113-day culture period during the rainy season, the study assessed the water quality, growth performance, production, and economic performance of *Litopenaeus vannamei* cultivated in four ponds (A1, A2, B1, and B2). Under comparable management circumstances, all ponds were filled on June 17, 2025, and harvested on October 7, 2025.

Water quality parameters

Throughout the culture phase, the water quality stayed mostly constant. All ponds had a pH of 7.9±2 to 8.0±2, a salinity of 4.9±2 to 5.0±2 ppt, Dissolved Oxygen (DO) of 5.0 ppm, and a feeding rate of 2.1%. These environmental factors point to a culture environment that is ideal for *L. vannamei* growth (Table 1).

Growth and Survival Rate

Average Body Weight (ABW) varied somewhat between ponds; Pond A2 had the highest value (33.33 g), followed by Ponds A1 and B1 (31.25 g) and Pond B2 (31.0 g). The survival rate ranged from 53% to 74%, depending on the pond. Pond B1 had the lowest survival rate (53%), whereas Pond A1 had the greatest (74%). At 30-32 shrimp per kilogram, the harvest size was comparatively constant. Pond A2 had the highest growth rate (0.30 g day^{-1}), showing better growth performance under comparable environmental circumstances. The Average Daily Growth (ADG) ranged from 0.27 to 0.30 g day^{-1} (Table 2).

Production and FCR

Each pond's production performance was different. Pond B1 had the lowest productivity (1431 kg), while Pond B2 had the largest overall harvest (2018 kg), closely followed by Pond A1 (1987 kg) and Pond A2 (1890 kg). Feed Conversion Ratio (FCR) results ranged from 1.32 to 1.76, indicating differences in feed usage as well. In terms of feed usage efficiency, Pond B1 had the lowest FCR (1.32), whereas Pond A1 had the highest FCR (1.76).

Economic analysis

Economic analysis, manufacturing costs stayed around Rs. 220 per kg, whereas production prices varied between Rs. 410 and Rs. 420 per kg. As a result, the profit margin ranged from Rs. 190 to Rs. 200 per kilogram, with Pond A2 making the most money. The whole profit was between Rs. 271,890 and Rs. 383,420, while the total expenditure was between Rs. 314,820 and Rs. 443,960. Pond B2 made the most money overall (Rs. 383,420), closely followed by Pond A1 (Rs. 377,530) and Pond A2 (Rs. 378,000) (Table 3).

DISCUSSION

Water quality parameters

Over the course of the 113-day culture period, the current study showed that the water quality parameters remained relatively stable, with pH ranging from 7.9 to 8.0, salinity from 4.9 to 5.0 ppt, and dissolved oxygen maintained at roughly 5.0 mg L^{-1} across all experimental ponds. The ideal environmental conditions for intensive shrimp farming, where constant water quality improves metabolic activity, feed consumption, molting, and disease resistance, are in line with these values. Similar findings were reported by Pratiwi *et al.* (2024), who discovered that shrimp growth and survival in intensive culture ponds were greatly enhanced by maintaining steady pH and dissolved oxygen. Roy *et al.* (2022) observed similar results, concluding that under intensive farming systems, maintaining dissolved oxygen over 5 mg L^{-1} considerably enhances shrimp health and decreases environmental stress.

Similarly, stable pH and salinity encourage steady growth and lessen metabolic stress in *L. vannamei*, according to Kumar *et al.* (2023). For extensive shrimp production, the water quality conditions found in this study thus offered a suitable culture environment. According to Brandão *et al.* (2024), shrimp survival and overall output are greatly increased when stable environmental conditions are combined with efficient pond management. Similarly, in order to maximize survival in commercial shrimp farming, FAO (2024) stressed the importance of biosecurity, water quality management, and routine health monitoring.

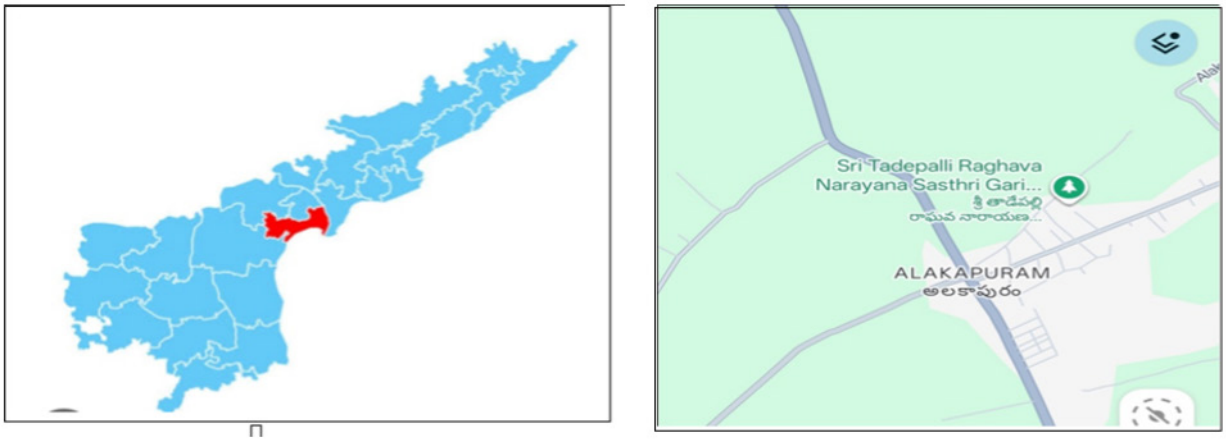

Figure 1: Location map of the study area (Alakapuram).

Table 1: Water quality parameters and growth performance in rainy season.

Details	PH (ppm)	Salinity (ppt)	DO (ppm)	Giving feed (%)	AVG fortnightly growth (g)	ABW (g)
Pond A1	7.9±2	4.9±2	5.0	2.1	4.46	31.25
Pond A2	7.9±2	4.9±2	5.0	2.1	4.76	33.33
Pond B1	7.9±2	4.9±2	5.0	2.1	4.46	31.25
Pond B2	8.0±2	5.0±2	5.0	2.1	4.42	31.0

Table 2: Pond performance details of *L. vannamei* culture in rainy season.

Details	Pond A1	Pond A2	Pond B1	Pond B2
WSA (ha)	0.4	0.4	0.4	0.4
Stocking date	17/06/2025	17/06/2025	17/06/2025	17/06/2025
Harvest date	07/10/2025	07/10/2025	07/10/2025	07/10/2025
DOC	113	113	113	113
Density (m^2)	25	25	25	25
Seed cost/piece (Rs)	0.35	0.35	0.35	0.35
Survival (%)	74	70	53	65
Harvest size (count)	32	30	32	32
ABW (gm)	31.25	33.33	31.25	31.0
ADG (gm)	0.28	0.30	0.28	0.27

Survival rate

Pond A1 had the highest survival rate, with rates ranging from 53% to 74%. Variations in survival could have been caused by variances in disease incidence, stress during molting, stocking uniformity, or pond-bottom conditions, even while water quality remained similar across ponds. Higher survivability boosts harvest biomass without correspondingly raising production costs, making it one of the most important elements influencing overall productivity and profitability. Similar findings were reported by Li *et al.* (2024), who discovered that in commercial farms, shrimp survival and harvest production significantly increased when optimal pond management procedures were maintained.

Feed

According to Do *et al.* (2024), shrimp biomass accumulation and average daily growth are greatly enhanced by optimum feeding techniques in conjunction with high-quality water. In a similar vein, Zhu *et al.* (2025) found that better microbial stability and pond management boost nutrient use and accelerate growth in *L. vannamei* culture systems.

Growth rate

Despite comparable environmental circumstances, ponds' growth performance differed. While Pond B2 provided somewhat lower growth values, Pond A2 had the highest average body weight (33.33 g) and average daily growth (0.30 g day^{-1}). Water quality alone may not be the only factor contributing to growth

variations; other factors include individual variance, survivability, feed consumption efficiency, and pond management techniques. Higher body weight gain is the outcome of efficient feed use, which improves nutrient conversion into biomass. According to recent research by Srinivas *et al.* and *Wang et al.* (2025), steady pond conditions and improved feeding techniques greatly enhance weight gain and average daily growth in *L. vannamei* cultivated under intensive settings.

Production performance

The biggest harvest (2018 kg) was produced by Pond B2, followed by Pond A1 (1987 kg) and Pond A2 (1890 kg). Despite having the best feed conversion ratio (1.32), Pond B1 had the lowest production (1431 kg). According to Puli *et al.* (2020), the production was 3200, 3318 and 3459 kg in summer season. This suggests that when biomass accumulation and survival are restricted, effective feed use is not enough to maximize production. Similar findings from earlier research have shown that feed efficiency, growth rate, stocking management, and survival all have a role in shrimp output, not just FCR. High production is attained when suitable water quality is combined with effective feeding and high survival rates, according to Boyd and McNevin (2023) and Mohammadi *et al.* (2024).

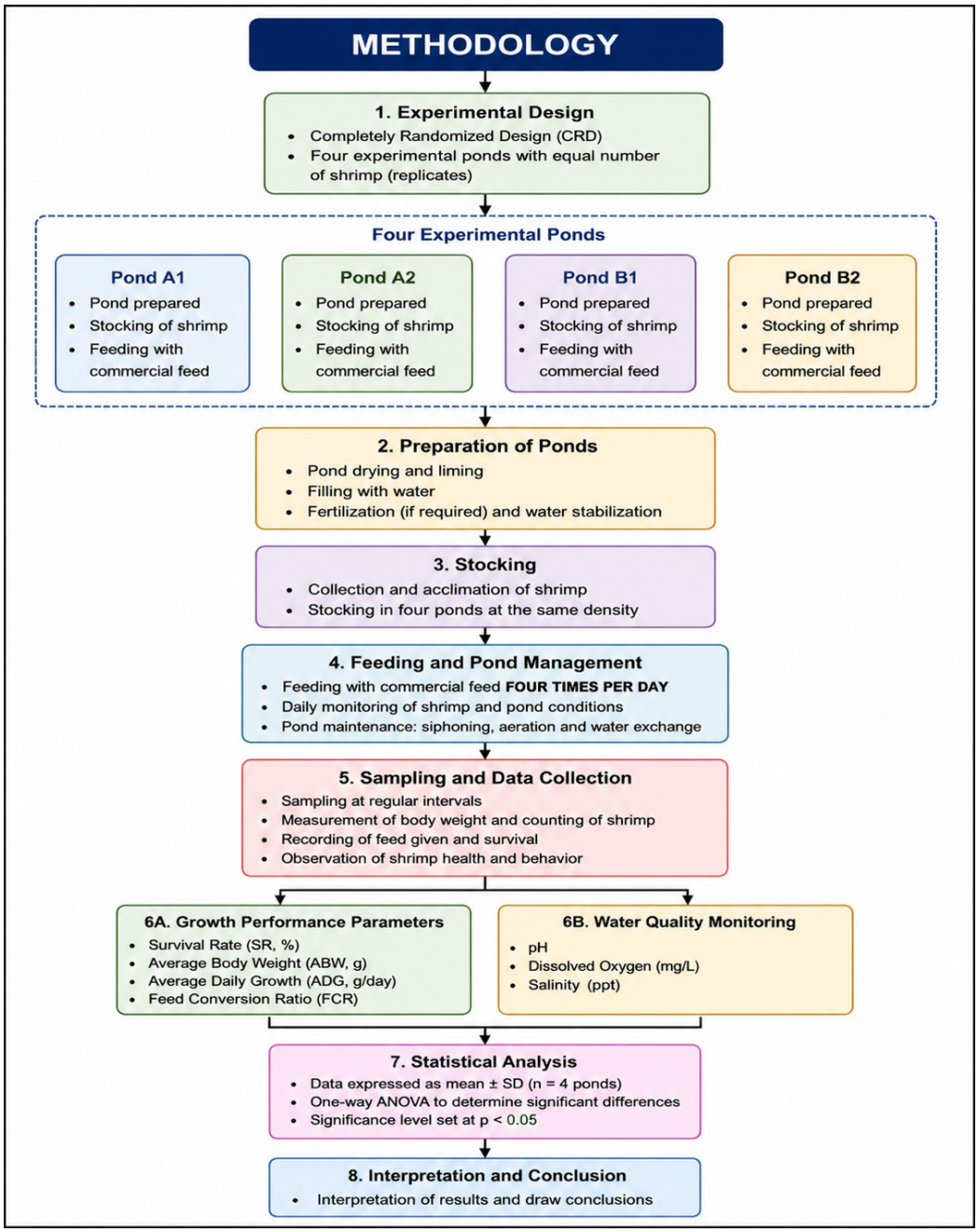

Figure 2: Shows the methodology.

Table 3: Economic status of *L. vannamei* culture in rainy season.

Details	Pond A1	Pond A2	Pond B1	Pond B2
Total feed (kg)	3500	3100	1900	2900
Feed price/kg (Rs)	85	85	85	85
Total production (kg)	1987	1890	1431	2018
Production price/kg (Rs)	410	420	410	410
Expenditure /kg (Rs)	220	220	220	220
Profit/kg (Rs)	190	200	190	190
FCR	1.76	1.64	1.32	1.43
Total Expenditure (Rs)	437140	415800	314820	443960
Total Profit (Rs)	377530	378000	271890	383420

Economic analysis

Significant variations in pond profitability were found by economic study. Due to its higher selling price, Pond A2 earned the largest profit per kilogram (Rs. 200 kg^{-1}), whereas Pond B2 produced the highest total profit (Rs. 383,420). Harvest output and market value had a direct impact on total profit even though the production cost stayed fixed at Rs. 220 kg^{-1}. These results show that farm profitability is highly influenced by biological performance and production efficiency. According to FAO (2024), shrimp farming's economic sustainability is greatly increased by increased production efficiency and enhanced management techniques. In a similar vein, Boyd and McNevin (2023) came to the conclusion that increasing economic returns in intensive aquaculture systems requires lowering production costs while optimizing survival and harvest biomass. According to Ravuru, *D. B., & Mude, J. N. (2026),* economic analysis indicated reported profits of Rs. 100, Rs. 120, and Rs. 110 kg-1 for Ponds A2, B3, and B4.

CONCLUSION

The current study showed that under stable water quality circumstances, intensive culture of *Litopenaeus vannamei* during the rainy season produced adequate growth, productivity, and economic returns. The maintaining ideal water quality, attaining high survival, putting effective feed management into practice, and optimizing harvest biomass are all necessary for successful intensive shrimp farming. Therefore, *L. vannamei* production during the rainy season depends on maintaining effective pond management methods throughout the culture period.

ACKNOWLEDGEMENT

The authors express their gratitude to farmer of the culture ponds in Alakapuram village, Bapatla district, Andhra Pradesh state, for his support and provision of facilities till the *L. vannamei* culture was harvested.

ABBREVIATIONS

***L. vannamei*:** *Liptopenaeus vannamei*; **WSA:** Water Spread Area; **DOC:** Days of Culture, **SR:** Survival rate; **PL:** Post Larvae; **DO:** Dissolved Oxygen; **ABW:** Average Body Weight; **ADG:** Average Daily Growth; **CAA:** Coastal Aquaculture Authority; **FCR:** Food Conversion Ratio.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Cite this article: Ravuru DB, Mude JN. Growth Performance and Survival of White Shrimp Using Bore Water During the Rainy Season, Alakapuram, Andhra Pradesh. Asian J Biol Life Sci. 2026;15(3):757-62.