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WATER QUALITY MANAGEMENT IN THE CULTURE OF VANNAMEI SHIRMP (*Litopenaeus vannamei*) IN AN INTENSIVE SYSTEM AT THAE BRACKISH WATER AQUACULTURE RESEARCH CENTER (BPBAP) GELUNG INSTALATION, SITUBONDO, EAST JAVA

Manajemen Pengelolaan Kualitas Air Pada Pembesaran Udang Vaname (*Litopenaeus vannamei*) Sistem Intensif di Balai Perikanan Budidaya Air Payau (BPBAP) Instalasi Gelung, Situbondo, Jawa Timur

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ABSTRACT

Water quality management in shrimp ponds is a complex but very important process. With proper monitoring, precise management, and the use of appropriate technology, water quality can be maintained at optimal levels. This not only supports shrimp growth but also ensures the success and sustainability of aquaculture operations. This study aims to identify and explain the optimal standards of water quality parameters that influence the growth and health of vannamei shrimp in intensive ponds at BPBAP Gelung, Situbondo, East Java, from July 24 to August 4, 2024. The study focuses on plots 1, 2, 3, and 4 using observational methods. The water quality parameters used include temperature, pH, salinity, and TOM. The measurement results of the water parameters are recorded as follows: temperature range 26.1°C-27°C, salinity range 24-30, pH range 7.40-7.91, and TOM range 5.8-10.1. The water quality in intensive ponds greatly affects the growth and health of vannamei shrimp, so good water quality management is necessary.

Keywords: Water quality, intensive system, vannamei shrimp

ABSTRAK

Manajemen kualitas air pada tambak udang adalah proses yang kompleks tetapi sangat penting. Dengan pemantauan yang baik, pengelolaan yang tepat, dan penggunaan teknologi yang sesuai, kualitas air dapat dipertahankan pada tingkat optimal. Hal ini tidak hanya mendukung pertumbuhan udang tetapi juga menjamin keberhasilan dan keberlanjutan usaha budidaya. Penelitian ini bertujuan mengidentifikasi serta menjelaskan standar optimal parameter kualitas air yang berpengaruh terhadap pertumbuhan dan kesehatan udang vaname di tambak intensif BPBAP Gelung, Situbondo, Jawa Timur pada tanggal 24 Juli - 04 Agustus 2024. Fokus penelitian ini pada petak 1,2,3 dan 4 dengan menggunakan metode observasi. Parameter kualitas air yang digunakan yaitu suhu, pH, salinitas dan TOM. Hasil pengukuran parameter air tercatat sebagi berikut: kisaran suhu 26,1℃-27℃, kisaran salinitas 24-30, kisaran pH 7,40-7,91 serta kisaran nilai TOM 5,8-10,1. Kualitas air di tambak intensif sangat mempengaruhi pertumbuhan dan kesehatan udang vaname sehingga diperlukan pengelolaan kualitas air yang baik.

Kata Kunci: Kualitas air, sistem intensif, udang vaname

INTRODUCTION

Indonesia's maritime fisheries potential offers excellent prospects for increasing foreign exchange earnings, particularly in the mainstay of fish and shrimp cultivation (Kharisma & Manan, 2012). Aquaculture is an alternative activity to increase fisheries production beyond capture. Requirements for successful aquaculture include the availability of cultivated organisms or cultivars, a living medium, and a culture container. Currently, shrimp cultivation is a leading aquaculture commodity due to its high economic value, diverse market share, even internationally, and a growing trend (Prastisca & Sardi, 2020).

The development of whiteleg shrimp (*Litopenaeus vannamei*) dominates compared to other whiteleg shrimp species due to its good disease resistance, high tolerance to environmental changes, and relatively faster growth (Sa'adah and Milah, 2019). Furthermore, these shrimp can be raised at high stocking densities using an intensive system, with a growth and development rate of more than three grams per week, thus offering bright prospects and promising profits for future generations (Babu *et al*., 2014).

One of the key factors in intensive shrimp farming is water quality. Water quality in shrimp farming is dynamic and fluctuates over time. According to Yunarty *et al*. (2022), good water quality parameters will ensure a stable ecological environment, and vice versa. Therefore, maintaining stable water quality within the water quality standards for shrimp farming is crucial for shrimp farmers. Water quality is crucial for ensuring a healthy shrimp lifespan, influenced by many factors, including temperature, pH, conductivity, and dissolved oxygen (DO). Water quality monitoring in shrimp farming is typically performed manually by taking water samples and then taking them to a laboratory for analysis (Hertika *et al*., 2021). The objectives of this study are to identify water quality parameters that affect the growth and health of whiteleg shrimp in ponds, explain the optimal standards of water quality (temperature, salinity, pH, dissolved oxygen, ammonia, nitrite, and nitrate) that support whiteleg shrimp cultivation, analyze the impact of water quality on whiteleg shrimp pond productivity, and identify the abundance of *Vibrio sp*. bacteria in intensive pond waters at the Gelung installation of BPBAP Situbondo.

RESEARCH METHODS

The tools used during the research were hoses, buckets, dippers, refractometers, pH meters, DO meters, and TDS meters. The materials used during the water treatment process included aquazime, mineral balance, lime, and the provision of POC with ingredients including water, molasses, ZA fertilizer, SP-36 fertilizer, yakult, yeast, probiotic starter, and skim milk. This research was conducted from June to August 2024 and took place at the (BPBAP) Brackish Water Aquaculture Center in Situbondo, East Java. BPBAP Situbondo Gelung Installation has a Standard Operating Procedure (SOP) created to facilitate pond workers in implementing water quality maintenance. The creation of this SOP has gone through many trials until finally the optimal SOP was determined. The SOP established by BPBAP in the intensive system shrimp pond BPBAP Situbondo Gelung Installation can be seen in the table below.

Table 1. Water Quality SOP Schedule

Monday	• Sipon • POC • Mineral balance
Tuesday	• Water quality check
Wednesday	• POC Production • Aquazyme • Chalk
Thursday	• Water quality check • Sipon • POC • Mineral balance
Friday	• Aquazyme • POC
Saturday	• Mineral balance • POC creation
Sunday	• Aquazyme • Chalk

The initial cultivation phase of liquid organic fertilizer (POC) for water formation requires a different dosage of ZA and SP-36 fertilizers than the initial cultivation phase. The initial cultivation phase contains a higher dosage of ZA and SP-36 fertilizers to accelerate plankton formation, thus concentrating the waters more quickly. After a week of cultivation, the fertilizer dosage is reduced because the nutrients from the accumulated feed are already available (Dewi and Rahadini, 2021). The POC is applied three times over the course of a week. Aquazyme requires culturing before application. The culturing process involves vigorously aerating a bucket of water to increase dissolved oxygen, followed by adding Aquazyme. Aquazyme is applied once a week at a dose of 62 grams per plot in powder form. Mineral balance is applied twice a week after the siphoning process at the Situbondo BPBAP (Ginger Bay) to replace minerals lost after the siphoning process. The mineral balance dosage is adjusted according to the weather and the age of the shrimp. During rainy or cloudy weather, the mineral balance dosage is increased. The dosage is also increased according to the age of the shrimp. For DOC 1-30, the dosage is 3 ppm, for DOC 31-65 the dosage is 5 ppm, and for DOC 66 until harvest the dosage is 7 ppm. The use of quicklime during shrimp cultivation requires precise dosage to avoid extreme increases in water pH. The dosage of lime given is 5 ppm. In the BPBAP Situbondo ponds at the Gelung Installation, siphoning is carried out twice a week under normal conditions. However, if there is a decline in water quality or disease attacks, the siphoning frequency is increased. After completing siphoning in one compartment and moving to another, farmers need to clean themselves with running water to prevent the transfer of pathogens from one compartment to another.

RESULTS

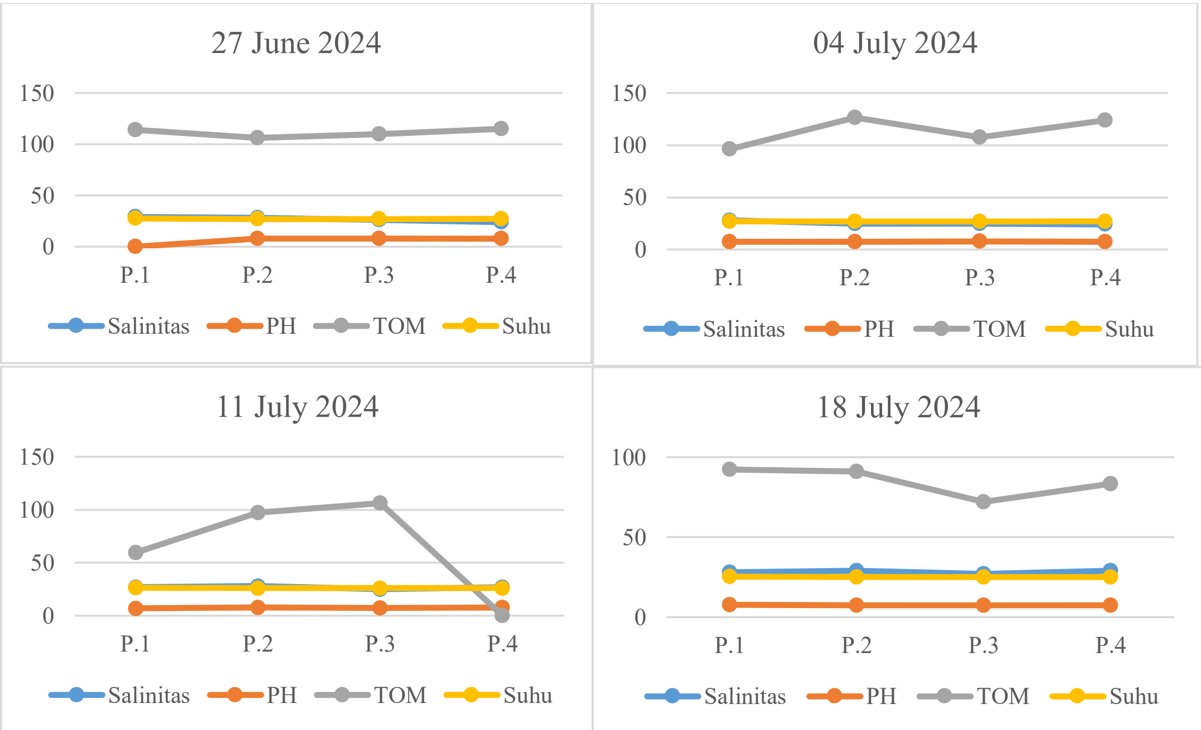
Test results at the intensive ponds of the BPBAP Situbondo show a picture of the cultivation environment conditions, including water quality, the total number of *Vibrio* colonies, and the color characteristics of the colonies. The analyzed water quality parameters serve as the main indicators of the stability of the rearing media, while the total number of *Vibrio* colonies reflects the presence of bacteria that are naturally present in culture waters but can cause problems if overpopulated. The combination of the results of these three tests serves as the basis for evaluating the potential risk of vibriosis and serves as a reference for shrimp health management in intensive pond systems.

Table 1. Total Abundance of *Vibrio sp.* Bacteria

Abundance of *Vibrio sp*. Bacteria (%)				
Date	Plot A	Plot B	Plot C	Plot D
June 24	(repeat)	2,73 %	8,17%	24,19%
July 01	34,17%	28,70%	12,14%	6,36%
July 08	0,50%	2,65%	38,85%	3,07%
July 16	57,14%	38,08%	16,88%	10,22%
July 22	8,09%	6,28%	16,50%	3,46%

Total bacteria can be calculated using the formula below:

$$\mathbf{N} = \frac{\sum C}{[(1 \times n1) + (0,1 \times n2) \times (d)]}$$



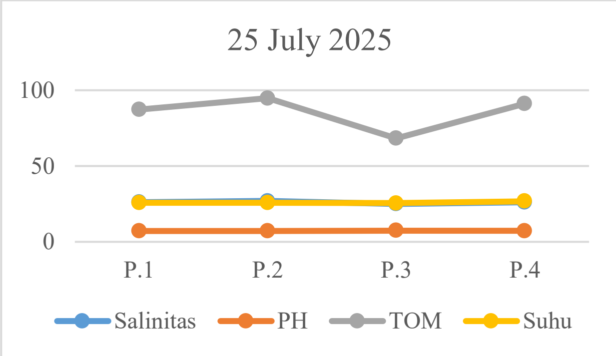


Figure 1. Results of Intensive Pond Water Quality Tests

DISCUSSION

Intensive whiteleg shrimp (*Litopenaeus vannamei*) cultivation relies heavily on optimal water quality (Utami *et al*., 2022). Water quality parameters such as pH, temperature, salinity, and total organic matter (TOM) play a crucial role in supporting shrimp growth and survival. Water pH is a key indicator affecting shrimp metabolism and health. The ideal pH range for whiteleg shrimp growth is between 7.5 and 8.5. A very low pH increases the solubility of metals in the water, which are toxic to aquatic organisms. Conversely, a high pH can increase the concentration of ammonia in the water, which is also toxic to aquatic organisms (Putra *et al*., 2023).

Studies have shown that pH is positively correlated with salinity and nitrite, which affect water clarity. As water clarity decreases, pH tends to increase, indicating that environmental conditions can influence each other. Water temperature plays a role in regulating shrimp metabolism. According to Pakaya *et al*. (2022), the optimal temperature for whiteleg shrimp survival is 26-32°C. Temperature indirectly affects the metabolism and life of aquatic organisms through oxygen solubility in water. The higher the water temperature, the lower the oxygen solubility. To support optimal growth and survival, the temperature must be within the optimal range (Supono *et al*., 2022).

Salinity reflects the concentration of dissolved salts in water. Whiteleg shrimp can adapt to a wide salinity range (5 to 40 ppt), but the ideal salinity ranges from 15 to 30 ppt. Excessive salinity increases energy requirements for osmoregulation, slows growth, and increases susceptibility to disease. Research has shown that salinity is negatively related to TOM, and increased TOM can affect salinity stability (Farabi & Latuconsina, 2023).

Total Organic Matter (TOM) describes the total organic matter concentration in water, consisting of dissolved, suspended, and colloidal organic matter (Supriatna *et al*., 2020). High TOM values indicate pollution and can affect overall water quality. Research has shown that TOM is negatively correlated with pH and salinity. The higher the TOM value, the lower the pH and salinity. Maintaining optimal water quality for shrimp growth requires TOM management through water exchange and the use of probiotics (Ariadi *et al*., 2021).

Research reveals that the population of *Vibrio sp.* bacteria in intensive shrimp ponds experiences significant fluctuations. This dynamic is closely related to water quality conditions. According to Aris *et al*. (2024), when water quality declines, as indicated by low dissolved oxygen (DO) concentrations, rising water temperatures, and the accumulation of leftover feed and feces, the number of *Vibrio sp.* tends to increase rapidly. This situation creates an environment rich in organic matter and poor in oxygen, ideal for *Vibrio* bacterial growth. This is due to the unstable environmental conditions, with sufficient oxygen and low levels of organic matter, which do not support the growth of these bacteria. Furthermore, high levels of organic matter are also believed to support an increase in the abundance of pathogenic bacteria in ponds (Alfiansah *et al*., 2018). Pathogenic bacteria such as *Vibrio sp.* will grow abundantly in pond waters with accumulated organic matter levels >90 mg/L (Ariadi & Wafi, 2020).

Fluctuations in the abundance of *Vibrio sp.* can serve as an indirect indicator of pond water quality. *Vibrio sp.* bacteria are natural components of microorganisms in marine and pond environments. If their populations explode due to declining water quality, *Vibrio* has the potential to become pathogenic (Kirstein *et al*., 2016). Vibrio population explosions can disrupt the balance of the pond's microbial ecosystem and risk causing vibriosis outbreaks in shrimp, ultimately reducing productivity and increasing mortality rates (De Souza Valente and Wan, 2021). Therefore, maintaining water quality is key to controlling *Vibrio* sp. populations. Good management includes regulating feeding to avoid excess, maintaining circulation and aeration to maintain high dissolved oxygen levels, and implementing regular water changes to prevent the buildup of organic matter. Through proper management, the balance of the microbial ecosystem can be maintained, thus controlling *Vibrio* growth and reducing the risk of shrimp disease (Andayani *et al*., 2024).

Management of water quality parameters such as pH, temperature, salinity, and TOM is crucial in intensive whiteleg shrimp farming systems. Good water quality not only supports optimal shrimp growth but also reduces the risk of disease and mortality. Therefore, these parameters should be monitored regularly to ensure successful cultivation.

CONCLUSION

Water quality in intensive ponds significantly impacts the growth and health of whiteleg shrimp. Physical, chemical, and biological factors need to be monitored through key parameters such as temperature (28–30°C), salinity (15–25 ppt), pH (7.5–8.5), dissolved oxygen (>4 mg/L), ammonia (<0.1 mg/L), nitrite (<0.5 mg/L), and nitrate (<20 mg/L). Failure to meet these standards can inhibit growth, reduce health, and increase the risk of disease. Therefore, proper water quality management is crucial for maintaining optimal and sustainable pond productivity.

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REFERENCES

Alfiansah, Y. R., Hassenrück, C., Kunzmann, A., Taslihan, A., Harder, J., & Gärdes, A. (2018). Bacterial abundance and community composition in pond water from shrimp aquaculture systems with different stocking densities. *Frontiers in microbiology*, *9*, 1-15. https://doi.org/10.3389/fmicb.2018.02457

Andayani, L., Fauziah, A., & Cahyanurani, A. B. DINAMIKA KELIMPAHAN VIBRIO Sp. PADA MEDIA BUDIDAYA DAN VIBRIO Sp. ORGAN HEPATOPANKREAS UDANG VANAME (Litopenaeus vannamei) DI CV. LAUTAN SUMBER REJEKI BANYUWANGI JAWA TIMUR. *Chanos Chanos, 22*(2), 99-108.

Ariadi, H., & Wafi, A. (2020). Water quality relationship with FCR value in intensive shrimp culture of vannamei (Litopenaeus vannamei). *Samakia: Jurnal Ilmu Perikanan, 11*(1), 44-50.

Ariadi, H., Syakirin, M. B., Pranggono, H., Soeprapto, H., & Mulya, N. A. (2021). Kelayakan finansial usaha budidaya udang vaname (l. Vannamei) pola intensif di pt. Menjangan mas nusantara, banten. *AKULTURASI, 9*(2), 240-249.

Aris, M., Samadan, G. M., & Ane, M. O. (2024). Perbandingan Kepadatan Bakteri Vibrio spp. pada Budidaya Udang Vaname (Litopenaeus vannamei) di Lokasi Berbeda. *Juvenil: Jurnal Ilmiah Kelautan dan Perikanan*, *5*(3), 214-222.

Ravuru, D. B., & Mude, J. N. (2014). Effect of density on growth and production of Litopenaeus vannamei of brackish water culture system in summer season with artificial diet in Prakasam District, India. *American International Journal of Research in Formal, Applied & Natural Sciences*, *14*(108), 10-13.

Dewi, N. N., & Rahadini, N. (2021). Aplikasi POC (Pupuk Organik Cair) Pada Persiapan Kolam Pembesaran Budidaya Udang Vaname (Litopenaeus vannamei) Terhadap Pertumbuhan, Tingkat Kelangsungan Hidup, Rasio Konversi Pakan, dan Efisiensi Pemanfaatan Pakan.

de Souza Valente, C., & Wan, A. H. (2021). Vibrio and major commercially important vibriosis diseases in decapod crustaceans. *Journal of Invertebrate Pathology*, *181*, 107527.

Farabi, A. I., & Latuconsina, H. (2023). Manajemen kualitas air pada pembesaran udang vaname (Litopenaeus vannamei) di UPT. BAPL (budidaya air payau dan laut) Bangil Pasuruan Jawa Timur. *Jurnal Riset Perikanan dan Kelautan*, *5*(1), 1-13.

Hertika, A. M. S., Kilawati, Y. K., Fajriani, S., Rosyidah, Z., Anggraini, D., Iswati, I., ... & Purnama, H. G. (2021). Pendampingan Kegiatan Monitoring Kualitas Air Pada Pembudidaya Udang Vaname di Kabupaten Probolinggo. *Journal of Innovation and Applied Technology, 7*(1), 1145-1153.

Kharisma, A., & Manan, A. (2012). Kelimpahan bakteri Vibrio sp. pada air pembesaran udang vannamei (Litopenaeus vannamei) sebagai deteksi dini serangan penyakit vibriosis. Jurnal Ilmiah Perikanan dan Kelautan, 4(2).

Kirstein, I. V., Kirmizi, S., Wichels, A., Garin-Fernandez, A., Erler, R., Löder, M., & Gerdts, G. (2016). Dangerous hitchhikers? Evidence for potentially pathogenic Vibrio spp. on microplastic particles. *Marine environmental research*, *120*, 1-8.

Pakaya, D., Tuiyo, R., & Lamadi, A. (2022). Pengaruh pemberian probiotik pada pakan terhadap pertumbuhan benih udang vaname (*Litopenaeus vannamei*). *Jurnal Vokasi Sains dan Teknologi*, *2*(1): 13-20.

Pratisca, S., & Sardi, J. (2020). Alat Pemberi Pakan Ikan Otomatis Berbasis Suhu Air pada Kolam Ikan. *JTEIN: Jurnal Teknik Elektro Indonesia*, *1*(2), 193-200.

Prihatno, H., Abida, R. F., & Sagala, S. L. (2021). Korelasi antara konduktivitas air laut dengan jumlah mineral terlarut pada perairan selat madura. *Jurnal Kelautan Nasional*, *16*(3), 211-222.

Putra, A., Syafa'Yumna, A., Alfiazh, A. T., Nugraha, B. A., Sartika, D., Ramadiansyah, F., ... & Suharyadi, S. (2023). Analisis kualitas air pada budidaya udang vaname (*Litopenaeus vannamei*) sistem intensif. *Jurnal Perikanan Unram*, *13*(3), 871-878.

Sa'adah, W., & Milah, K. (2019). Permintaan Udang Vannamei (*Litopenaeus vannamei*) di Kelompok Pembudidaya Udang At-Taqwa Paciran Lamongan. Mimbar Agribisnis: *Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis, 5*(2), 243-251.

Supono, S., & Sarida, M. (2022). Pengaruh penambahan kalsium pada media kultur salinitas rendah terhadap performa udang vaname Litopenaeus vannamei. *Journal of tropical marine Science, 5*(2), 90-97.

Supriatna, M., Mahmudi, M., & Musa, M. (2020). Model pH dan hubungannya dengan parameter kualitas air pada tambak intensif udang vaname (Litopenaeus vannamei) di Banyuwangi Jawa Timur. *JFMR (Journal of Fisheries and Marine Research)*, *4*(3), 368-374.

Utami, D. A. S., Ramlanis, A. A., Faruq, W. E. M., & Saputra, F. (2022). Padat tebar optimum untuk mendukung optimasi kualitas air dan produksi tambak intensif udang vaname (*Litopenaeus vannamei*). *Jurnal Akuakultura Universitas Teuku Umar*, *6*(1), 52-60.

Yunarty, Y., Kurniaji, A., Budiyati, B., Renitasari, D. P., & Resa, M. (2022). Karakteristik kualitas air dan performa pertumbuhan budidaya udang vaname (Litopenaeus vannamei) pola intensif. *PENA Akuatika: Jurnal Ilmiah Perikanan dan Kelautan*, *21*(1), 75-88.