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WATER QUALITY MANAGEMENT IN VANNAMEI SHRIMP *(Litopenaeus vannamei)* CULTURE AT PT. ANUGERAH NUSANTARA KRAKSAAN PROBOLINGGO REGENCY, EAST JAVA PROVINCE

Manajemen Kualitas Air Pada Pembesaran Udang Vannamei *(Litopenaeus vannamei)* di PT. Anugerah Nusantara Kraksaan Kabupaten Probolinggo Provinsi Jawa Timur

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ABSTRACT

Water quality management is the main factor in rearing vannamei shrimp cultivation. Quality shrimp is produced from optimal water quality management. PT. Anugerah Nusantara Kraksaan is a company that operates in the field of rearing vannamei shrimp. So this research aims to determine the application of water quality management in rearing vannamei shrimp (Litopenaeus vannamei) at PT. Anugerah Nusantara Kraksaan, East Java Province. The research was carried out for 1 month from January to February 2025 starting from DOC 68 until DOC 96. This research was carried out on Plots G3, Plots G5, and Plots H4 with concrete construction. The fry used in the research were from PLB (Prima Larvae Bali) on Postlarva 10. Data taken on these water quality parameters were Brightness, Temperature, pH, Dissolved Oxygen, Salinity, Amonnium, Phospat, Alkalinity, and TOM. To overcome fluctuations in environmental parameters, it is necessary to change water, filter, and administer probiotics periodically until the total harvest is achieved. It can be concluded that the results of the best water quality management is in plot G3, because plot G3 can last longer, but plots H4 is the most stable for its water quality even though it ends up being affected by Infectious Myonecrosis disease.

Keywords: Enlargement, Vannamei Shrimp, Water Quality Management

ABSTRAK

Manajemen kualitas air merupakan faktor utama dalam budidaya pembesaran udang vannamei. Udang yang berkualitas di hasilkan dari manajemen kualitas air yang optimal. Sehingga penelitian ini bertujuan untuk mengetahui penerapan manajemen kualitas air pada pembesaran udang vannamei *(Litopenaeus vannamei)* di PT. Anugerah Nusantara Kraksaan Provinsi Jawa

Timur. Penelitian dilakukan selama 1 bulan pada Bulan Januari hingga Februari 2025 dimulai dari DOC 68 sampai dengan DOC 96. Penelitian ini dilakukan pada Petak G3, Petak G5, dan Petak H4 dengan konstruksi beton. Benur yang di pakai pada penelitian ini yaitu dari PLB (Prima Larvae Bali) pada Postlarva 10. Data yang diambil pada parameter kualitas air ini yaitu Kecerahan, Suhu, pH, Oksigen Terlarut, Salinitas, Amonium, Phospat, Alkalinitas dan TOM. Dalam mengatasi fluktuasi parameter lingkungan perlu dilakukan, pergantian air, penyiponan, dan pemberian probiotik secara berkala sampai dengan panen total. Dapat disimpulkan hasil dari manajemen kualitas air yang paling baik terletak pada petak G3, dikarenakan petak G3 dapat bertahan lebih lama, akan tetapi pada petak H4 yang paling stabil untuk kualitas airnya meskipun akhirnya terkena penyakit *Infectious Myonecrosis*.

Kata Kunci: Manajemen Kualitas Air, Pembesaran, Udang Vannamei

INTRODUCTION

Shrimp is one of the commodities that is very popular with farmers at this time. This is influenced by the increasing market demand, so that shrimp cultivation has a high economic value. Shrimp is one of the largest export commodities, even its position is ranked fifth in the world of non-oil and gas exporters, especially in Indonesia (Dayat et al., 2023).

One type of shrimp that is widely cultivated is vannamei shrimp (*Litopenaeus vannamei*) because this shrimp has many advantages, namely it is resistant to disease, grows faster, is resistant to environmental disturbances, has a high survival rate, is feed efficient, and has a short cultivation time which is in the range of 90-100 days in each cycle (Dayat et al., 2023).

Probolinggo Regency has very great potential for vannamei shrimp cultivation because it is one of the largest shrimp cultivation centers in East Java. Shrimp cultivation is highly dependent on good water quality management, because ideal water quality can help shrimp growth, increase productivity, and reduce the risk of disease. Some important factors that determine good water quality include temperature, brightness, altitude, pH, salinity, and color that can be observed visually. On the other hand, other parameters such as nitrite, nitrate, phosphate, ammonia, and dissolved oxygen are taken from water samples and then analyzed in the laboratory (Dede et al., 2014). To maintain environmental conditions suitable for shrimp growth, each parameter has an important role.

The main challenges in water quality management include fluctuations in environmental parameters, pollution from external sources, and the efficiency of waste management systems. The application of technologies such as aeration systems, filtration, and automatic monitoring is essential to overcome these challenges. In addition, the knowledge and skills of pond managers in identifying and controlling water quality parameters are also determining factors for successful cultivation. Water quality management is very important so that the condition of the pond waters remains optimal for the survival of the shrimp being cultivated (Hertika et al., 2021).

To increase vannamei shrimp production, farmers can use water quality management. Water quality management can be seen from the physical, chemical, and biological factors of the waters, including monitoring and maintenance activities if there is a deviation from the optimal value of water quality parameters. If water quality management is carried out optimally and supported by supporting facilities and infrastructure, it is hoped that the results will be better.

METHODS

Research Method

The research method used in this study is the descriptive method. According to Sugiyono (2019), descriptive analysis is analyzing data by describing or depicting the data that has been collected as it is without intending to make conclusions that apply to the public or generalization. The author analyzes data on water quality management in each parameter, then the data that has been collected can be concluded. This analysis aims to determine whether the parameters analyzed are appropriate or not for the cultivation of vannamei shrimp (*Litopenaeus vannamei*).

Research Location

This research was conducted in January-February 2025 in Kalibuntu Village, Kraksaan District, Probolinggo Regency, East Java Province.

Tools and Materials

There are three research plots, namely plots G3, G5, and H4. These three plots have an area of 2,250 m^2 with a stocking density in plot G3 of 184 shrimp/m^2, plot G5 of 169 shrimp/m^2, and plot H4 of 161 shrimp/m^2. Temperature and DO measurements were carried out using a DO meter, salinity measurements were carried out using a refractometer, pH measurements were carried out using a pH meter, Alkalinity and TOM were carried out using permanganometric titration, while ammonium and phosphate measurements were carried out using a test kit. Observations of all parameters during sampling were carried out based on a predetermined schedule, then the results were recorded in a water quality monitoring book.

Water Quality

Measurement of water quality parameters was carried out in the morning and afternoon using ex-situ and in-situ during the maintenance period. The in-situ method includes checking water height, water clarity, and water color. While the ex-situ method includes water quality parameters measured including temperature, salinity, dissolved oxygen (DO), pH, Ammonium, Phosphate, Alkalinity, Tom, and TBC and TVC. Checks on physical parameters as well as pH, temperature, salinity, DO are carried out every day. Then for Alkalinity, TOM, Phosphate, Ammonium are carried out every 5 days. While for TVC and TBC are checked every 3 days.

RESULTS

The results of checking the water quality parameters in plot G3 can be seen in Table 1, then checking the water quality parameters in plot G5 can be seen in Table 2, and checking the water quality parameters in plot H4 can be seen in Table 3.

Table 1. Measurement of Water Quality Parameters in Plot G3

Parameter	Unit	Value	Measuring Instrument	Time	G3	
					DOC 68-80	DOC 81-95
Temperature	°C	23-32	Thermometer		28.1-29.5	28.5-29.5
Brightness	cm	30-50	Secchi disk	Morning	30-40	30
				Evening	25-30	25
Salinity	ppt	5-35	Refractometer		28-30	28-29
pH	-	6-8.5	pH meter	Morning	7.5-8.2	7.5-8.2
				Evening	7.5-8.2	7.8-8.6
DO	mg/l	>4.0	DO meter		4.39-4.72	4.25-4.54
Alkalinity	mg/l	100-150	Burette		104-148	100-120
TOM	mg/l	<90	Burette		96-116	102-118
Ammonium	mg/l	<0.1	Test kit		0.01-0.07	0.04-0.1
Phosphate	mg/l	0.1-5	Test kit		2.5-3	2-2.7

Description: The text in red is above the unit value.

Table 2. Measurement of Water Quality Parameters in Plot G5

Parameter	Unit	Value	Measuring Instrument	Time	G5	
					DOC 68-75	DOC 76-80
Temperature	⁰C	23-32	Thermometer	Morning Evening	28.2-29.7	28.5-29.5
Brightness	cm	30-50	Secchi disk		20-30 20	20-25 20
Salinity	ppt	5-35	Refractometer	Morning Evening	28	28-29
pH	-	6-8.5	pH meter		7.6-8 7.7-8.7	7.5-8.2 7.6-8.4
DO	mg/l	>4.0	DO meter		4.56-4.98	4.42-4.98
Alkalinity	mg/l	100-150	Burette		120-132	120-128
TOM	mg/l	<90	Burette		104-112	111-112
Ammonium	mg/l	<0.1	Test kit		0.1-0.08	0.04-0.08
Phosphate	mg/l	0.1-5	Test kit		2.3-2.5	2.3-2.5

Description: The text in red is above the unit value.

Table 3. Measurement of Water Quality Parameters in Plot H4

Parameter	Unit	Value	Measuring Instrument	Time	H4	
					DOC 68-73	DOC 74-75
Temperature	⁰C	23-32	Thermometer	Morning Evening	28.1-29.7	28.1-28.6
Brightness	cm	30-50	Secchi disk		40 cm 35-40 cm	40 35-40
Salinity	ppt	5-35	Refractometer	Morning Evening	28-30 ppt	29-30
pH	-	6-8.5	pH meter		7.6-7.8 7.7-8.5	7.7-8 7.7-8.3
DO	mg/l	>4.0	DO meter		4.01-4.41	4.32-4.97
Alkalinity	mg/l	100-150	Burette		136	132
TOM	mg/l	<90	Burette		92	114
Ammonium	mg/l	<0.1	Test kit		0.2	0.07
Phosphate	mg/l	0.1-5	Test kit		2.7	3

Description: The text in red is above the unit value.

Specifically, the graph of the temperature data results on plots G3, G5, and H4 can be seen in Figure 1.

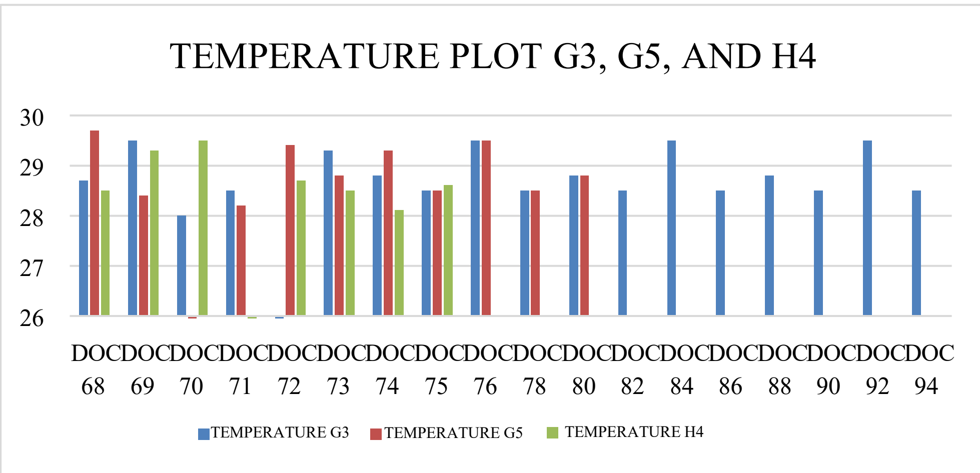

Figure 1. Temperature Data Results on Plots G3, G5, and H4

Specifically, the graph of the brightness data results on plots G3, G5, and H4 can be seen in Figure 2.

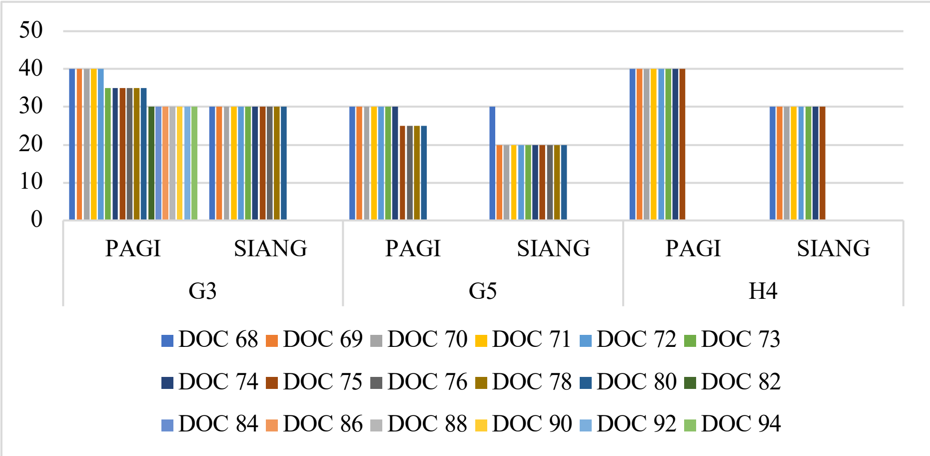

Figure 2. Brightness Result Data on Plots G3, G5, and H4

Specifically, the graph of DO result data on plots G3, G5, and H4 can be seen in Figure 3.

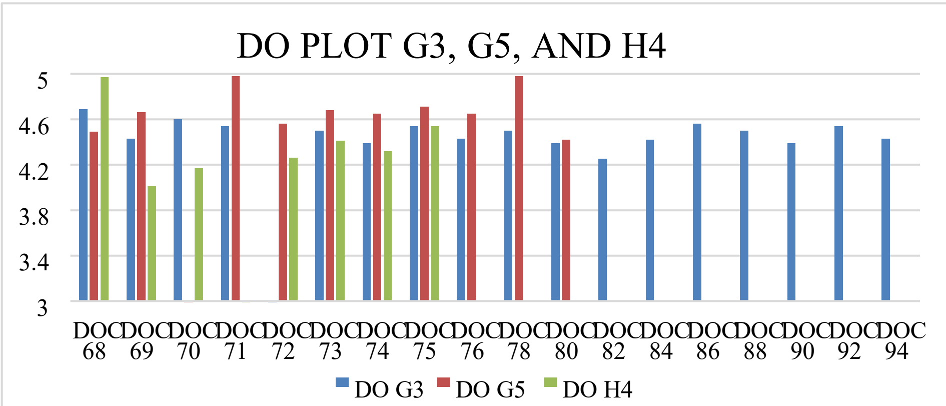

Figure 3. DO Result Data on Plots G3, G5, and H4

Specifically, the graph of the pH result data on plots G3, G5, and H4 can be seen in Figure 4.

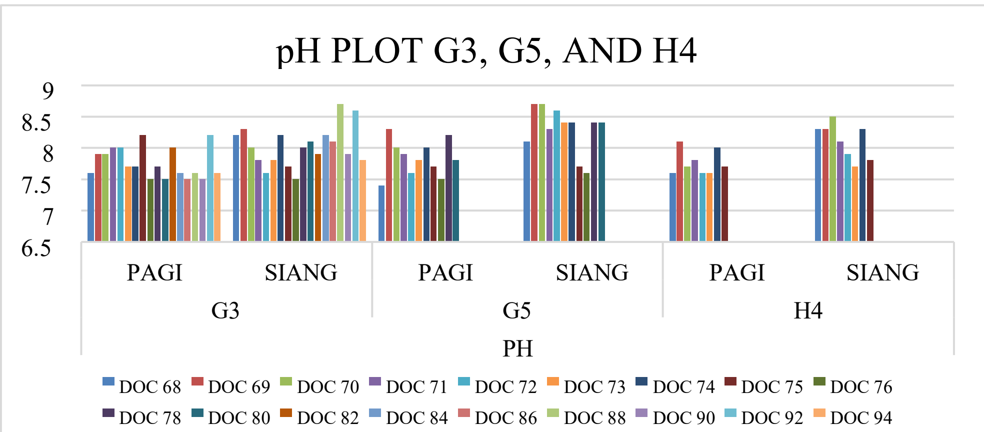

Figure 4. pH Result Data on Plots G3, G5, and H4

Specifically, the graph of the salinity result data on plots G3, G5, and H4 can be seen in Figure 5.

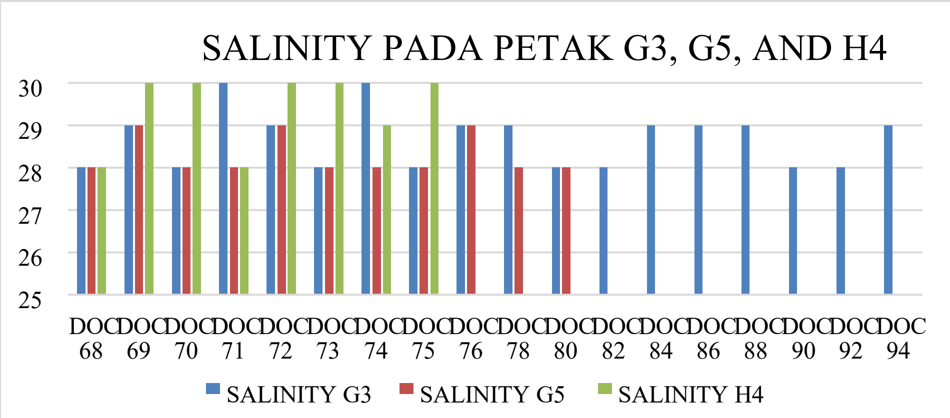

Figure 5. Salinity Result Data on Plots G3, G5, and H4

Specifically, the graph of the alkalinity result data on plots G3, G5, and H4 can be seen in Figure 6.

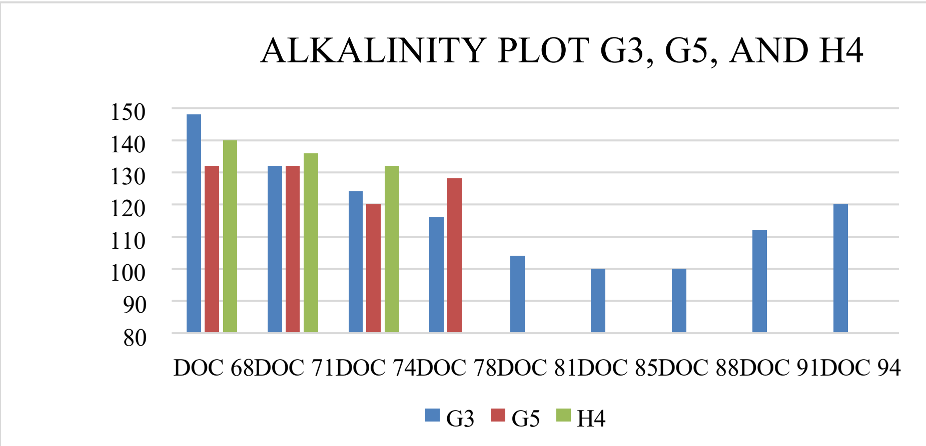

Figure 6. Alkalinity Result Data on Plots G3, G5, and H4

Specifically, the graph of the TOM result data on plots G3, G5, and H4 can be seen in Figure 7.

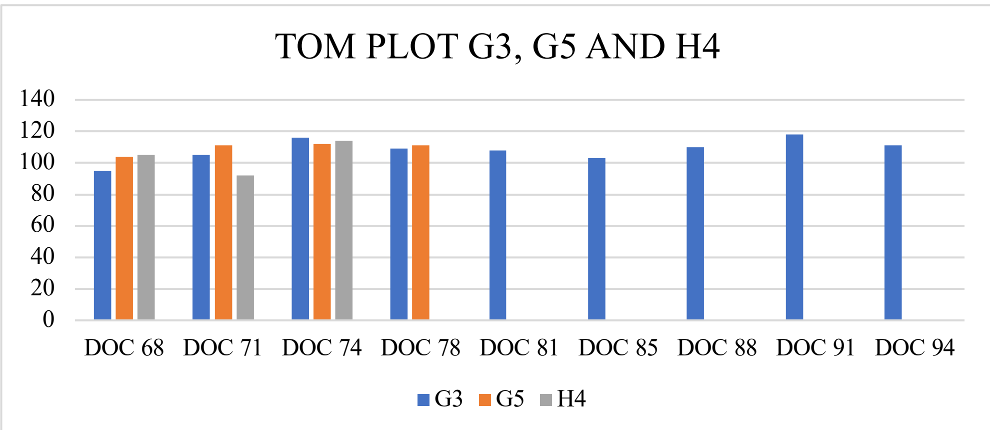

Figure 7. TOM Result Data on Plots G3, G5, and H4

Specifically, the graph of the salinity result data on plots G3, G5, and H4 can be seen in Figure 8.

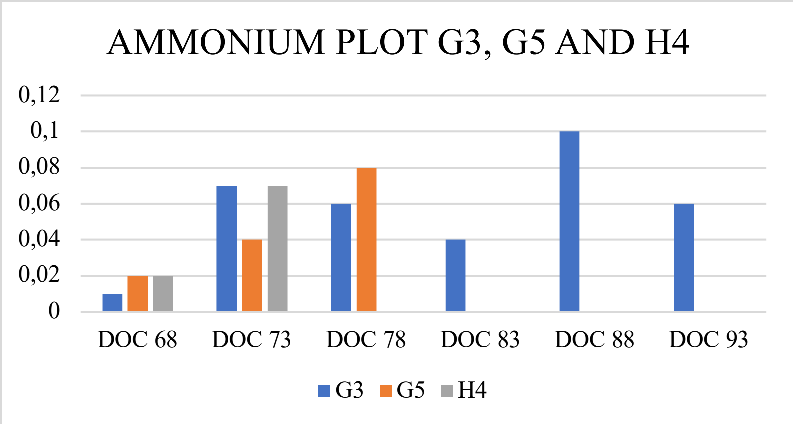

Figure 8. Ammonium Result Data on Plots G3, G5, and H4

Specifically, the graph of the salinity result data on plots G3, G5, and H4 can be seen in Figure 9.

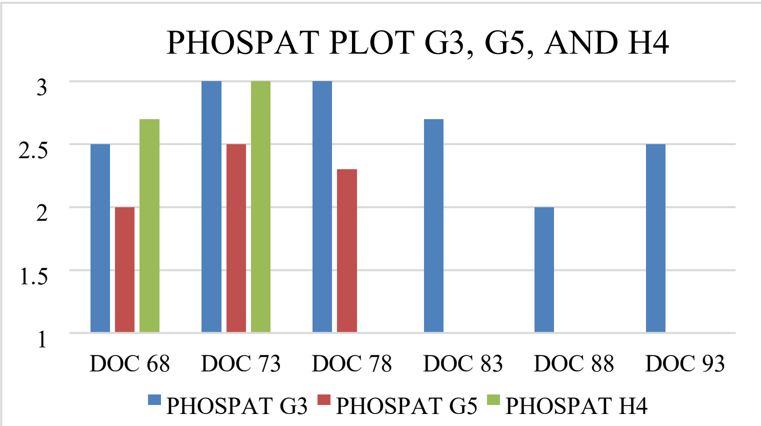

Figure 9. Phosphate Result Data on Plots G3, G5, and H4

DISCUSSION

It can be seen from the temperature parameters in Figure 1 that the temperature range in the G3 plot is between 28.1-29.5°C, in the G5 plot it is between 28.2-29.7°C, and in the H4 plot it is between 28.1-29.7°C, then the brightness parameters in Figure 2 that the brightness range in the morning in the G3 plot is between 30-40 cm, in the G5 plot it is 20-30 cm, and in the H4 plot it is 40 cm. While in the afternoon the brightness in the G3 plot is 25-35 cm, in the G5 plot it is 20-30 cm, and in the H4 plot it is 30-40 cm, then the DO parameters can be seen in Figure 3 that the G3 plot is in the range of 4.29-4.72, in the G5 plot it is 4.49-4.98, and in the H4 plot it is 4.01-4.97. However, DO decreased at DOC 90, which was 4.39 ppm. The decrease in DO occurred because the shrimp had grown larger and the need for oxygen in the waters increased. Halim et al. (2021), that temperature, shrimp age, and water level all contribute to the decrease in DO. High temperatures can cause high oxygen consumption, resulting in low DO, as shown by the pH parameters in Figure 4, where the morning pH value in plot G3 is 7.5-8, in plot G5 it is 7.6-8.3, and in plot H4 it is 7.4-8.1. The pH of pond water in the afternoon is higher than in the morning because aquatic biota absorb at night while photosynthesis occurs in the morning which produces oxygen. According to Supriatna et al., (2020), this is caused by photosynthesis carried out by natural feed, such as phytoplankton, which absorbs CO_2, then the salinity parameters can be seen in Figure 5 that the results of salinity measurements in the G3 plot are 28-29 ppt, in the G5 plot it is 28-29 ppt, and in the H4 plot it is 30 ppt. In DOC 70 in the G3 plot and DOC 71 in the G5 plot there was a decrease in salinity of 28 ppt due to water filling. Salinity greatly affects shrimp, salinity affects the osmotic pressure of water, the higher the salinity, the higher the osmotic pressure of water so that it affects the level of osmoregulation in shrimp (Supono, 2017), then the temperature parameters can be seen in Figure 6 that in DOC 68 there was an increase in alkalinity of 148 mg/l. Alkalinity that is too high causes shrimp to experience skin hardness, while a decrease in alkalinity causes shrimp to molt quickly and become porous so that it will interfere with shrimp growth. According to Prabowo et al., (2022) said that low levels of alkalinity <100 mg/l will cause pH fluctuations in large or unstable ponds, then the TOM parameters can be seen in Figure 7 that the results of TOM measurements in the G3 plot with an average of 108.4 mg/l, in the G5 plot, namely 109.5 mg/l, and in the H4 plot, namely 103.6 mg/l. The highest TOM occurred in DOC 91 in the G3 plot, which was 118 mg/l. Along with the increasing age of the shrimp, the organic matter will increase, then the ammonium parameters can be seen in Figure 8 that the results of ammonium measurements in the G3 plot with an average of 0.05 mg/l, in the G5 plot with an average of 0.08 mg/l, and in the H4 plot with an average of 0.04 mg/l. However, in DOC 88, ammonium increased due to the accumulation of high organic matter and decomposing bacteria that did not function properly. This is in accordance with the opinion of Halim et al., (2022) who stated that although ammonium dominates waters at low pH, it is relatively non-toxic. However, at high pH, ammonium can be a toxic compound for shrimp if converted into ammonia compounds (NH_3). Ammonium parameters can be seen in Figure 9, where the results of the Phosphate check reached an average of 2.6 mg/l in plot G3, 2.2 mg/l in plot G5, and 2.8 mg/l in plot H4.

CONCLUSION

Based on the results of water quality monitoring in plots G3, G5, and plot H4, the results have been quite optimal. For checking physical parameters including brightness, air color, and temperature. For checking chemical parameters including pH, DO, salinity, alkalinity, TOM, ammonium (NH_4^+), phosphate (PO_4) and the results of the best air quality management among plots G3, plot G5 and plot H4 are in plot G3 because it can survive at DOC 96. However, for air quality stability, it is in plot H4.

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REFERENCES

Dayat, H., Alfirdaus, A., & Wahyurini, E. T. (2023). Analisis Produksi Tambak Terpal Pada Budidaya Udang Vannamei *(Litopenaeus Vannamei)* Semi Intensif Di Desa Lembung Kecamatan Galis Kabupaten Pamekasan. *Fisheries: Jurnal Perikanan dan Ilmu Kelautan*, 5(2), 78-93.

Dewi, I. C., Subariyanto, S., & Ernawati, E. (2023). Pengaruh Pemberian Probiotik *Lactobacillus Sp.* Dan *Bacillus Sp.* Dengan Dosis Yang Berbeda Pada Media Pemeliharaan Terhadap Pertumbuhan Dan Kelangsungan Hidup Udang Vannamei *(Litopenaeus Vannamei)*. Nekton, 3(1), 37-50.

Fahmi, M. N. (2016). Manajemen Kualitas Air pada Pembesaran Udang Vannamei *(Litopenaeus Vannamei)* dalam Tambak Budidaya Intensif di Balai Layanan Usaha Produksi Perikanan Budidaya (BLUPPB) Karawang, Jawa Barat.

Farabi, A. I., & Latuconsina, H. (2023). Manajemen Kualitas Air pada Pembesaran Udang Vannamei *(Litopenaeus Vannamei)* di UPT. BAPL (Budidaya Air Payau dan Laut) Bangil Pasuruan Jawa Timur. *Jurnal Riset Perikanan dan Kelautan.* 5(1), 1-13.

Fiyanti, A. (2017). Sistem Otomasi Kincir Air Untuk Respirasi Udang Tambak Menggunakan *Sensor Dissolved Oxygen* (DO).

Ghufron, M. (2017). Teknik Pembesaran Udang Vannamei *(Litopenaeus Vannamei)* Pada Tambak Pendampingan Pt Central Proteina Prima Tbk Di Desa Randutatah, Kecamatan Paiton, Probolinggo, Jawa Timur.

Halim, A. M., K. Mega, A. Fauziah. (2021). Performa Budidaya Udang Vanamei *(Litopenaeus Vannamei)* Semi Intensif di Desa Purworejo Kecamatan Pasir Sakti Kabupaten Lampung Timur. *Jurnal Rekayasa dan Teknologi Budidaya Perairan*, 6(2), 692 – 698.

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

Industries, F. (2021). Manajemen Pakan Pada Pembesaran Udang Vannamei. 47(8), 170–179.

Mahulauw, F. R., Lamadi, A., & Mulis, M. (2022). Patogenitas Bakteri *Vibrio sp.* pada Udang Vannamei di Kabupaten Pohuwato. *The NIKe Journal*, 10(1), 031- 039.

Mulatsih, S., Dina, K. F., Hartanti, N. U., & Safitri, R. D. (2023). Identifikasi dan Kelimpahan Plankton di Tambak Udang Vannamei *(Litopenaeus Vannamei)* Desa Sawojajar Kecamatan Wanasari, Kabupaten Brebes. Clarias: Jurnal Perikanan Air Tawar, 4(2), 1-10.

Nabil, M. G. (2016). Penambahan Karbon Aktif Pada Transportasi Dengan Kepadatan Yang Berbeda Terhadap Sintasan Dan Kualitas Benur Udang Vannamei *(Litopenaeus Vannamei)* (Doctoral dissertation, Universitas Muhammadiyah Gresik).

Prabowo, A. (2022). Pengelolaan Kualitas Air Dalam Pembesaran Udang Vanname *(Litopenaeus Vannamei)* Salinitas Rendah (Doctoral dissertation, Politeknik Negeri Lampung).

Ratnasari, R., Jaya, A. A., Hamal, R., & Nurdin, F. (2022). Teknik Pengeringan Pada Persiapan Tambak Udang Vannamei *(Litopenaeus Vannamei)* Di Desa Talaka, Kecamatan Ma'rang Kabupaten Pangkep. In Prosiding Seminar Nasional Politeknik Pertanian Negeri Pangkajene Kepulauan, 3, 816-823.

Scabra, A. R., Satria, I., Marzuki, M., & Setyono, B. D. H. (2021). *The Influence of Different Aclimatization Times on Survival Rate and Growth of Vannamei Shrimp (Litopenaeus vannamei). Jurnal Perikanan Unram*, 11(1), 120-128.

Shilman, M. I., Suparmin, S., Irmawan, F., & Budiman, B. (2023). Efisiensi Pemberian Pakan Pada Usaha Pembesaran Udang Vannamei *(Litopenaeus Vannamei)* Pola Tambak Intensif Pusat Unggulan Teknologi (PUT) Politeknik Negeri Pontianak di Mempawah. MANFISH JOURNAL, 4(1), 19- 26.

SNI 8008. (2014). Produksi Udang Vaname *(Litopenaeus Vannamei)* Intensif di Tambak Lining.

Solahudin, M., Slamet, W., & Dwi, A. S. (2018). Vannamei *(Litopenaeus Vannamei)* Shrimp Fry Counting Based On Image Processing Method. *In IOP Conference Series: Earth and Environmental Science*, 147(1), 012014. IOP Publishing.

Supono. (2017). Teknologi Produksi Udang. Yogyakarta:Plantaxia.

Supono. (2018). Manajemen Kualitas Air Untuk Budidaya Udang. Bandar Lampung. Aura.

Supriyatna., M. Mahmudi., M. Musa., dan Kusriani. 2020. Hubungan pH Dengan Parameter Kualitas Air Pada Tambak Intensif Udang Vannamei *(Litopenaeus Vannamei)*. *Journal of Fisheries and Marine Research*, 4(3), 368-374.

Syadillah, A., Hilyana, S., & Marzuki, M. (2020). Pengaruh Penambahan Bakteri *(Lactobacillus* sp*.)* Dengan Konsentrasi Berbeda Terhadap Pertumbuhan Udang Vannamei *(Litopenaeus Vannamei)*. *Jurnal Perikanan Unram*, 10(1), 8-19.

Wahyuni, R. S., Rahmi, R., & Hamsah, H. (2022). Efektivitas Oksigen Terlarut Terhadap Pertumbuhan Dan Sintasan Udang Vannamei *(Litopenaeus Vannamei)*. *Jurnal Perikanan Unram*, 12(4), 536-543.

Widigdo, B., & Wardianto, Y. (2013). Dinamika Komunitas Fitoplankton dan Kualitas Perairan di Lingkungan Perairan Tambak Udang Intensif : Sebuah Analisis Korelasi. *Jurnal Biologi Tropis*, 13(2), 160–184.

Yunarty. (2022). Karakteristik Kualitas Air dan Performa Pertumbuhan Budidaya Udang Vaname *(Litopenaeus Vannamei)* Pola Intensif. *Jurnal Ilmiah Perikanan dan Kelautan*, 21(1), 75-88.

Yunus, R., Haris, A., & Hamsah, H. (2020). Pengaruh Penambahan Kapur Dolomite Dan Kapur Tohor Dalam Media Pemeliharaan Terhadap Moulting.