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Probiotic utilization enhances vannamei (*Litopenaeus vannamei*) growth and survival ratio during dry and rainy season

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ABSTRACT

The study was conducted at the Vannamei Shrimp Pond Unit of the Pontianak State Polytechnic Technology Excellence Center, Mempawah Regency, and the Vannamei Shrimp Enlargement Unit of the Vocational and Nautikan High School, Sambas Regency. The study aims to determine the growth performance and survival of vannamei shrimp feed conversion intensively raised using probiotics in the dry season (March-August) and the rainy season (September-February) in 2022-2023. PL-15 vannamei shrimp fry were stocked at a density of 120/m² in 2 pond plots with an area of 2,500 m² and 2 pond plots of 3000 m². The data collection method used observation and participation in the cultivation process, starting from land preparation, feed management, and water quality to harvest. The data were analysed descriptively, and a literature review was conducted to compare the technical activities applied in the field with the supporting theoretical basis. From the 120-day maintenance activity in the dry season, the average value of SR was 98.27%, biomass 26,749.7 kg, ABW 41.58 gr/pcs, ADG 0.27 gr/pcs, this shows relatively better results when compared to the rainy season maintenance period with an average value of SR 85.73, Biomass 20,794.6 kg, ABW 35.11 gr/pcs, ADG 0.21gr/pcs.

Introduction

West Kalimantan Province has a coastal area of 51,857.36 km^2 with a coastline of 2,039.57 km (DKP Prov. Kalbar, 2019). The vast coastal area has great potential for developing aquaculture businesses, especially vannamei shrimp. Vannamei shrimp has several advantages as a cultivation commodity, namely for export purposes so it has an enormous market share (Komardi, 2020). Sa'adah, Milah (2019) stated that foreign market demand includes Japan, Taiwan, China, and America. High market demand has a positive impact to the price of vannamei shrimp increases by 10% every year. Gufron, Kordi (2007) stated from the cultivation aspect, the advantages of vannamei shrimp include being able to be maintained at high densities, adaptability to high environmental changes, especially salinity ranging from 5-45 ppt, high appetite, converting feed well and fast growth. BPBAP Situbondo (2021) vaname shrimp has a growth rate of 1-1.5 gr/week, can be cultivated with high density distribution (80-500 fish/m^2), is tolerant to salinity (0.5-45%0), lower feed protein requirements (20-30%) compared to other species, Feed Conversion Ratio (FCR) is lower (1:1.1-1.2), uniform harvest size, and low undersize numbers.

The selling price of vannamei shrimp and high export market demand encourage entrepreneurs to increase the volume of cultivation production. The rise in production volume is carried out by increasing stocking density, intensifying cultivation technology, and large amounts of feed input. Since 60–70% of production costs are devoted to feed provision, an increase in feed input is associated with a significant increase in production costs (Sa'dah, Milah., 2019; Harahap, Aulia, 2022; Akbar & Fazli, 2023).

Efforts to raise production are often not comparable to the results obtained because there are risk factors that become limitations, caused by viral and bacterial infections. Shrimp cultivation is very susceptible to viral and bacterial infections, which result in high mortality (Ridlo, Pramesti, 2009; Akbar *et al*., 2025). Viruses are triggering factors that play a

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role in disease attacks on shrimp. Virus attacks cause abnormalities in the body, non-uniform growth and size of shrimp, and mass death (Hidayani *et al.*, 2015). Another limiting factor is feed input that does not fulfil shrimp needs, as well as a decrease in the quality of the maintenance media.

The risk of failure in vannamei shrimp cultivation can be minimized by applying technology, improving feed management, and maintaining proper water quality. The utilization of probiotics to the maintenance media is one of the vannamei shrimp cultivation technologies that is expected to enhance the water quality of the maintenance and production media (Sevin *et al.*, 2023). Rahim *et al.* (2021) researched on vannamei cultivation in super-intensive ponds proved that the utilization of zero water discharge had a very significant effect on growth and the value of the food conversion ratio (FCR). Suwoyo, Tampangallo (2015) added carbon sources to the vannamei shrimp maintenance media, causing an increase in the population of bacteria that form biofloc. Wiyoto *et al.* (2023) added hydrogen peroxide to the maintenance media, causing an increase in the vannamei shrimp growth performance.

Probiotics are microorganisms that can modify the composition of bacteria in the digestive tract of aquatic animals, water, and sediment, in addition to being used as feed supplements to improve host health as biocontrol agents (Lara-Flores, 2011). The application of probiotics is intended to enhance water quality because of their ability to decompose organic matter produced from shrimp waste and unconsumed feed residues. Citra *et al.* (2018) stated that probiotics can transform complicated substances into simpler forms, facilitating digestion in shrimp. The addition of fermented probiotics to feed has been shown to increase the highest specific length growth rate of 3.17 and weight growth of 0.26% and provide a survival rate of 93% for vannamei shrimp (Wijayanto *et al.*, 2020). Several studies have shown that probiotics containing *Bacillus* sp. and *Pseudomonas* sp. can decompose organic matter resulting from the accumulation of waste and feed residues quickly so that there is no excessive accumulation at the bottom of the pond. The application of probiotics also allows the formation of biofloc, which can be an additional natural feed in vannamei shrimp cultivation media.

This study aims to determine the utilization of probiotics as an effort to enhance the growth performance and survival ratio of vannamei shrimp (*Litopenaeus vannamei*) during dry and rainy season.

Materials and Methods

Location and Time of Research

The research was conducted at the Vannamei Shrimp Farming Unit of the Pontianak State Polytechnic Technology Excellence Center (SFU_TEC Polnep), Mempawah Hilir District, Mempawah Regency, and the Vannamei Shrimp Enlargement Unit of the Vocational and Nautical High School (SEU_SMKN), Pemangkat District, Sambas Regency. Vannamei shrimp were intensively raised using probiotics in the dry season (March-August) and the rainy season (September-February) in 2022-2023.

Research Materials and Design

Vannamei shrimp were raised in 4 ponds consisting of 2 ponds in SFU_TEC Polnep covering an area of 2,500 m^2 and 2 ponds in SEU_SMKN covering an area of 3,000 m^2. Cultivation was carried out intensively, equipped with 8 waterwheels each pond and supported by equipments for measuring water quality, growth sampling, and harvesting. Materials that were used such as active lime, dolomite lime, chlorine, quicklime, captan, probiotics (*Biotrex* and *Mprotex*), Omyacrab lime, enzymes (*Issozme*), yeast (*Mauri pan*), urea and NPK (nitrogen (N), phosphorus (P), and potassium (K)) fertilizers, milk powder, bran, and molasses.

Data collection was conducted through observations, interviews, and active participation in cultivation activities. The stages of activities start from pond preparation and maintenance media, seed distribution, feed management, water quality management, growth sampling, and harvest.

Pond Preparation

The initial stage of pond preparation was checking the embankment to ensure that the embankment section did not leak, tidying up/repairing the embankment section coated with HDPE, and installing/repairing the pond bottom tarpaulin. Draining the water was done using a gravity system; mud, leftover feed, and shrimp waste were disposed of through a discharge point or central point (central drain) and pushed using a water pump spray. The pond bottom was dried for 1-2 weeks.

The second stage were water filling, sterilization, and water color formation (fertilization). Water come from a reservoir that had been deposited for 2 weeks. The pond was filled with water until it reached a height of 1.2 m and it would be sterilized.

Sterilization aimed to purify water and kill pests in vannamei shrimp farming activities. Supono (2017) stated that water sterilization was the process of applying a certain material to the maintenance media, aimed at eradicating carriers and predators in the pond. Sterilization used 60% chlorine with a dose of 30 ppm. Before being spread, chlorine was diluted using pond water, then spreaded evenly throughout the plot and left for 24 hours. The use of chlorine functions as a disinfectant that was effective in killing pests and disease agents (Edhy *et al*., 2010). During the sterilization process, 2 water wheels were turned on and lasted for 2-3 days. The use of a small number of water wheels so that the toxicity of the chlorine given was more effective because the availability of oxygen was not excessive. After 3 days of sterilization, the next step was to provide active lime at a dose of 120 ppm and dolomite lime at 40 ppm.

The establishment of water color (fertilization) occured after the seventh day of sterilization or when the pond water conditions were normalized, as evidenced by the absence of chlorine odor. The formation of water color by applying probiotics and a mixture of molasses, rice bran, and AMF (Animal Manure Fertilizer). The probiotics used *Biotrek* and *Mprotek*. Before it were being applied to pond water, the bacteria *Lactobaliciius* sp. and *Bacillus* sp. were multiplied by culture and fermentation.

Bacterial culture was carried out in this way: first, put 2 liters of molasses into a container, then mixed with the probiotics *Biotrex* and *Mprotex*, 120 grams each of them, 30 grams of mauri pan, 100 grams of milk, and 2 liters of bran, then added sufficient water to the plastic drum and provideed aeration. Bacterial culture lasted for 2 days before was being used/spreaded evenly in pond water.

One liter of molasses, one liter of bran, 100 grams of milk, thirty grams of Mauri pan, and 60 grams of each of the probiotics *Biotrex* and *Mprotex* were added to start the fermentation process. Enough water was then added and stirred until the mixture was smooth. After that, closed the plastic drum and waited 3 days before applying it to the pond water.

At the time of appplication, Urea, NPK (nitrogen (N), phosphorus (P), and potassium (K)), and AMF (Animal Manure Fertilizer) fertilizers were prepared. The dosage of urea and NPK fertilizers ranges from 0.4 to 0.8 ppm. Urea and NPK that had been weighed were mixed with PKH, put in a small sack, pierced using nails, and then stored at the bottom of the feeding tray pier (anco bridge) or near the waterwheel. The application of probiotics and the addition of fertilizers aimed to accelerate the growth of phytoplankton, watercolor, and aquatic microorganisms in the pond.

Shrimp Maintenance

Shrimps were stocked with an average density of 120/m^2, as presented in Table 1, during the maintenance period, water replacement was carried out as little as possible. Water replacement was only carried out if there was an indication of a decrease in water quality or accumulation of organic matter from leftover feed and feces, which was indicated by the appearance of odor and thick watercolor. Water requirements were supplied from reservoirs or water reservoirs that had received sedimentation treatment for at least 3-7 days. If necessary, water was replaced at the bottom of the pond by opening the PVC pipe on *the central drain*. The amount of water released was approximately 20%-25%. The addition of new water was carried out immediately after the water reduction process.

Probiotic utilization and liming were done daily during the shrimp maintenance period. Daily liming used dolomite lime, omyacrab lime, and captan at a dose of 10-60 ppm. Liming was spreaded depending on field conditions, especially when it was rain or when the shrimp were molting.

In the early maintenance period (Day Of Culture (DOC) 1–30 days), the amount of feed given was based on blind feeding; the DOC 30 days feed program until harvest was determined based on daily feed requirements (demand feeding program) and was determined based on the results of sampling every 10 days and daily feeding tray control (anco bridge). Adjustment of the amount of daily feed took into account the appetite reflected from the results of checking the remaining feed in the feeding tray control (anco bridge).

Observation Parameters

Observations were focused on Average Body Weight (ABW), Average Daily Growth (ADG), Biomass , Survival Rate (SR), Mean Body and Food Conversion Ratio (FCR), which were calculated based on the following formula (Situbondo Brackish Water Aquaculture Center, 2021):

$$ABW = \frac{\text{Shrimp weight (gr)}}{\text{Number of shrimp } (pcs)}$$

$$ADG = \frac{\text{ABW 2} - \text{ABW 1}}{\text{Day differences (2nd \& 1st sampling))}}$$

$$\text{Biomass} = \text{Population x ABW}$$

$$SR = \frac{\text{Population x 100 \%}}{\text{Number of fry stocked (pcs)}}$$

$$FCR = \frac{\text{Accumulative Feed Amount (kg)}}{\text{Biomass (kg)}}$$

Daily and weekly measurements were made of the water quality. Temperature, brightness, salinity, pH, dissolved oxygen (DO), ammonia (NH_3), and alkalinity were among the water quality parameters that were monitored.

The same instrument used to evaluate oxygen solubility was also used to measure temperature: the DO-meter; a secchi disc was used to measure brightness; a hand-refractometer was used to measure salinity; a pH-meter was used to assess acidity level; test kits were used to measure ammonia and alkalinity. Equipment for monitoring shrimp appetite and sampling, which was conducted every ten days using nets for growth sampling and daily feed determination using feeding trays.

Data analysis

Data on growth, biomass, survival rate, feed conversion value, and water quality were analyzed descriptively from the average value. Sugiyono (2010), descriptive analysis is a method to describe the facts or characteristics of a certain condition of the population in an actual manner carefully to find elements, characteristics, or properties of existing problems.

Table 1. Pond area, stocking density and total stocking

Pond	Pond Area (m^2)	Density of Distribution	Number of Spreads	Number of Spreads
		(pcs/m^2)	(pcs/pond)	(pcs/hectares)
AMK-1	2,500	126.00	315,000	1,260,000
AMK-2	2,500	120.51	301,275	1,205,100
BMK-1	3,000	122.00	366,000	1,464,000
BMK-2	3,000	128.50	385,500	1,542,000
AMH-1	2,500	120.00	300,000	1,200,000
AMH-2	2,500	123.00	307,500	1,230,000
BMH-1	3,000	119.00	357,000	1,428,000
BMH-2	3,000	122.00	366,000	1,464,000

Description: AMK (Pond Plots in SFU_TEC Polnep Dry Season),
BMK (Pond Plots at SEU_SMKN Dry Season),
AMH (Pond Plots in SFU_TEC Polnep Rainy Season),
BMH (Pond Plots at SEU_SMKN Rainy Season)

Results

The Growth

The data collected includes the length of the maintenance period, the calculation of the average shrimp weight (ABW) and shrimp biomass at the end of the maintenance as shown in Table 2, the average weight data of individual shrimp (ABW) from the first sampling to the end of the maintenance period is presented in the form of a graph in Figure 1, while the daily growth value of individual vannamei shrimp (ADG) is as shown in the graph in Figure 2.

Table 2. Maintenance period, average weight (ABW), and total biomass at the end of maintenance

Parameter	Map the Pond							
	AMK-1	AMK-2	BMK-1	BMK-2	AMH-1	AMH-2	BMH-1	BMH-2
Maintenance Period (days)	125	120	115	120	120	120	125	122
Average Daily Growth (ADG) gr/pcs	0.32	0.25	0.27	0.26	0.26	0.19	0.16	0.22
Mean of ADG (gr/pcs)	0.27				0.21			
Average weight (ABW) gr/pcs	43.23	39.82	42.62	40.65	36.11	34.06	35.14	35.13
Mean of ABW (gr/pcs)	41.58				35.11			
Biomass (kg)	6532	5545	7198	7474.7	5129	4327.6	6141	5197
Total Biomass (kg)	26,749.7				20,794.6			

The primary determinants of shrimp aquaculture performance are growth and survival. The overall biomass generated at the conclusion of culture is determined by the growth and survival of the shrimp. According to Table 2, shrimp raised during the dry season often performed better in terms of growth than shrimp raised during the wet season. In the AMK-1 plot, shrimp raised during the dry season had the highest daily growth value, while in the AMH-2 plot, shrimp raised during the wet season had the lowest. Shrimp had an average daily growth value of 0.27 grams per day during the dry season and 0.21 grams per day during the wet season.

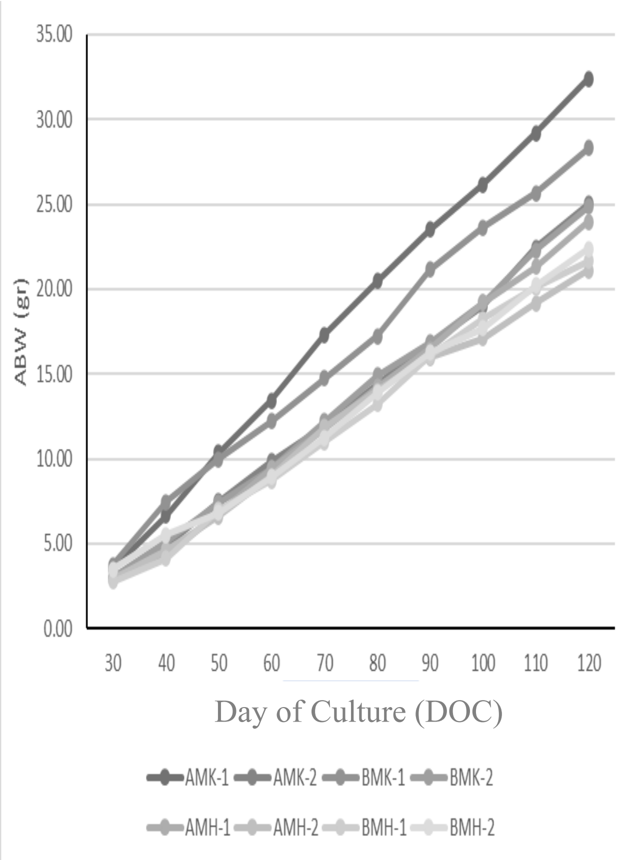
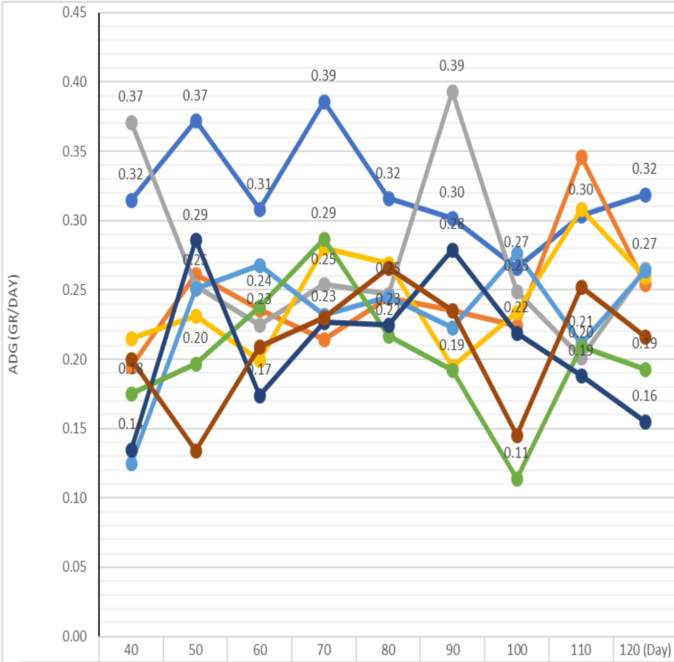


Figure 1. Average weight of individual shrimp (ABW) from the first sampling to the end of the maintenance period .

Average weight gain is an indicator of growth performance. Figure 1 shows that, in comparison to shrimp growth in other ponds, the average weight of individuals from DOC-30 sampling through the end is consistently larger in the AMK-1 and BMK-1 ponds. Individual weights in AMK-1 (43.23 gr/pcs) and BMK-1 (42.62 gr/pcs) at the conclusion of maintenance. The AMH-2 and BMH-1 ponds display the lowest value. The average weight of the individuals in AMH-2 (19.18 gr/pcs) and BMH-1 (20.10 gr/pcs) at the conclusion of the maintenance period was determined.



	40	50	60	70	80	90	100	110	120 (Day)
AMK-1	0.32	0.37	0.31	0.39	0.32	0.30	0.27	0.30	0.32
AMK-2	0.20	0.26	0.24	0.21	0.24	0.24	0.22	0.35	0.25
BMK-1	0.37	0.25	0.23	0.25	0.25	0.39	0.25	0.20	0.27
BMK-2	0.22	0.23	0.20	0.28	0.27	0.20	0.23	0.31	0.26
AMH-1	0.13	0.25	0.27	0.23	0.25	0.22	0.28	0.21	0.26
AMH-2	0.18	0.20	0.24	0.29	0.22	0.19	0.11	0.21	0.19
BMH-1	0.14	0.29	0.17	0.23	0.23	0.28	0.22	0.19	0.16
BMH-2	0.20	0.13	0.21	0.23	0.27	0.24	0.15	0.25	0.22

Figure 2. Daily growth value of individual vannamei shrimp (ADG)

The daily growth rate of vannamei shrimp at each sampling interval is displayed in Figure 2. During the dry season, the daily growth rate of vannamei shrimp varies between 0.22 and 0.39 grams per day. The daily growth rate ranges from 0.14 to 0.28 grams per day during the rainy season. Shrimp growth rate tends to reduce after the 70th day of culture, then increase on the 80th day following the first partial harvest, as well as decline on the 90th day and then rise on the 100th day following the second partial harvest.

Survival Ratio **(SR) and** ***Food Conversion Ratio*** **(FCR)**

Shrimp survival is the ratio of the total number of live shrimps at the end of the maintenance period to the shrimp stocked at the beginning of maintenance multiplied by one hundred percent. The size of the shrimp is used to determine the population (number of live shrimp) during each partial and total harvest. Table 3 shows that shrimp retain an average survival value of 98.27% during the summer and 85.73% during the rainy season. The AMK-1 plot had the highest survival value (99.16%), while the B MH-1 plot had the lowest (85.23%). The quality of the fry, water quality, and insect and disease infestations all affect shrimp survival.

The feed conversion value shows how well shrimp can turn the energy from feed into meat through their digestive systems. Shrimps with smaller feed conversion values that are closer to 1 (one) have a better ability to convert feed. When the weight of the shrimp biomass is maintained, the total amount of feed utilized is compared to the feed conversion. If the feed conversion value is 1, one kilogram of feed is required to generate one kilogram of biomass. Table 3 shows that the feed conversion value falls between 1.21 and 1.4 throughout the maintenance time. The summertime average feed conversion value is 1.18 lower than the rainy season average of 1.3.

Table 3. Survival Ratio, Biomass, Total Feed and Food Conversion Ratio

Pond Plot	Observation Parameters			
	Survival Ratio (SR)	Biomass	Total Feed	Food Conversion Ratio (FCR)
AMK-1	99.16	6,532.00	7,903.72	1.21
AMK-2	98.25	5,545.00	7,208.50	1.30
BMK-1	98.27	7,198.00	7,198.00	1.00
BMK-2	97.38	7,474.70	8,969.64	1.20
Total	393.06	26,749.70	31,279.86	4.71
Average	98.27	6,687.43	7,819.97	1.18
AMH-1	86.37	5,129.00	6,667.70	1.30
AMH-2	87.41	4,327.60	5,193.12	1.20
BMH-1	85.23	6,141.00	7,983.30	1.30
BMH-2	83.92	5,197.00	7,275.80	1.40
Total	342.93	20,794.60	27,119.92	5.20
Average	85.73	5,198.65	6,779.98	1.30

Water Quality

Water quality is influenced by many factors including environmental factors, sea tides, weather, sunlight intensity, rainfall intensity, increased volume of organic material from leftover feed and shrimp waste, as well as the accumulation of phytoplankton, zooplankton, and decomposing bacteria in the pond. The purpose of water quality measurement is to predict and preserve water quality so that it stays within the ideal range for shrimp life. Shrimp growth and survival are significantly impacted by the quality of the water. The outcomes of water quality tests can be used as a reference for managing shrimp health issues and implementing preventative actions. Table 4 displays the results of water quality measurements taken throughout the maintenance period.

Table 4. Results of water quality measurements during the maintenance period

Pond Plot	Water Quality Parameters					
	Temperature (°C)	pH	DO (ppm)	NH_3 (ppm)	Salinity (ppt)	Alkalinity (ppm)
AMK-1	29.5-31.3	6.73-7.83	4.75-5.11	0.04 - 0.05	20-24	137-155
AMK-2	29.4-32.8	6.63-7.84	4.55-5.21	0.05 - 0.06	21-25	128-154
BMK-1	29.3-31.5	6.70-7.61	4.93-5.01	0.06 - 0.08	20-25	145-153
BMK-2	28.2-32.8	6.67-7.88	4.75-5.00	0.06 - 0.071	19-24	132-144
AMH-1	27.3-29.2	6.68-7.83	4.15-4.21	0.07 - 0.12	17-22	122-143
AMH-2	28.4-30.2	6.78-7.64	4.21-5.43	0.08- 0.43	16-21	132-147
BMH-1	27.3-29.2	6.61-7.43	4.32-5.31	0.06 - 0.23	17-20	120-136
BMH-2	27.1-31.2	6.63-7.52	4.25-4.80	0.03 - 0.23	18-21	119-132
Standard*	29-30*	6.5 – 8*	4 – 6*	< 0.8*	15-25*	120-160*

Discussion

Shrimp growth differs from that of other fish or animal species in certain ways. In shrimp, molting (skin changes) is a sign of growth. The shrimp will either develop slowly or struggle to grow if the skin change process is hampered. Shrimp growth, according to Witoko *et al.* (2018), is the result of protoplasmic addition, ongoing cell creation, and three-dimensional addition that only takes place during skin modifications.

In the first sampling on the 30th day, the average weight of individual shrimp kept in the dry season was 3.28 gr/pcs, and in the rainy season 3.04 gr/pcs. The increase in individual shrimp weight tended to continue to increase until the end of the maintenance period, the average individual weight value was 41.58 gr/pcs in the dry season and 35.11% in the rainy season (Table 2). The average shrimp weight obtained in this study was much higher than that obtained by Hakim, *et al.* (2018) who carried out semi-intensive shrimp maintenance for 112 days. The growth value obtained ranged from 18.8 gr/pcs to 20.4 gr/pcs. Purnamasari, *et al.* (2021) obtained an average weight of 29.18 gr/pcs–29.23 gr/pcs for a maintenance period of 126 days. Yunarty, *et al.* (2022) with an average individual weight of 21.98 gr/pcs for a 105-day maintenance period with an intensive pattern. Witoko, *et al.* (2018) obtained an average individual weight of 19.3 gr/day of maintenance in floating net cages during a maintenance period of 80 days. The difference in individual weight obtained was due to differences in cultivation systems and the stocking density applied. The high increase in individual weight from this study was due to a regular feeding pattern, good quality feed provided, strict adjustment of the amount of daily feed based on shrimp appetite, and good water quality management.

Shrimp growth was also greatly aided by the daily addition of probiotics to the feed and maintenance media. Shrimp could use natural feed, which consists of clumps of organic material from residual feed and shrimp feces, bacteria, plankton, and other microorganisms, in addition to obtaining energy sources from direct feed. According to Suwoyo, Bunga (2015), heterotrophic bacteria start to produce flocs when they reach a rather high population density. A number of major phytoplankton species, including *Oscillatoria* sp., *Protoperidinium* sp., *Chlorella* sp., *Cryptomonas* sp., *Ceriatium* sp., *Diplosalis* sp., *Eutreptia* sp., and *Thallasionema* sp., were present in biofloc in addition to bacteria. Additionally, the zooplankton kinds include worms, *Coppepoda* sp., and *Branchionus* sp.

In the meanwhile, adding probiotics to diet could enhance the nutrients absorption and digestion. According to Wijayanto *et al.* (2020), it was believed to be the result of the shrimp metabolism process improving as a result of absorbing feed that had been fermented with probiotics. According to Citra *et al.* (2018), the quantity of probiotics administered to shrimp can have an impact on their growth since these bacteria can enhance the quality of the water and the digestion of their digestive tracts, resulting in healthy growth.

Climate and water quality were considered to be significantly impacted by variations in crop areas and locations. In the meantime, climate changed and variations in rainfall were mostly responsible for the growth disparities between upkeep during the summer and rainy seasons. There was a lot of rainfall throughout the rainy season. and happened nearly daily. These circumstances made it easy for water quality indicators like temperature, pH, and alkalinity to fluctuate. During the rainy season, sufficient lime application was required to preserve water stability.

The difference in survival rate (SR) in each pond between the dry season and the rainy season could be seen in Table 3. This study showed shrimp survival value was significantly higher than research result of Hakim *et al.* (2018), whose SR value ranged from 58% to 100%; Yuniarty *et al.* (2022), whose SR value peaked at 88.41%; and Witoko *et al.* (2018), whose SR value was 33%.

Shrimp survival was influenced by internal factors that include genetic factors, antibodies, and resistance to environmental changes. While external factors were environmental conditions and the presence of pathogens. Shrimp will be healthy if genetic and environmental factors are good. Probiotics applied to the maintenance media improve water quality conditions, while those applied to feed will increase the shrimp's immune system. This is in line with what Citria, *et al.* (2018) stated that probiotics can increase shrimp's immune system because the bacteria contained in probiotics can suppress the growth rate of bacterial growth and stimulate the formation of hemocyte cells which function to increase the body's immunity from bacterial infections.

The maximum FCR value for shrimp rearing is 1.4 (Supono, Wardiyanto, 2008). The feed conversion value obtained during the dry season maintenance period ranges from 1-1.21 and during the rainy season ranges from 1.2-1.4. This showed that to produce 1 kg of shrimp during the rainy season maintenance period, much more feed was needed.

This indicated that in addition to the occurrence of excess feed (*overfeeding*), it was also caused by fluctuating environmental carrying capacity so that food digestibility was less than optimal. The dominant environmental factor that affected food digestibility was temperature. A decreasing in temperature during rain, affected metabolism. A decreasing in pH and alkalinity could have an impact on stress on the shrimp was being raised and disrupted the molting process.

Water quality significantly affected the survival rate and growth of shrimp was affected by disturbed molting frequency. The range of water quality for shrimp maintenance in the dry season and the rainy season was still within the optimal range to stimulate shrimp growth and survival rate. The lowest temperature value was 27.3ºC and the highest was 32.8ºC. According to Hilman, Adijaya (2005), the ideal temperature range for vannamei shrimp growth is 26 ºC–32 ºC. In the meantime, Witoko *et al.* (2018) state that the ideal temperature range is between 28ºC and 32ºC.

Vannamei shrimp life and growth were significantly impacted not just by temperature but also by the water's acidity. If the pH value of the water was less than 5, shrimp wiould grow slowly; if it was more than 10, they would perish (Witoko *et al.* 2010). The stability of pH was influenced by the alkalinity value of the water, if the alkalinity value was low, the pH tended to fluctuate and would to decrease if it rains or there was a process of decomposition of organic matter from leftover feed and shrimp feces. The results of pH measurements during the study were the lowest at 6.63 and the highest at 7.88, while alkalinity ranged from 120-155 ppm. According to Suwoyo, Tampangallo (2015), biofloc in ponds was significantly impacted by pH variations. Another element contributing to shrimp stress was acidity level (pH).

Dissolved oxygen (DO) from this study obtained a range of 4.21-5.43 ppm, salinity 16-25 ppt, while the ammonia (NH_3) value ranged from 0.03-0.12 ppm. Changes in water quality parameters were not only influenced by weather and rainfall but also caused by an increase in biomass that was maintained so that it required higher oxygen availability and used along with the length of maintenance time would also increase the input of organic materials from leftover feed and shrimp feces. Therefore, in order to maintain the water quality within the ideal range, excellent and cautious management practices must be continued throughout the maintenance period. The water quality was discovered to vary, but it was still within acceptable bounds and supported shrimp development and survival.

Conclusion

Utilizing probiotics in the cultivation media and in the food had a positive effect on growth performance, shrimp survival ratio, and water quality. The growth performance, survival ratio, and feed conversion values of vannamei shrimp cultivated in the dry season were better than those cultivated in the rainy season. The average SR value was 98.27%, Biomass 26,749.7 kg, ABW 41.58 gr/pcs, ADG 0.27 gr/pcs, this showed better results than compared to the rainy season cultivation period with an average SR value of 85.73%, and Biomass 20,794.6 kg, ABW 35.11 gr/pcs, ADG 0.21 gr/pcs.

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