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Cultivation White Shrimp (*Litopenaeus vannamei*) with Intensive System to Growth Rate, Survival Rate, and Feed Conversion Ratio

Budidaya Udang Vannamei (Litopenaeus vannamei) dengan Sistem Intensif Terhadap Pertumbuhan, Kelangsungan Hidup dan Feed Conversion Ratio

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Abstract

Intensive vannamei shrimp cultivation is a high-density culture to get maximum results with the use of limited cultivation space. High cultivation activities cause high waste production, which inhibits growth, survival rate, and feeds conversion ratio (FCR). This study aims to determine the cultivation of vannamei shrimp with an intensive system on growth, survival rate, and FCR. The research was carried out in Lengokjawa, Pangandaran in the period March–May 2022. The research was carried out by means of a survey and analyzed by a quantitative descriptive approach. The results of the study obtained growth values, namely: Mean Body Weight (MBW) ranges from 1.61 to 21.11 g/head, Average Daily Growth (ADG) ranges from 0.14 to 0.62 g/day, size is 49 fish/kg and biomass is 7,680 kg. The survival rate value obtained is around 95.07 – 84.87%, while the feed conversion ratio (FCR) value ranges from 1.2 to 1.5. In general, the results of growth, survival rate, and FCR showed high performance and supported the success of vannamei shrimp culture with intensive systems.

Keywords: White Shrimp, Intensive, Growth Rate, Survival Rate, FCR

Abstrak

Budidaya udang vannamei secara intensif merupakan budidaya dengan kepadatan tinggi untuk mendapatkan hasil maksimal dengan pemanfaatan ruang budidaya yang terbatas. Kegiatan budidaya tinggi menyebabkan produksi limbah juga tinggi, hal tersebut menghambat pertumbuhan, kelangsungan hidup dan *Feed Conversion Ratio* (FCR). Penelitian ini bertujuan untuk mengetahui budidaya udang vannamei dengan system intensif terhadap pertumbuhan, kelangsungan hidup dan FCR. Penelitian dilaksanakan di Lengokjawa, Pangandaran pada periode Maret – Mei 2022. Penelitian dilaksanakan dengan cara *survey* dan dianalisis dengan pendekatan deskriptif kuantitatif. Hasil penelitian diperoleh nilai pertmbuhan, yakni: *Mean Body Weight* (MBW) berkisar 1,61 – 21,11 g/ekor, *Average Daily Growth* (ADG) berkisar 0,14 - 0,62 g/hari, *size* sebesar 49 ekor/kg dan biomassa sebesar 7.680 kg. Nilai kelangsungan hidup yang didapatkan sekitar 95,07 – 84,87%, sedangkan untuk nilai *Feed Conversion Ratio* (FCR) berkisar 1,2 –1,5. Secara umum, hasil pertumbuhan, kelangsungan hidup dan FCR menunjukan performa yang tinggi dan mendukung keberhasilan budidaya udang vannamei dengan system intensif.

Kata Kunci: Udang vannamei, intensif, pertumbuhan, kelangsungan hidup, FCR

1. Introduction

Vannamei shrimp is a fishery commodity that has high economic value that is widely cultivated. Vannamei shrimp breeding activities are strongly influenced by the breeding technology used. Breeding Vannamei shrimp can be done using intensive technology. Intensive technology is applied to ponds equipped with plastic mulch, water pumps, wheels or aerators as oxygen suppliers and application of feed or pellets and high stocking densities ranging from 100-300 ind/m^2 (Purnamasari *et al*., 2017; Rangka & Burhanuddin, 2016). High-density farming of vannamei shrimp aims to increase production. Vannamei shrimp can be produced after a maintenance period of 60-120 days or a size of 20-40 g/tails and the productivity of vannamei shrimp ranges from 10-15 tons/ha (Peraturan Menteri Kelautan dan Perikanan Nomor 75 Tahun 2016).

Cultivation of Vannamei shrimp with intensive technology can cause various problems if not managed properly. High production will affect the waste load produced both by leftover feed if the feed conversion rate is high, as well as by manure or shrimp waste (Mangampa & Suwoyo, 2010; Syafaat *et al*., 2012). Shrimp farming waste can lead to population decline and damage or decrease in the quality of the aquatic environment as a living medium (Muqsith, 2014). Decreased environmental quality can hinder the growth of vannamei shrimp, conversely optimal pond water quality will provide living space for shrimp to live properly and develop optimally (Supriatna *et al*., 2020).

Vannamei shrimp can grow well in an aquatic environment that is preserved in both quality and quantity. In a suitable environment according to the needs of the shrimp, the survival rate is high and the growth of the shrimp is optimal so that the production target is reached as expected (Supriatna *et al*., 2020). Therefore, the quality of aquaculture water is an important factor in Vannamei's technology-intensive shrimp farming. The quality of Vannamei shrimp aquaculture water is prone to changes, which may hamper farming activities. According to Harianja *et al.* (2018), several factors that can affect the quality of aquaculture water for Vannamei shrimp are uneaten food, excrement from dead organisms and plankton breeding, and organic matter in the form of suspended and dissolved solids transported through the water Water intake, which is a source of organic matter in ponds, so this affects the water quality. Leftover fish feed is a key factor in pond water quality deterioration, while dead shrimp in ponds have less of an impact on water quality deterioration than leftover fish feed or feces (Hangsheng *et al*., 2008; Syah *et al*., 2014).

Using excess feed or feed that is not used properly can inhibit Vannamei shrimp production and growth. The need or use of feed in the intensive technological Vannamei shrimp farming needs to be considered, as it is related to the growth, survival and accumulation of organic matter in ponds, as well as production cost efficiency. Feed requirements can be managed by calculating the Feed Conversion Ratio (FCR) value. Good FCR values in technology-intensive Vannamei shrimp farming activities range from 1,1 to 1,2 (Wyban & Sweeney, 1991). The FCR value must be reduced as little as possible; this study aims to reduce production costs. Conversely, a high FCR value leads to media water pollution through the accumulation of uneaten food and the rapid excretion of ammonia, which can inhibit shrimp growth and survival (Syafaat *et al*., 2012). Therefore, it is necessary to research the breeding of Vannamei shrimp with an intensive system for growth, survival, and FCR.

2. Material and Method

2.1. Research Location

The research was conducted in intensive aquaculture ponds in Legokjawa area, Pangandaran from March to May 2022.

2.2. Method

The research was conducted using a survey method by collecting data on aquaculture ponds. The data collected consisted of growth data (mean body weight, average daily growth, height and biomass), survival and Feed Conversion Ratio (FCR). The observed data were analyzed using a quantitative descriptive approach to obtain growth, survival and FCR values of vannamei shrimp.

2.3. Data Analysis

2.3.1. Vannamei Shrimp Growth

Mean Body Weight (MBW) is average weight of the shrimp obtained at the time of sampling. According Purnamasari *et al.* (2017) MBW can calculated using the formula below:

$$\text{MBW} = \frac{\text{Shrimp Weight (g)}}{\text{Number of shrimps sampel (shrimp)}}$$

Average Daily Growth (ADG) is speed growth shrimp based on addition heavy shrimp daily average in period time certain. According Suriawan *et al.* (2019) ADG can calculated using the formula below:

$$\text{ADG (g/day)} = \frac{\text{initial MBW - Final MBW}}{\text{Rearign periods (days)}}$$

Size is the size of the shrimp based on the number of shrimp in 1 kg (1000 g) of shrimp weight. According to Umidayati *et al.* (2021), size is the number of shrimp per kg with the following formulation:

$$\text{Size} = \frac{1000\ (g)}{\text{MBW (g)}}$$

Biomass is the weight or weight of the completely cultivated shrimp. According to Effendi (2000), the calculation of biomass can be calculated using the following formula:

$$\text{Biomass} = \frac{\text{Feed per day}}{\%\text{Food Ratio}}$$

2.3.2. Survival Rate of Vannamei Shrimps

Survival rate is the percentage level of live shrimp at the end of cultivation activities. The SR value is obtained by calculating the number of initial stockings and the number of survivors at the end of cultivation. According to Effendie (1979), the calculation of SR can be done using the following formula:

$$\text{SR} = \frac{\text{Number of Harvested shrimps}}{\text{initial number of shrimps}} \text{ x } 100\%$$

2.3.3. Feed Conversion Ratio

Feed Convertion Ratio (FCR) is the total weight of artificial feed compared to the total weight of harvested shrimp. According to Pratama *et al.* (2017), the FCR value can be obtained from the following formula:

$$\text{FCR} = \frac{\text{Pakan komulatif (kg)}}{\text{Biomassa (kg)}}$$

3. Result and Discussion

3.1. Vannamei Shrimps Growths

The growth of the Vannamei shrimp was quite good during the study period (Daily of Culture / DOC 30-90). The results of growth of Vannamei shrimp are shown in Table 1.

Table 1. Vannamei Shrimp Growth

No	Growth Parameters	Value	Comparison value	Reference
1	*Mean Body Weight* (g/tails)	1,61 – 20,11	12,1-20,0	Witoko *et al.* (2018)
2	*Average Daily Growth* (g/day)	0,14 – 0,62	0,14-0,35	Purnamasari *et al.* (2017)
3	*Size* (tails/kg)	49	55	Akmal *et al.* (2021)
4	Biomassa (kg)	7680	15.000	Permen KP No. 75 Tahun 2016

The Mean Body Weight (MBW) values obtained ranged from 1,61 to 20,11 grams/head (Fig. 1). This value is consistent with the research by Witoko *et al*. (2018) where the average shrimp weight is between 12,1 and 20,0 grams/head at DOC 81-120. A high MBW value indicates that the shrimp can use and digest food, so it has an impact on the weight gain of the Vannamei shrimp. Providing good quality and high protein feed can promote the growth of Vannamei shrimp that are intensively farmed. According to Mudeng & Longdong (2019), protein contained in feed is used for body maintenance, body tissue growth and replacement of damaged body tissues. Protein-rich feed can optimally increase the growth of Vannamei shrimp (Kaligis, 2015).

The Average Daily Growth values (ADG) obtained during the rearing phase (DOC 30-90) ranged from 0,14 to 0,62 g/day (Fig. 2). The ADG values obtained were very good, ranging from 0,98 to 4,34 g/week. A high ADG value indicates that shrimp farming with an intensive system affects the growth of Vannamei shrimp. According to Purnamasari *et al.* (2017), Vanammei shrimp are said to be growing well when the growth rate reaches 1-2,5 g/week or about 0,14-0,35 g/day. Average ADG increased every day except DOC 41, 62 and 90. The ADG value decreased from 0, 21 g to 0,16 g in DOC 41, which was influenced by an increase in ammonia value, so the appetite and metabolism of the shrimp were greatly affected. The ammonia value obtained was 2,5 mg/l, while the maximum required for Vannamei shrimp culture was 0,1 mg/L (Atmomarsono *et al*., 2014). The high ammonia value in the intensive culture is caused by the content of organic substances or feed residues, which are not optimally utilized and accumulate at the dead center of the pond. Unstable water quality such as high ammonia levels can affect the growth of the shrimp, e.g. B. lack of appetite of the shrimp, which can lead to stress and death of the shrimp (Jumraeni *et al.*, 2020).

The decrease in shrimp appetite affects the body's metabolic processes of shrimp. Metabolism of the shrimp is influenced by the protein and energy content of the feed. Considering the energy content of the feed, the better the protein is utilized by shrimp, so the formation of body tissue and more optimal. According to Winaldi

(2017), shrimp can grow optimally when the feed given has sufficient energy content to meet daily metabolic energy needs and high enough protein content to build or repair damaged cells and for growth. The size values obtained during rearing (DOC 30-90) were between 621 and 49 fish/kg. The size value at the end of rearing is placed in the high category (20,40 g/tails). According to Akmal *et al.* (2021), the size value in DOC 88 was 55 tails/kg or 18,18 g/tails, showing that size higher weight in research activities with almost the same rearing time. A high weight value indicates that the Vannamei shrimp breeding activities have experienced good growth. The good growth of Vannamei shrimp is due to the provision of feed that has been mixed with probiotics and vitamin C to allow the nutrients in the feed to be properly absorbed and digested by the shrimp. According to Anwar *et al.* (2016), adding probiotics to feed can improve feed quality by adding addictive ingredients in the form of decomposing microbes contained in probiotics. In addition, the breakdown bacteria found in probiotics can be useful for regulating the microbial environment in the gut, inhibiting pathogenic microorganisms in the gut, and improving feed efficiency by releasing enzymes that can aid in the digestion of food

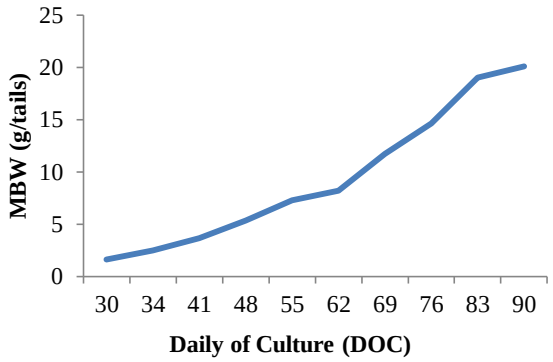

Figure 1. Mean Body Weight (MBW)

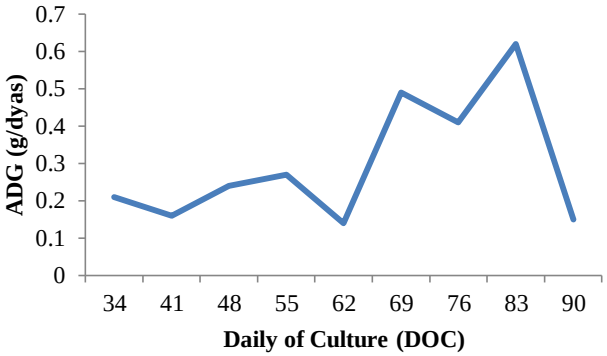

Figure 2. Average Daily Growth (ADG)

The value of biomass (DOC 30-90) obtained during rearing was 7.680 kg (7,68 tons) with a pond area of 3,000 m^2 (0.3 hectares). This biomass value belongs to the high category compared to the standard that cultivation of Vannamei shrimp can produce 10,000–15,000 kg/hectare (Peraturan Menteri Kelautan dan Perikanan Nomor 75 Tahun 2016). From this it can be concluded that the biomass production of Vannamei shrimp is more than half of the established maximum production, but with an area of not more than 0,5 hectares. The value of the obtained biomass is directly proportional to the value of MBW, ADG and size during the rearing period; this shows that during the rearing of the shrimp experienced good growth with intensive technology. Shrimp growth during rearing is related to protein synthesis in the shrimp body, which affects shrimp weight gain. According to Winaldi (2017), the protein found in shrimp food is directly related to supporting protein synthesis in the body. Increased levels of protein in the body means shrimp can make optimal use of the protein in their diet for body needs such as repairing damaged cells and for growth and biomass gain.

3.2. Survival Rate Vannamei Shrimps

The survival rate (SR) of Vannamei shrimp during the rearing period (DOC 30-90) ranged from 95,07 to 84,87% (Figure 3). The SR value obtained during nursing is included in the high category, this is in line with Renitasari *et al.* (2021) revealed that SR value reaching 80% is in the high growth category, while a good SR - Value for a total harvest is more than 70%. The high SR value is caused by a low mortality rate. The low mortality rate is influenced by several factors, including the nutritional needs in the feed given have been fulfilled and cause the shrimp to grow optimally.

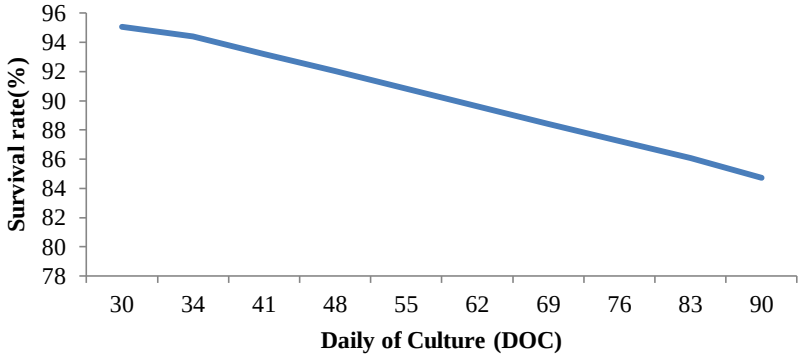

Figure 3. Survivale Rate Vannamei Shrimp

The vannamei shrimp feed that is given must fulfill the nutritional needs of the shrimp; it is given on time and the dose very sufficient so it can affect the survival rate of the shrimp (Rais, 2018). Vannamei shrimp require feed with a protein content of at least 35% of the total nutrients contained in the feed. Feed is a factor that dominantly influences the growth of aquatic biota (fish and crustaceans) because feed serves as a supplier of energy to stimulate growth and maintain survival. According to Nuhman (2009), the use of different feeds has no effect on survival.

3.3. Feed Conversion Ratio

Feed Conversion Ratio (FCR) is the ratio of the amount of feed given to the amount of biomass. FCR is used to find out how much feed is needed to produce one kilogram of meat. FCR values obtained during maintenance range from 1,25 to 1,52 and are still in a good category for aquaculture activities. According to Arsad *et al.* (2017), the maximum FCR value for Vannamei shrimp farming is 1,5. FCR values that are too high can lead to higher production costs for feed. According to Handajani & Widodo (2010), in an intensive fishing system, artificial feed is needed to meet the nutritional needs of fish, with feed costs affecting production costs by 60%. Conversely, a low FCR value is better because feed costs are also lower, resulting in higher profits at the end of the rearing.

The FCR value is an indicator of the successful production of Vannamei shrimp farming. A low FCR value indicates that the feed given during rearing can be well ingested and utilized by the shrimp. According to Samadan *et al*. (2018), properly ingested and utilized feed affects efficiency feed and shrimp growth can be stable because the nutrients contained in the feed are properly utilized. Furthermore, Supono (2017) explained that the low FCR value is caused by the biology of Vannamei shrimp, which are omnivores that can utilize natural food from ponds such as plankton and detritus contained in the water column thereby reducing feed intake in the form of pellets. Reducing the input of pellets in the form of feed causes the potential for waste generated from vannamei cultivation activities.

4. Conclusion

The results of research on vannamei shrimp farming with an intensive system on growth, survival and Feed Conversion Ratio (FCR) are still in the good category for aquaculture activities. The growth values of vannamei shrimp cultivation with an intensive system obtained include Mean Body Weight ranging from 1,61 to 21,11 grams/tails, Average Daily Growth (ADG) ranging from 0,14 to 0,62 g/day, size of 49 tails /kg, and biomass of 7,680 kg. The survival rate obtained was around 95,07 – 84,87%, while the Feed Conversion Ratio (FCR) ranged from 1,2 – 1,5. FCR values can be reduced by maintaining water quality at the required limit in order for shrimp, not to experience stress that can be affecting in feed appetite, so that metabolic processes and the efficiency of nutrient uptake and feeding are inhibited. In general, the results of growth, survival, and FCR show high performance and support the success of Vannamei shrimp farming with an intensive system.

5. Suggestion

Cultivation of shrimp vannamei with system-intensive showing high-performance _ and supports successful cultivation. However, the successful cultivation of shrimp vannamei with system-intensive and not free from the management of quality waters. Results study show that enhancement ammonia takes effect to decline lust eat and metabolism of shrimp so which hinders growth. Therefore, needed the effort to manage quality waters to guard the stability cultivation of shrimp.

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