

Growth rate and survival of green shells (*perna viridis* L.) Inponds, alue naga village, banda aceh

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Abstract. Alue Naga is one of the coastal and marine areas in the city of Banda Aceh which has the potential for aquaculture and high economic value, namely green mussels (*Perna viridis* L). This research aims to determine the growth and survival rate of green mussels with different stocking densities in Alue Naga ponds which are still influenced by the tides of seawater. The layout of the green mussel cultivation container is at the pond water gate. The method used is an experimental test method using a Completely Randomized Design (CRD) model with 3 treatments, each treatment 3 times repeated. Research shows that the best average growth and survival rate for green mussels are found in treatment A with a stocking density of 20 seeds/basket, absolute length growth with an average value of 45.52 ± 0.42 mm, weekly length growth rate with an average value -an average of 3.79 ± 0.03 mm/week and an average weight of 25.92 ± 0.19 grams, while the survival rate reached 91.66%. Differences in green mussel stocking density had a significant effect on absolute length growth (PM), absolute weight (BM), and weekly length growth rate (LPPM), while survival (SR) had no significant effect.

1 introduction

Alue Naga is one of the coastal and marine areas in the city of Banda Aceh which has the potential for aquaculture and has high economic value, namely green mussels (*Perna viridis* L). Green mussels (*Perna viridis* L) are a type of shellfish that can live in bay waters, estuaries, waters around mangrove areas, and river estuaries, with environmental conditions where the bottom of the waters are muddy mixed with sand, with sufficient light, and salt levels that are not too high [1]. Green mussels are widely used locally for aquaculture because of their economic value and delicious taste. The increasingly rapid development of industry causes high levels of pollution in waters caused by the large number of industries dumping waste in waters, thus affecting the biological processes of aquatic biota [2].

The rapid development of green mussel cultivation is due to the ease of cultivation techniques for this species, compared to other biota cultivation technologies. Factors promoting the development of green mussel aquaculture include the relatively fast growth rate of green mussels, which requires a short culture period to reach a consumable size [3,4,5].

Growth rate is an overall measurement of performance which is easy to interpret

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(profitable when increasing or detrimental when decreasing) and growth is related to birth and death rates. This can have important influences on population and community structure [6]. The growth of green mussels depends on energy supply and the body's metabolic processes. Salinity, dissolved oxygen content and media temperature are related to the growth of green mussels [7]. Similar results in the waters of Semarang Bay, the relative growth rate obtained in Tambak Lorok which is on the coast of Semarang Bay for 60 days shows that the average relative growth rate at the first station was 220.69%, the second station was 190.16% and the second station was 190.16%. third amounted to 133.33%. Appropriate environmental parameters will influence the growth of green mussels such as depth, temperature, water, salinity and oxygen content [8].

The potential of ponds in Banda Aceh is very profitable if used well, and there are still many ponds around coastal areas that are neglected, because people have not utilized ponds properly. According to observations in the field, green mussels are one of the biota that can be cultivated in ponds, the same as research studies in Tambak Lorok, Semarang. The cultivation of green mussels in ponds is very controlled compared to in reservoirs, this is because the pond environment is not easily contaminated by other waste, and the optimal salinity does not decrease which could result in green mussels dying as a result of the decrease in salinity, temperature, and DO [9].

2 Material And Method

2.1 Time and Place

Data collection was carried out from January to March 2022. This research was conducted in Alue Naga Waters, Syiah Kuala District, Banda Aceh.



Fig. 1. Map of research locations in Alue Naga, Banda Aceh

2.2 Material and Tools

The main tools used in this research were baskets, hanging ropes for baskets, bamboo. Meanwhile, the material used in this research was green mussel seeds.

2.3 Method of Data Collection

The research method used was an experimental method using a Completely Randomized Design (CRD) model with 3 treatments and 3 replications. Sampling was carried out once a week for 12 weeks. The total number of seeds was 225 seeds, with different densities, namely 20, 25 and 30/basket. Baskets A1, A2, A3 contain 20 seeds, baskets B1, B2, B3 contain 25 seeds, while baskets C1, C2, C3 contain 30 green mussel seeds. Weekly measurements of the length and weight of the clams were measured randomly using dice.

2.4 Container Preparation and Sample Testing

The container used in this research used a rectangular basket measuring (30 x 50 cm), with a plastic basket type, PP Block Copolymer material. The basket is placed on top of the pipe as a support for the basket. Light pipes are installed on the left and right to prevent the basket from shifting and tilting. Then the green mussels are tied using a 60 cm long fiber rope for attachment. The basket is made floating in the middle of the pond, tied to bamboo as a support. The green mussels used in this research were green mussel seeds measuring 27-32 mm obtained from the Alue Naga reservoir. Containers are differentiated based on the density of 20 seeds, 25 seeds, and 30 seeds/basket using the floating method.

2.5 Growth Parameters

Green mussel growth and weight parameters including absolute length, absolute width, LPPM, and survival of green mussels were analyzed using the ANOVA test of variance prog, to see if there was a significant effect ($P < 0.05$) and continued with the Duncan further test. to see more clearly the differences.

2.6 Data Analysis

2.6.1 Absolute Length

The absolute length growth of green mussel shells was measured using the following formula [3].

$$L = L_2 - L_1$$

Where,

L = Absolute length (cm)

L2 = Final length (cm)

L1 = Initial length (cm)

2.6.2 Weekly Length Growth Rate

The weekly length growth rate can be calculated using the formula [10]:

$$WLGR = \frac{L_t - L_o}{t}$$

Where,

WLGR = Weekly length growth rate (cm)

Lt = Average length at the final of research (cm)
L0 = Average initial length of research (cm)
t = Sampling time (12 minggu)

2.6.3 Absolute Weight

The weight growth of green mussels was measured using the following formula [11]:

$$W = W_t - W_o$$

Where,

W = Absolute weighted average (g)
Wt = Average weight of individuals at time – t
Wo = Average individual weight at the start of research

2.6.4 Survival Rate

Calculating the survival of green mussels uses the following formula [12]:

$$SR = \frac{N_t - N_o}{N_o} \times 100\%$$

Where,

SR = Survival rate (%)
Nt = Number of shellfish at the final of research (sample)
No = number of shellfish at the start of research (sample)

3 Results And Discussion

3.1 Results

The results of research on the growth of rate increase every week with various treatments. Treatment A (stocking density of 20 green mussels) had the fastest growth rate compared to treatments B (stocking density of 25 green mussels) and C (stocking density of 30 green mussels) can be seen in (Figure 1). Based on the absolute length and weight growth charts, green mussels recorded an increase in growth every week, with the highest growth achieved by treatment A at a stocking density of 20 seeds/basket, with an average absolute length of 45.52 mm and weight 25.92 g.

The test results obtained using ANOVA also showed that stocking density had a significant effect ($P < 0.05$), namely on absolute length growth, weekly length growth rate, and weight growth. The highest treatment was obtained in treatment test A, with the lowest stocking density of 20 seeds/basket with an average absolute length value of 45.52 mm, an average absolute weight of 25.92 g, and a long weekly with an average of 3.79 mm. Meanwhile, for survival, the results of the ANOVA test showed that there was no significant effect ($P > 0.05$), where the differences in changes were not too much different between treatments, with the highest treatment having a stocking density of 20 seeds/basket reaching 91% (Table 1).

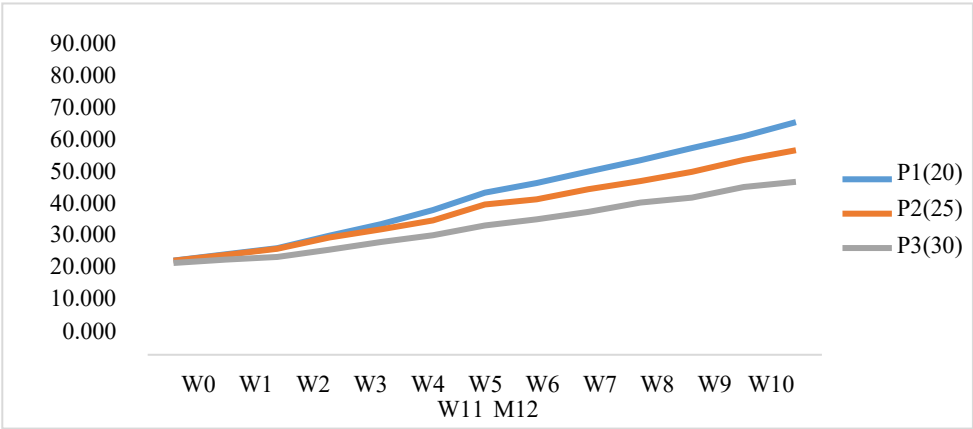


Fig. 1. Graphic growth rate of green mussels with block P1 (treatment A), P2 (treatment B), and P3 (treatment C)

Table 1. Treatment results on the growth of Absolute Length (AL), Absolute Weight (AW), Weekly Length Growth Rate (WLGR), and Survival Rate (SR) of green mussels

Stocking Density Treatment	AL (mm)	AW (g)	WLGR (mm/week)	SR (%)
A (Treatment 20)	45,52±0,42 ^c	25,92 ± 0,19 ^c	3,79 ± 0,03 ^c	91,66 ± 2,88 ^a
B (Treatment 25)	36,34±0,10 ^b	22,69 ± 0,61 ^b	3,02 ± 0,00 ^b	90,66 ± 2,30 ^a
C (Treatment 30)	26,69±0,627 ^a	19,39 ± 0,29 ^a	2,22 ± 0,05 ^a	88,89 ± 1,92 ^a

Treatments A, B, and C differ significantly in absolute length (AL), absolute weight (AW), and weekly length growth rate (WLGR). However, there was no significant difference in the survival rate (SR) of green mussels

Table 2. Water quality parameters in pond Alue Naga

Water Quality	Measurement results	Satuan
Flow	0,16	m/s
Salinity	30	ppt
pH	8,7	-
Temperature	28	°C
Dissolved Oxygen	4,8	mg/l

3.2 Discussion

Results from a study conducted over a 12-week period showed that differences in stocking density had a significant impact on absolute linear growth, absolute weight, weekly linear growth rate, and survival rate. was shown. There is no significant effect on survival rate. The best average growth and survival of green mussels was in treatment A with a stocking density of 20 seeds/basket, with an average absolute linear growth rate of 45.52 mm, a weekly linear growth rate of 45.52 mm, and a weekly linear growth rate of 45.52. showed that it was mm. The average weight was 3.79 mm/week, the average weight was 25.92 g, and the survival rate reached 91.66%.

Measurements of green mussel growth in this study included length and weight. The water environmental factors in Alue Naga ponds are very supportive for cultivating green mussels, because the availability of the food needed is sufficient and there is a water flow entrance into the pond so it is possible for food not only to be in the pond. Environmental

factors that greatly influence the growth rate of green mussels are aquatic ecological factors. Environmental factors are important parameters because they influence feed requirements and intake, which can influence the growth rate of shellfish. The process of green mussels looking for food is by filtering particles in the water and then filtering the food in the mantle cavity or called a filter feeder [13]. Filtration speed is related to the length of the clam shell, the longer the clam shell, the faster the filtration [14]. Filtration is influenced by environmental factors such as pH, dissolved oxygen, temperature and salinity [15].

High density will result in reduced feed efficiency, increased energy consumption, reduced feed rate, and digestibility of *Labeo victorianus* [16]. This is in balance with the results of research cultivation of green mussels (*Perna viridis* L) with different methods and densities in the coastal waters of Kuala Langsa, Aceh which were observed for 3 months or 12 weeks with a treatment density of 20 individuals/ 5.30 L bags had the highest survival, compared to treatment densities of 30 and 40 individuals/5.30 L bags, so it can be concluded that the higher the density, the lower the survival and growth of green mussels [17].

Survival rate is a comparison between the number of individuals alive at the end and the beginning from number of individuals [18]. The survival rate of green mussels in each treatment for 12 weeks showed results that were not too different. The highest survival rate in this study was in treatment A, namely 91%, B 90%, and C 88%. However, based on the results of ANOVA analysis, the differences between treatments were not significantly different ($P>0.05$). The treatment that experienced the most deaths was treatment C with a percentage of 88%. This is thought to be because high density will affect the death rate of green mussels. High density will cause predation or competition, where green mussels compete with each other for space, food, and other factors [19]. Competition in space will lead to aggression between green mussels which leads to death [20].

The survival of green mussels is also greatly influenced by temperature, temperatures that are too high can also have a negative effect on the growth and survival of green mussels. The temperature in the results of this research was 28°C, which is still in good condition for the growth of green mussels. Green mussels are best cultivated at natural temperatures ranging from 23-31°C. pH also greatly influences the growth rate and survival of green mussels, changes in pH can result in the activity and growth of green mussels, because low pH will also have low DO. The results of pH measurements in this study were still relatively good, namely 8.7 [21]. The appropriate and good pH used for cultivating green mussels is around 6.5-9. Another important factor that can influence the success of green mussel cultivation is salinity [22]. The salinity measurement results obtained were 30 ppt. Good salinity for green mussel cultivation is between 27-32 ppt [23].

4 Conclusion

The results showed that average growth and survival of green mussels were best in treatment A with a stocking density of 20 seeds/basket. The average absolute linear growth was 45.52 mm, the weekly linear growth rate was 3.79 mm/week, the average weight was 25.92 g, and the survival rate reached 91.66%. Differences in stocking density of green mussels had a significant effect on absolute body length, absolute weight, and weekly body length growth rate, but did not have a significant effect on survival rate.

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