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Success Rate Of Mangrove Crab (Scylla Serrata) Molting With Different Salinity Treatments In Controlled Containers

To cite this article: Suyono 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **755** 012037

Success Rate Of Mangrove Crab (Scylla Serrata) Molting With Different Salinity Treatments In Controlled Containers

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Abstract. Market demand for mud crab (Scylla serrata) is increasing so that its catch in nature is high in the long term. The growth of mud crabs (Scylla serrata) occurs through molting (molting) mechanisms. Softshell crab has a higher economic value than hard shell crab. The purpose of this study was to assess the molting rate of mud crab (Scylla serrata) with different salinity treatments in controlled containers. The study used a completely randomized design (CRD) with three treatments of 20 ppt, 25 ppt, and 30 ppt salinity with three replications. The crabs used are mud crabs (Scylla serrata) measuring 80-175 grams with the carapace still hard. The test parameters include the weight gain and absolute length of the individual, daily growth rate, molting percentage, and survival and mortality rates. Besides, the chemical-chemical parameters of the culture media water and the effectiveness of using controlled containers were also observed. The research data were analyzed descriptively quantitatively. The difference in treatment and the use of controlled containers had a significant effect on the 95% significance level ($\alpha = 0.05$) on all parameters of the response to treatment. Absolute individual weight values 40.6–47.41 grams, absolute individual length 2.6–3.2 cm, molting percentage 75–100%, daily growth rate 1.3–1.6 grams, 75–100% survival and mortality of mud crab (Scylla serrata) 25-16.7%. Optimal salinity level at 20 ppt. Water quality parameters during the study were still feasible for mangrove crab (Scylla serrata) cultivation. Controlled containers using a water rotation system are quite effective for the cultivation of mud crab (Scylla serrata).

1. Introduction

Many types of mud crab (Scylla serrata) live in mangrove areas in coastal areas, but the large exploitation of mangrove crab fishing in the long term causes the population of mangrove crabs (Scylla serrata) to decline drastically (Triyanto et al., 2013). Mangrove crab cultivation is considered profitable because of its fast growth rate and easy maintenance and has a high selling value (Dumas et al., 2012). The growth of mangrove crabs is through a molting process so that they experience a soft shell crab phase during the molting period. Softshell crab has a higher economic value than during the hard shell period, that is, all parts of the crab can be used (Karim, 2015). Mud crabs have a tolerance for high salinity changes making them strong and adaptable. However, to be able to molt perfectly with a relatively fast periodization, mangrove crabs need a habitat with optimal salinity conditions (Sitaba, et al., 2017).

One of the characteristics of crabs is cannibalism (Usman, et al., 2016) which means that if cultivated, you must use a container in the form of a solitary basket made of plastic and see the key water quality parameters in the form of temperature, pH, salinity. Mangrove crab cultivation is generally carried out in ponds and ponds or areas that are the original habitat of crabs in mangrove areas. Along with the increasing need for land, the land for mangrove crab cultivation is getting

smaller. For this reason, a breakthrough in mangrove crab cultivation is needed on a household scale using buckets or other containers that tend to be practical. Thus, more and more coastal communities will be able to cultivate mangrove crabs without having to provide or use large areas of land. The purpose of this study was to determine the optimal level of salinity and the level of efficiency of using controlled containers in the cultivation of mud crab (Scylla serrata).

2. Research Methods

The research was conducted in May-July 2020 at the Nature School, Kaliwlingi Village, Brebes, and at the Fish and Environmental Health Laboratory, Indramayu, West Java. This research is experimental and descriptive, using a completely randomized design (CRD), normality test, and homogeneity test or Kruskal Wallis and Anova with 3 treatments, each with 3 repetitions. Treatment A1: Use of 20 ppt salinity; Treatment A2: Use of 25 ppt salinity; and Treatment A3: Use of 30 ppt salinity. The crabs used are mud crabs (Scylla serrata) measuring 80-175 grams with the carapace still hard. Field observations were carried out in two simultaneous activities, namely measurement of water physicochemical parameters and observation of 12 crab samples that experienced random molting from the total population in each treatment and repeated in a controlled container. Treatment success indicators include molting percentage rate, life level and mortality, and growth including absolute, relative, and daily growth.

3. Results and Discussion

3.1. Result

a) Absolute Individual Weights

Treatments using different salinity levels to the absolute individual weight of mud crab (Scylla serrata) are presented in Table 1 and Figure 1.

Table 1. Growth of absolute individual weight (gr) of mud crab (Scylla serrata)

Repeat	Treatment		
	A1	A2	A3
1	47,00	40,00	45,50
2	45,00	44,75	38,25
3	50,25	36,50	38,00
Average	47,41	40,41	40,60

Source: Research results (2020)

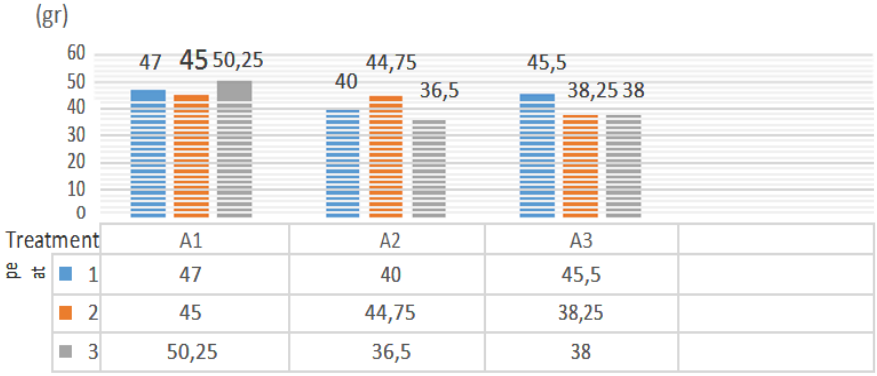

Figure. 1. Weight gain (gr) of mud crab (Scylla serrata)

The final result of the Kruskal Wallis test on weight gain data for mangrove crabs (Scylla serrata) shows that the data is normal and has a homogeneous distribution. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the weight growth of mangrove crabs (Scylla serrata). The asymp. sig value. (0.446)> (0.05). Bodyweight gain ranges from

40.6 - 47.41 grams. The highest increase in body weight growth of tested animals was in A1 treatment (47.41 grams), which was followed by A2 treatment (40.41 grams), and A3 treatment (40.6 grams).

b) Absolute Individual Length

Treatments using different salinity levels for the absolute length increase of mangrove crabs (Scylla serrata) are presented in Table 2 and Figure 2.

Table 2. Growth of absolute individual length (cm) of mangrove crabs (Scylla serrata)

Repeat	Treatment		
	A1	A2	A3
1	3,2	2,6	2,6
2	2,9	2,8	2,4
3	3,2	2,3	2,4
Average	3,1	2,6	2,4

Source: Research results (2020)

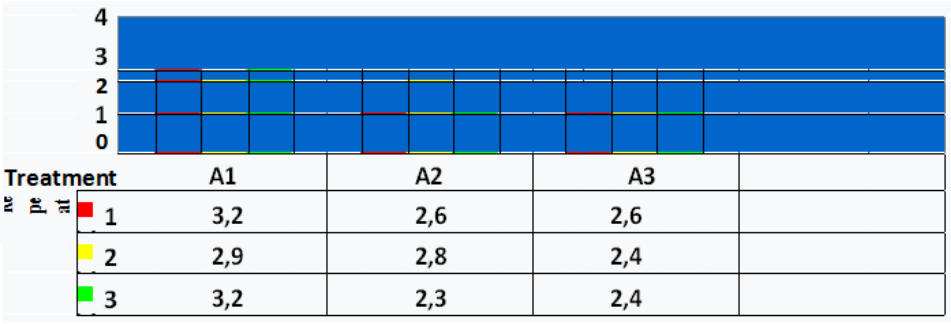

Figure. 2. Increase in Length (cm) of Mud Crab (Scylla serrata)

The final results of the Kruskal Wallis test on the absolute length gain data for mangrove crabs (Scylla serrata) showed that the data were normal and distributed homogeneously. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the absolute length increase of mangrove crabs (Scylla serrata). The asymp. sig value. (0.202)> (0.05). The highest increase in carapace length of the tested animal was obtained in treatment A1 (3.2 cm), then treatment A2 (2.8 cm), treatment A3 (2.6 cm).

c) Daily Growth Rate

Data on the percentage of daily growth rates for each of the different salinity treatments are presented in Table 3 and Figure 3.

Table 3. Percentage of daily growth rate for smelly crabs (Scylla serrata)

Repeat	Treatment		
	A1	A2	A3
1	1,6	1,3	1,5
2	1,5	1,5	1,3
3	1,7	1,2	1,3
Average	1,6	1,3	1,4

Source: Research results (2020)

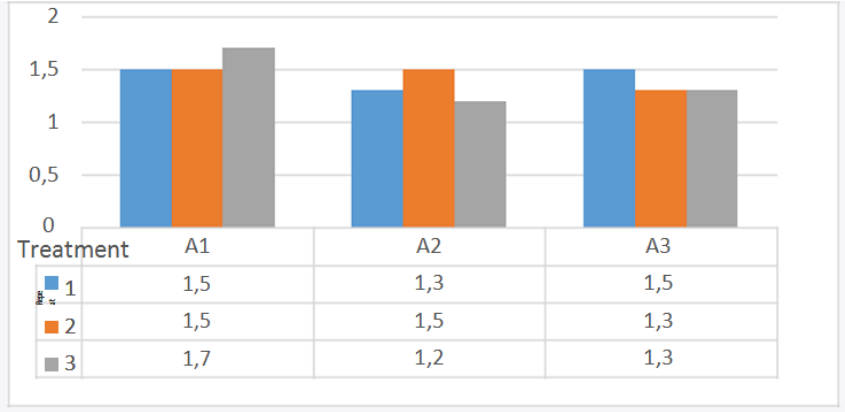

Figure. 3. Percentage of Daily Growth Rate (%) of Mud Crab

The final result of the Kruskal Wallis test on the percentage data of the daily growth rate of mangrove crabs (Scylla serrata) shows that the data is normal and has a homogeneous distribution. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the percentage of the daily growth rate of mangrove crabs (Scylla serrata). The asymp. sig value. (0.113)> (0.05). The highest daily growth rate was obtained in treatment A1 (1.6 cm), then treatment A2 (1.3 cm), treatment A3 (1.4 cm).

d) Molting Percentage

Treatments using different salinity levels to the molting percentage of the tested mangrove crabs are presented in Table 4 and Figure 4.

Table 4. Molting percentage (%) of mud crab (Scylla serrata)

Repeat	Treatment		
	A1	A2	A3
1	75	50	100
2	50	100	100
3	100	75	100
Average	75	75	100

Source: Research results (2020)

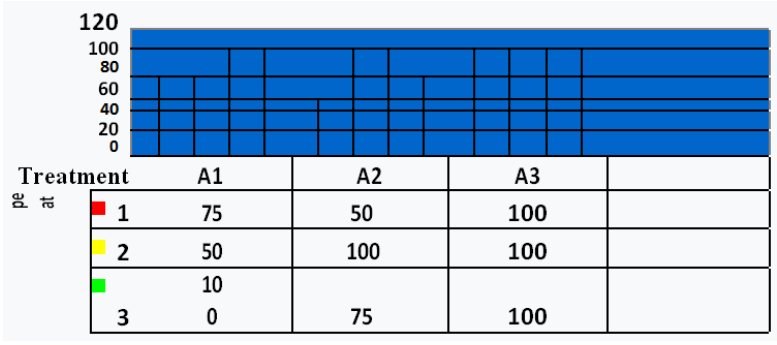

Figure. 4. Percentage (%) Molting Mud Crab (Scylla serrata)

The final results of the Kruskal Wallis test on the molting percentage data of mangrove crabs (Scylla serrata) show that the data is normal and has a homogeneous distribution. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the molting percentage of mangrove crabs (Scylla serrata). The asymp. sig value. (0.230)> (0.05). The molting

percentage produced in this maintenance ranges from 75 - 100%. The highest percentage of molting resulted in treatment A1 (75%), followed by A2 treatment (75%) and A3 (100%).

e) Survival Rate

Survival data for mud crab (Scylla serrata) at different salinity levels are presented in Table 5 and Figure 5.

Table 5. Percentage of Mud Crab Survival Rate (Scylla serrata)

Repeat	Treatment		
	A1	A2	A3
1	75	50	100
2	50	100	50
3	100	75	100
Average	75	75	83

Source: Research results (2020)

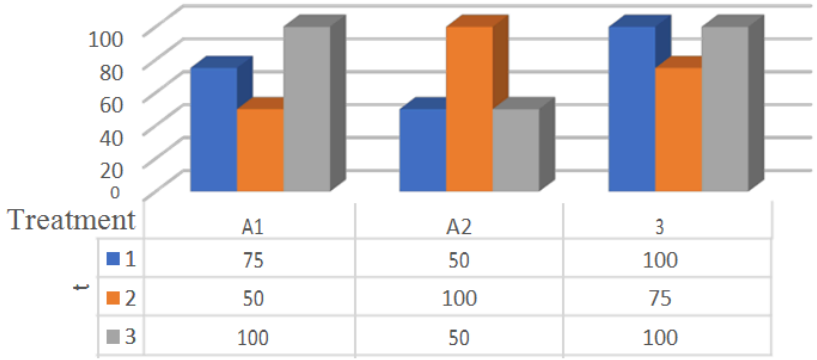

Figure. 5. Percentage of Mud Crab (Scylla serrata) Survival Rate

The final results of the Kruskal Wallis test on the survival rate percentage data for mangrove crabs (Scylla serrata) showed normal data and homogeneous distribution. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the survival rate percentage of mangrove crabs (Scylla serrata). The asymp.sig value. (0.859)> (0.05). The highest survival was obtained in treatment A1 (75%), A2 (75%), and A3 (100%).

f) Mortality

Testing of mud crab (Scylla serrata) mortality using different salinity levels is presented in Table 6 and Figure 6.

Table 6. Percentage of mud crab (Scylla serrata) mortality

Repeat	**Treatment**		
	A1	**A2**	**A3**
1	25	50	0
2	50	0	50
3	0	25	0
Average	25	25	16,7

Source: Research results (2020)

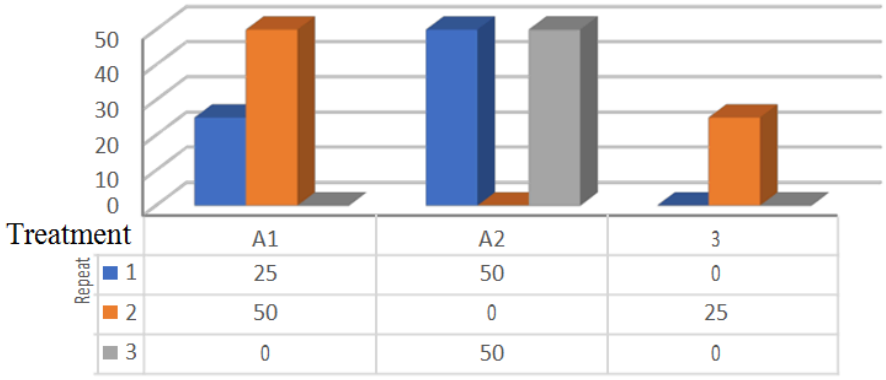

Figure. 6. Percentage of Mortality for Mud Crab (Scylla serrata)

The final result of the Kruskal Wallis test on the mortality percentage data for mangrove crabs (Scylla serrata) shows that the data is normal and has a homogeneous distribution. The results of the analysis of variance showed that the treatment is given had a significant effect (P> 0.05) on the mortality percentage of mangrove crabs (Scylla serrata). The asymp. sig value. (0.859)> (0.05).The percentage of mortality resulting from this breeding ranges from 20-26.67%. The highest percentage of mortality resulted in treatment A1 (25%), A2 (25%), A3 (16.7%).

g) Physical-Chemical Parameters of Water

The results of the measurement of important water-chemical parameters during the study are presented in Table 7.

Table 7. Results of water measurements

Parameters	Measurement Results	Standardized (Hastuti, et al., 2019 and Hubatsch, 2015)	Measuring tools
Salinity (ppt)	20-30	25-30	Refractometers
Water temperature (°C)	27-28	26,9 – 27,3	Thermometers
pH	7,75-8,25	7,75 – 8,50	pH meters
Dissolved oxygen (ppm)	4,50-5,50	3,50 – 6,00	DO meters
Ammonia (NH3)	0,10-0,30	< 0,50	Ammonia test kit
Nitrite (NO2)	0,00-0,002	< 0,05	Nitrite test kit

Source: Research results (2020)

The results of the measurement of water physicochemical parameters during the study in the form of salinity, water temperature, and pH, dissolved oxygen, ammonia, and nitrite were still in the appropriate range for mangrove crab (Scylla serrata) cultivation. The salinity level of 20 ppt was excluded because it was a research treatment.

h) Controlled Container

The controlled container for the cultivation of mud crab (Scylla serrata) used in this study was adopted from the results of research by Hastuti, et al. (2016) and Aji (2019). The water management system for cultivation media uses water rotation (recycle) using a water pump, pipe arrangement, and container arrangement in 4 levels using the cross water flow method. One container in the form of a 3,100 ml clear plastic jar can accommodate 80 - 175 grams of mud crab and is still within the normal range of mud crab movements. In each plastic container/jar, a 3-inch round hole is made in the lid for water intake and the bottom of the jar for the discharge of cultivated medium water. At the bottom of the jar, a 5-inch piece of PVC pipe is attached which has been divided into two parts. This pipe serves as a temporary water reservoir to be filtered again by flowing it into the aquarium which is insulated with a 5 mm thick mattress with a size according to the room. The water is also filtered through a

medium-density sponge filter equipped with river stones which are contained in a 25x15 cm net. After the filtering process is complete, the clean water has flowed to the other side of the recycle and pumped to the top of the jar with the help of a clear aquarium pipe. The water is then flowed back through the intake channel than to the outlet channel to be rotated back as before. For each treatment, a set of controlled containers consisting of 20 equipment was used, in the form of 12 plastic jar containers, 1 aquarium, 2 plastic pipes, 1 pump, 1 table, 1 modified PVC pipe, 1 heater, and 1 socket.

Besides, a red lamp measuring 110 cm long with a brightness level of 2700 K. This lamp is closed using a 5 ml black mattress cover in the shape of a cube-like wicket with a front opening. The lights are placed on the back covering the back of the housing and the sides with front openings to keep the housing under control. The external lamp functions as a temperature heater from outside the controlled container at 01.00-04.00 in the morning. At that time the air temperature drops below 30oC so that the water temperature also drops below the ideal limit. Sketches of controlled containers for mud crab (Scylla serrata) cultivation in this study are presented in Figures 7, 8, and 9.

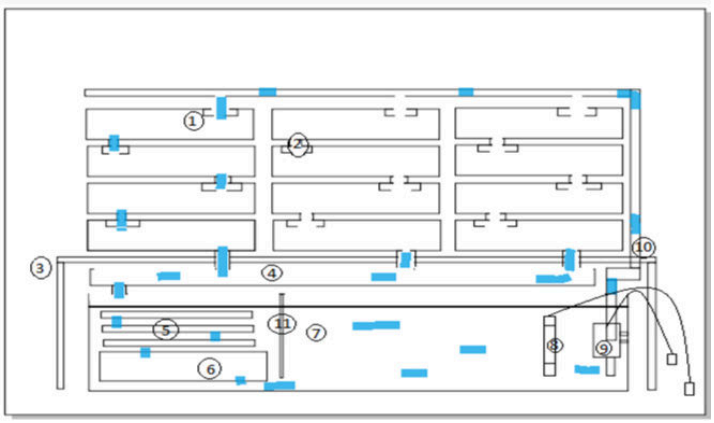

Figure. 7. Controlled container for mangrove crab (Scylla serrata) cultivation

Information :
1. Jar
2. Input and output pipes
3. The table
4. PVC pipe modification
5. Filter spoon
6. Stone filter 7. Aquarium
8. Water heater
9. Water pump
10. Clear pipe
11. Mattress modification

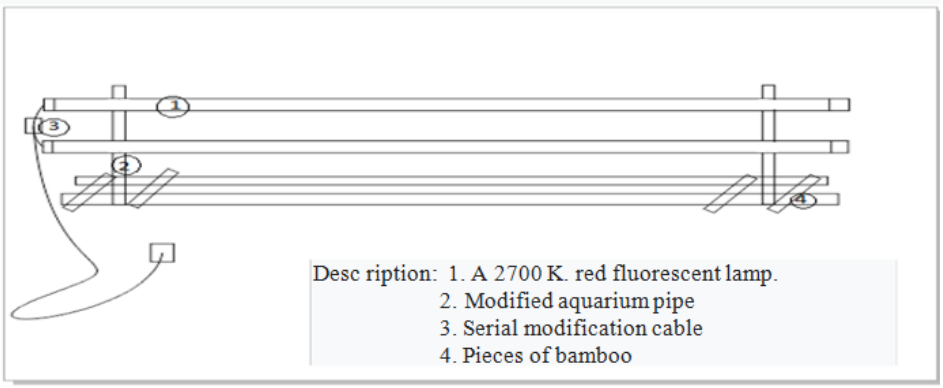

Figure. 8. External lamp design
Source: Research results (2020)

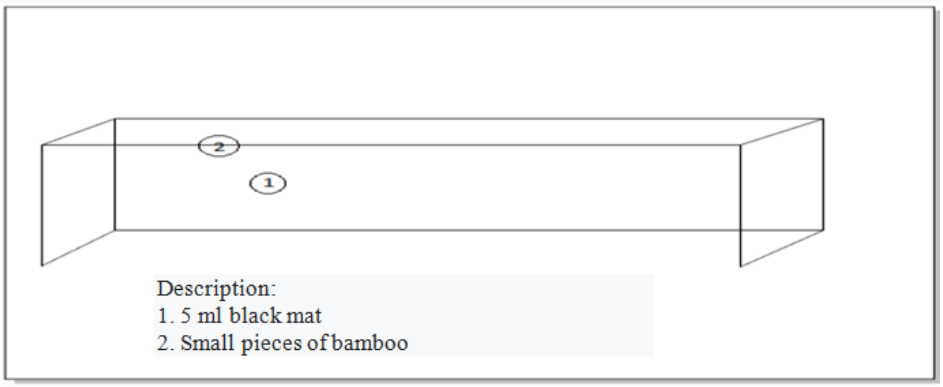

Figure. 9. External lamp cover frame
Source: Research results (2020)

3.2. Discussion

Absolute individual weight in mud crab (Scylla serrata) with different salinity treatment showed optimum results in the range of 40.6 - 47.41 grams. The highest increase in body weight growth of tested animals was in the treatment of 20 ppt (A1) salinity levels, namely 47.41 grams. Likewise, the optimum absolute individual length increase in an average of 3.1 cm occurred in the salinity treatment of 20 ppt (A1). According to Sitaba et al. (2017), mangrove crabs (Scylla serrata) can live and grow in a salinity range between 10 ppt to 30 ppt. However, crabs cultured at a salinity of 10 ppt had growth that was not significantly different from those cultured at a salinity of 20 ppt. Meanwhile, the crabs cultured at a salinity of 30 ppt had the smallest growth and were significantly different from those cultured at 10 ppt and 20 ppt. Crabs obtain energy through the feed that is consumed and used for various activities including for osmoregulation purposes. The rapid growth is determined not only by the efficiency of feed utilization but also by the low osmotic load. To obtain optimal growth, mangrove crabs are cultured in brackish waters with salinity between 10 ppt - 20 ppt.

The optimal percentage of mangrove crab molting (Scylla serrata) in the 30 ppt (A3) salinity level treatment was 100%. According to (Katiandagho, 2012) the optimal salinity is in the range of 30-33 ppt and increases the percentage of molting, in the temperature range of 28- 320C. This shows that mangrove crabs need the right range of salinity and temperature to support the molting process.

In the 20 ppt, 25 ppt, and 30 ppt salinity treatment, the optimal daily growth of mangrove crabs (Scylla serrata) occurred in the 20 ppt (A1) treatment of 1.6 grams/day with survival of up to 75% as well as the 25 ppt salinity level treatment. (A2). The 30 ppt (A3) salinity treatment resulted in a survival of 83% with a mortality of 16.7%. This is following several previous research results. The quality of culture water, especially temperature and salinity, affects the metabolism (Scylla serrata)

and physiological conditions of mud crabs. Salinity directly affects the life of organisms, including growth rate, amount of feed consumed, feed conversion value, and viability of aquatic biota (Ikhwanuddin et al., 2012). The rest, Rusmiyati, (2012) and Hubatsch (2015) state that adult crabs are tolerant of changes in salinity and can live in water with a salinity of 0-50 ppt. Susanthy, et. al (2019) stated that the maximum growth of mangrove crabs (Scylla serrata) was achieved at the salinity of 10 ppt and 20 ppt. Furthermore, Pedapoli and Ramudu (2014) reported that at a salinity of 10 ppt the mangrove crab had a daily growth rate of 2.3 grams/day, and at a salinity of 29-30 ppt, the daily growth rate was 0.97 - 1.25 grams/day. On the other hand, Hastuti et al. (2016) stated that mangrove crabs cultured at a salinity of 25 ppt had a daily growth rate of 1% and a survival rate of 50%, and at a salinity of 15 ppt, the daily growth rate was 0.4% with a survival rate of 15%. Setiawan and Triyanto (2012) state that good salinity for growth of mangrove crabs (Scylla serrata) ranges from 15-25 ppt and the growth decreases at a salinity of 25-30 ppt. Based on these things it can be stated that to obtain optimal growth, mangrove crabs are cultured in brackish waters with salinity between 10 ppt - 20 ppt.

The temperature range during the study was 28.2oC - 27.3oC with a pH of 7.75 - 8.25. According to Aslamyah and Fujaya (2014) temperature is an important abiotic factor that affects survival, growth, and molting activities. In general, the growth rate increases with increasing temperature to a certain extent. The optimum temperature for crabs is 25-35oC. Furthermore, Hubatsch (2015) states that mangrove crabs can live and grow well at 23-320C with temperature changes that do not occur suddenly. Temperature fluctuations in this study qualify for soft shell crab cultivation.

The mud crab (Scylla serrata) cultivation container with a simple and controlled system has advantages in terms of cost and location. This container can be made of cheap materials with relatively good quality. The container can be moved both outdoors and indoors. This controlled container is practical, does not require a large area because the mud crab cultivation container can be arranged vertically. A water management system with a recirculation pattern also allows water quality to be maintained properly in addition to using water efficiently. The efficiency of water use is important if mangrove crab cultivation is carried out in a location that is relatively far from the coast so that it is not easy to get seawater at any time as a cultivation medium. The heating lamp installed on the lid of the container also has an important role in supporting the success of mangrove crab cultivation. In particular, the water temperature conditions of the culture media can always be maintained ideally, especially in the early morning when the water temperature drops drastically.

4. Conclusions and Suggestions

4.1. Conclusion

Based on the research results, it can be concluded that:

1. The difference in treatment and the use of controlled containers has a significant effect on the 95% significance level ($\alpha = 0.05$) on all parameters of the response to treatment.
   Absolute individual weight values 40.6–47.41 grams, absolute individual length 2.6–3.2 cm, molting percentage 75–100%, daily growth rate 1.3–1.6 grams, 75–100% survival, and mortality of mud crab (Scylla serrata) 25-16.7%. Optimal salinity level at 20 ppt.
2. Water quality parameters during the study were still feasible for mangrove crab (Scylla serrata) cultivation. Controlled containers using a water rotation system are quite effective for the cultivation of mud crabs (Scylla Serrata)

4.2. Suggestion

Further studies are needed regarding the optimal type and level of feeding to accelerate the molting of mud crabs (Scylla serrata).

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