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Growth Analysis of Red Algae *Eucheuma spinosum* using Basket Method in Tesabela Village, Kupang Regency

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ABSTRACT

The purpose of this study was to determine the growth of red algae *Eucheuma spinosum* using basket method in Batubao marine waters, Tesabela Village, West Kupang District. This research has been conducted for three months, from September to November 2020. The method used in this research were observation and experiments in the field. The results showed that the red algae *Eucheuma spinosum* cultivated for six weeks had a slow growth rate. The absolute weight measurement results at the end of the study were only 199 g, although it was slow but the growth continued, the observations showed that the cultivated red algae was not predated by herbivore fish or turtles, because of the use of baskets. The slow growth is due to environmental factors, especially poor of brightness. The condition of the waters during the study tended to be cloudy with a maximum visibility of 1.5 meters with a water temperature that was high enough to reach 30 ^{o}C.

Key words : *Growth, Eucheuma spinosum, Basket, Tesabela Village*

Introduction

Macro algae known by the public as seaweed, is a low-level plant that does not have a different arrangement of structure such as roots, stems and leaves. Naturally, algae are benthic or grow stuck and attached to the substrate in marine waters, marine algae have multiple functions in various industries such as the food, beauty, pharmaceutical, textile and agricultural industries (Hamid, 2009). Carrageenan is a hydrocolloid compound consisting of esters of potassium, sodium, magnesium and calcium sulphate with galactose, carrageenan can be obtained from precipitation with alcohol, drum drying and freezing. The availability of seaweed in nature is increasingly limited so that cultivation techniques are needed to increase the amount of production so that demand can be met sustainably (Iskandar *et al.*, 2015).

One type of algae that is cultivated by the community is *Eucheuma spinosum*, this type is widely cultivated as is done by the community in Tesabela village. This is because the cultivation technology is relatively cheap and easy and post-harvest handling is easy and simple. Apart from being used as industrial raw materials, the algae *Eucheuma spinosum* is processed into food that can be consumed directly as well as permanent processing or processed into lunkhead, even many are sold dry without going through processing.

The success of macroalgae cultivation is highly dependent on the choice of the right cultivation technique; The selected cultivation method should provide maximum growth, easy to apply and the raw materials used are easy to obtain. The cultivation methods developed include the floating raft method, the off-bottom method and the basket or net bag method. The selection of the basket method is to avoid the growth of predators such as turtles, sea urchins, fish and other organisms (According to Atmadja, 1996).

Tesabela Village is located in West Kupang District, Kupang Regency with the majority of the population's livelihood being fishermen and seaweed cultivators, depending on this business as their main source of income. Seaweeds that are widely cultivated by local people are the types of *Kappaphycus alvarezii* (sakol), and *Eucheuma spinosum* (known by cultivators as "SP" or natural seaweed). The method used were the Long line method.

Research methods

The method used in this research is the method of direct observation and experimentation in the field. Sample measurements were carried out every 7 days for 6 weeks. The environmental parameters measured were Salinity, Current velocity, Water temperature, pH, Brightness.

Seaweed Growth Analysis

Daily Growth

Measurement of growth is calculated using the formula proposed by Aslan (1998).

$$PH=(W_t-W_0)/t$$

Where :

PH : Daily growth

Wt : wet weight of algae at the end of the week of observation (g)

Fig. 1. Research Location of Batubao, Tesabela Village

Wo : wet weight of algae at the beginning of the week of observation (g)
t : time (7 days)

Absolute Growth Analysis

Measurement of absolute growth in marine algae using the formula used by Efendi (1997), namely:

$$GW = Wt - W\_0$$

Where :
GW : Weight gain
Wt : Weight (g) average wet weight of algae at the end (t)
Wo : Weight (g) average wet weight of marine algae at the beginning of the study

Results and Discussion

The weight gain of the red algae *Eucheuma spinosum* during the study can be seen in Figure 2.

The weight gain of the red algae *Eucheuma spinosum* showed an increase from week to week even though its growth was slow. The average growth of algae weight at the sixth week of growth at the end of cultivation reached a weight of 299 grams. Research at the same location conducted by Kambajawa (2018) obtained that the final weight of *Eucheuma spinosum* which was cultivated for 45 days was 671 g. There are differences in the weight of algae in these two studies, this is presumably due to the different time of the research; Kambajawa (2018) carried out cultivation in July – August, while this study was conducted in October – November, where when conducting research the water conditions were not good, the brightness reached 1 – 1.5 m, the water conditions looked cloudy throughout the maintenance period. This is thought to be the main cause of the slow growth

According to Maturbongs (2015), the growth of macroalgae is influenced by the level of turbidity of the waters, this is because the turbidity of the waters affects the penetration of light into the water column because light has an important role for algae, especially in the photosynthetic process.

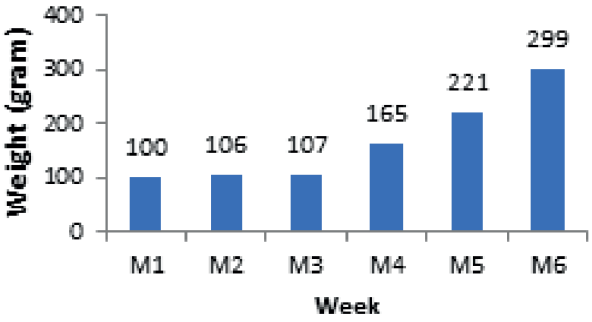

Fig. 2. Weight Gain of Red Algae *Eucheuma spinosum*

Daily Growth of Red Algae *Eucheuma spinosum*

The daily growth of the Red Algae *Eucheuma spinosum* during the study can be presented in Figure 3.

Figure 3 illustrates the average daily growth of the red algae *Eucheuma spinosum* ranging from 0.14 grams to 11.14 grams per day. The highest daily growth was in the sixth week. Daily fluctuations in growth values are caused by unfavorable environmental conditions for algae growth. Kambajawa (2018) obtained the highest daily growth in the fifth week with a value of 13,028 g per day. The difference in daily growth is thought to be due to different environmental conditions, the low daily growth of algae is thought to be due to water conditions that do not support the overall growth of algae.

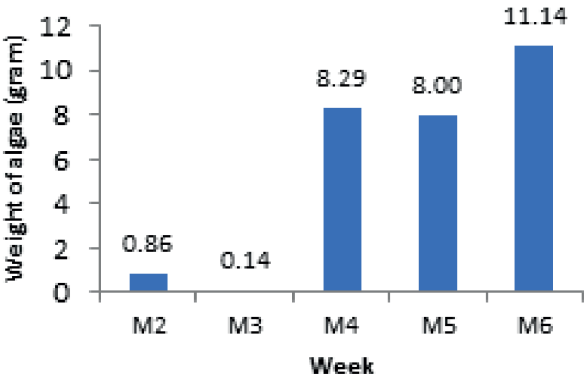

Fig. 3. Daily Growth of Red Algae *Eucheuma spinosum*

Absolute Growth of Red Algae *Eucheuma spinosum*

The results of measuring the absolute growth of red algae *Eucheuma spinosum* in this study were 199 g, Effendi (2003) in Abdan *et al.* (2013) stated that the absolute growth of marine algae during the study was calculated based on the difference between the average weight at the end of the study and the average weight at the end of the study. the beginning of the study. The average measurement results in the last week are reduced by the average measurement results in the first week of cultivation. Kambajawa's research (2018) obtained the absolute growth of *Eucheuma spinosum* at the end of the rearing period weighing 621 g, this result is different from this study which only obtained an absolute weight of 129

g. This difference is caused by environmental factors at the time of the study that were not very good. The water temperature is in the range of 28-30 ºC, this indicates that the temperature at the time of the study was quite high. According to Rima, *et al.* (2016), one of the supporting factors for seaweed growth is water temperature, then according to Anggadiredja (2006), the success of seaweed cultivation is largely determined by ecological factors which include water substrate conditions, temperature, current, salinity and brightness. A good water temperature for *Eucheuma spinosum* cultivation is 20-28 ºC. The increase in temperature will affect the growth of algae.

In this study, no predatory animals (herbivore fish) were found that eat seaweed. So it can be concluded that the slow growth is thought to be caused by the influence of environmental factors, especially rising water temperatures and brightness.

Water Environment Parameter Condition

The environmental parameters measured at the time of the research were Temperature, Salinity, Current Speed, pH, Brightness. The results of the measurement of environmental parameters at the research site are described in succession as follows.

Temperature and Salinity

Temperature is one of the factors to determine the feasibility of seaweed cultivation locations. Temperature is very influential for the growth of seaweed in carrying out photosynthesis and indirectly affects the solubility of oxygen used for respiration of marine organisms, temperature can inhibit the growth of seaweed. An increase in temperature can cause the seaweed thallus to turn pale yellow.

The results of temperature measurements during the study in Figure 4 ranged from 28 °C-30 °C. The lowest temperature range is in the first and second weeks while the highest temperature is in the third and fourth weeks. The difference in temperature is caused by different light intensity during maintenance. The temperature tends to increase at the time of conducting the research, regarding the dry season in the East Nusa Tenggara area, which until the end of November had not rained.

Nur *et al.* (2016) stated that oxygen saturation in water is influenced by water temperature, the higher the temperature, the lower the dissolved oxygen concentration, the good water temperature for *Eucheuma spinosum* cultivation is 20-28 ºC. The increase in water temperature affects the growth of algae, this can be seen from the growth trend from the first week to the last week of the study which tends to be slow. According to Kordi (2010), the suitable water temperature for *Eucheuma* red algae is between 20-30 ºC. Furthermore Aslan (1998), states that the optimal temperature for the growth of red algae *Kappaphycus alvarezii* is in the range of 25-30 ºC. Although the temperature in this study reached 30 ºC, it was still tolerable and still supported the growth of the algae.

The results of salinity measurements (Figure 4) during cultivation ranged from 32‰ – 33‰. The results obtained by Kambajawa (2018) during the maintenance period obtained a salinity value of 33‰ during the cultivation period. Prasetyarto and Suhendar (2010) and Arminta (2011), state that the high and low levels of salt are influenced by the number of rivers that empty into the sea, the more rivers that empty into the sea, the lower the salinity of the sea, and conversely the fewer rivers that flow into the sea. empties into the sea, the salinity becomes high, this is influenced by the supply of fresh water that enters the sea.

The results of salinity measurements during the study were still in the normal range so that they were able to support the growth of seaweed. According to Yuliana (2015), salinity has a very real influence on the growth of seaweed, while according to Kadi and Atmaja (1988) in Kamlasi (2008) stated that the salinity range for seaweed growth is 30-34 ppm. From these statements, it was concluded that the salinity range at the study site was still within the normal range for the growth of the red algae *Eucheuma spinosum*.

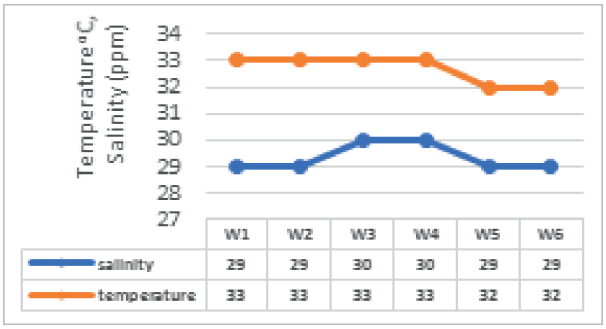

Fig. 4. Measurement of Temperature and Salinity of Batubao Waters

Current

Measurement of current velocity during the re-

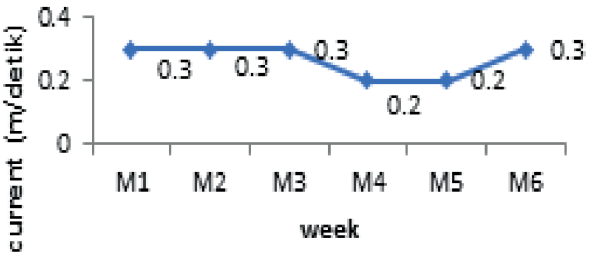

Fig. 5. Current Velocity in Batubao Waters

search results fluctuated. The measurement results are presented in Figure 5.

The results of the current velocity measurement ranged from 0.2 m/sec – 0.3 m/sec. The highest current velocity is found in the first week, until the third and sixth weeks, which is 0.3 m/second while the other weeks of observation obtained a current velocity of 0.2 m/second. According to Ambas (2006) in Farnani *et al.* (2013) the ideal current velocity for *Eucheuma spinosum* cultivation ranges from 0.1-0.3 m/sec. Currents play an important role in waters, for mixing water masses, as transporting nutrients, transporting oxygen. Furthermore, it is stated that current is a factor that must be prioritized in choosing a location for seaweed cultivation because currents will affect sedimentation in the waters, which will also affect light penetration. In addition, currents play a role in the availability of oxygen, if there is sufficient oxygen in the waters, the seaweed can carry out respiration optimally. This statement is the same as the opinion of Sudino (2004) in Farnani et al (2013) which states that currents play an important role in the growth of *Eucheuma spinosum*, because ocean currents carry nutrients which are food ingredients for the thallus.

The results of current velocity measurements in this study are different from the results of research conducted by Farnani *et al.* (2013) in the waters around BBL (Sea Cultivation Center) Lombok, Gerupuk Village, where Farnani *et al.* (2013) obtained current velocity measurements ranging from 0.2-0 ,4 m/second, while in the Kambajawa study (2018) the same current velocity was obtained. The difference in current velocity is thought to be due to the different cultivation locations and growing seasons.

Brightness

The results of the measurement of water brightness in the Batubao coastal waters obtained that visibility only reached 1 – 1.5 m throughout the seaweed cultivation period. This is thought to be due to the condition of the sandy mud waters substrate which, if there is a slight shaking, will cause turbidity.

Brightness is also related to the penetration of sunlight, good water brightness causes sunlight to penetrate the water column so that the photosynthesis process of seaweed can run well. The brightness of the waters can also be caused by sedimentation from the river mouth. Lack of sunlight penetration due to sedimentation will cause a decrease in growth speed. The ideal conditions for the brightness of the waters for planting *Eucheuma spinosum* seaweed are approximately 2 meters (Aslan, 1998; and Kalla, 2015).

Degree of Acidity of Waters (pH)

The results of the measurement of the degree of acidity of the waters (pH) measured during research activities are shown in Figure 6.

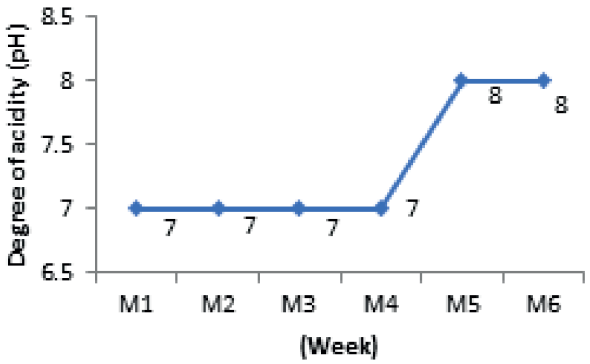

Fig. 6. Degree of Acidity (pH) in Batubao Waters

The results of pH measurements during the study were in the range of pH 7-8. At the beginning of the first week of measurement until the fourth week a pH value of 7 was obtained, while in the last two weeks the pH value was 8. The difference in pH values in the fifth and sixth weeks was thought to be caused by the influence of rain. that occurred at the end of the study week. The opinion of Partosuwiryo and Hermawan (2008) in Kalla (2015) states that the pH value that is still feasible for seaweed cultivation is between 6-9 and the expected optimal pH value is 7.5 - 8.0. Meanwhile, according to Aslan (1998) in Kalla (2015) states that the optimum acidity for marine algae cultivation ranges from 6.8 to 8.2.

The pH range obtained during the study was still in the normal range for the growth of the Red Algae *Eucheuma spinosum*.

Conclusion

The results showed that the red algae *Eucheuma spinosum* cultivated in Batubao Coastal Waters experienced a slow growth rate, the absolute weight at the end of the study was only 199 g, although the growth was slow, the algae continued to grow. The results showed that the red algae that were cultured were not predated by herbivore fish or turtles. This slow growth is due to the influence of environmental factors, especially the poor brightness with a visibility of 1 -1.5m and a recorded temperature of 30^{o}C.

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