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Effect of transplantation media on *Pocillopora* coral growth rate at TWAL Pulau Weh

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ABSTRACT

Coral reef ecosystems have a vital role in waters so that damage to coral reef ecosystems can reduce ecological and socio-economic functions that can impact environmental imbalances, such as reef fish and benthic communities. This study aims to determine the effect of transplant media on the growth rate of the genus *Pocillopora* coral and see whether it has a significant effect on the rate of coral growth in TWAL Pulau Weh, Aceh Province. The method used is a purposive sampling method in determining stations, analysis using the ImageJ 1.52 application. The results showed that the effect of transplant media on the growth rate of *Pocillopora* corals were significant differences between structures given an electric current and those not given an electric current with a 95% confidence interval. The average growth value of *Pocillopora* corals given an electric current is 25.06 mm/month. While the *Pocillopora* corals that were not given an electric current average growth value was 16.50 mm/month.

Introduction

Geographically, Pulau Weh is located at coordinates 05° 46 "28" - 05° 54 "28" North Latitude and 95° 13 "02" - 95° 22 "36" East Longitude. Pulau Weh has a Marine Nature Park (TWAL) in the form of TWAL Pulau Weh. TWAL is a form of Marine Protected Area (KKL) which is managed under the authority of the Ministry of Environment and Forestry. Marine conservation areas have a very important role, both ecologically and economically, so their management must be a top priority. TWAL Pulau Weh which was determined based on the Decree of the Minister of Forestry No. 76 / IV-KKBHL / 2015 dated 23 March 2015 with an area of Marine Tourism Park (TWL) ± 2,600 Ha. However, the Marine Tourism Park (TWAL) has not been demarcated.

Dense tourism activities will have an impact on the coral reef ecosystem, where damage caused by marine tourism activities generally occurs due to physical contact of tourists with coral reefs, either intentionally or unintentionally. Damage to coral reef ecosystems can reduce ecological and socio-economic functions which can have an impact on environmental imbalances, such as reef and benthic fish communities. This is because the coral reef ecosystem is a spawning ground, nursery ground, and a place to find food (feeding ground) so that this habitat is needed for other biota (Rizal *et al.*, 2018). Coral reef ecosystems have the ability to repair themselves if they are given protection from the negative impacts that attack them, but their recovery takes a long time (Rizky, 2014).

Suharsono (2008) states that *Pocillopora* is a coral that is widely found, and its distribution can be found throughout Indonesia. *Pocillopora* coral has a fast growth power and a high survival rate (Aditiyana,

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2012). so that the use of *Pocillopora* corals is widely used for transplantation (Ariston, 2013).

One of the engineering methods to keep coral reefs sustainable is Biorock. According to Maulina (2009), biorock is an artificial coral reef technique using a sturdy frame structure that is supplied with low-voltage electricity. The working principle of biorock is like the principle of electrolysis, where dissolved minerals in seawater are converted into solid $CaCO_3$ and Mg (OH) 2 which are owned by native reefs. Arifin *et al.* (2017) also stated that the Biorock method is a new method for rehabilitating coral reefs. The advantages of using this method are that it stimulates the growth of the transplanted corals, the medium is sturdy and also makes the structure easy. Apart from corals, a large number of fish are attracted to this medium, which in turn will form new reef fish communities.

Therefore, this research needs to be carried out considering the function and role of coral reefs which are very important in the waters so that it is necessary to design an electronically stimulated transplantation method so that later coral reef ecosystems will be better for the balance of the underwater world.

Materials and Methods

Site and time

Data were collected in August, November and December 2019. This research was conducted in the Pulau Weh TWAL area, Sukakarya District, Sabang City (Figure 1).

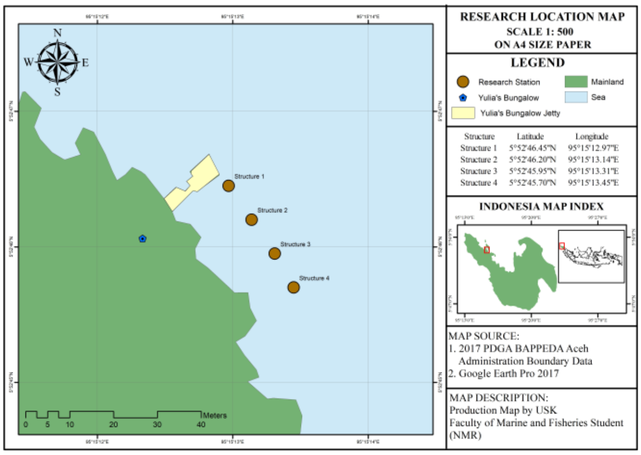

Figure 1. Map of the research location.

Data analysis

ImageJ

Processing of photo data using the ImageJ 1.52 software application to obtain the distance value of the coral growth rate seen from the length of coral growth (Rayyan, 2016), then processing the graphic display data using the Microsoft Excel 2019 software application. The data collection procedure begins with a scale setting (tool bar set scale) on the observed coral photo, this is done to determine the length of the transplanted coral and then adjusted to the existing scale, namely with 3-colored paper with units of millimeters (mm). Next, the process is to choose a straight line selection on the tool bar, then calibrate the scale along the 3-color paper as a reference then select Analyze on the tool bar then select set scale for column contents with 240 mm as the scale determinant for coral measurement. Next, select a straight line selection and draw a straight line across the reef to determine the length of the coral. The final step is to select a measure in the Analyze section of the tool bar. Then the measurement results will appear automatically and save the results as a document (.csv).

Coral growth rate

The coral growth rate can be calculated by comparing the colony size in the month of observation (T0-T1; T1-T2; T2-T3) (Ricker, 1975). The formula for calculating the coral growth rate is:

$$\beta = L_t - L_0$$

Where:

β = Growth rate (mm/month)

L_t = Coral colony size at time -T

L_0 = Coral colony size at time T_0

The influence of the rate of coral growth on electrified and non-electrified structures

Independent T-Test analysis is used to compare the growth rate of corals in electrified and non-electrified structures using IBM SPSS Statistics software or also known as PAWS (Predictive Analytics Software). Analysis Test Independent T Test is a statistical test that compares two different groups or compares the average value of two independent groups of analysis (Setyawan *et al.*, 2014). The confidence interval used is 95% because this research is an experimental study. To get t table can be obtained by referring to the formula (α / 2); (df), where α is the maximum error or error value, while the df value is the degree of freedom (degree of freedom). The decision making criteria are as follows:

H_0 rejected when t test < t-table

H_1 accepted when t test > t-table

with the hypothesis in this study are as follows:

H_0: There is no significant difference in coral growth rates between the electrified and control structures.

H_1: There is a significant difference in the rate of coral growth between the electrified structures and the control.

Results

The growth rate of *Pocillopora* corals at the research location experienced an increase in growth. The growth rate of *Pocillopora* corals on structures given an electric current, the average growth rate is 25.06 mm / month. On the other hand, the average growth rate of *Pocillopora* corals that are not given a current is 16.50 mm / month, so it can be said that coral reefs that are electrified and those that are not electrically have a significant effect.

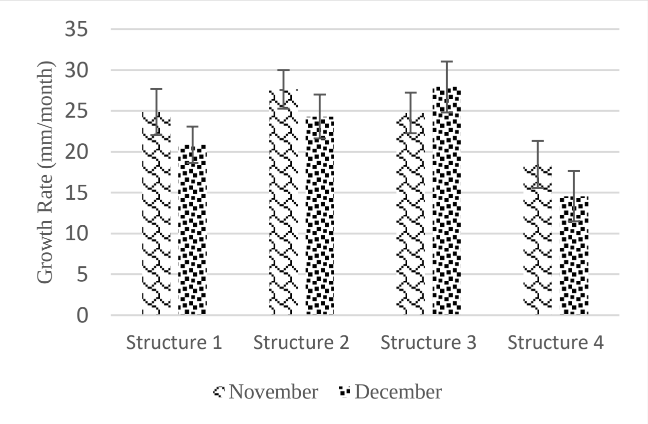

Figure 2. Comparison chart of the average growth of *Pocillopora* corals.

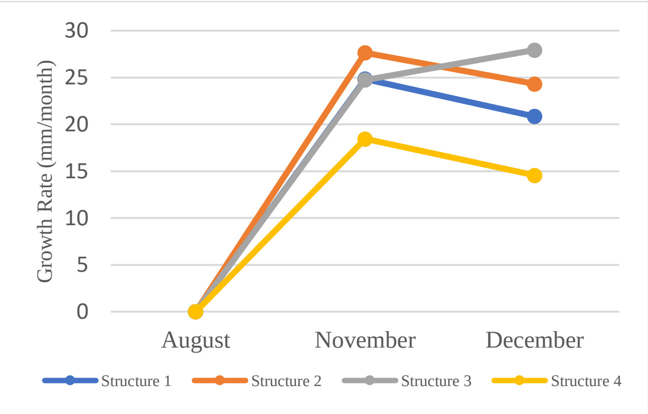

Figure 3. Graph of *Pocillopora* coral growth rate for each structure.

Discussion

The growth rate of *Pocillopora* corals has increased which is also strengthened by the Independent T-Test analysis where the value obtained is the Sig. obtained 0.965> 0.05, so it can be said that the data structure 3 and structure 4 are homogeneous (Appendix 4). The Sig (2-tailled) value obtained is 0.004 and when compared to the experimental error (α) is 0.05 we can get the Sig (2-tailled) value <α value so that H0 is rejected (H1 accepted) (Anggoro *et al.*, 2013). Therefore there is a significant difference in coral growth rates between electrified and controlled structures (not supplied with electricity).

In addition, based on the comparison of the t value of 3.075 with t table of 2.042, the value of t count> t table so that it can be concluded that reject H0 (accepted H1), which means that the average value of the growth rate of *Pocillopora* coral structure 3 with structure 4 has a significant difference. between those that are electrified and those that are not. In the second observation, the growth rate of *Pocillopora* corals was not greater than the first growth rate. This is presumably due to the coral recovery process at the research location (Tortolero-Langarica *et al.*, 2019; Rodríguez-Villalobos *et al.*, 2016), this is also the same as Siregar's research (2012) on Pramuka Island, DKI Jakarta (Figure 4).

The growth rate of *Pocillopora* corals in structure 3 has an average growth rate better than other structures. This is presumably because the resistance of *Pocillopora* corals in structure 3 is better than other structures, so that their growth is not inhibited (Figure 5) (Erftemeijer *et al.*, 2012).

The water conditions at the research location have a characteristic temperature of 25-29ºC, degree of acidity (pH) 7.55 - 8.10, dissolved oxygen (DO) 4.22 - 5.11 mg / L and a salinity of 33 - 34 ppt and the bottom conditions of the waters / substrate consist of sand and coral fragments. . Based on the Decree of the State Minister for the Environment No. 51 of 2004, the environmental parameters of coral reefs in the TWAL Pulau Weh area still support coral life. Where the growth of *Pocillopora* corals is increasing, but the coral growth is different between those with electricity and those that are not, where the corals with electricity are better than those without electricity (Kurniawan *et al.*, 2016; Suzuki *et al.*, 2011). In addition, environmental factors greatly affect the growth of *Pocillopora* corals that are supplied with electricity and those that are not (Goreau and Prong, 2017).

Conclusion

Based on the results of this study can be concluded that there was a significant difference between structures that were given electric current and those that were not given an electric current with a 95% confidence interval. The average growth value of *Pocillopora* corals given the current was 25.06 mm / month. Meanwhile, those not supplied with electricity have an average growth value of 16.50 mm / month.

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