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CORAL REEF TRANSPLANT SUCCESS RATE IN BONETAMBU ISLAND, SPERMONDE ARCHIPELAGO

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ABSTRACT

The world's coral reefs are under threat from human activities through pollution and habitat changes. This condition is influenced by several factors, such as human activities and natural phenomena. Many efforts have been made by humans to overcome or repair coral reef ecosystems that have been damaged. One of the efforts made is to carry out coral transplants. The main goal of coral transplantation is to improve the quality of coral reefs such as increasing live coral cover, biodiversity and uniqueness of coral topography. The stages of the method carried out in the research include mapping the bottom of the waters (sounding); mapping conditions of water cover; transplantation process and monitoring. This study used the spider skeleton method for the transplant media. The results showed that the percentage of live coral cover ranged from 10% - 25% and it was found that rubble cover dominated up to >70%. During the monitoring process, it was found that algae dominated almost all of the transplant media. The high nutrients and the lack of algae-eating fish resulted in a high algae cover found on the surface of the structure and had an impact on the death of the transplanted corals. Efforts are being made to regularly clean algae to increase the survival rate and replant dead coral.

Keywords: Coral reef, transplant, Bonetambu Island, Spermonde

INTRODUCTION

The world's coral reefs are under threat from human activities through pollution and habitat change (Burke et al., 2011). As reported from the International Union for Conservation of Nature (IUCN) several species of coral reefs are included in the category of endangered (Endangered species) (IUCN, 2021). The results of the review by Saputra (2021) indicated that approximately 6.56% of coral reefs in Indonesian seas are in very good category, 22.96% are in the good category, 34.3% are in the medium category, and 36.18% are in the bad category . This condition is influenced by several factors, such as human activities and natural phenomena. Human activities that have a lot of impact on coral reef ecosystems are the use of bombs and cyanide. Damage to coral reefs is exacerbated by the phenomenon of coral bleaching due to an increase in sea surface temperature. This increase in sea water temperature is increasingly common, based on data from the National Oceanic and Atmospheric Administration (NOAA) it is known that an increase in temperature which has an impact on the occurrence of the coral bleaching phenomenon occurred in 2010 and 2016 (NOAA, 2015).

Many efforts have been made by humans to overcome or repair coral reef ecosystems that have been damaged. In general, the efforts made are management, for example the establishment of water conservation areas or with rehabilitation technologies such as artificial reefs and coral transplants. The coral transplantation method is a simple way to improve the condition of damaged coral reef ecosystems (Haris, 2011). Various groups can be involved in trying and carrying out coral rehabilitation with this method. Each stage in the implementation of coral transplants is a key factor in the success of coral transplants (Subhan et al., 2014). The main objective of coral transplantation is to improve the quality of coral reefs such as increasing live coral cover, biodiversity and uniqueness of coral topography (Soedharma and Arafat, 2006).

Currently, there are many choices of methods for transplanting coral reefs (Johan et al., 2008). Some of the methods often used are the net and substrate rack method (Mustafa et al., 2020), concrete (Dedy Kurniawan et al., 2021), nets and shards (Saputra et al., 2020), natural substrates (Hermanto & Utara, 2015), the biorock method (Siahaan et al., 2018) and the spider skeleton (Tenilo & Boalemo, 2021). Each method has its advantages and disadvantages and must be adapted to the transplant site.

MATERIALS AND METHODS

This research was conducted from April to August 2022 on Bonetambu Island, Spermonde Archipelago, Makassar City. The stages of the method carried out include Mapping the Bottom of

the Waters (Sounding); Mapping Conditions of Water Cover; Transplantation Process and Monitoring.

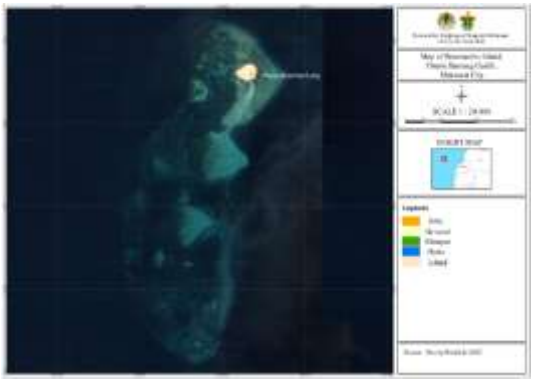

Figure 1 Map of Bonetambu Island

Water Bottom Mapping (Sounding)

Mapping of the water bottom was done to find out the representative locations for laying spider transplants. This mapping is done using the GPS Mapsounder tool installed on the speedboat which is then run according to the route that has been set. The results of the mapping carried out were then analyzed using Surfer 10 Software to produce a topographic map of the bottom of the waters. The results obtained from the mapping of the bottom of the waters are in the form of depth and shape or bottom relief of the waters.

Mapping of Water Cover Conditions

Monitoring of the condition of the bottom cover of the waters was carried out to find out the appropriate locations for spider transplants placement. In addition, this activity was also intended to find out the source of donor coral broodstock to be used during transplantation. To determine a suitable location for transplantation, the Manta Tow method is used, this method is a technique for observing coral reefs by means of an observer behind a small motorized boat using a rope as a link between the boat and the observer. With a constant boat speed and passing over the coral reefs with a drag time of two minutes, observers will see several objects that cross as well as the percentage value of live coral cover (hard coral and soft coral) and dead coral and identify the exact location.

Tranplantation Process

The transplantation was conducted in two stages. The first stage was the attachment of the coral to the spider structure and the arrangement/layout of the spider structure at the rehabilitation site. The tying of corals to spider structures was carried out in shallow areas to make tying easier and to involve the community. The tying of the corals to the spiders was carried out on a cork raft, after all the corals have been bound, the spider structure will be placed underwater before being transported to the rehabilitation sites, this was done to prevent the corals from being exposed in the air for long period which will cause the corals to die.

Arrangement/layout of the structures that have been transplanted was carried out using diving equipment, each spider structure was arranged in relation to one another. Every 10 units installed will be given a benchmark. This connection will result in the structure to be more resistant to the waves and not easily overturned. The positioning of the spider underwater will follow the available empty space so that the existing coral reefs will not be disturbed by the spider structure.

Reef modules designed specifically for coastal protection can be very useful when the natural protection of coral reefs is lost. Even though it has many shortcomings, artificial reefs are very helpful in coral reef rehabilitation activities, including; a rapid increase in the complexity of the topography of the waters, a stable substrate for corals and other associated biota, a hard structure that keeps it from being damaged if hit by fishing nets or trawls, as an alternative dive site to reduce pressure on natural coral reefs.

Determination of the area for placement of transplant constructions and artificial reefs in coastal waters will greatly determine the success of artificial reef development. Oceanographic conditions in the form of relief and bottom substrate, current action and sedimentation, water quality (temperature, salinity and light intensity), as well as navigational aspects are a number of things that must be considered. Placement of the artificial reef formation was carried out at a depth of 6 meters, on a broken coral and sandy substrate obtained during the initial survey.

Monitoring

Transplanted corals require intensive maintenance to ensure proper survival and growth. The main coral maintenance activity is replanting or replacing dead coral with new coral, this is done to prevent algae from growing on dead coral which will affect other transplanted corals.

Monitoring is carried out after 3 months from the time of placement of transplants and artificial coral reefs. Monitoring of transplanted corals includes measuring growth and counting dead corals. At the time of monitoring, cleaning of the substrate from algae cover was also carried out, especially species of algae that could interfere with coral growth.

Data Analysis

Data analysis was carried out descriptively with the assistance of Microsoft Excel version 16.43 software.

RESULTS AND DISCUSSION

Batimetric Survey

A bathymetric survey or depth profile mapping is carried out to map the potential locations based on the ideal depth range for coral growth. The results of the bathymetry survey mapped the shallow waters of Bonetambung Island around the south side where up to 3 km from the island to the south there is still a depth of 4 – 8 meters, consisting of sandbars and flat coral reefs. For the east side, the depth range is 0 – 5 meters which is 270 m apart, the topographical conditions on the north side to the east tend to be sloping where the depth distance between 0 and 5 meters is only about 100 m. This location is ideal as an island pier location. On the west side, the depth fluctuates were greatly in the range of 3 - 8 meters and the bank of the slope is at a distance of 500 meters from the island.

The ideal depth range for coral growth is 3-10 meters. so it is necessary to measure the bottom profile of the waters at a depth line of 5 to 10 meters with the assumption that this depth interval is considered ideal for coral growth.

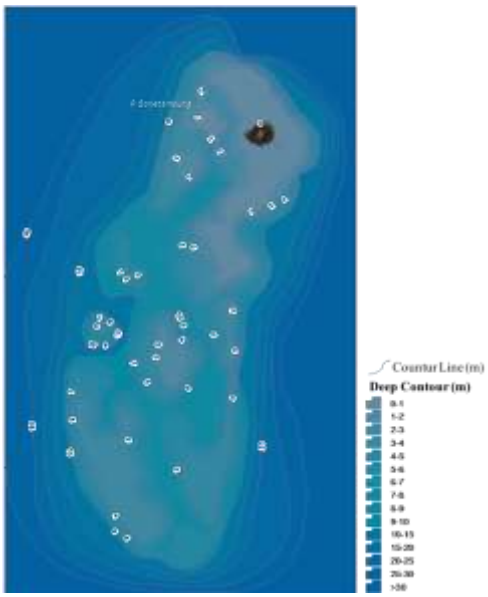

Figure 2 Bathymetry map of Bonetambu Island

The degree of slope of the bottom morphology of Bonetambung Island waters was measured at several points to obtain a location that was considered ideal for the planned placement of artificial reefs.

Distribution of Bottom Aquatic Substrates

Bonetambu Island's coral reefs are scattered abundantly in the north, west and south of the island. The largest distribution is in the south of the island with the length of the reef from the coast reaching 3.2 km of the total length of the coral reef reaching 3.88 km. The coral reef area of Bonetambu Island is about 377 hectares. This great coral reef potential is not followed by good coral reef cover.

Retrieval of data on the condition of coral cover was carried out using the RRA method by diving or using snorkeling equipment. Observations were made by estimating the bottom cover of the waters and categorized into 6 categories, i.e., Hard Coral, Dead Coral with Algae, Rubble, Sand, Algae, and Soft Coral. The results of these observations are grouped based on the Decree of the Minister of Environment No. 4 of 2001 concerning Standard Criteria for Damage to Coral Reefs.

Table 1 Standard Criteria for Damage to Coral Reefs Based on Minister of Environment Decree No. 4 Year 2001

Parameter	Quality Standard of Coral Reefs (in %)		
Percentage Area of Living Coral Reef Coverage	Damaged	Poor	0 – 24.9
		Medium	25 – 49.9
	Good	Good	50 – 74.9
		Very Good	75 - 100

Based on the observations in several locations, it was found that much of the coral cover was in a damaged condition. The following is a description of the observations sites:

Site 1

This location is to the west of the previous rehabilitation site. The condition of the coral reefs in this location is classified as damaged with only 15% live coral cover. This location is dominated by sand and rubble cover of 35% and 40% respectively with a total cover of 75%. The dead coral cover is only about 10%.

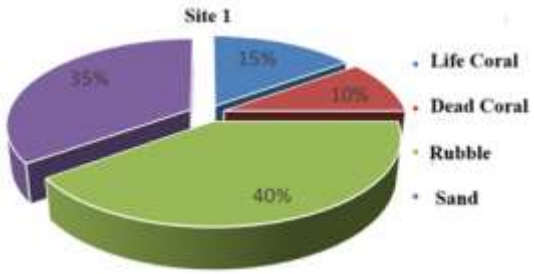

Figure 3 Percentage of seabed cover at site 1

This location has the potential for rehabilitation, but it is best to avoid locations with high sand cover because the sandy substrate tends to be unstable,

which means that the substrate will be covered by sand. There is also the potential that the transplanted coral will be covered by sediment if there is stirring due to large waves or strong currents.

Site 2

The condition of the coral reefs at site 2 was dominated by rubble coral with a cover percentage of up to 75%, live coral cover was only 10% which was dominated by *Fungia* sp, *Porites cylindrica* and *Montipora* sp with branched growth forms, dead coral and sand each 10% and 5%. This location is very good as a rehabilitation location considering that the unstable coral rubble substrate makes it very difficult for this location to recover naturally, so rehabilitation efforts need to be implemented with the help of a more stable growing medium.

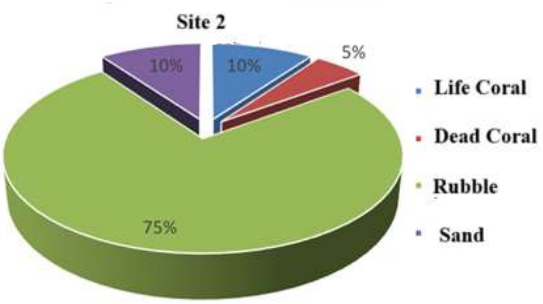

Figure 4. Percentage of seabed cover at site 2

Site 3

At site 3 the condition of the coral reefs was relatively better compared to the 2 previous sites. The live coral cover at this site is 25% which, if referring to the Decree of the Minister of Environment No. 4 of 2001 concerning Standard Criteria for Damage to Coral Reefs, this location is still classified as damaged. The dominating substrate cover is coral rubble, which is as much as 70% and 5% sand cover. The type of coral that dominates this location is coral *Montipora sp, Acropora sp, Porites silindrica* and *Fungia Sp.*

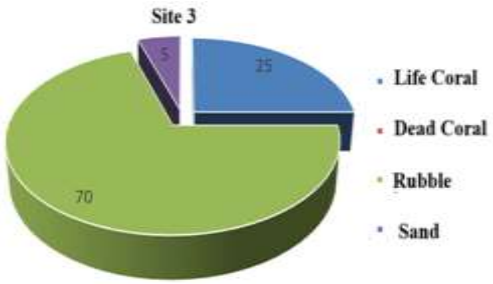

Figure 5. Percentage of seabed cover at site 3

Monitoring was carried out for three consecutive months to see the condition of the transplanted corals. This activity consisted of embroidering dead coral and cleaning spider skeletons which began after the transplant was one month old.

Figure 6. Dominating algae

The monitoring results for the first month found that >70% of the structure was overgrown with turf algae and other organisms such as Padina sp. (Figure 6). The same thing happened to the 2018 transplant activities at the same location. The relatively high growth of algae is probably caused by several things, such as high nutrients in the waters of Bonetambu Island or a lack of herbivore fish around the rehabilitation area.

The percentage of dead corals found was quite high, reaching 87% with the dominant coral species from the *Acropora* genera. The death of the coral was caused by several factors such as the transplantation process which was not good due to the coral fragments used experiencing stress due to the large surface area of the polyp touched by the hand, this often occurs for transplants carried out by fishing communities who are used to holding the entire surface of the coral. The second cause was during the acclimatization process after transplantation before being placed in the rehabilitation site, the high tidal ranges exposed the transplanted corals.

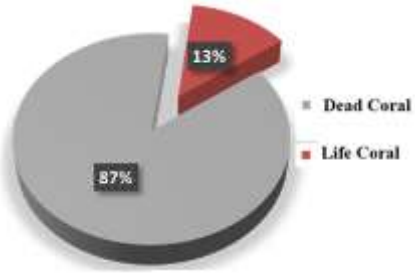

Figure 7. Survival rate graph

Figure 8. Embroidering activities

Maintenance step is carried out by cleaning the spider structure from algae using a steel brush. Apart from that, embroidery is also carried out or replacing dead coral with new coral. This embroidery activity is carried out underwater by taking the same type of coral as the type of coral that has survived. This embroidery is done underwater without lifting the spider structure.

CONCLUSION

High levels of nutrients and a lack of algae-eating fish result in high algae cover found on the surface of structures and this impacts the death of transplanted coral. Efforts are made to clean algae periodically to increase the survival rate and replant dead coral.

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REFERENCES

Burke, L., Reytar, K., Spalding, M., & Perry, A. (2011). *Reef at Risk Revisited*. Wasington, DC : World Resource Institute.

Dedy Kurniawan, B., Dwirama Putra, R., Febrianto, T., Septiani Putri, D., & Ramlan, M. (2021). Transplantation of Corals as a Coral Reef Conservation in. *Journal of Maritime Empowerment*, *3*(2). https://ojs.umrah.ac.id/index.php/jme

Haris, A. (2011). Trabplantasi Karang Acroporidae Pada Substrat Alami. *Omni Akuatika*, *10*(12), 33 0 42.

Hermanto, B., & Utara, S. (2015). JurnalIlmiahPlatax JurnalIlmiahPlatax ISSN : 2302-3589. 3(2), 90–100.

IUCN. (2021). The IUCN Red List of Threatened Species. Version 2021-1.

Johan, O., Soedharrna, D., & Suharsono. (2008). Tingkat keberhasilan transplantasi karang batu pada lokasi berbeda di gugusan Pulau Pari Kepulauan Seribu Jakarta. In *Jurnal Riset Akuakultur* (Vol. 3, Issue 2, pp. 289–300). http://ejournal-balitbang.kkp.go.id/index.php/jra/article/view/2479

Mustafa, A., Oetama, D., & Sidiq, A. (2020). Perbandingan Pertumbuhan Fragmen Karang Acropora sp. yang Ditransplantasi Menggunakan Metode Ikat dan Metode Gantung. *JSIPi (Jurnal Sains Dan Inovasi Perikanan) (Journal of Fishery Science and Innovation)*, *4*(1), 38. https://doi.org/10.33772/jsipi.v4i1.11527

NOAA. (2015). NOAA declares third ever global coral bleaching event.

Saputra. (2021). Literatur Review : Status dan Pola Pengelolaan Ekosistem Terumbu Karang di Indonesia. IPB.

Saputra, D., Perairan, B., Pontianak, U. M., Nugini, P., Leste, T., & Coral, H. (2020). *Hexadome Coral : Upaya Pelestarian Terumbu Karang Dengan Metode Transplantasi*. *2020*.

Siahaan, S. B., Studi, P., & Sumberdaya, M. (2018). Aplikasi biorock terhadap kelangsungan hidup transplantasi karang dan keanekaragaman ikan di pulau karimunjawa. 7, 164–170.

Subhan, B., Madduppa, H., Arafat, D., & Soedharma, D. (2014). *BISAKAH TRANSPLANTASI KARANG PERBAIKI EKOSISTEM TERUMBU KARANG ? 1*(3), 159–164.

Tenilo, D., & Boalemo, K. A. B. (2021). TEKNIK TRANSPALANTASI KARANG MENGGUNAKAN METODE RANGKA-SPIDER DI SEKITAR PANTAI RATU. 4, 569–573.