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Coral Bleaching in Tanjung Dehegila Water, Morotai Island District

Djainudin Alwi[1]*, Iswandi Wahab[2], Muh Irsan[3]
Morotai Pacific University, North Maluku
Corresponding Author: Djainudin Alwi djainudinalwi@gmail.com

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ABSTRACT

This study aims to identify the types of corals that experience bleaching and the factors that cause it. This research was conducted in Tanjung Dehegila Waters, Morotai Island Regency, in August-September 2021. Data was collected using the Line Intercept Transect (LIT) and Photo Line Intercept Transect (LIT) methods. Observational data were analyzed descriptively. The identification results of coral bleaching species were dominated by the genus Acropora (branching corals), where species were found to be bleaching in almost all research stations, while coral bleaching in Tanjung Dehegila waters was more due to natural factors, namely high water temperatures ranging from 30-34 0C. The temperature conditions of these waters pass the optimum limit for coral reef life.

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INTRODUCTION

Coral reefs are ecosystems that are fertile and rich in food. Their complex physical structure makes them attractive habitats for many types of marine biota. Therefore the inhabitants of coral reefs are very diverse, both plants and animals. The benefits contained in coral reefs are very large and varied. Sawyer (1993) and Cesar (1996) in Dahuri (1999) stated that estimates of the types of benefits contained in coral reefs could be identified into two, namely direct benefits in the form of utilization of fish resources, coral reefs, tourism, research and utilization of another aquatic biota that are contained therein. At the same time, indirect utilization is the utilization of the function of coral reefs as a barrier to coastal abrasion, biodiversity, and all that.

The existence of Indonesia's coral reef ecosystem is currently experiencing a lot of worrying degradation. It is shown from the percentage of live coral cover in damaged and moderate conditions, respectively 39.5% and 33.5%, while those showing satisfactory and good conditions were only 5.3% and 21.7%, respectively (Dahuri, 1999). In general, the causes of damage to coral reefs can be grouped into two parts, namely, damage caused by human activities (anthropogenic causes) and damage caused by natural processes (natural causes) (Dahuri, 1999). Damage caused by natural processes is divided into two parts: Damage caused by physical processes and damage caused by biological processes (Fagerstrom, 1987).

Coral bleaching events are one of the Damages caused by natural processes where this damage is affected by fluctuations in sea surface temperature (SST). Corals are almost certain to be subject to more frequent and extreme bleaching if average temperatures continue to rise due to global climate change. Therefore, climate change can be the greatest threat to coral reefs worldwide. Bleaching is a common phenomenon in a coral reef. However, mass bleaching is an uncommon symptom. Usually, this is triggered by a sudden rise in seawater temperature (Marshall & Baird, 2000). Mass coral bleaching events were reported in 1998 in almost all tropical waters of the world and Indonesia, followed by the mass death of individual corals, especially species that are intolerant to higher temperature changes (Suharsono, 2002). The death of individual corals in bleaching events results from the release of zooxanthellae from the coral body tissue or the difficulty of relocating to individuals who have been left behind. Zooxanthellae are unicellular algae as symbionts for coral animals (Westmacott et al., 2000).

Tanjung Dehegila waters, Morotai Island Regency, has various types of coral reefs used by the local community as a potential area for fishing. However, recently, based on visual observations, it can be seen that the condition of the coral reefs in Tanjung Dehegila waters at several points has experienced coral bleaching.) the causal factors for this event are unknown, so it is necessary to study the coral bleaching in the coral reef ecosystem of Tanjung Dehegila waters. Research on coral bleaching has been carried out by other researchers, such as Coral bleaching in the Southern Natuna Sea (Edi, 2010), damage to coral reefs due to biological processes by (Tioho & Roeroe, 2002), Westmacott et al. (2000)

regarding management coral reefs that have been bleached and damaged and there are many more studies on coral bleaching regarding this research.

METHODOLOGY

This research was carried out in August-September 2021 in Tanjung Dehegila Waters, Morotai Island Regency.

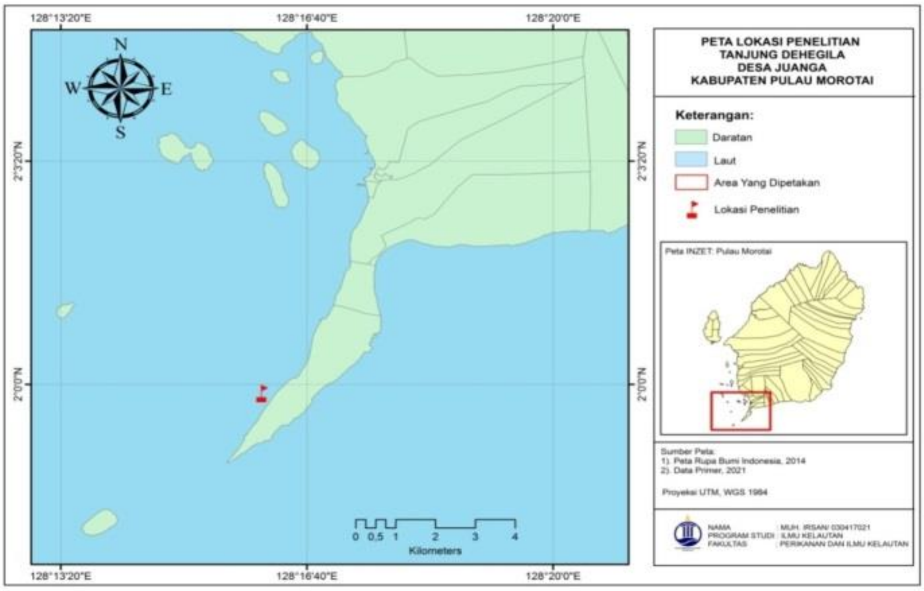

Figure 1. Map of Research Locations

Tools and Materials

The tools used in this study were hand refractometers, pH meters, thermometers, current meters, Secchi disks, diving equipment, roll meters, GPS, iron stakes, and stationery. At the same time, the material is coral reefs as the object of observation.

Data Collection Techniques

Data collection on coral bleaching (bleaching) was carried out at an observation station in Tanjung Dehegila waters, Juanga Village, Morotai Island Regency, using the Line Intercept Transect (LIT) and Photo Line Intercept Transect (PLIT) methods according to English et al. (1994) modified by Johan (2003) (Fig. 2). It consists of 3 (three) stations where each station is placed as many as 2 (two) transects with a transect length of 50 m parallel to the coastline with 2.5 observation areas on the left side and 2.5 on the right side. The placement of the transects is adjusted to the depth, namely 2-5 m (transect 1) and 5-7 m (transect 2), so a total of 6 (six) transects will be placed.

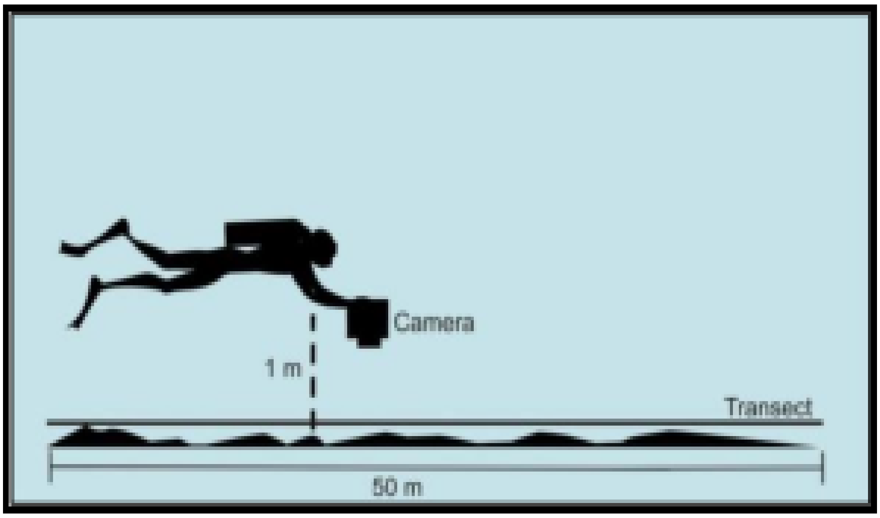

Figure 2. Data Collection for Coral Bleaching Using the LIT and PLIT Methods.

Data on genera and the number of individual corals experiencing bleaching were taken by combing the transect area attached and taking documentation/photos of individual and genera of corals experiencing bleaching. Then the data were identified using guidelines (Suharsono, 2008; Raymund et al., 2008). As supporting data, environmental parameters such as temperature, pH salinity, current speed, and water brightness are also measured.

Data Analysis

The identified list of genera of corals experiencing coral bleaching was then analyzed descriptively and presented in the form of graphs and tables.

RESULTS

The results of field research found that five genera of corals experienced bleaching in the waters of Tanjung Dehegila, Morotai Island Regency. They were identified as hard corals from *Acropora*, *Favites*, *Goniastrea, Favia*, and *Astreopora*, with a total of 31 individuals (Table 1), with details of 25 individuals from the genera *Acropora, Favites*, and *Astereopora* each found 2 (two) individuals. In contrast, the genera *Gonistrea* and *Favia* each found 1 (one) individual.

Table 1. Number of Coral Genera That Experienced Bleaching at the Study Site

No	Genera	Station			Total
		I	II	III	
1	*Acropora*	8	2	15	25
2	*Favites*	1	0	1	2
3	*Goniastrea*	1	0	0	1
4	*Favia*	1	0	0	1
5	*Astreopora*	0	2	0	2
Number of Individuals (*bleaching*)					**31**

Bleaching Based On The Type Of Coral

Figure 3 (a station I) shows that nine corals experienced bleaching among the six species of the *Acropora* genus (*A. formosa, A. fermentosa, A. samoniensis, A. tenius*, and *A. hyacinhtus*). The rest were *Favites halicora, Goniastrea retiformis*, and *Favia rotundata*. Types of *A. formosa* and *A. tenius* were the most frequently bleached species, with two individuals each, while the other types experienced one individual each.

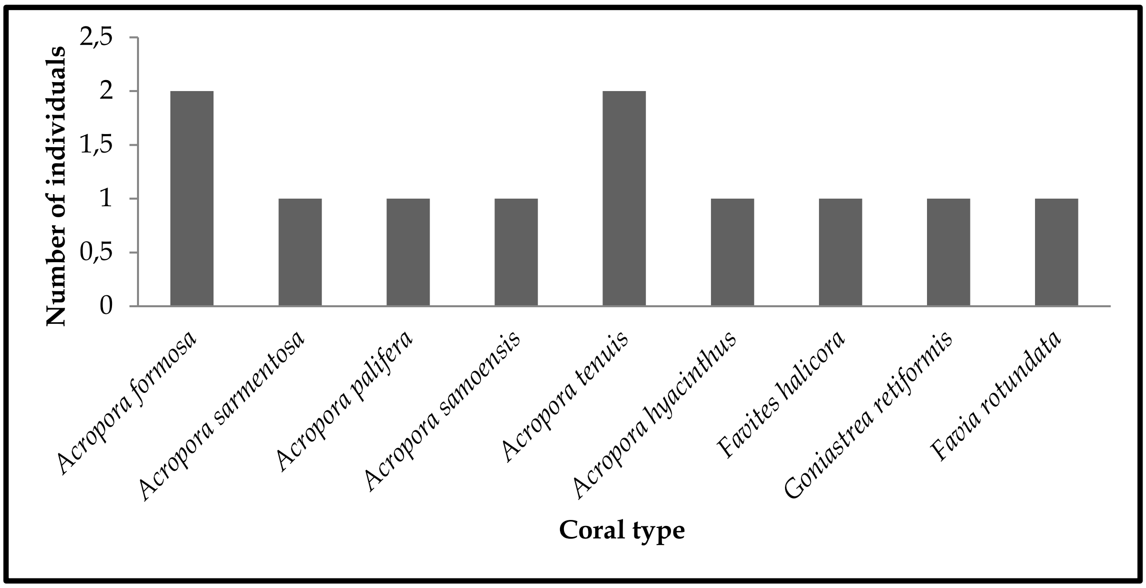

Figure 3. Graph of Coral Bleaching By Species at Station I.

In contrast to station II (Figure 4), two corals experienced bleaching, *Acropora hyacintus*, and *Astreopora gracilis*, with two individuals each.

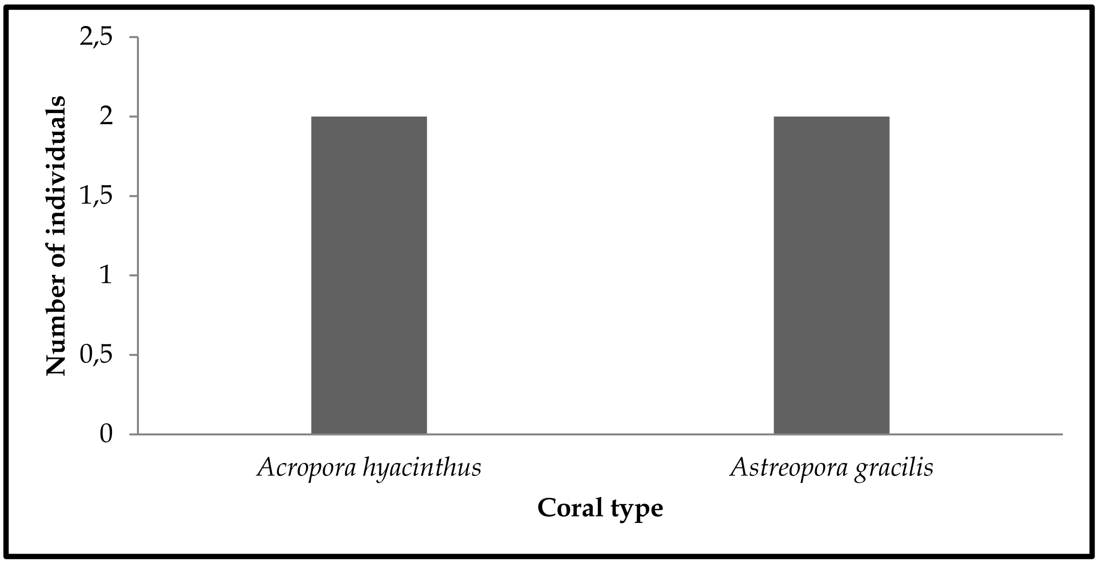

Figure 4. Graph of Coral Bleaching By Species at Station II.

The results of observations at station III (Figure 5) found that five species of coral experienced bleaching, including three species from the genus *Acropora* (*A. formosa, A. hycenthus*, *A. millepora,* and *A. prostrata*), while one species from the genus *Favites*, namely *Favites halicora*. The number of individuals that experienced the most bleaching was *A. hycenthus*, with seven individuals, followed by *A. millepora*, with five individuals, and the least was *Favites halicora* and *A. prostrata*, each one individual.

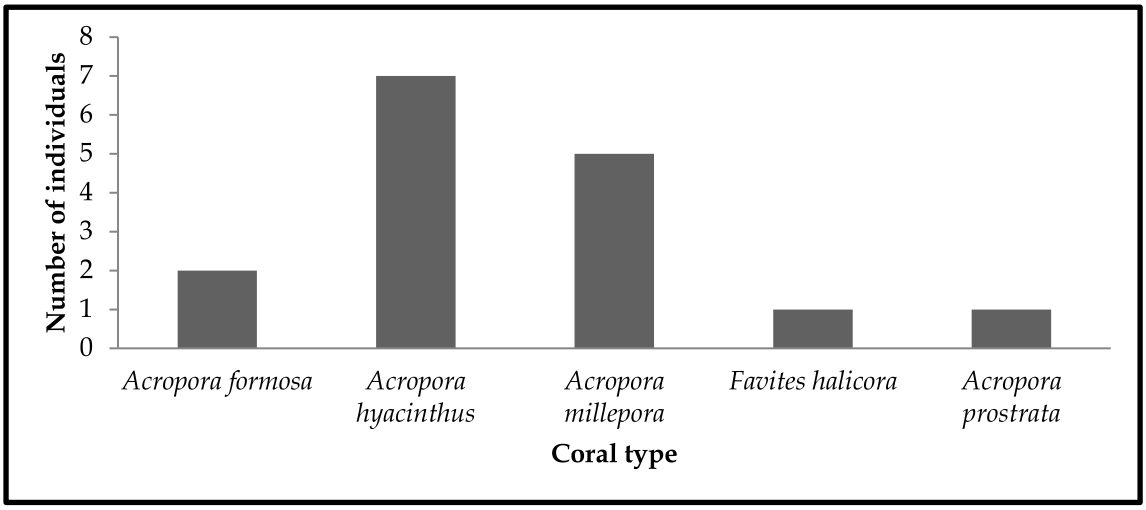

Figure 5. Graph of Coral Bleaching By Species at Station III.

Coral bleaching based on growth form

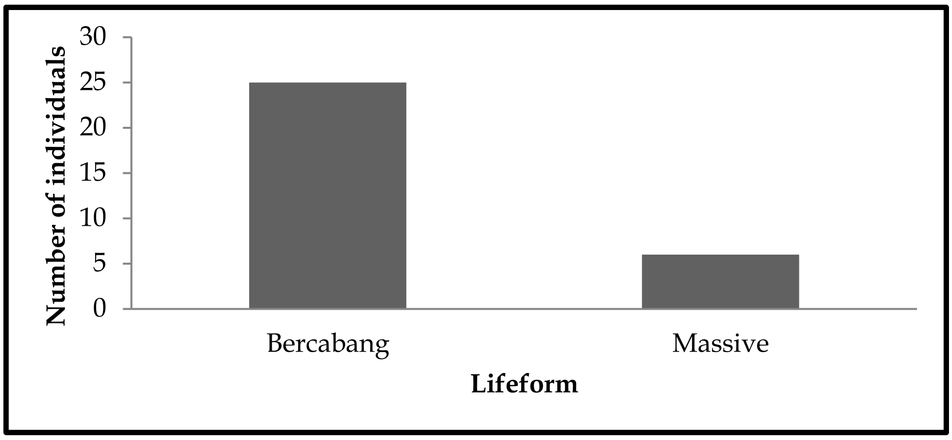

Figure 6**.** Graph of Coral Bleaching By Growth Form.

Observation data carried out at each research station was then sorted based on the form of coral growth that experienced bleaching and identified as many as two categories, namely branching corals and massive corals (Figure 6). The results showed that the type of coral that experienced the most bleaching turned out to have more branching corals compared to massive corals, which only experienced slight bleaching, with a total of 25 individuals for each category for branching corals and six individuals for massive ones. The following is an example of a coral category experiencing bleaching in Tanjung Dehegila (Figure 7).

Figure 7. Coral Bleaching (Bleaching) on Massive (A) and Branching (B) Corals in Tanjung Dehegila Waters, Kab. Morota Island

Environmental Parameters

Table 2. Environmental Parameters in Tanjung Dehegila Waters

Indicators	**Station**		
	I	**II**	**III**
temperature (°C)	30	34	34
current speed (m/s)	0,27	0,05	0.05
salinity (‰)	35	35	35
brightness (m)	6	6	6
pH	8	7	7,15

DISCUSSION

Environmental parameter measurement data measured in the waters of Tanjung Dehegila as the observation location (Table 2) show that the water temperature is between 30-34 ^{0}C, the current speed is in the range of 0.05-0.27 m/s, the salinity is 35‰, the brightness is at a depth of 6 m while the pH ranged from 7-8.

Based on the data found above (Table 1 and Figure 3-7), it can be seen that corals from the genus *Acropora* (branching) experienced the most bleaching and were always found at each observation station. It shows that Acropora corals are very susceptible to damage and disease. Moreover, at station I, many types of Acropora corals were experiencing bleaching. In line with that, in the opinion of Grimsditch (2009) that Acropora coral is known as a coral that easily and quickly grows so that it is very dominant in all waters of the world with the highest number of species, but this coral belongs to a group that is not resistant (susceptible) to environmental changes and easily and experiences bleaching. According to Veron (2000) in Rudi (2012), Acropora coral is dominant in Indo-Pacific waters in terms of abundance and the number of species. Acropora and other susceptible corals are often found in entire bleaching individuals. In contrast to massive coral (non-Acropora), massive coral is a type of coral with high adaptability to changing waters because this type of coral has large polyps (Barus et al., 2018).

The occurrence of coral bleaching in Tanjung Dehegila can be related to an increase in water temperature, where the results of temperature measurements in the waters ranged from 30-34 ^{O}C. The high temperature was caused by natural factors such as global warming. It is in line with the opinion of Westmacott (2000). The causes of coral bleaching are abnormally high seawater temperatures, high levels of ultraviolet light, lack of light, high levels of turbidity due to sedimentation, disease, abnormal salt levels, and pollution, while the majority of coral bleaching on a large scale in the last two decades associated with an increase in sea surface temperature (SST).

Nybaken (1988) suggests that seawater temperatures commonly found in Indonesian waters range from 27-32 ^{O}C. Meanwhile, Sukarno et al. (1981) in Patty and Akbar (2018) stated that the rock coral (Sleractinia) forming coral reefs requires rather high temperatures in the range of 20-30 ^{O}C and can normally live in the temperature range of 25-28 ^{O}C. Other environmental parameters measured in Tanjung Dehegila, such as salinity, current speed, pH, and water brightness, are still within optimum limits for coral reef life (Table 2).

Mass coral bleaching events were reported in 1998 in almost all tropical waters of the world and Indonesia, followed by the mass death of individual corals, especially species that are intolerant to higher temperature changes (Suharsono, 2002). The death of individual corals in bleaching events results from the release of zooxanthellae from the coral body tissue, especially hard coral species, permanently or the difficulty of relocating to individuals who have been left behind. *Zooxanthellae* are unicellular algae as symbionts (Westmacott et al., 2000).

CONCLUSIONS

The identification results of coral bleaching species were dominated by the genus Acropora (branching corals), in which species were found bleaching in almost all research stations. Coral bleaching in Tanjung Dehegila waters was caused more by natural factors, namely high water 30-34 ^{O}C. The temperature conditions of these waters pass the optimum limit for the life of coral reefs.

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