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## CONDITION OF CORAL REEFS IN THE WATERS OF PANDANGAN ISLAND

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### ABSTRACT

Coral reef ecosystems are one of the resources of coastal areas that are very vulnerable to damage, especially those caused by human behavior / surrounding communities. This research aims to calculate the percentage of coral cover and determine the condition of coral reefs in the waters of Pandangan Island, Mattiro Ujung Village, Liukang Tupabbiring District, Pangkep Regency. This research is carried out from February to April 2022, using the *Underwater Photo Transect* (UPT) method which is processed and analyzed with *CPCe software*. The results obtained were 27 types of coral growth forms, namely *Acropora Digitate, Acropora Encrusting, Acropora Submassive, Acropora Tabulate, Acropora Branching, Coral Branching, Coral Encrusting, Coral Heliopora, Coral Massive, Coral Millepora, Coral Mushroom, Coral Submassive, Coral foliose, Dead Coral, Dead Coral With Algae, Sponge, Other, Soft Coral, Halimeda, Turf Algae, Macro Algae, Coralline Algae, Algae Assamblage, Rubble, Sand, Silt, and Rock*. The percentage of coral cover from each station, namely at station I was 23.17%, Station II was 25.44%, Station III was 26.56%. with an average coral cover of 25.06% and the condition of coral reefs in the waters of Pulau Views is in the moderate category referring to the Decree of the Minister of the Environment Number 4 of 2001 concerning the standard criteria for coral reef damage.

### KEY WORDS

Coral reefs, Pandangan island waters, underwater photo transect (UPT).

Coral reefs are one of the main components of coastal and marine resources, besides mangrove forests and seagrass beds. Coral reefs and all the life that is in them is one of the natural wealth owned by the Indonesian people which is priceless. It is estimated that the area of coral reefs in Indonesian waters is approximately 75,000 km<sup>2</sup> representing 15% of the world's coral reefs, which are widely distributed from the waters of western Indonesia to eastern Indonesia (WWF, 2010).

A wide expanse of coral reefs surrounds Kapoposang Island and extends to the west. Meanwhile on Pandangan Island, the reef shelf is almost the same width in every direction. Several taka and gusung that lie around the Island of View include Gusung Taka Banynyara, Tattoroe, Kampe, Sipakkaluro, Pallawangeng, Timpusu Cakka, Batu Sellae and Karang.

The condition of the waters around the Gaze Island is quite clear, in the reef top and reef edge areas you can still find live coral cover which can reach 32% (moderate category), but its distribution is at a depth of 4–15 m near the reef cliff area on the south side of the island. The average reef on the north and west sides of the island is dominated by crushed coral, dead coral covered with algae and sand. The use of bombs in this area is also seen with a rubble condition of 16% (Coremap report, 2011).

Based on the results of the 2011 Coremap research, it is important to conduct research on "Condition of Coral Reefs in the Waters of Pandangan island, Mattiro Ujung Village, Liukang Tupabbiring District, Pangkajene and Archipelago Districts". The purpose of this



study was to determine the percentage of cover and condition of coral reefs, with the hope that this could provide information and could be used as material for consideration by the local government in managing coral reefs.

### METHODS OF RESEARCH

This research was conducted from February to April 2022, located in the waters of the Pandangan Islan (TWP Kapoposang Islands, Mattiro Ujung Village, Liukang Tupabbiring District, Pangkajene and Islands District). The location map can be seen in Figure 1.

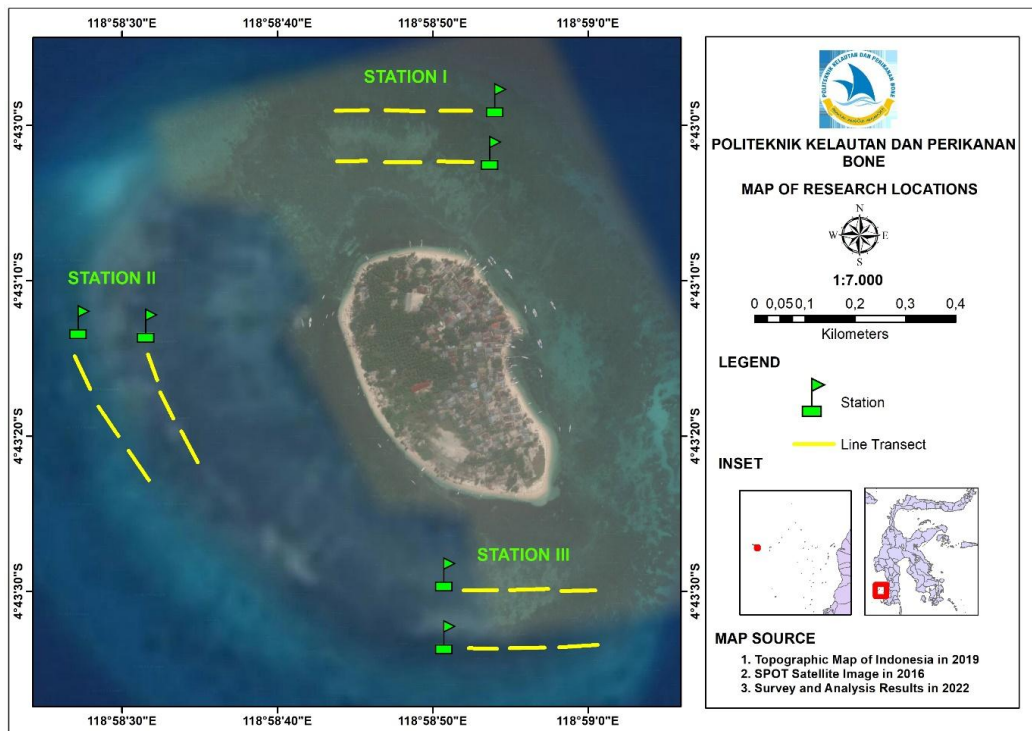


Figure 1 – KPA Location Map

In the figure it can be seen that observations of the condition of coral reefs were carried out at 3 observation points, namely: Observation station I is located in the northern part with coordinates S  $-04^{\circ}71' 5.84''$  and E  $118^{\circ}98' 1.37''$ . Observation station II is located in the western part with coordinates S  $-04^{\circ}71' 9.83''$  and E  $118^{\circ}97' 2.53''$  and observation station III is located in the southern part with coordinates S  $-04^{\circ}72' 6.21''$  and E  $118^{\circ}98' 0.57''$ .

Some of the tools and materials used in this study to identify the condition of coral reefs and collect water quality data can be seen in Table 1.

Table 1 – Tools and Materials

No	Tools and materials	Utility
1.	Diving equipment (scuba set)	Collecting data
2.	Motor ship	Means of transportation
3.	Underwater camera	Take a picture
4.	Frame (squared transect)	Area barrier
5.	Roll meter	Transect line puller
6.	GPS	Take coordinates
7.	External hard drive	Save photos
8.	computers	Analyze photos
9.	CPCe program	Processing data
10.	Refractometer	Measure the Salinity of seawater
11.	thermometer	Measure seawater temperature
12.	PH meter	Measure the pH of seawater
13.	Flow kite	Know and measure ocean currents

Source: Primary Data 2022.



Referring to COREMAP-CTI (2014) regarding monitoring the health of coral reefs, this practice uses the UPT (Underwater Photo Transect) method. Data collection is done by using an underwater digital camera or an ordinary digital camera equipped with a casing so that it is resistant to seawater seepage. The captured photos were then analyzed using the Coral Point Count with Excel Extensions (CPCe) to obtain quantitative data.

The steps in collecting coral reef data using the Underwater Photo Transect method in Botubarani waters adopting the COREMAP CTI 2017 are as follows:

1. The determination of the observation location is carried out by taking into account the representativeness factor, the transect safety factor, the safety factor and work comfort. Placement of transect stations was chosen on a representative basis where Station I was located on the north side of the island, Station II was located on the west side and station III was located on the south side of the island;
2. Draw the transect line using a roll meter (scale tape). The length of the transect line is 150 meters at a depth of 2-4 meters and 150 meters at a depth of 6-8 meters at each station or 50 meters with 3 repetitions at each depth. The distance between repetitions 1 to 2 and 3 is 5 meters. For uniformity in drawing the transect line, the position of the island is to the left of the observer;
3. After the transect line is installed, data collection is carried out by underwater shooting, where the angle of taking photos is perpendicular to the bottom of the substrate or the shooting area is the size of the frame (58 x 44) cm<sup>2</sup>, shooting starts from the 1st meter or an odd number on the left transect line, followed by taking photos at the 2nd meter or even number on the right side of the transect line and so on until the end of the transect.



Figure 2 – Illustration of Sampling Using the UPT Method (Source: Giyanto et al., 2014)

After all the photo taking is complete, then the photos that have been stored in the camera's memory are ready to be moved to the hard drive and photo analysis will be carried out in the CPCe software.

Analysis based on photo shoots was carried out using a computer and CPCe software (Giyanto et al., 2014). The CPCe Version 4.1 (Coral Point Count With Excel Extension) application is a computer application that can be used to calculate the area of the bottom substrate of an observed photo using an underwater digital camera. Besides being able to calculate the percentage of base substrate cover using the point count method, it can also be used to calculate the area of each type of bottom substrate that we will analyze. A total of 30 sample points were selected for each photo frame and each point was coded according to the code for each category and the biota and substrate at that point.

Based on the photo analysis process carried out for each photo frame, the percentage value of category cover for each frame can be calculated based on the formula (English et al., 1997) as follows:

$$\text{Category cover percentage} = \frac{(\text{the number of points in that category})}{(\text{lots of random points})} \times 100\%$$



After all the photos have been identified, a coral cover value will be obtained and then the results of the photo analysis will be displayed using Microsoft Excel. Assessment of the condition of coral reefs based on the percentage of live coral cover refers to the Decree of the Minister of Environment No. 4 of 2001 concerning standard criteria for damage to coral reefs. The status of coral reefs is grouped into 4 categories as follows:

- a. Very good : 75%-100%;
- b. Good : 50%-74.9%;
- c. Moderate : 25%-49.9%;
- d. Bad : 0%-24.9%.

## RESULTS AND DISCUSSION

The percentage cover for the coral category was obtained by analyzing photos in the CPCe software. Photos were obtained using the Underwater Photo Transect method, while the data collection process can be seen in Photos 1-4.



1



2



3



4

Photos 1-4 – Data collection process (drawing transect lines, placing frames, taking pictures, extending the roll meter)

The process of collecting data on coral reefs using the UPT method makes it easier for observers to analyze the types of coral growth in a waters without having to dive for long.



The results of data processing using the CPCe software were to obtain the percentage of coral cover categories at each station per depth in the waters of Pandangan Island with percentage values as shown in Figures 3 and 4.

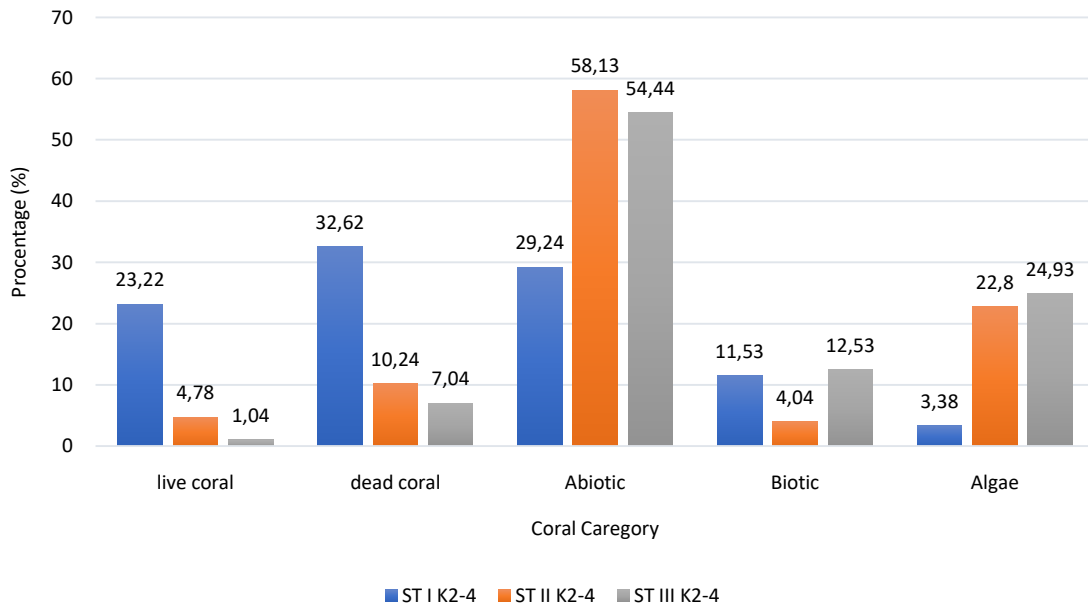


Figure 3 – Percentage cover for the coral category with a depth of 2-4 m

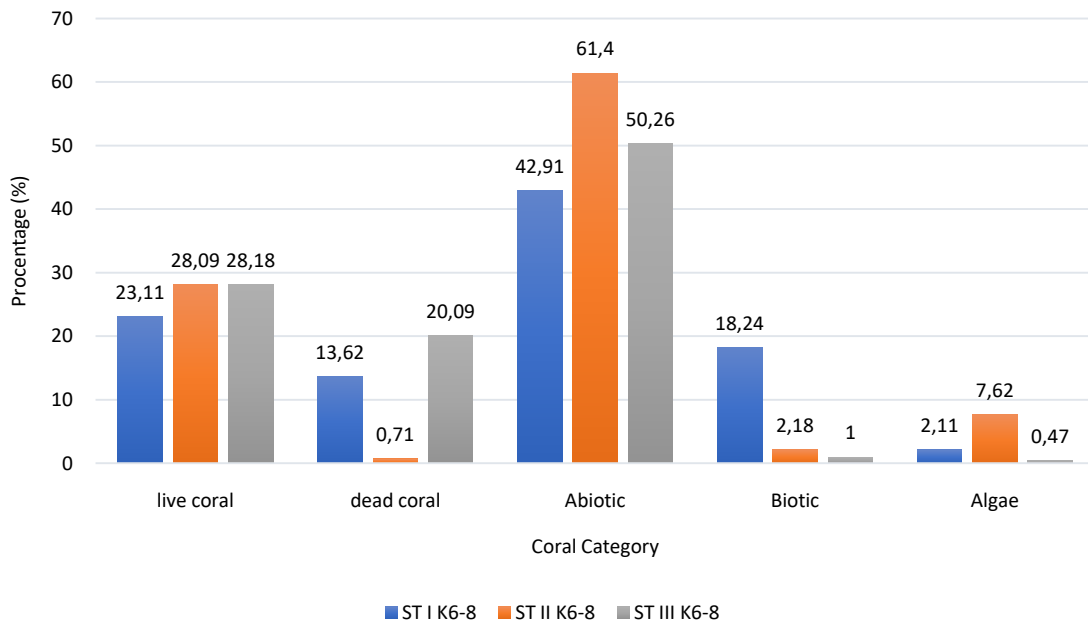


Figure 4 – Percentage cover for the coral category with a depth of 6-8 m

Percentage (%) of coral reef category cover, station I the northern part of the island at a depth of 2-4 m, live coral 23.22%, dead coral 32.62%, abiotic 29.24%, biotic 11.53%, algae 3.38%. For station II the western part of the island at a depth of 2-4 m, live coral 22.80%, dead coral 4.04%, abiotic 58.13%, biotic 10.24%, algae 4.78%. Furthermore, at station III the southern part of the island at a depth of 2-4 m, live coral 24.93%, dead coral 12.53%, abiotic 54.44%, biotic 7.04%, algae 1.04%.



Percentage (%) of coral reef category cover, station I the northern part of the island at a depth of 6-8 m, live coral 23.11%, dead coral 13.62%, abiotic 42.91%, biotic 18.24%, algae 2.11%. For station II the western part of the island at a depth of 6-8 m, live coral 28.09%, dead coral 0.71%, abiotic 61.40%, biotic 2.18%, algae 7.62%. Furthermore, at station III the southern part of the island at a depth of 6-8 m, live coral 28.18%, dead coral 20.09%, abiotic 50.26%, biotic 1.00%, algae 0.47%.

Based on the Decree of the Minister of Environment No. 4 of 2001, the condition of coral reefs is determined from the percentage of live coral cover, because the main component in a coral reef ecosystem is hard coral (Giyanto, 2017) and also according to Sukarno (1993) The condition status of coral reefs is determined using the level of cover live coral.

Live coral cover at station I at a depth of 2-4 m was 23.22% while the value of live coral at a depth of 6-8 m was 23.11%. The high percentage of DCA coverage is due to the location of Station I. This is because fishermen operating in this area, especially fishermen from the outside, use explosives (bombs) and local people use toxic materials to catch fish. In addition to damaging the coral reefs around the blast site, it can also cause the death of other organisms that are not the target. At a depth of 6-8 m the DCA value is also quite high at 13.60%, compared to a depth of 2-4 m the DCA value at a depth of 2-4 m is much higher 32.56%, due to areas that are very dense with human activity.

The cause of the condition of coral reefs is high algae dead coral cover (DCA) where DCA cover is the dominating cover, at a depth of 2-4 m that is 32.56%, while at a depth of 6-8 m that is 13.60%. Algae dead coral is coral that has died and its surface has been overgrown with algae (Giyanto, 2017).

The presence of algae will become a competitor for corals so that corals will find it difficult to survive, algae will have a negative impact on slow-growing coral communities, so if growth is controlled the algae community will soon dominate coral reef ecosystems (Dianastuty, 2016).

It can be seen in Figures 9 and 10. The percentage of live coral cover at Station II, at a depth of 2-4 m is 22.80%, while the percentage of live coral cover at a depth of 6-8 m is 28.09%. According to the Decree of the Minister of Environment No. 4 of 2001 the value of live coral station II, at depths of 2-4 and 6-8 can be categorized as bad at depths of 2-4 m and moderate at depths of 6-8 m.

The results of station III coral cover can be seen in Figures 5 and 6. The percentage of live coral cover in Station III at a depth of 2-4 m was 24.93% while the percentage of cover at a depth of 6-8 m was 28.18%. The value of live coral at station III can be classified in the bad category at a depth of 2-4 m and moderate at a depth of 6-8 m, according to the Decree of the Minister of Environment Number 4 of 2001 the bad value is categorized in the range 0% - 24.9%, moderate is categorized in the range of 25% - 49.9%.

The highest percentage of living coral category was at station III in the southern part of the island at a depth of 6-8 m at 28.18%, dominated by Massive Coral species at 7.76%. The coral lifeform categories at station III in the southern part of the island consist of the Acropora Digitate, Encrusting, Submassive, Tabulate, Branching and Non-Acropora categories with Coral Branching, Encrusting, Heliopora, Massive, Millepora, Mushroom, Submassive and Foliose growth forms. Station III in the southern part of the island had the highest percentage of live coral categories. Furthermore, the lowest percentage of live coral categories was at station II in the western part of the island with a depth of 2-4 m at 22.80%. The low live coral cover at station II on the western part of the island is due to human activities.

The condition of the coral reef community of TWP Kapoposang, Pandangan Island, which can be seen from the total percentage value of live coral cover at each station (live coral station I + live coral station II + live coral station III) gets a percentage value of 25.06%. classified in the moderate category according to the Decree of the Minister of Environment No. 4 of 2001, the value is categorized in the range of 25% - 49.9%. At Kapoposang TWP, View Island, the abiotic cover (R+S+SI+RK) dominated the coral cover in the waters of View Island, which was 49.40%.



Snorkeling tourism is a tourism Based on observations in the field, Pandangan Island is the location for fishing and tourist boats to anchor, which is the cause of the breaking or death of coral reefs caused by the lowering of the ship's anchor which directly hits the coral reef itself.coral itself.

The high level of human activity and interaction with the environment has the potential to reduce the carrying capacity of the environment, especially coral reef ecosystems. As revealed by the World Research Institute (2000) and Ranjbar (2010), snorkeling tourism is one of the tourism activities that is vulnerable to damage to coral reefs (Webler and Jakubowski, 2016). The high value of the percentage of Abiotic cover (R+S+SI+RK) on Kapoposang Island greatly affects the low percentage of live coral cover where, Rubble is one of the live competitors for coral reefs (Prasetia, 2015). The high percentage of Abiotic cover is due to high primary productivity, for Abiotic cover can be seen in Figures 5 and 6.

The results of data processing using the CPCe software obtained the percentage of coral cover categories at each station in the waters of Pandan Island with percentage values as shown in Figure 5.

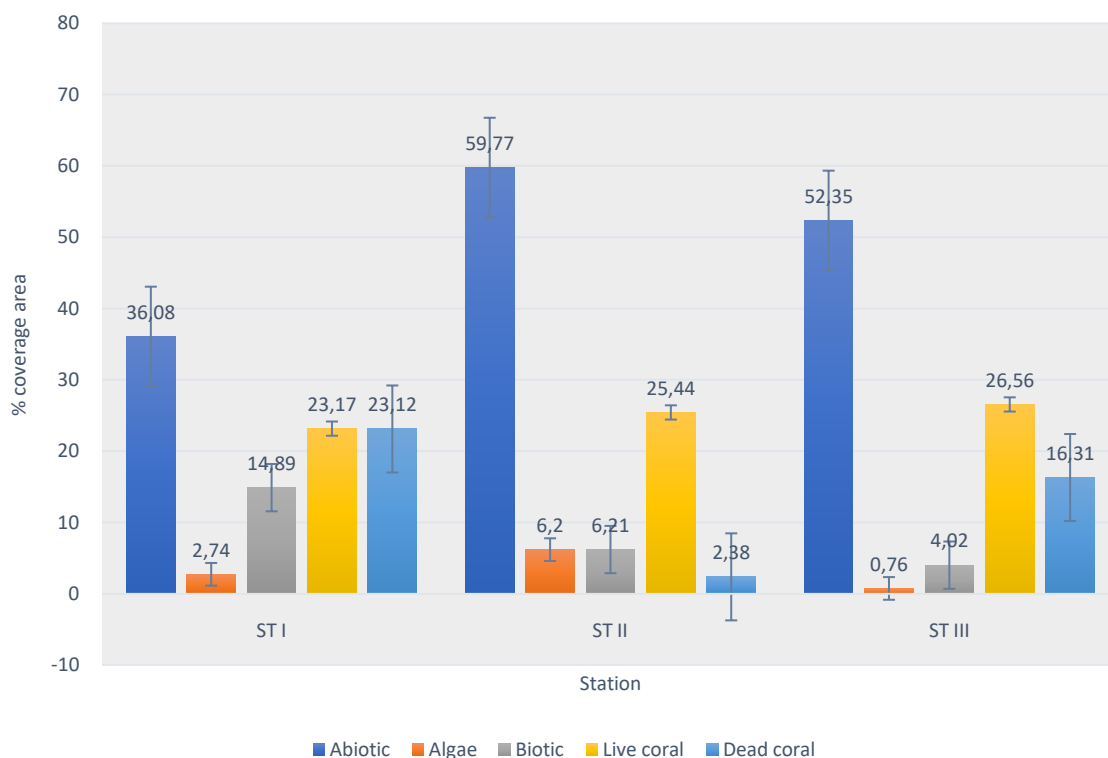


Figure 5 – Percentage of coral category cover per station

The results showed that at Station I the northern part of the island had the lowest percentage of live coral cover of 23.17% which was dominated by Coral foliose of 13.12%, dead coral of 23.12%, biotic of 14.89%, algae of 2.74% and abiotic by 36.08%.

For station II of the western part of the island, the percentage of coral from each category was obtained, namely live coral by 25.44% which was dominated by massive coral species by 8.99%, dead coral by 2.38%, biotic by 6.21%, algae by 6.20% and abiotic by 59.77% . Furthermore, at station III in the southern part of the island, the highest percentage of live coral category was obtained at 26.56% which was dominated by massive coral species at 7.07%, dead coral at 16.31%, biotic at 4.02%, algae at 0.76% and abiotic at 52.35%.

Based on the results of observations and analysis, the percentage of coral reef cover was obtained. It can be seen that the condition of coral reefs at each station at each depth in the waters of Pandangan Island is presented in Table 2.



Table 2 – Condition of coral reefs at each depth

Station	Percentage of Live Coral Cover (%)		Depth 6-8 m	Category
	Depth 2-4 m	Category		
I	23.22	Bad	23.11	Bad
II	22.80	Bad	28.09	Moderate
III	24.93	Bad	28.18	Moderate

Source: Primary Data (2022).

Table 2. Shows that the condition of the highest live coral cover at a depth of 2-4 m was at station III with a value of 24.93% in the bad category, followed by station I with a value of 23.22% in the bad category and the lowest was in station II with a value of 22.80% in the category bad. while the condition of the highest live coral cover at a depth of 6-8 m was at station III at 28.18% with the moderate category, followed by station II at 28.09% with the moderate category and the lowest was at station I at 23.11% with the bad category. Based on the Decree of the Minister of Environment No.4 of 2001 concerning Standard Criteria for Damage to Coral Reefs.

Based on the results of observations and analysis of the percentage of coral reef cover, it can be seen that the condition of the coral reefs at each station in the waters of Pandangan Island is presented in Table 3.

Table 3 – Condition of coral reefs at each station

Station	Percentage of Live Coral Cover (%)	Category
I	23.17	Bad
II	25.44	Moderate
III	26.56	Moderate
Average	25.06	Moderate

Source: Primary Data (2022).

The table above shows that the condition of coral reefs at station I is in the bad category at 23.17%, which causes poor condition of the corals because based on observations, the bottom of the waters is algal with sand along the transect line, and coral growth is dominated by rubble and Dead Coral With Algae ( DCAs). Because fishermen operating in this area, especially fishermen from extraordinary use explosives (bombs) and local people use toxic materials in catching fish. The use of explosives and toxic materials can destroy organisms and damage the environment. The use of explosives in fishing has a huge negative effect. In addition to damaging the coral reefs around the blast site, it can also cause the death of other organisms that are not the target.

The condition of the coral reefs at station II was in the moderate category at 25.44%, where at station II human activity was not too dense causing coral growth at station II to be better than at station I, while the condition of the coral was due to destructive activity at a depth of 2-4 meters from human activities that have occurred such as the use of bombs in this area has damaged the coral as evidenced by the amount of rubble.

While the condition of the coral at station III was also in the moderate category at 26.56%, which was the highest percentage of live coral cover. Even though the water quality parameters at stations I, II and station III are supportive, due to uncontrolled human activities it is a real threat to the existence of coral reefs.

The average percentage of live coral cover in the waters of Pandangan Island, Mattiro Ujung Village, Liukang Tupabbiring District, Pangkep Regency, South Sulawesi Province in 2022. In general, the condition of the coral reefs in the waters of Gampang Island is in the moderate category with an average percentage of coral cover. life of 25.06% referring to the Decree of the Minister of Environment No. 4 of 2001 concerning Standard Criteria for Damage to Coral Reefs.

Water quality parameters were measured directly at the observation site (In Situ) prior to collecting data on the condition of coral reefs. Water quality data was collected once per station. The results of water quality measurements can be seen in table 4.





Table 4 – Water Quality at Observation Stations

Station	Temperature	Salinity (ppt)	pH	Current	substrate
I	30	22	9	00:10:19	Algae
II	29	22	6.8	00:33:28	sandy
III	29	22	7.73	00:51:89	sandy

Source: Primary Data (2022).

According to Barus et al (2018), the conditions of the aquatic environment have both positive and negative impacts on the form of coral reef growth in the waters. The parameters of the aquatic environment that were measured included temperature, salinity, pH, and currents. Water temperature measurements are carried out at each station where the temperature at observation stations, residential waters and waters without settlements has a temperature range of 29°C – 30°C where this value includes the optimal range of coral reef life. Based on the Decree of the Minister of Environment Number 51 of 2004, which is good for the life of coral reefs ranges from 28°C – 32°C. Hartoni (2011), said that corals can still tolerate a maximum annual temperature of 36°C – 40°C and a minimum of 18°C. An increase in temperature of 2°C from the optimal temperature can reduce the level of primary productivity of corals and increased damage to coral reefs can be caused by an increase in temperature (Suharsono, 2014). Based on the optimal temperature criteria above, the temperature value at the observation station can be categorized as good for coral reef life.

Measurements of water salinity are carried out at each station where the salinity at observation stations, residential waters and waters without settlements has a value of 22‰, which is where the value is less than the optimal value for coral reef life. coral reef life ranges from 33‰ – 34‰. However, according to Coral Watch (2011) and Sudiarta (1995) corals have a salinity tolerance ranging from 27-40‰. Salinity can change due to the increase and decrease of water molecules in the evaporation process of rainwater and vice versa if the rainfall is greater than evaporation, the salinity decreases and this condition depends on latitude and season (Prasetia, 2015). Based on the optimal salinity criteria, the salinity value of the observation station is low but still good for coral reef life.

Based on the criteria for a good pH for coral reef life, it ranges from 7 – 8.5. The pH value in a waters is influenced by various factors including rainfall and influences from the land as well as oxidation processes which can result in a low pH value (Edward and Tarigan, 2003). Changes in pH can have adverse effects on the life of marine biota, both directly and indirectly (Prasetyo et al., 2018). Based on the optimal pH criteria above the pH value at the observation station it can be categorized as good for coral reef life.

Measurement of current data is taken at one point at each station with measurements at each station, measurements of water currents are considered to represent the currents of the observation station waters, flowing waters allow corals to obtain a good source of water, provide oxygen, avoid sediment deposition, sources of nutrients and food (Sugiyanto, 2004). The current factor can be good or bad. It is positive when it carries nutrients and organic materials needed by corals and zooxanthellae, while it is negative when it causes sedimentation in coral reef waters and covers the coral surface resulting in coral death (Prasetia, 2015). Based on the average value of the current velocity of the observation station, the current velocity value is classified as low because it is less than the optimal value of 0.05-0.08 m/s (Suharsono, 1991).

## CONCLUSION

The condition of coral reefs in the waters of the Pandangan Island, Village of Mattiro Bone, Liukang Tupabbiring District, Pangkep Regency, South Sulawesi Province, from the average percentage of the three stations, a result of 25.06% was categorized into moderate conditions (Moderate: 25.0-49.9%) based on the Decision Minister of Environment Number 4 of 2001 concerning Standard Criteria for Damage to Coral Reefs.



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