CORAL REEF ECOSYSTEM CONDITION IN BINTALAHE BEACH BONE BOLANGO

Atrila Latinulu*, Ramli Utina, Hasim
Department of Population and Environment Gorontalo State University
Jl. Jend. Sudirman No. 6 Kota Gorontalo, 96128
**Correspondence email: atrila.latinulu07@gmail.com*

ABSTRACT

This study aims to analyze the condition of the coral reef ecosystem in Bintalahe Beach Bone Bolango. This was carried out on November 7th and 10th-12th, 2020 in Bintalahe Beach. Meanwhile, the analysis is conducted in *Laboratorium Perikanan Universitas Negeri Gorontalo*. The method used is descriptive. Results demonstrate that coral growth in Station 1 is fair at 69%, in Station 2 at the 3-meter depth is fair at 39.2%, in Station 2 at the 5-meter depth is good at 55.76%, and in Station 3 is fair at 44.8%. Moreover, the abundance of coral fish is low, i.e., 1143 ind/ha in Station 1, 1637 ind/ha in Station 2 at the 3-meter depth, 2182 ind/ha in Station 2 at the 5-meter depth, and 1802 ind/ha in Station 3. The diversity index is 1.729 in Station 1, 2.1089 in Station 2 at the 3-meter depth, 1.5898 in Station 2 at the 5-meter depth, and 1.6187 in Station 3. The plankton dominance index is 0.067 in Station 1, 0.081 in Station 2 at the 3-meter depth, 0.048 in Station 2 at the 5-meter depth, and 0.065 in Station 3. The water quality parameters measured in this study are considered suitable for coral reefs and other biotas to grow.

Keywords: *Descriptive Study, Coral Reef Ecosystem, Water Environment*

INTRODUCTION

Coral reefs are a group of organisms living on the bottom of shallow water, especially in tropical areas. Coral reef formation is deployed to limit tropical marine environments. Coral reefs are composed of class Anthozoa, phylum Cnidaria, and ordo Madreporian, which encompasses hermatypic corals or types of corals which can breed coral buildings or structures from calcium carbonate ($CaCO_3$). In the animal classification, corals belong to the large group of Cnidaria/coelenterate (hollow animals), such as jellyfish and sea anemones (Kordi and Ghufran, 2010).

Coral reefs are categorized into reef corals, i.e., organism individuals, and coral reefs, i.e., an ecosystem to which coral organisms belong. Two types of corals have been identified, namely hermatypic corals or reef-building corals, which are corals able to form reefs or limestone buildings, and ahermatypic corals which have no ability to form coral reefs or buildings (Ghufran, 2010). The crucial component of coral reefs is coral animals, either stony corals or soft corals. Many living biota species anchor on corals, where they create a functional relationship in an ecosystem called a coral reef ecosystem. As an ecosystem in coastal or sea areas, coral reefs have irreplaceable or imperative ecological functions. Sea biotas, e.g., small fishes, live there. As larger fishes depend on small fishes, once corals are damaged, the home of multiple sea biotas is destroyed and the

food chain is broken (Maulana *et al*., 2016).

Gorontalo Province is located between the Sulawesi Sea and the Gulf of Tomini. The location brings about abundant coastal resources, either renewable (fish, coral reefs, seagrass, and mangroves) or non-renewable (minerals and energy), and marine services (marine tourism and sea transportation). One of the villages which have diverse types of coral reefs is Bintalahe, located in Kabila Bone Bone Bolango. The village is directly bordered by the Gulf of Tomini. It was part of Molutabu before area expansion in 2017. There we can find a PLTU industry operated using steam power as a driving force to generate electricity, with coal fuel producing various kinds of liquid waste from the operating process. Wastes from condensers (cooling water) are called hot water waste or heat waste.

GENERAL DESCRIPTION OF STUDY AREA

Coral reef ecosystem observation is performed in the waters of Bintalahe Kabila Bone Bone Bolango in the position of between 0°27'50.54"LU and 123°08'06.55"BT. The eastern part of the village is an open sea, directly bordered by the Gulf of Tomini. In general, Bintalahe has the same water topography as Bone Bolango, i.e., facing a steep mountainous area. This brings about the obstructed movement of the wind from the sea, bringing on wind rotation and maximum waves in the coastal area of the coast. The bottom of the waters of Bintalahe is a sloping base around the coastline which then becomes a drop-off form or with a very large angle of inclination so that it is shaped like a seabed cliff. This condition impacts the stretch of coral reefs found from the low receding coastline to the drop-off area. Collating components of the coral reef ecosystem in Bintalahe are both biotic and abiotic. The biotic components are Acropora, non-Acropora, algae, soft corals, and others, whereas the abiotic ones are dead corals, sand, coral fragments, stones, mud, and water.

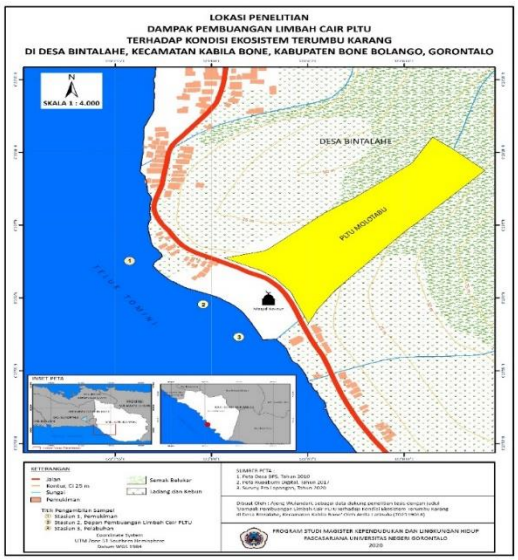

Figure 1. Map of Study Area

The study area has three stations, i.e., Station 1 existing in 0°26'1.21"NL-123°7'57.6"EL. Station 1 is a dense residential area with different resident activities. The water base substrate in Station 1 starts from a sandy beach, stones, and coral stones; Station 2 existing in 0°25'59.56"LU-123°7'59.57"BT. Station 2 right in front of the waste disposal from the steam power plant production activities. The water base substrate in Station 2 starts from stones, sand, and coral stones. The water current is moderate and not too strong. The water is oily and has a considerable hot temperature, notably in the water surface, which may be caused by PLTU wastes; and Station 3 existing in 0°25'56.24"LU-123°8'2.18"BT. Station 3 is close to the port and not too distant from the residential area and PLTU waste disposal. Station 3 is a favorite fishing area. The water base substrate starts from a stony beach, sand, and coral stones. The water base is cliff-like shaped. The current condition while observed is not too strong.

STUDY METHOD

The study of coral reef ecosystem condition was carried out on November 7th, 2020 in the waters of Bintalahe Beach Kabila Bone Bone Bolango Gorontalo Province, which lays between 0°27'50.54"LU and 123°08'06.55"BT. Meanwhile, plankton sample identification was conducted on November 10th-12th, 2020 in *Laboratorium Hidrobioekologi dan Biometrik Perikanan Universitas Negeri Gorontalo*.

1. Data Collection

The research area is divided into three observation stations after a field observation in that area.

2. Oceanographic Parameter Measurement

Oceanographic parameters of the water are in-situ measured in all observation stations using a boat as a means of transportation. Parameters measured are temperature, dissolved oxygen, salinity, current velocity, and brightness. The seawater test sampling method refers to SNI 6964.8:2015.

3. Plankton Identification

Data collected were plankton as the biological parameter. Sampling was undertaken vertically using a plankton net. Plankton sampling was carried out at the 3-meter and 5-meter depth. The seawater test sampling method refers to SNI 6964.8:2015.

4. Coral Fish Identification

Coral fish data collection in each station is conducted using the underwater visual census method by English *et al*. (1994).

5. Coverage Percentage

To examine the coverage percentage of each of the lifeforms in the field, we have to investigate the length of the respective categories using the formula (UNEP/AIMS, 1993) as follows:

$$PSK = TKT - TKS$$

Where:

PSK = the length of a category
TKT = the transition of the category
TKS = the transition of the previous category

6. Coral Reef Condition Status

Criteria for the total coral reef coverage percentage found will be

categorized based on the Decree of the Ministry of the Environment Number 04/2001, as shown off in Table 1.

Table 1. Category of Coral Reef Health Condition

Percentage (%)	Category
75 – 100	Excellent
50 – 74.9	Good
25 – 49.9	Fair
0 – 24.9	Bad

The measurement result of total coral coverage percentage will help us identify the coral reef condition criteria that can be the yardstick of their health.

RESULTS AND DISCUSSION

1. Waters Parameter Condition

The waters parameters observed in the respective stations are temperature, DO (Dissolved Oxygen), salinity, current, and brightness, and the measurement result is presented in Table 2.

Table 2. Observation Result of Waters Parameters

Observation Station		Water Quality Parameters				
		Temperature	DO (mg/l)	Salinity (ppt)	Brightness (m)	Current (m/det)
I	3 meters	30	7.1	30	3	0.56
II	3 meters	30	6.4	25	3	1.12
	5 meters	31	6.9	27	5	1.19
III	3 meters	30	4.1	25	3	1.47

2. Plankton Type Identification

Based on Figure 2, the diversity in Station 1, Station 2 at the 3-meter depth, Station 2 at the 5-meter depth, and Station 3 is 1.729, 2.1089, 1.5898, and 1.6187, respectively. Meanwhile, the dominance in Station 1, Station 2 at the 3-meter depth, Station 2 at the 5-meter depth, and Station 3 is 0.067, 0.081, 0.048, and 0.065, respectively. Dominance in all stations is considered low as the dominance of phytoplankton in each station is below 1.

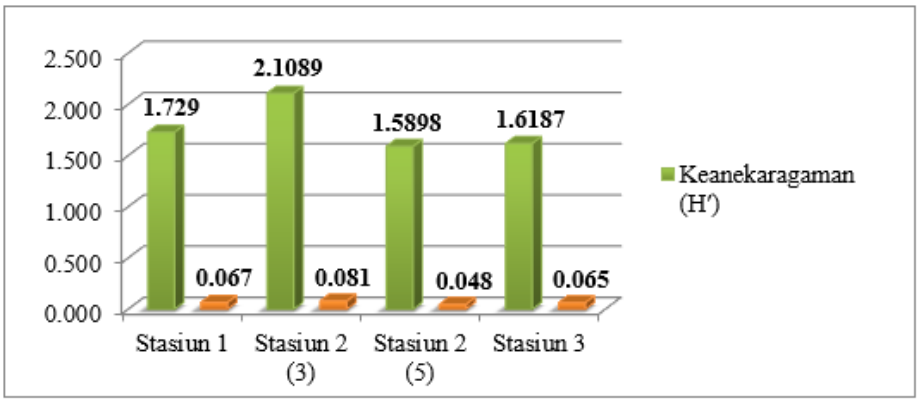

Figure 2. Measurement Result of Diversity and Dominance in the Respective Stations

3. Coral Fish Abundance

Figure 3 exhibits coral fish abundance, which is apparently relatively low in all stations. The highest coral fish abundance, i.e., 2182 ind/ha, is found in Station 2 at the 5-meter depth. This result is because the location is deep and corals there have a better condition than that in the other stations. Conversely, the lowest coral fish abundance. i.e., 1143 ind/ha, is in Station 1 at the 3-meter depth. The lowest abundance is because of the location close to the residential area and thereby boosting fishing activities, and the coral reef condition there is in a fair condition.

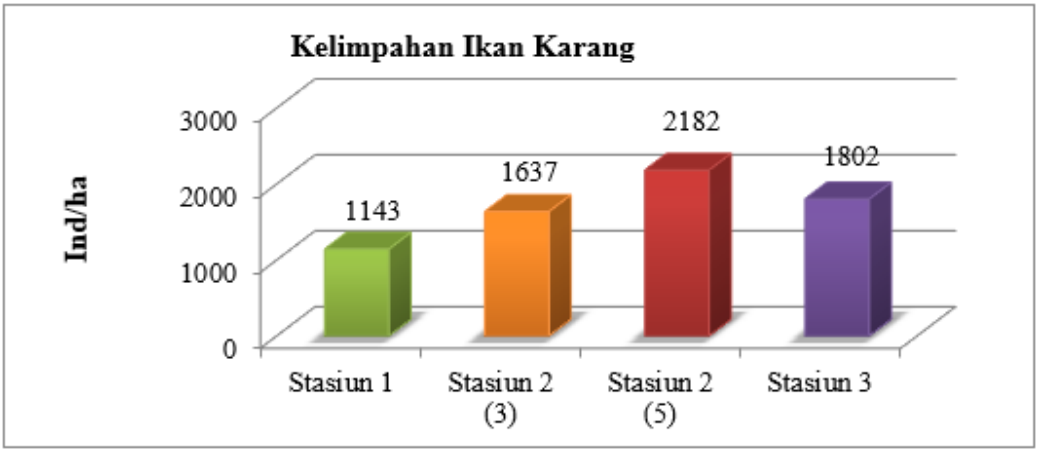

Figure 3. Quantification Result of Coral Fish Abundance in the Respective Stations

4. Coral Growth Lifeforms

Coral growth lifeforms in the waters of Bintalahe Beach vary in each of the category Acropora and non-Acropora. Coral growth lifeforms in the three stations are affected by the condition of the environment there. Residential areas adjacent to some stations impact the coral growth there. Additionally, wastes disposed of by industrial manufactures generate oils which contaminate the waters in certain observation areas.

5. Coral Reef Condition

Figure 4 portrays coral reef conditions in Bintalahe Beach. In Station 1 at the 3-meter depth, live corals, dead corals, algae, others, and abiotic comes at 68%, 15%, 0%, 0%, and 17%, respectively. The percentages are figured out by quantifying coral growth lifeforms. The percentage of live corals is high because Station 1 at the 3-meter depth has a brightness of 100%. Moreover, the highest live coral coverage percentage, 68%, is in Station 1, followed by Station 2 at the 5-meter depth (55.76%), Station 3 (44.8%), and Station 2 at the 3-meter depth (39.2%). Overall, coral reef condition in the waters of Bintalahe Beach is in the fair-good category.

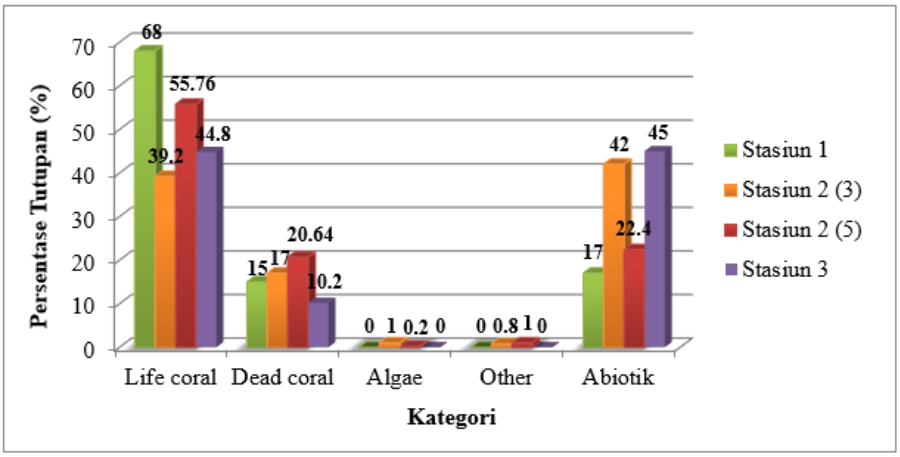

Figure 4. Coral Reef Condition in Bintalahe Beach

As stated in Table 3, Station 1 and Station 2 at the 5-meter depth have a good coral reef condition at 68% and 55.76%, respectively. Coral reefs living in those locations still greatly vary. Also, the water quality parameters are good (temperature of 30-310C, DO of 6.9-7.1 mg/l, the salinity of 27-30 ppt, current of 0.56-1.19 m/det, and brightness of 100%), inducing a stable and good environment for corals to grow. Meanwhile, Station 2 at the 3-meter depth and Station 3 have a fair coral reef condition at 39.2% and 44.8%, respectively. Both locations are close to industrial waste disposal. Station 3 is located near the port where coals are stored. Consequently, when coals accidentally fall down to the water, they may cover coral reefs living below. Despite proponent water quality parameters, coral reefs get threatened by uncontrolled activities which may harm their growth.

Table 3. Live Coral Coverage Percentage

Station	Live Coral Coverage Percentage	Category
I	68%	Good
II	39.2%	Fair
	55.76%	Good
III	44.8%	Fair

As clarified by Farid *et al*. (2018), coral reef distribution and growth rely on environmental conditions. However, this condition is sometimes unstable because of interferences from either nature or humans. Coral reef condition in the waters of Bintalahe Beach Kabila Bone Bone Bolango is feared to continue experiencing damage if there are no initiatives from the community or local government to perform good management and maintenance resulting in well-preserved coral reefs.

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