The condition of coral reefs of the larea-larea Island in the sembilan Island region, Sinjai Regency South Sulawesi, Indonesia

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ABSTRACT

The waters condition of Sembilan Island is an indicator for the quality of the environment in the land and sea areas. These indicators include the status of damage to coral reefs. River water sedimentation and pollution, is a source of damage from the land area. While the source of damage from the sea in the form of sea waves and sea water pollution. This research aims to; (1) to find out the current condition of coral reefs in the Larearea island region in support of marine tourism activities; 2) find out the parameters of water quality in supporting the development of marine tourism in the Sembilan island. The results of this study are expected to contribute ideas that are beneficial to policy makers and decision makers in providing development direction and can be used as a reference in the development policy of the Sembilan Island region. This research was conducted from October to November 2019 in the island of Sembilan, Sinjai Regency, South Sulawesi Province, Indonesia. Location of coral reef sampling and water quality on Larearea Island in 2 Stations, namely Station 1 at coordinates: 05 ° 04 '15.88 "S and 120o 23' 36.98" E and Station 2 at coordinates: 05 ° 04 '15, 88 "S and 120o 23 '36.98" E. The data to be observed are coral reefs using the survey method and using Landsat 8. The survey of coral reef conditions was conducted using the LIT (Line Intercept Transeck) method (English, 1997). From observations using Landsat 8 images of coral reef conditions on Larearea Island, Sinjai Regency, South Sulawesi Province, there are live corals of 17.45 ha, dead corals of 27.23 ha and sandy areas of 1.99 ha. Coral cover on the waters of Larearea Island is included in the damaged category 8.9% to 24.35. Live coral is dominated by massive and branched growth types, while dead coral is dominated by dead coral overgrown with algae.

Key words : Coral Reef, Larearea Island, Sembilan Island Region, Sinjai Regency.

Introduction

The Sembilan island region is a group of small islands located in the Bone Bay region east of Bone Regency and Sinjai Regency. With a distance of about 10 km from the district city center. Sembilan island area has the potential of marine coral reef ecotourism with clear and clean waters so that its beauty is a special attraction for visitors. Coral reef is a marine ecosystem that attracts a lot of attention

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because it is a natural area compared to other ecosystems. Coral reefs are the most beautiful ecosystems in terms of color, shape and design. They are very rich in the diversity of species of biota that live in them (Nybakken, 1992).

The waters condition of Sembilan Island is an indicator for the quality of the environment in the land and sea areas. These indicators include the status of damage to coral reefs. River water sedimentation and pollution is a source of damage from the land area. While the source of damage from the sea in the form of sea waves and sea water pollution (Alamsyah et al., 2019). The potential of natural resources owned by the waters of the Sembilan Island region, namely natural beauty with its own distinctiveness, has pushed the Sembilan island region to become a marine tourism destination. As a tourist destination, the island of Sembilan is now starting to be visited by tourists, both domestic and foreign. Noted the number of tourist visits that come an increase in the number of visitors each year.

This research aims to; 1) to find out the condition of the Larearea island in supporting marine tourism activities; 2) find out the parameters of water quality in supporting the development of marine tourism in the Sembilan island. The results of this study are expected to be used as a reference for policy makers and decision makers in providing development direction and can be used as a reference in the development policy of the Sembilan island region, especially Larearea island.

Materials and Methods

The Study Area

This research was carried out on Larearea Island, Sembilan Island, Sinjai Regency, South Sulawesi Province, Indonesia, from October to November 2019. The research location was shown in Image 1 below. Location Sampling was carried out at 3 observation stations namely: Station 1 at coordinates: 05 ° 04 '15.88 "S and 1200 23' 36.98" E, station 2 at coordinates: 05 ° 04 '19.80 "S and 1200 23 '26.95 "E and station 3 at coordinates:: 05 ° 04' 16.25" S and 120 ° 23 '03.75 "E.

Observation of coral reef data was done by the survey method and using Landsat 8. The survey method was carried out using the LIT (Line Intercept Transect) method or the Transect Line Method (English, 1997). This method basically used a transect line placed on a coral colony. The sampling technique used the LIT method, such as: (1) Plugging stakes made of wood at a predetermined point to hold one end of the meter with the help of 2 person. (2) Extending the meter along 50 meters with the help of just two person above the coral reef ecosystem (3) Retrieval of data usedsnorkling and writing tools (white sheets and 2B pencils) and then taken some pictures by camera.

Water Quality Parameters

Water quality parameters observed during the



Fig. 1. Research Location

study can be seen in the following Table 2:

Data Analysis

Large percentage of dead coral cover, live coral, and other types of lifeform calculated by the formula according to (English *et al.*, 1997):

 $56 = \Sigma a / A 5e 100\%$ Where :

C = Percentage of closing lifeformi

a = length of lifeform transect i

A = total length of transect

Category of Live Coral Cover

From the results of the above calculation will be analyzed using the category of percent coral cover where the percent of coral community cover is the sum of the percentage of hard coral cover, the percentage of soft coral cover, and the cover category of others (OT) (Yulianda *et al.*, 2010). These criteria use 4 categories:

a) Broken: 0 - 24.9%

b) Moderate / critical: 25 - 50%

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c) Good: 50.1 - 75%
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d) Very good: 75.1 - 100%
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Results and Discussion

Condition of Coral Reefs

Coral reef ecosystems are coastal ecosystems which contain important and beneficial natural resources for humans. The existence of coral reef ecosystems with a high level of diversity is a great potential that must be preserved. The diversity of coral species in Indonesia consists of Scleractinia (rock coral) as many as 569 species, non-sclerectinia 8 types Octocoralia (soft coral) 311 types and Gorgonia (fan coral) as many as 271 species (Suharsono, 2014). Study and observation of coral reefs in Pulau Sembilan has been carried out by Suharyanto and Utojo (2005) and found the condition of coral reefs on moderate to good criteria. Coral is dominated by branching Acropora, non acropora branching coral, leaf coral and massive coral.

From our observations on Larearea Island used SPOT imagery and Landsat 8 imagery, the results obtained where SPOT imagery shows the condition of coral reefs on Larearea island with live corals of 17.45 ha, dead corals of 27.23 ha and sandy areas of 1.99 ha (Figure 3). From these observations it can be seen that living corals were smaller in area than dead corals because of illegal fishing and the use of non-environmentally friendly fishing gear such as bombing and the use of cyanides in fish catching. According to Lutfhi, et al. (2019) the decrease in the area of coral reefs was more caused by anthropogenic factors than others. Whereas (La Sara, 2014) said the taking of materials for building materials caused a decrease in the function of natural protection against coastal erosion and damage to ecosystems, decreased fishermen income, reduced aesthetic value of the beach, and decreased water quality.

The results of Landsat 8 image processing showed different results from SPOT imagery where the area of live coral was greater than the area of dead coral. The area of live coral cover of Larearea island was 17.34 ha, while the area of dead coral cover was 4.24, this was different from the SPOT



Figure 2. Extent of coral reef in Larearea Island, Sinjai Regency with SPOT Image

imagery, which was that the condition of live coral was smaller than that of dead coral. In Landsat 8 imagery where the life cover of coral was bigger than the cover of death coral.

Coral cover will be an indicator in determining the health condition of coral reefs in an area or region that can be identified by observing lifeforms and percentage of cover (Table 2). While the survey we conducted at 3 observation stations obtained results at all research stations the percentage of live coral cover was lower than that of dead coral. Live corals consist of hard corals and soft corals, whereas dead corals consist of dead corals and overgrown with algae, coral fragments and non corals (sand). While observations by taking 3 station points in the Larearea island region the results can be seen in the following Table 3.

From the results of the three observational data stations above shows that the condition of coral reefs in the Sembilan island, especially Larearea island, was severely damaged. This can be seen in the condition of coral reefs at station 1, only 8.90% was obtained, while the highest was found at station 2 with the value of 24.35% while the highest abiotic reached 82.30% at station 3 while the lowest was obtained at station 2 with a value of 47.12%. From the field data and processed data from Landsat 8, the results showed the same results, which showed the condition of the coral reefs in the Sembilan islands, especially Larearea, which was damaged. From the results of research Suharyanto and Utoyo (2005) conducted on the islands of Sembilan and surrounding areas get better results than now with the condition of 42.85%. While the results of research conducted by Rani et al, (2017) get the value of live coral cover with an average of 26.17%.

Standardization of categorizing coral reef conditions refers to the Decree of the Minister of Environment No. 04 / MENLH / 02/2001 concerning the standard criteria for Coral Damage which is divided into 4 (four) categories: Damage (0-24.9%), Moderate (25-49.9%), Good (50-74.9%), and Very Good

Table 2. Types of water quality parameter data observed in the study.

	5	
Component Data	Method of collecting data	Data source
1. Depth of Water	Depth observation	Observation
2. Salinity	Insitu	Mensuration
3. Current Speed	Insitu	Mensuration
4. Temperature (°C)	Insitu	Mensuration
5. Brighnees Water	Insitu	Mensuration
6. DO	Insitu	Mensuration

Table 2. Percentage of Lifeform Cover of Larearea Island coral reefs.

No	Lifeform	Nilai/ Stasiun		
		Stasiun 1	Stasiun 2	Stasiun 3
1	Acropora branching (ACB)	46	37	1
2	Acropora Encrusting (AE)		2	
3	Acroporadigitate			8
4	Coral foliose (CF)	42		
5	Coral massive (CM)	19	38	363
6	Coral millepora (CME)		9	
7	Coral mushroom (CMR)		3	
8	Dead coral with algae (DCA)	20	151	273
9	Diseased coral (DSCR)		48	
10	Old dead coral (ODC)		26	
11	Ascidians, anemones, gorgonians, giant clams, etc (OT)	36	15	32
12	Soft corals (SC)	3		57
13	Sponge (SP)			14
14	Algae assemblage (AA)	6	14	42
15	Turf algae (TA)			18
16	Rubble (R)	600	394	291
17	Sand (S)	223	251	429

(75-100%) (State Minister for the Environment, 2001).

From the observations above, it can be seen that Acropora was found in all observation stations, but not all types have every station, only Acroporants are found in all three stations. While the type of massive coral was also found at each station but the highest was found at station 3 with score 363. Dead Coral Algae was also found at each observation station but the highest value was obtained at station 3 with score 273. While Rubble was highest at every station with the highest value obtained at station 1 with score 600. While Sand was also found at each station and the highest value was obtained at station 3 with score 429.

Based on lifeform or coral growth patterns, the highest number is obtained on massive (massive) corals. Found on all stations with a fairly high percentage. The high frequency of massive coral is one of the causes because it is more resistant to environmental stress compared to other corals. Some have died and become coral fragments. A massive form of coral growth can survive in high current conditions (Zamani, 2015).

Coral cover with the highest percentage of life was obtained at station 2 which was 24.35%. The high cover is because this area was located in the south of the island which does not get much influence from anthropogenic activities including fishing activities. According to Lutfhi *et al.* (2019) the decrease in the area of coral reefs is more caused by anthropogenic factors than others. In addition, the southern location of the island was also an open area so that the exchange of water through the current can run well. The current pattern that flows continuously guarantees the availability of food for coral animals, clear water, hard bottom substrates and deep beach curves and the least sedimentation

Table 3. Percentage of Coral Cover on Larearea Island,Sinjai Regency.

No	Lifeform	Percentage Cover			
		1	2	3	
1	Coral (C)	8,90	24,35	11,20	
2	Non-Coral (Nc)	0,10	0,00	0,00	
3	Dead Coral (Dc)	22,50	17,87	2,00	
4	Other Biota (Other)	1,50	6,74	3,90	
5	Algae (Algae)	2,40	3,93	0,60	
6	Abiotic (Abiotic)	64,60	47,12	82,30	

carried by rivers is a guarantee for ideal coral growth (Zamani, 2015).

The lowest percentage of live coral cover was obtained at station 1. This condition was caused by the fact that the area was very close to the pier so that more damage was caused by anchor dumping when the ship docked. This can be seen from the high percentage of dead coral and coral fragments which is 22.50%. This condition also affects station 3 which is quite close to station 1, where the percentage of dead coral reaches 2.00%. Larearea Island is currently one of the tourist areas in Sinjai Regency so it is suspected that tourism activities also affect the percentage of dead coral. The percentage of coral cover is strongly influenced by pressures from the surrounding environment including tourism pressure (Farid *et al.*, 2018).

Water Quality Parameters

From the observations we made we get the results as presented in Table 4. In general, the average score of water quality parameters in the waters of Pulau Sembilan is still feasible or supportive for conducting marine tourism activities. This can be seen from the score obtained was still in the range of water quality standards for marine tourism determined by LH State Decree No. 51 of 2004. Conditions of water quality in the waters of the Pulau Sembilan region can be seen in Table 4.

From the 6 parameters tested (Table 4), there were no parameters that exceeded or exceeded the sea water quality standard for marine tourism according to LH State Decree No. 51 of 2004. The condition of the quality of these waters is inseparable from the condition of Pulau Sembilan, which is not affected by pollution from the mainland of the capital of the Regency, it is located quite far from the mainland capital of the Regency and is in the vicinity of Bone Bay, so that anthropogenic waste does not exist.

Conclusion

From the results and discussion it can be concluded that coral cover in the waters of Larearea Island is included in the damaged category with a rate of 8.9% to 24.35%. Live coral is dominated by massive and branched growth types, and dead coral is dominated by dead coral that has been overgrown with algae.

No	Coordinate Point	Station	Percentage of Coral Cover	Category
1	05° 04′ 15,88" S and 120° 23′ 36,98" E	Station 1	8,90	Broken
2	05° 04′ 19,80" S and 120° 23′ 26,95" E	Station 2	24,35	Broken
3	05° 04′ 16,25" S and 120° 23′ 03,75" E	Station 3	11,20	Broken

Table 3. Categories of coral cover in the waters of Larearea Island

Table 4. Water Quality Parameters of Larearea Area, Sembilan Island

Stasiun	Temperatur (°C)	pН	Salinitas (‰)	DO (mg/L)	Kecerahan(%)
1	26.24	8.15	36.7	15.44	100
2	26.32	8.34	36.7	22.31	100
3	26.27	7.74	36.5	15.44	100

Source: Primary Data 2020

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