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Condition of Coral Reef Ecosystem Cover in the Selayar Islands Marine Protected Area

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Abstract: ***Coral reefs in the marine protected area of the Selayar Islands are one of the expanses of ecosystems found in Indonesia's tropical marine waters which have a very important position in the treasury of the national marine wealth. The importance of this coral reef ecosystem, apart from being a medium for nutrient supply, breeding, care and protection, as well as a place for biological, chemical and physical cycles to take place, as well as being a protector against currents, storms and tidal waves. Since 1987 this area was pioneered as a marine ecotourism area in the Takabonerate area of the Selayar Islands, South Sulawesi Province. Through observation surveys as well as the Point Intercept Transect (PIT) method, it was found that the condition of coral reef cover in the Marine Protected Areas (MPA) in the archipelagic zone and in the mainland zone generally indicates medium (moderate) meaning that this coverage area requires recovery time in the future for recovery. to good condition. In line with LIPI's research (2007), this area is included in the Middle and Northeastern Indonesia water zones which are in moderate to relatively good coral reef cover conditions.***

Keywords: Coral reefs, Selayar islands

1. Introduction

1.1. Background

Coral reefs are one of the expanses of ecosystems found in Indonesia's tropical marine waters which have a very important position in the treasury of the national marine wealth. The importance of this ecosystem is because apart from being a food supply, breeding, nurturing and protection area, it is also a place for biological, chemical, physical cycles to take place, as well as being a damper against currents, storms and tidal waves.

The results of observations of the condition of coral reefs in Indonesia conducted by the Indonesian Institute of Sciences (LIPI), show that only 6% of reefs are very good, and 62% are not good, and the rest are classified as damaged. According to Moosa et al., (2006), the percentage of live coral reef cover in Indonesian waters which is still in very good condition is only 6.2%, in good condition 23.72%, moderate condition 28.30%, and damaged condition 41.78%. And from these conditions, it turns out that coral reefs in the western and central regions of Indonesia have worse conditions than those in eastern Indonesia. This information is taken into consideration by local governments together with the central government and international agencies in order to reduce the exploitation and degradation pressures that occur on these coral reefs.

One of the coral reef cover areas in Central Indonesia which is thought to have experienced degradation due to various past destructive actions (decades of the 80-90s) which is currently being considered for its recovery is the coastal area of the Selayar Islands which administratively is included as a Marine Protected Area (MPA) in a cluster islands in South Sulawesi Province. In general, the islands in the Selayar Islands Regency have a coastal ecosystem that is dominated by hermatypic coral reefs, so it is not wrong if the Takabonerate National Park, which is the center of marine tourism development, is said to have the third largest coral atoll in the world after Kwajifein in the Marshall Islands and Suvadiva in the Moldiva Islands. . The area of the atoll is about 220,000 hectares with coral reefs spread out flat on an area of 500 km2 (Jemmy and Johan, 2008).In order to maintain the coral reef ecosystem in the marine protected area of the Selayar Islands so that it still exists as a group of islands that are tourist destinations, ecological monitoring is carried out with research activities on the condition of coral reef cover in the islands.

1.2. Goals and Usage

This study aims to determine the condition of coral reef cover in several areas of the Selayar Islands Marine Protected Area. And its use is expected as a reference in evaluating and developing coral reef zoning in various future interests.

2. Research Methods

2.1. Time and Place

Observations were made over a period of three months (March - May 2021) located in several marine protected areas (MPA) of the Selayar Islands Regency (Figure 1).

Figure 1: Map of the Selayar Islands Marine Protected Area

2.2. Location Determination

The research location is based on coral reef distribution areas which include Mainland Selayar and Archipelago Selayar which are Marine Protected Areas based on the provisions of Coremap II. From 34 points of Marine Protected Areas, 15 points were chosen randomly (7 MPA in Selayar Mainland and 8 MPA in Selayar Islands) with the consideration that the survey to 15 MPA points could represent other MPA points.

2.3. Research Implementation Procedure

The initial research was a direct survey at each MPA station by taking primary data related to the type of coral colony and its cover area. Meanwhile, secondary data relates to the general description of ecosystem conditions accompanying the location in the Selayar Islands Marine Protected Area, which is compared with data from the Marine and Fisheries Service and data from the local Coremap II Secretariat.

The method used is the line transect method. The length of the transect is 25 m, stretched parallel to the coastline where the mainland/island is on the left. Recording the presence of coral colonies is done byusing Point Intercept Transect (PIT) in an easy and practical way (Hill and Wilkinson, 2004). Technically, the PIT method is a way to determine the percentage of base substrate cover at random, using marked ropes at every 0.5 m distance or with a scaled tape (roll meter). The tools used in this research are; 1) scuba deeping for diving, 2) underwater camera for underwater documentation, 3) GPS for determining the location of MPA, 4) Roll meter for data collection of coral reefs, and 5) speed boat for transportation to monitor the location of MPA. Each coral colony, benthic biota or substrate that passed or was below the transect line was recorded for every 50 cm interval. Technically in the field, what is recorded is the benthic component starting from points 0.50, 1.0, 1.50, 2.0, 2.50, and so on up to a point of 25 m. The total number of points traversed and recorded is 50 points. Transects were carried out in the upper reef slope area with the assumption that coral growth was quite good and normal. Observation data is then compiled in the form of a table for further analysis purposes, including the percentage of the presence of coral species, benthic biota and substrates.

2.4. Data analysis

Data analysis was carried out descriptively based on the PIT method, namely the percentage of benthic components, as follows:

$$\sum Ind. = \frac{\text{Quantity of each component}}{\text{Number of dots}} \text{x} 100\%$$

The categories of coral reefs for which data were taken were as follows: AC (Acropora), NA (Non Acropora), SC (Soft Coral), DCA (Dead Coral Algae), DC (Dead Coral), FS (Flesy Sea Weed), R (Rock), Rb (Rubble), S (Sand), SI (Silt), SP (Sponge), and OT (Other). While the criteria for coral reef health indicators were analyzed based on Gomez and Yap (2008), as follows: 1) damaged, if the percentage of live coral cover was between 0 - 24.9%, 2) Medium, if the percent cover was between 25 - 49.9%, 3) good, if the percent cover is between 50 – 74.9%, and 4) very good, if the percent cover is between 75 – 100%.

3. Results and Discussion

The condition of the existence of coral reefs in the Marine Protected Area of the Selayar Islands Regency (MPA) is described based on the method used for each substance studied and presented in the form of tables and graphic diagrams. Table 2 shows the total biotic and abiotic components between the Mainland and Archipelagic MPA zones, which are 270 and 338 point count fragments, respectively. Of the magnitudes of the two MPA zones, they consist of a biotic composition of 270 (30.70%) and abiotic 88 (10.40%) in the mainland Selayar zone, and 338 (40.38%) and 158 (18.54%) in the Island Selayar zone.

3.1. Coral Reef Ecosystem Condition

In general, the condition of coral reef cover in the marine protected area of Selayar Regency can be seen in the pie chart Figure 2. This data shows the percentage of coral reef cover types in the Marine Protected Area (MPA) between the water zones of Selayar Mainland and Selayar Islands. In the SelayarDaratan MPA zone, the types of coral cover were as follows: AC (Acropora) 23%, NA (Non Acropora) 21%, DCA (Dead Coral Algae) 24%, DC (Dead Coral) 3%, FS (Flesy Sea Weed) 1%, SC (Soft Coral) 2%, SP (Sponge) 1% . While in the Selayar Islands DPL zone, the percentage of coral reef cover types is: AC (Acropora) 17%, NA (Non Acropora) 19%, DCA (Dead Coral Algae) 18%, DC (Dead Coral) 4%, FS (Flesy Sea Weed) 2%, SC (Soft Coral) 8%, SP (Sponge) 1%. The two zones of the Marine Protected Area in the Selayar Islands have criteria as marine tourism areas, namely the availability of various types of coral reef cover (Jemmy and Johan, 2018).

In general, the waters of the Selayar Islands which are marine protected areas and Takabonerate tourism objects have the composition of coral reefs with the following percentages: branching 48%, encrusting 18%, submassive 7%, digitae 16%, tabulate 11%, branching 29%, encrusting 20% , foliose 6%, massive 17%, submassive 20%, milepora 10%, heliopora 12%, algae covering 62%, soft coral 17%, sponges 4%, assemblage 1%, coralline algae 3%, halimeda 1%, macro algae 1%.

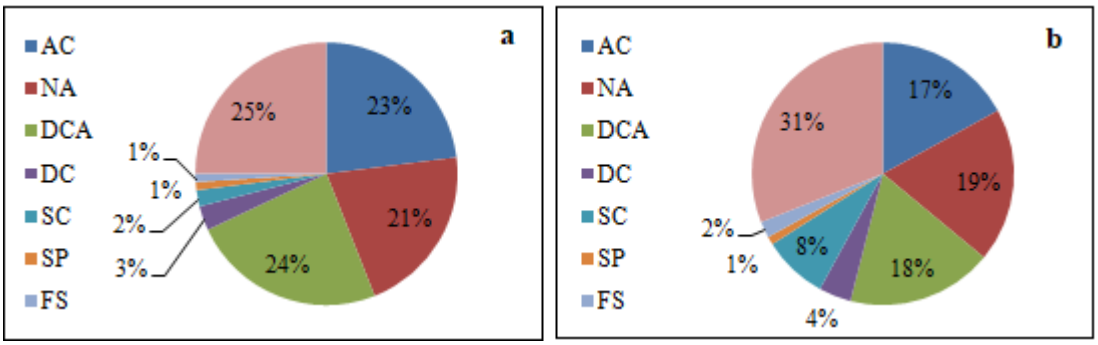

Figure 2: Percentage of reef cover types in Selayar Mainland MPA (a) and Selayar Islands MPA (b)

The results of research by Antonius (2010), revealed that most of the compositions of these species are complementary to water quality parameters that are appropriate as habitats for living together with coral reef ornamental fish scattered in the world's marine waters. In the case of observing coral reef ecosystems in the waters of the Selayar Islands, the coral reef fish indicated as indicator fish groups are from the families: labridae, acanthuridae, chaetodontidae, serranidae, napoleon, pomacanthidae, lutjanidae, tetraodontidae, bleniidae, and gobidae.

Table 1: Percentage of reef group coverage at each MPA point in two zones of the Selayar Islands

MPA Zone Group	No.	Village Name Point MPA	Percentage of Reef Group Cover (with code) (%)							
			AC	NA	DCA	DC	SC	SP	FS	Abiotic
Mainland Selayar	1	Pamatata	44	0	18	0	4	0	0	38
	2	Parak	28	26	28	0	0	0	0	18
	3	Bontolebang	14	28	36	0	4	0	0	18
	4	Buki	18	26	34	2	0	0	0	20
	5	Patkarya	10	38	20	4	0	0	3	25
	6	Pasioge	20	10	4	14	0	0	0	52
	7	Bontoborusu	36	20	30	2	2	0	0	10
Archipelago Selayar	1	Tambolongan	16	12	32	0	14	2	1	23
	2	Tanamalala	32	18	0	16	22	0	0	10
	3	Masungke	24	12	18	12	14	0	0	20
	4	KembangRagi	16	28	16	8	2	0	0	30
	5	BontoSaile	24	24	0	2	10	5	3	32
	6	BontoBaru	0	26	42	2	10	2	0	18
	7	BontoMalling	12	10	20	0	8	9	5	36
	8	KombaKomba	10	22	14	0	20	0	4	30

Based on the percentage of the presence of reef groups (Table 1), in general all MPA points show high and even diversity with the composition of coral reef species as an important indicator of marine tourism ecosystems.Hill and Wilkinson (2014) note that the existence of 5 - > 10 types of indicator reef groups for marine tourism zones can make a marine area an alternative to ecotourism areas and deserves to be conserved for this access.

Based on the composition of coral reef cover types found in the marine protected area of the Selayar Islands, it is presented in Table 1 below.

Table 2: Existence (Amount) Composition of Coral Reef Species in Two MPAs in Selayar Regency

Types of Coral Covers		Existence (amount) Composition of Coral Reefs in Two MPA Zones in Selayar District	
Code	Composition	Mainland Zone of MPA	Archipelago Zone of MPA
AC	*Branching*	*34*	*48*
	Encrusting	*15*	*16*
	Submassive	*4*	*7*
	Digitae	*20*	*7*
	Tabulate	*10*	*9*
	∑	**83**	**87**
NA	*Branching*	*27*	*19*
	Encrusting	*13*	*19*
	Foliose	*6*	*4*
	Massive	*13*	*14*
	Submassive	*2*	*13*
	Milepora	*6*	*3*
	Heliopora	*8*	*10*
	∑	**75**	**82**
DCA	*Alga covering*	*86*	*89*
DC	*Dead coral*	*11*	*19*

SC	*Soft coral*	*6*	*42*
SP	*Sponges*	*5*	*7*
FS	*Assemblage*	*0*	*2*
	Coraline alga	*2*	*7*
	Halimeda	*1*	*1*
	Macro alga	*1*	*2*
	∑	**4**	**12**
Total Biotic Components in MPA Zone		**270**	**338**
OT/ Abiotik	*Sand (g/m^2)*	√	√
	Rubble (m^2)	√	√
	Silt (g/m^2)	√	√
	Rock (m^2)	√	√
∑ Abiotic components		***88***	***158***

3.2. Water Quality

In general, the average water quality obtained in both the mainland Selayar coastal waters and in the archipelagic Selayar waters shows normal and proper quality for coral reef ecosystems and other biota. The range of water quality in the two waters is presented in Table 2. The range of water quality in the two waters of the Selayar Islands MPA is sequentially, as follows: Mainland Selayar; light intensity 79 – 100%, current velocity 1.2 – 2.0 cm-s, temperature 28 – 32^{o}C, pH 7.8 – 8.6, salinity 33.5 – 35 ppt, Oxygen 4 – 5 ppm; while for Selayar Islands; light intensity 85 – 100%, current velocity 1.2 – 2.0 cm-s, temperature 28.5 – 33^{o}C, pH 7.8 – 9.0, salinity 33.7 – 35 ppt, Oxygen 3.5 – 4 ,8 ppm. Except in the marine protected area of PatikaryaSelayar Village, the mainland, the brightness is low to below 75% compared to other protected areas, this is because it is relatively adjacent to river mouths which carry a lot of sediment that affects turbidity, and this has a negative impact on the health of coral reefs, especially acropora and soft corals other. Likewise, the relatively high temperature of 32^{o}C – 33^{o}C in the Selayar Islands MPA compared to the mainland SelayarMPA, thus affecting the death of reefs in the area with the presence of coral bleaching events.

Table 2: Water Quality in Selayar Mainland and Selayar Archipelago Marine Protected Areas

MPA Zone	No.	Village name (MPA point)	Light intensity (%)	Current (cm^{-det})	Temperature (^{o}C)	pH	Salinity (ppt)	O_2 (ppm)
Mainland Selayar	1.	Pamatata	96	1,5	29,5	8,6	35	4,6
	2.	Parak	100	2,0	30	7,8	34	4,8
	3.	Bontolebang	100	1,8	28	8,4	33,5	5,0
	4.	Buki	94	1,2	28	8,4	34,5	4,0
	5.	Patikarya	79	1,6	32	8,6	35	4,0
	6.	Pasioge	96	2,0	29	7,9	34,6	4,6
	7.	Bontoborusu	100	2,0	29,6	8,0	35	5,0
Archipelago Selayar	1.	Tambolongan	86	1,6	33	9,0	35	4,0
	2.	Tanamalala	100	2,0	30	8,7	34	4,8
	3.	Masungke	96	1,4	32,5	8,0	35	3,8
	4.	KembangRagi	96	1,2	33	7,8	34,5	3,5
	5.	BontoSaile	96	2,0	29,6	7,8	35	4,5
	6.	BontoBaru	100	1,5	29	8,0	33,7	4,6
	7.	BontoMalling	85	2,0	29	8,6	35	3,8
	8.	KombaKomba	96	2,0	28,5	7,8	35	4,8

In general, the water quality at all MPA points of the Selayar Islands meets the viability of living for coral reefs, including the fish biota that live with them.The range of water quality recorded in Table 2 is relevant to Jemmy and Johan's (2018) observations on coral reef rehabilitation in their management program in Indonesia.

4. Conclusion

The distribution of cover composition of reef biotic and abiotic factors in the archipelago Selayar zone has a wider distribution than the mainland Selayar zone. In general, the condition of coral reef ecosystems in the two MPA zones of the Selayar Islands shows moderate to relatively good quality criteria with a relatively high and dominant percentage of live reefs.

The range of each water quality parameter, generally supports the distribution of coral reefs in all points of the Marine Protected Area of the Selayar Islands Regency.

5. Suggestion

Relevant observations are needed on the condition of coral reefs in the Makassar Strait Spermonde waters, in line with the appeal of the Department of Marine Affairs and the Environment together with stakeholders who are observers of the marine environment who often voice the importance of conserving these marine resources.

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References

[1] Anna E.W.M. and Djuwariah. 2009. Guide to the Point Intercept Transect Method for the Community. Baseline Study and Monitoring of Coral Health in Protected Areas.
[2] Antonius, A. 2010. Threat to and protection of coral reef. http:www.sbg.ac.at/ipk/avstudio/pierofun/funpage.htm. (1 Nov. 2019)
[3] Bengen, D. G. 2012. Sinopsis Ekosistemdan Sumberdaya Alam Pesisirdan Lautserta Prinsip Pengelolaannya. Pusat Kajian Sumberdaya Pesisirdan Laut Institut PertanianBogor (PKSPL-IPB). Bogor. 66h.
[4] Dahuri, R., J. Rais, S. P. Gintingdan M. J. Sitepu. 2006. PengelolaanSumberdaya Wilayah PesisirdanLaut SecaraTerpadu. PradnyaParamita, Jakarta. 328h.
[5] Gomez, E. D. and H. T. Yap. 1988. Monitoring reef condition in: R. A. Kenchinton& B.E.T. Hudson (eds). Coral Reef Management. Handbook, UNESCO Jakarta: 187-195.
[6] Hill, J. and C. Wilkinson. 2014. Methods for Ecological Monitoring of Coral Reefs. A Resources for Managers. Australian Institute of Marine Science, Townville. 117pp.
[7] Jemmy S. dan P. Johan. 2018. Baseline TerumbuKarang Daerah PerlindunganLautSelayar, dalam*Coral Reef Rehabilitation and Management Program*LembagaIlmuPengetahuan Indonesia, COREMAP II-LIPI, Jakarta.
[8] Krupp, D. A. 2011. Coral Reefs Biology 200 Lecture Notes and Study Guide. Krupp.wcc.hawaii.edu/BIOL200/LectNotesBiol200.pdf. 113pg.
[9] Kudus, U. A. dan I. Wijaya. 2011. Transplantasi Biota Karang.Laporan Ke-2 Program Penelitian. Assosiasi Koral, Kerangdan IkanHias Indonesia (AKKII). PusatPenel. Oseanologi P2O-LIPI, dan Pusat Penel. LingkunganHidup (PPLH)-IPB. Jakarta, 112h.
[10] Moosa, M. K., Soekarnodan O. K. Sumadhiharga. 2006. EkosistemTerumbuKarang; Peranan, Potensidan Masalah Pengelolaannya. P3O-LIPI, Jakarta. 238h.
[11] Mistr, S., and D. Bercovici. 2013. A Theoritical Model of Pattern Formation in Coral Reefs. Journ. Ecosystem 6:61-74.