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Original research article

The Analysis of Coral Reef Coverage Condition in The Waters of Central Bangka Regency

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ABSTRACT

This research aims to discover the percentage of coral reef coverage and the condition of the coral reef ecosystem in small islands in Central Bangka regency waters. The research was conducted on May 2022 on six small islands: Panjang Island, Semujur Island, Ketawai Island, Ketugas Island, Gusung Asam Island, and Bebuar Island. The method used was underwater photo transect (UPT) and then analyzed using Coral Point Count with Excel extension software (CPCe). The result shows that of 6 small islands, only Semujur Island is populated. Coral reefs in small islands in Central Bangka regency were a type of *fringing reef* dan *patch reefs* with 3,0 - 8,8 meter depth. Standard damage criteria show that the damage was Moderate (44,60%) to Excellent (87,00%). The details were Moderate category on Ketugar Island, Good category was in Panjang Island, Gusung Asam Island, and Bebuar Island, while the coral reefs in Excellent category were in Semujur Island and Ketawai Island. 24 lifeform types were found with a dominant percentage value of approximately 18,47 - 46,87%. Lifeform was dominated by Coral Foliose (CF), Acropora Tabulate (ACT), dan Dead Coral with algae (DCA). Live coral reefs closer were dominated by healthy lifeforms, with most of the close being Dead Coral with algae. It showed that coral reefs might get disturbed by algae occurrence and triggers massive algae expansion. Fish in Coral reefs primarily targeted fish. It prefers the lifeform type to dead coral with algae lifeform.

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Introduction

Bangka Belitung archipelago has potential in coral reef ecosystems such as Central Bangka Regency waters. The potential coral reefs occur in some small islands in Central Bangka Regency waters, such as Ketawai Island, Gusung Asam Island, Ketugar Island, Bebuar Island, Semujur Island, and Panjang Island. Coral reefs give ecosystem services as nursery grounds for coral reef fish, which human needs. The ecosystem service mentioned provides economically important valued fish, such as targeted fish for fishermen as the main caught (Ariyanti et al., 2022). Coral reefs grow nicely on those islands in the form of fringing reefs and create patch reefs surrounding the islands. The coral reef type around Ketawai Island was a fringing reef (Adi et al., 2013). The potential of the coral reef ecosystem in those small islands generally is just used as fishing grounds and marine tourism. Based on Local Government Regulation number 3, 2020, about coastal area zonation and small islands in Bangka Belitung Archipelago Province 2020-2040. It stated that small islands included in the tourism zone sub-ABL (Underwater Attraction) and water sports zone are Bebuar Island, Gusung Asam Island, Ketugar Island, Ketawai Island, Panjang Island, and Semujur Island.

Previous research on coral reef ecosystems in Bangka Island was Adibarta (2013) (40,95- 67,8%); Siringoringo & Hadi (2013) (21,33-76,46%); Amrillah (2019) (49,94-78,88%); Adi et al., (2020) (40,3-62,06%); and Muftiadi (2021) (50,20-66,20%). In general, coral reef conditions

on Bangka Island were in the state of moderate to very good. Coral reefs' existence in this area brings direct and indirect functions. The coral reef damage can cause fish composition change, which impacts the caught results for local fishermen (Brandl et al., 2020). The direct functions and benefits for humans include coral reef view, coral reef fish, research and utilization of coral reef fish and coral reef resources. The indirect benefits of coral reefs are the ecological function as the beach protection from high wave and sea currents, biodiversity and protection from abrasion. As coral reefs have many benefits to ecology and surrounding, Thus, regular data collection is needed to monitor the ecological or economic function in Bangka Tengah Regency waters. This research aims to discover the percentage of lifeforms of coral reef coverage and to identify the coral reef ecosystem in small islands in Central Bangka Regency waters.

Materials and Methods

Time and Place

The research was conducted on March 2022 on six small islands in Bangka Regency Central waters, consisting of Panjang Island, Semujur Island, Ketawai island, Ketugar Island, Gusung Asam Island, and Bebuar Island. The station locations were decided using a purposive sampling method considering the coverage and the representative of the areas in small islands waters in Central Bangka Regency. Data collection was conducted in 8 stations. Research location maps are shown in Figure 1.



Figure 1. Research Location

Table	1.	Research	location	coordinate
1 4010	. .	1.000001011	1000001011	000101110000

Station	Cool	rdinate	Location Description					
Code	Χ	Y	- Location Description					
1	2.15330833	106.25601111	The western part of Panjang Island					
2	2.14462222	106.30182778	The north part of Semujur Island					
3	2.25191111 106.33226667		The north part of Ketawai Island					
4	2.26035278 106.40238889		The east part of Ketugar Island					
5	2.26160278	106.35144167	South part of Gusung Asam Waters					
6	2.24742778	106.34620000	North part of Gusung Asam Waters					
7	2.29001944	106.44096389	South part of Bebuar Island					
8	2.27303056 106.44142222		The north part of Bebuar Island					

Research Materials

Materials and tools used were SCUBA set, 44 x 58 cm frame, underwater camera, permanent stake, roll meter, underwater stationery and global positioning system (GPS).

Data Collection Method

The method used in this research *is an* Underwater Photo Transect (Giyanto et al., 2010). This method described and documented the research station, and then, data results and transect photos were analyzed using Coral Point Count with Excel extension (CPCe) software. How the data were collected is illustrated in Figure 2.



Figure 2. Data Collection using Underwater Photograph Transect (UPT) Source: Giyanto et al. (2010)

The standard damage criteria on coral reefs are based on the regulation of the Ministry of Environment number 4 in 2001. The criteria are shown in Table 2.

Table 2. Coral Reef	s Criteria
Condition	Coverage (%)

Condition	Coverage (70)
Bad	0-24,9
Moderate	25-49,9
Good	50-74,9
Very Good	75-100

Result and Discussion

Research Location Description

Research locations showed that location 2 was a habited island; stations 1. station 3, station 4, station 5, station 6, station 7 and station 8 were inhabited. Station 1 is located in the western part of Panjang Island; as it is named, the characteristic of Panjang Island is the long deposit land and white sand beach. It has mangrove land vegetation, and in that location was found much-detached fish caught house, and it was semi-close to water. Station 2 was in the north part of Semuiur Island, this station was populated by villagers, with a long white sand beach on the lowest tide, and the land vegetation in this station was brushwood and coconut tree. This station was the fishing ground for local fishermen and was also a semi-closure water.

Station 3 was located on north Ketawai Island; there were cottages for

tourists. This island has a white sand beach dominated by beach vegetation such as coconut and ketapang trees. Around this island were a seagrass ecosystem and a coral reef ecosystem. The waters were crystal clear. Station 4 was located in the east part of Ketugar Island, with the characteristic of a long sand beach, and there was a mangrove ecosystem with rhizophora type spread randomly. This island was the fishing ground for local fishermen.

Both stations 5 and 6 were located in the south and north of Gusung Asam waters; the location of Gusung Asam Island was just a short distance from Ketawai island. This island has ketapang tree as the land vegetation. Stations 7 and 8 were located in the south part of Bebuar Island and the north part. The land vegetation found were ketapang and coconut trees with white sand. The waters area of station 7 and station 8 were the fishing ground for local fishermen.

Coral reefs in Central Bangka regency were in the form of fringing reefs and patch reefs surrounding the islands. The coral reefs are located at 3,0 - 8,8 meters in depth and are usually utilized as the fishing ground area for small fishermen and marine tourism by local villagers. The result showed that the percentage of live coral reefs coverage was Moderate to Excellent condition in (44,60%-87,00%) (Kepmen LH No. 4,2001). The coral reefs' coverage percentage is shown in Figure 3.



Figure 3. The Percentage of Coral Reefs Coverage

Based on the research, the highest life coverage of coral reefs was on station 3, with 87% coverage in the Excellent category. (Baku Mutu Kerusakan Terumbu Karang based on Kepmen LH No. 4 tahun 2001). The water condition in station 3 was more apparent than in other stations. This statement was supported by the previous study that turbidity impacted the coral reefs' coverage by 63,8% more significantly than the other physical and chemical parameters. (Andaris et al., 2015). The previous research in this station stated that the area's coral reef Good categorized coverage was (Adibarta, 2013; Nurhasinta et al., 2019; Muftiadi, 2021). Based on the research conducted, there was an improvement from 2013-2022.

The lowest percentage of coral reef coverage was found in station 4, with a percentage was 44,60% and categorized as moderate. The reason behind the low coverage was the high of dead coral, with the Algae percentage in this area, with the percentage being 46,87%. These conditions also happened because of the sedimentation in the water column. Mahatir (2022), 2,46% prevalence of health disturbance was gang

sedimentation damage. The sedimentcovered corals will cause the coral reefs to lose their polyps and hamper the coral because system of the sediment accumulation on the corals' surface. Generally, it is found in high-turbidity waters (Raymundo, 2008). Based on a previous study (Nurhasinta et al., 2019), one of the factors of the abundance of Dead Coral With Algae (DCA) was because of the existence of human activities that caught the fish with unsustainable gear, moreover the shipping line, anchor dropping, and marine tourism around this area. The cause of the decrease in coral reefs was the anthropogenic activities that caused disadvantaged humans and anthropogenic pollution apart from the natural disaster globally. The coral reefs' decrease was also caused by temperature and beach reclamations anomalies (Naser, 2022). The improvement of human activities decreased ocean biodiversity, including fish and coral reefs. Besides human activities, nature disturbance was also predicted to cause a low percentage of coral reef coverage in this station. Coral reef compositions based on the genus are shown in Table 2.

NO	GENUS		ISLANDS							
NU		1	2	3	4	5	6	7	8	
1	Acropora sp. (ACSP)	+	+	+	+	+	-	+	+	
2	Caulastrea sp. (CASP)	-	-	+	-	-	+	+	+	
3	Coscinaraea sp. (CNSP)	-	-	-	-	-	-	-	+	
4	Cyphastrea sp. (CYSP)	-	-	-	-	-	+	-	-	
5	Ctenactis sp. (CTSP)	+	+	-	+	+	-	+	+	
6	Diploastrea sp. (DISP)	+	-	+	-	+	+	+	+	
7	Echinopora sp. (ECSP)	+	+	+	+	+	-	+	+	
8	Echinophyllia sp. (ELSP)	-	-	-	+	-	-	-	+	
9	Euphyllia sp. (EUSP)	-	+	-	-	-	-	-	-	
10	Favia sp. (FASP)	+	-	+	+	+	+	+	+	
11	Favites sp. (FTSP)	+	+	+	+	+	-	+	+	
12	Fungia sp. (FUSP)	+	+	+	+	+	-	+	+	
13	Galaxea sp. (GLSP)	+	+	+	+	+	+	+	+	

Table 2. Coral Reefs Compositions based on Genus in Central Bangka Regency Waters

NO	CENIUS	ISLANDS							
NU	GENUS		2	3	4	5	6	7	8
14	Goniastrea sp. (GSSP)	+	+	+	+	+	+	+	+
15	Goniopora sp. (GOSP)	+	+	+	-	-	+	+	+
16	Heliofungia actiniformis (HFACT)	-	-	-	-	-	-	+	-
17	Hydnophora sp. (HYSP)	-	-	+	+	-	-	-	-
18	Leptoseris sp. (LPSP)	+	+	-	-	+	+	+	-
19	Lobophyllia sp. (LOSP)	+	+	+	+	+	-	+	-
20	Merulina sp. (MESP)	+	+	+	+	+	+	+	+
21	Montastrea sp. (MOSP)	-	-	-	+	+	-	+	-
22	Montipora sp. (MPSP)	+	+	+	+	+	-	+	+
23	Mycedium sp. (MYSP)	+	-	-	-	-	-	-	-
24	Oulophyllia sp. (OUSP)	+	-	-	-	-	-	-	-
25	Pachyseris sp. (PASP)	+	+	-	-	+	-	+	+
26	Pavona sp. (PVSP)	+	+	+	-	+	+	+	+
27	Pectinia sp. (PESP)	+	+	+	+	+	+	+	+
28	Platygyra sp. (PLSP)	+	+	+	+	+	-	+	-
29	Plerogyra sp. (PGSP)	+	-	+	-	+	-	-	-
30	Porites sp. (PRSP)	+	+	+	+	+	+	+	+
31	Symphyllia sp. (SYSP)	+	-	+	+	+	+	+	-
32	Turbinaria sp. (TUSP)	+	+	+	-	+	+	+	+

The results show that in Central Bangka Regency waters found, 32 genus Galaxea sp. (GLSP), consist of Goniastrea sp. (GSSP), Merulina sp. (MESP) Pectinia sp. (PESP) and Porites sp. (PRSP.) dominated every station. According to Adi et al. (2020), in a previous study that 20 genus was found in Gelasa Island waters, with the dominant genus being Acropora, Porites and some types in the family of Faviidae. Furthermore, based on (Amrillah et al., 2019) research, In Kelapan island, South Bangka Regency waters found 19 genus with the dominant genus found were Merulina, Acropora, and Montipora, which is often found. In Siringoringo & Hadi's (2013) research, 89 types of coral reefs were divided into 13 genus in Bangka waters, including South Bangka Waters and West Bangka. The result showed that 24 lifeforms were found. Coral lifeforms found are shown in Table 3.

The results showed that 11 types of lifeforms and 13 corals were found.

Genus dominated in this research was Coral Foliose (CF) (Ketawai Island, Gusung Asam Island, Ketugar Island, Bebuar Island, Semujur Island, and Panjang Island). This condition occurred because the coverage was still in the Moderate to Excellent category. The study from Amrillah et al. (2019) stated that the factors that caused the domination of coral foliose in the research location were because that lifeform was easy to adapt in high turbidity and high sedimentation areas. Similar research by Muftiadi (2021), in the north area of Ketawai island, stated that 11 types of lifeforms were found. Such as Acropora Branching (ACB), Acropora Digitate (ACD), Acropora Encrusting (ACE), Acropora Tabulate (ACT), Coral Branching (CB), Coral Encrusting (CE), Coral Foliose (CF), Coral Massive (CM), Coral Millepora (CME), Coral Mushroom (CMR), Coral Submassive (CS) with the dominant lifeform was Coral Foliose.

	CATEGODIES				ISLA	NDS			
NO	LIFEFORM (%)	PJGC0 1	SMJC0 1	KTWC0 1	KTGC0 1	GAC0 2	GAC0 1	BBRC0 2	BBRC0 1
	Coral								
1	Acropora Branching (ACB)	1,73	0,00	17,27	0,00	2,00	0,00	0,07	7,67
2	Acropora Digitate (ACD)	0,07	0,40	7,33	2,60	2,60	0,00	0,00	0,53
3	Acropora Encrusting (ACE)	0,00	0,00	1,07	0,00	0,00	0,00	0,00	0,00
4	Acropora Tabulate (ACT)	2,67	2,00	32,53	0,00	0,00	0,00	0,00	0,13
5	Coral Branching (CB)	0,00	0,47	0,13	4,67	1,13	5,13	0,53	0,00
6	Coral Encrusting (CE)	15,93	15,93	3,20	11,07	6,07	2,60	10,00	5,27
7	Coral Foliose (CF)	18,47	43,73	6,20	0,40	30,27	15,07	20,20	38,80
8	Coral Heliopora (CHL)	0,00	0,93	0,67	0,00	0,00	0,27	0,00	1,80
9	Coral Massive (CM)	14,20	0,60	10,93	3,27	10,00	5,33	3,67	3,47
10	Coral Mushroom (CMR)	2,07	2,73	0,13	7,00	0,33	0,53	1,00	1,13
11	Coral Submassive (CS)	15,47	13,73	7,53	15,60	7,13	23,47	19,07	9,53
	Recent Dead Coral								
12	Recently Dead Coral (DC)	2,73	0,20	0,80	0,00	0,00	0,00	0,00	0,07
	Dead Coral with Algae								
13	Dead Coral with algae (DCA)	17,07	14,60	9,20	46,87	35,53	30,33	29,27	20,60
14	Turf Algae (TA)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,07
	Soft Coral								
15	Soft Coral (SC)	0,00	0,00	0,00	0,00	0,00	0,00	0,07	0,00
	Sponge								
16	Sponge (SP)	3,67	0,27	0,33	0,00	0,20	5,07	3,40	0,33
	Fleshy Seaweed								
17	Makro Algae (MA)	0,00	0,13	0,13	0,13	0,07	0,00	0,00	1,20
	Other Biota								
18	Coralline algae (CA)	0,33	0,00	0,00	0,00	0,00	0,00	0,00	0,00
19	Halimeda (HA)	0,73	0,93	1,53	4,60	0,07	0,40	0,00	2,67
20	Other (Fauna) (OT)	2,60	0,73	1,00	3,80	2,20	3,47	1,47	1,07
21	Zoanthid (ZO)	0,53	1,13	0,00	0,00	0,00	0,00	1,13	3,40
	Rubble								
22	Rubble (R)	1,40	0,00	0,00	0,00	0,00	2,40	1,73	0,40
	Sand								
23	Sand (S)	0,33	0,47	0,00	0,00	1,87	5,93	8,20	1,73
	Silt								
24	Silt (SI)	0,00	1,00	0,00	0,00	0,53	0,00	0,20	0,13
	TOTAL	100	100	100	100	100	100	100	100

Table 3. The result of the Coral lifeform in Central Bangka Regency Waters.

Based on 24 types of lifeforms, the dominant percentage range between 18,47% to 46,87%. For instance, Panjang Island was dominated by Coral Foliose (CF) at 18,47%, Semujur island was dominated by Coral Foliose (CF) with an amount percentage of 43,73%, and Ketawai Island was dominated by Acropora Tabulate (ACT) by 32,53%. Subsequently, Ketugar Island was dominated by Dead Coral with algae 46,87%, (DCA) by Dead Coral dominated Gusung Asam Island with algae (DCA) as well by 35,53%, and Bebuar Island was dominated by Coral Foliose (CF) with a percentage was 38.80%. After losing coral reef habitats, the highest consumer community, such as Teleostei, decreased (Brandl et al., 2020). In this case, the ecosystem service is essential in providing fish sources for the fishermen. Ecosystem services are necessary, especially for the targeted fish (Ariyanti et al., 2022).

Life coral reef coverage was dominated by healthy coral type. However, if dead coral dominates this area with algae will trigger the invasion of massive algae and open new ideas for research in the future. The growth of coral will improve the targeted fish resources for fishermen as the targeted fish. Algae expansion in the coral reefs' ecosystem can jeopardize the coral reefs and trigger the polyps to be covered by Total Suspended Solid (TSS). As a result, fish will avoid that area.

Consequently, fish will search for new nursery grounds. The spread of TSS was usually caused by human activities that exploited coastal resources. Furthermore, these human activities on the biosphere can shift and change the biological community in the whole ecosystem (Brandl et al., 2020).

Conclusion

Semujur Island was the only populated island among all the islands in

this research. Coral reefs in Central Bangka Regency waters were fringing reefs and patch reefs surrounding the islands with 3,0 - 8,8 meters depth. Refers the regulation of Ministry of to Environment number 4 in 2001 about standard damage category based on coral reefs coverage, the coverage in the islands was categorized as moderate to very good. The category and percentage of coral reef coverage with moderate level were Ketugar Island (44,60%), Good categories were Panjang Island (70,60%), Gusung Asam island (59,53%), and Bebuar Island (68,33%). Furthermore, the categorized Islands as Excellent categories were Semujur Island (80,53%) and Ketawai Island (87,00%). There were 24 types of lifeforms found, consisting of 11 coral lifeforms and 13 coral reef components. Based on lifeform type, the dominance value ranged between 18,47% to 46.87%. Lifeform domination in Panjang Island was dominated by Coral Foliose (CF), Semujur island was dominated by Coral Foliose (CF), Ketawai Island was dominated by Acropora Tabulate (ACT), and Bebuar Island was dominated by Coral Foliose (CF).

Furthermore, Ketugas Island and Gusung Asam dominated Dead Coral with algae (DCA). Coral reef coverage dominated by lifeforms coral was the condition that coral reefs were healthy. In contrast, the one dominated by dead coral with algae showed that this area was disturbed and would trigger massive algae expansion. The lifeforms type was more dominated by coral fish, mainly targeted fish, compared to lifeforms with dead coral with algae.

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