Original Research Article

Correlation of Coral Reef Cover with Catch Results in Supiori Waters Papua, Indonesia

ABSTRACT

Coral reefs are a habitat for aquatic resources to grow and reproduce to continue their survival. This research aims to analyze coral cover and the composition of fish caught in areas around coral reefs on Wandos Beach, Supiori Regency. This research uses a descriptive quantitative approach. Sampling was carried out at six stations with the criteria of station one, two. three and four are fishing areas, station five is a community residential area and station six is a tourist area. The results of the research found that coral cover for all stations was in the poor/sparse cover category with the most coral type found being *Acropora* followed by *Coelastrea aspera*. The catch for all stations was 66 fish consisting of 10 types. The highest catch composition of aquatic resources was obtained at station five with the condition of coastal coral reefs near residential areas totaling 43 fish (65.15%) and the lowest at stations one and six each with two fish (3.03%) with the condition The station is a fishing area. The composition of catch species in coral reef areas is dominated by *Siganus* Sp fish. as many as 37 individuals (56.06%), *Charanx ignobilis* nine individuals (13.63%), *Etelis carbunculus* six individuals (9.09%), *Leptoscarus vaigiensis* five individuals (7.57%), *Lutjanus monostigma, Balistapus undulatus* and *Sphyraena sphyraena* respectively two individuals each (3.03%). *Scomberomorus commerson, Lutjanus campechanus* and *Tylosurus crocodilus*one individualseach (1.51%). Station five with coral reef conditions near residential areas provided the largest catch of rabbitfish (*Siganus* Sp.).

Key words: Catch, coral cover, fish species composition, coral reefs, Wandos

Comment [RE1]: Use different keywords with the title

1. INTRODUCTION

The Central Statistics Agency reports that the area of coral reef ecosystems in Indonesia will reach 2.53 million hectares (ha) in 2021. Based on this area, 270.16 ha are conservation areas [1]. One of the roles of the coral reef ecosystem is to have the ability to protect against currents and coastal waves and as a place for snorkeling and diving tourism activities [2]. [3] Until 2013, the condition of coral reefs in Indonesia experienced damage of 30.4% with details of poor 5.29%, very good 27.14% and good 37.18%. [4] reported that damage to Indonesia's coral reef cover in 2019 reached 50%.

Small islands have an important role in terms of natural resources, geography, social, economic, cultural, political, defense and security in Indonesia. Small islands have more than one ecosystem and are very sensitive to change [5], so changes in one ecosystem can affect other ecosystems. Numfor Island, Biak-Supiori and Padaido Islands, which face directly to the Pacific Ocean, are surrounded by fringing reefs, barrier reefs, patch reefs and atolls, and have economic potential. in the fisheries and marine tourism sectors [6]. Supiori Regency is an expansion district of Biak Numfor Regency, a Regency which was formed by Law Number 35 of 2003 [7]. Wandos Village is in East Supiori District which borders the Pacific Ocean to the north, Wopes Village to the east, Mount Sombunem and forests to the south, and Waryesi Village to the west.

Coral reefs can contribute to economic, social, cultural, political, regional and environmental improvements that can be used as marine tourism spots [8]. Marine tourism is part of ecotourism, which means that its utilization sources are located in coastal and marine areas and its development is carried out with a conservation approach [9]. The coral reef ecosystem is one of the important ecosystems in tropical waters as a feeding, nursery and spawning ground and is very rich in germplasm. In coral reef ecosystems, the process of forming food chains and networks is very complex and involves various organisms [10].

Coral reefs also have ecological characteristics as a source of nutrients for marine biota, physical protection from waves, spawning grounds, play areas and nurturing for marine biota. However, it also has an economic function as a tourist attraction, as a producer of building construction materials and lime making, as a producer of active ingredients for medicines and cosmetics and as a natural laboratory to support education and research [11]. This research is important to carry out considering that coral reefs are habitats that support biodiversity, as a food source, fisheries productivity and protection from predators. This research aims to analyze the relationship between coral reef cover and fish catches in Wandos waters, Supiori Regency.

2. MATERIALS AND METHODS

This research was carried out from May to July 2024 in the coral reef area in Wandos coastal waters, East Supiori District, Supiori Regency, Papua Province. The research used 6 (six) stations each with coordinates, station one S: 0°43'10" ; E: 135°46’23”, second station S: 0°42’48” ; E: 135°46’38”, station three S: 0°42’58” ; E: 135°46’49”, station four S: 0°42’41” ; E: 135°46’55”, station five S: 0°42’43” ; E: 135°47’06” and station six S: 0°42’32” ; E: 135°47’11”

Underwater observations to record coral types and monitor coral reef cover. Coral reef cover data was collected using the LIT (*Line Intercept Transect*) method. LIT (*Line Intercept Transect*) is a method used in coral reef monitoring surveys [12], [13]. The length of the transect used is 50 m, which is installed paralel to the depth contour which is parallel to the coastline. Observations were made by recording the type of live coral at each station.

Data collection was carried out at six stations with different environmental conditions, namely stations one to four are fishing areas, station five is a coral reef near a residential area and station six is a tourist area. Coral types from the research location were identified using the Coral Finder Tool Kit [13]. The condition of coral reefs is estimated using the percentage approach of live coral reef cover with condition categories [14], [15].

$$Ni = \frac{Li}{L} \, x \, 100 \, \%$$

Where:
Ni = percentage of live coral reef cover (%)
Li = length of coral colony extending the line transect (cm)
L = length of transect line (cm)

Based on the percentage value of live coral reef cover, the condition of coral reefs can be determined, such as the grouping carried out by the Oceanographic Research Center of the Indonesian Institute of Sciences (Puslit Oceanography-LIPI) [16]. The criteria for assessing live coral cover are 75-100% very good, 50-74.9% good, 25-49.9% moderate and 0-24.9% enough or poor.Information on the composition of fish catches was obtained through surveys carried out by local fishermen using handline at each station, with calculations using the formula proposed by [17], namely,

$$KJ = \frac{ni}{N} \, x \, 100$$

Where:
KJ : fish species composition (%)
Ni : number of individuals of each fish species
N : number of individuals of all fish species

3. RESULTS AND DISCUSSION

3.1 Coral reef cover

Based on the results of identifying coral reef types from all transects, the type, number, cover value and status of coral reef cover were found (Table 1). The coral reefs found consisted of *Coelastrea aspera, Acropora* and *Stichodactyla gigantea* (*sea anemone*) species. *Acropora* was the most common type found for each station and the least was *Stichodactyla gigantea* and was found only at stations three and five. However, the cover status for all types of coral found was in the low cover category. The results of the analysis of coral reef cover based on the level of cover according to the *Normalized Difference Vegetation Index* (NDVI) for each station obtained values in the sparse cover category (Table 1).

NDVI is usually used for vegetation and is less relevant to coral cover, other than that it is not found in the method, please include it

Table 1. Coral type, number, cover value, cover status and number of fish caught

Stations	Types of Coral Reefs			Amount	Cover Value	Covers Status	Number of fish (individuals)
	Ca	A	Sg				
1	8	10	0	18	0,18	enough	2
2	6	8	0	14	0,14	enough	9
3	4	7	2	13	0,13	enough	2
4	12	16	0	28	0,28	enough	7
5	6	8	3	18	0,18	enough	43
6	13	14	0	27	0,27	enough	3
Amount	49	63	5	118	1,18		66

Where: Ca = *Coelastrea aspera*, A = *Acropora*, Sg =

Comment [RE2]: Before this paragraph, cite previous research studies using recent references on the correlation of coral cover and catches

Comment [RE3]: The word types is incorrectly replaced with species

Comment [RE4]: NDVI is usually used for vegetation and is less relevant to coral cover, other than that it is not found in the method, please include it

Comment [RE5]: idem

Stichodactylagigantea

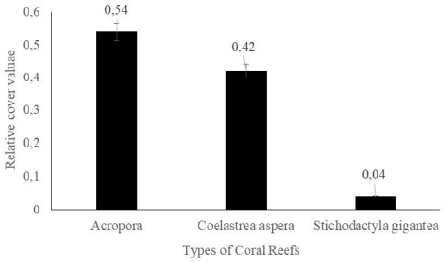

Figure 1. Relative cover values based on coral type

Figure 1 shows that the number of corals of the Acropora type reached 63 (0.54%) and dominated, followed by Coelastrea aspera. Acropora and Coelastrea aspera were found at all stations, while Stichodactyla gigantean was only found at stations three and five. The dominance of certain corals is an indication that there are environmental factors that do not support coral growth. [18] that the growth of living corals is more diverse, indicating that environmental conditions are more favorable for the growth of many types of coral.

Low coral reef cover has an impact on decreasing biodiversity, thereby reducing the ecological function of coral reefs, which can lead to reduced economic and tourism potential. Low coral reef cover can be caused by natural factors and due to human activities. Natural factors relate to coral disease, changes in oceanographic conditions, predation by organisms or storms that can destroy coral structures.Meanwhile, factors resulting from human activities include coral bleaching, destructive fishing, marine pollution, sedimentation and tourism activities.

The Acropora type of coral is found at all stations and is classified as dominant, presumably because this coral has a high growth rate, efficient reproductive ability, has the ability to tolerate a wide range of environments and has morphological variations that enable it to adapt to ever-dynamic environmental conditions. Meanwhile, Stichodactyla gigantea (sea anemone) was very rarely found during research, which is thought to be related to habitat preferences, has high sensitivity to environmental changes, may not be able to compete for space, has limited distribution or may be exploited by humans because of its beauty.

3.2 Composition of fish catch types

There were 66 fish caught during the research for all stations using gillnets, spears and fishing gear, consisting of 10 types of fish and all of them were classified as bony fish. The composition of the catch was dominated by 37 rabbitfish (*Siganus* Sp.) (56.06%), followed by 9 (13.64%) redfish (Eteliscarbunculus), 6 red fish (Eteliscarbunculus) (9.09%) and murmer parrotfish (Leptoscarusvaigiensis) as many as 5 (7.58%) (Figure 2).

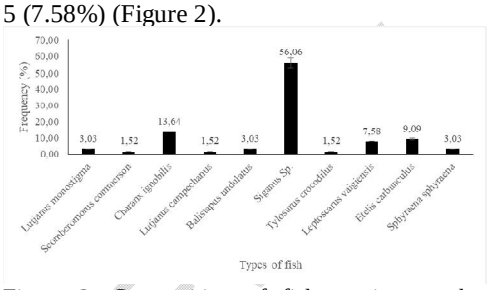

Figure 2. Composition of fish species caught during the research

The composition of fish species caught based on stations showed that at station five there were 43 fish and it was dominated by baronang fish (Siganussp), followed by station four at eight fish, dominated by six fish (*Charanxignobilis*) and at station two there were eight fish. which is dominated by the fish species Eteliscarbunculus (Figure 2). Stations one, three and six provided the lowest catches. The number of catches after the student t test obtained different results between stations. This shows that community activities at each station contribute to the amount of fish caught. [19] argue that coral reefs are the most significant factor influencing fish catches.

The condition of coral reef cover for all stations is classified as low cover so there is no difference between stations. However, there are differences in catch results based on station conditions, namely stations as fishing areas, stations close to residential areas and stations that are tourist hotspots. Differences in catches between research station conditions are thought to be related to the contribution of human activities at each station, habitat conditions, fishing pressure exerted by the community, regulations relating to management or due to the presence of dominant species. [20] revealed that the abundance and diversity of coral fish species depend on live coral cover, substratum diversity, and structural diversity and coral reef area.

Rabbitfish (*Siganus*Sp) are more commonly caught at station five with coral reef conditions

Comment [RE6]: Cite several references for comparison with other studies

Comment [RE9]: write down the t value test result obtained

Comment [RE7]: This paragraph is a general statement that needs to be supplemented with reference sources

Comment [RE8]: This paragraph needs to be strengthened with references

located near residential areas, thought to be due to several factors, including food availability, intensive fishing activities, limited habitat, changes in fish behavior or because of ecosystem pressure at the location. another arrest. Residential settlements produce organic waste flowing into the sea which can increase primary productivity around coral reefs thereby attracting plankton which is the main food for rabbitfish (Siganussp). The close distance to settlements makes access easier and causes fishing to occur more frequently. On the other hand, limited habitat due to degradation factors due to pollution, sedimentation and other human activities causes rabbitfish to gather at certain points, making it easier to catch them. Fishing interactions carried out by the community can have an impact on changes in movement patterns, causing fish to move to places where catching is easier. [21], [22] argue that the catches obtained on coral blood are the result of a positive relationship between coral fish and the habitat in which they live which is caused by functional aspects of the structure and composition of the habitat which provide shelter and food for coral fish. Damage to coral reef ecosystems contributes to a decline in biodiversity and socio-economics for coastal communities [23].

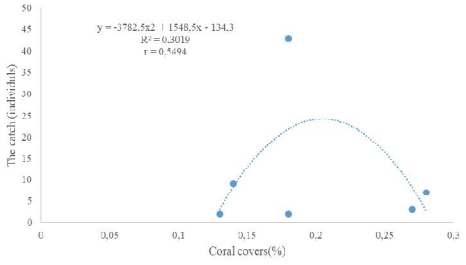

Figure 3. Correlations between coral reef cover and fish catch

The results of a simple linear regression analysis show that coral reef cover and catches in the Wandos waters of Papua show a correlation coefficient (r) value of 0.5494 and a coefficient of determination (R2) value of 0.3091 (Figure 3). This provides information that coral reef cover contributes to coral fish catches by 30.91%, which means that the higher the percentage of coral reef cover, the more coral fish catches will increase. The correlation coefficient (r) value of 0.5494 means that the relationship between live coral reef cover and catches is in the sufficient category [24]. The level of close relationship between live coral reef cover and catches at the research location is thought to be caused by the percentage of coral reef cover being classified as deficient. The striking relationship between coral reef cover and rabbitfish catches at station five is an indicator that the coral reef ecosystem adjacent to residential areas is a good habitat for rabbitfish.

4. Conclusion

Coral cover for all stations is in the poor or rare category with the dominant coral type found being Acropora. The number of catches between stations was different and the highest catch was found at station five of the rabbitfish (SiganusSp). There is a positive relationship between coral cover and fish catches.

Comment [RE10]: which is true poor or rare? Please use one of the following

REFERENCES

Comment [RE11]: add and use references of the last 10 years

1. HandayaniM& Citra SUD.Coral Reef Ecosystem at Tawang Beach, Pacitan Regency. Journal of Marine Research. 2023. 12 (4): 623-629. https://doi.org/10.14710/jmr.v12i4.38669
2. Sukandar., Dewi CSU &Handayani M. Analysis of Land Suitability and Environmental Carrying Capacity for the Development of Marine Tourism on Bawean Island, Gresik Regency, East Java Province. Journal of Aquatic, Coastal and Fishery Sciences.2017. 6(3): 205-213.DOI: https://doi.org/10.13170/depik.6.3.7024
3. Indonesian Institute of Sciences. 30.4 percent deer coral reef. 2014. http:// kependudukan.lipi.go.id/id/berita/liputan-media/146-lipi-30-4-persen-terumbu-karang-rusak.
4. Hadi TA, Muhammad A, Giyanto, Prayudha B, Johan O, Budiyanto A, Rezza A, Alifatri LO, Sulha S, & Shar SS. The Status of Indonesian Coral Reefs 2019. 2020. Coral Reef Rehabilitation and Management Program Coral Triangle Initiative (COREMAP-CTI).https://www.researchgate.net/publication/342663285_The_Status_of_Indonesian_Coral_Reefs_2019
5. Goldberg D. Lagomasino N. Thomas, & Fatoyinbo T.“Global declines in human-driven Terumbu Karang loss,” Glob. Chang. Biol., 2020. 26 (10): 5844–5855.DOI: 10.1111/gcb.15275
6. Suharsono. Coral reef management in Indonesia. Inauguration oration of Research Professor, Marine Biology - LIPI. 2007. 112 p.https://supiorikab.go.id/profil/sejarah
7. Dariusman A. Development of Marine Tourism on the Lampung Bay Coast. Tourism Policy Research and Development. Journal of Indonesian Tourism Destinations, 2016. 1 (1): 45-66.

8. Adi AB, Mustafa A, &Ketjulan R.Study of the Regional Potential and Suitability of the Coral Reef Ecosystem on Lara Island for the Development of Marine Ecotourism. Indonesian Marine Mina Journal. 2013. 1: 49-60.
9. Wainwright PC, & Bellwood DR. Ecomorphology of Feeding in Coral Reef Fishes. Coral Reef Fishes. 2002. p.33–55
10. Tuwo A. Coastal and Marine Ecotourism Management: Ecological, Socio-Economic, Institutional and Regional Facilities Approaches. Brilliant International Publishers. 1st printing. 2011. Surabaya
11. Wahib NK. &Luthfi OM. Study of the Effectiveness of Using LIT, PIT, and QT Methods for Monitoring Substrate Cover. Journal of Fisheries and Marine Research.2019. 3(3):331-336.https://scholar.google.co.uk/citations?view_op=view_citation&hl=ja&user=Gy2OUW0AAAAJ&citation_for_view=Gy2OUW0AAAAJ:SeFeTyx0c_EC
12. Veron JEN. Coral of The Word Volume 11. 2002. Australian Institute of Marine Science. Australian. https://www.aims.gov.au/sites/default/files/New%20species%20described%20in%20Corals%20of%20the%20World.pdf
13. United Nation Environment Protection. Coral reef observation in change. Science Marine Science. Australia. 1993.https://www.un.org/esa/dsd/resources/res_pdfs/ga-66/inputs/australia.pdf
14. Nurhasinta, Umroh dan Syari IA. Abundance of Chaetodontidae and Pomacentridae fish in the coral reef ecosystem of Ketawai Island and Gusung Asam Island, Central Bangka Regency. Maspari Journal: Marine Science Research, 2019. 11(2): 97-114. DOI: https://doi.org/10.56064/maspari.v11i2.9476
15. Odum TH. Systems Ecology: An Introduction. Gadjah Mada University Press. 1992. Yogyakarta
16. Siringoringo RM, Giyanto, Utama RS, Sari NWP, Edrus IN, Wardana AK, Pramudji, Indarto H, Adji AS. Monitoring Coral Reef Health and Related Ecosystem Health in North Nias Regency. 2014. COREMAP-CRITC-LIPI. Jakarta
17. Fachrul MF. Bioecological Sampling Methods. 2007. PT. Bumi Aksara. Jakarta.
18. Siringoringo RM &Hadi TA. Condition and Distribution of Stone Corals (Scleratinia corals) in Bangka Waters. Journal of Tropical Marine Science and Technology, 2013.5(2): 273-285.https://media.neliti.com/media/publications/101213-ID-none.pdf
19. Puspitasari HM, Anwar A, Sutarto Y. The Impact of Coral Reef Damage on Fish Catches in Lemukutan Island Village, Bengkayang Regency, West Kalimantan Province. 2014. 2 (1): 1-10. DOI: https://doi.org/10.26418/jtllb.v2i1.6625
20. Lestaluhu AR. Coral Fisheries Production in Coral Reef Waters TWAL Pombo Island, Salahutu District, Central Maluku Regency, Maluku Province. BULLET: Multidisciplinary Journal of Science. 2023. 2 (40: 1023-1030. https://journal.mediapublikasi.id/index.php/bullet
21. Öhman MC. &Rajasuriya A. Relationships between habitat structure and fish communities on coral and sandstone reefs. Environmental Biology of Fishes 1998.53:19-31.DOI:10.1023/A:1007445226928
22. Anderson K. A Study of Coral Reef Fishes along a Gradient of Disturbance in the Langkawi Archipelago,Malaysia. 2002. Undergraduate thesis in biology, Departemen of Animal Ecology, Uppsala University, Sweden
23. Ulfah M, Fazillah MR, Turnip IN, Seragih A.Temporal Study of Coral Fish Communities (2014-2018) in the Waters of Mesjid Raya and Peukan Bada Districts, Aceh Besar Regency. Journal of Tropical Marine Science and Technology, 2020.12(1): 183-193. DOI: http://doi.org/10.29244/jitkt.v12i1.27407
24. Tanjung A. Experimental Design (3rd Revised Edition). Tantaramesta Publishers. Bandung: 2014. Indonesian Directory Association.