

Correlation of Coral Reef Cover with Catch Results of Target Fish Species 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 reef 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 research results found that coral reef cover for all stations was in the poor cover category, ranging from 0.14-0.27%, with the most coral species found being *Acropora* followed by *Coelastrea aspera*. The catch for all stations was 66 fish consisting of 10 species. The highest catch composition of aquatic resources was obtained at station five with the condition of coastal coral reefs near residential areas totaling 43 individuals (65.15%) and the lowest at stations one and six each with two individuals (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 *Sphyaena sphyaena* respectively two individuals each (3.03%). *Scomberomorus commerson*, *Lutjanus campechanus* and *Tylosurus crocodilus* one individual each (1.51%). Station five with coral reef conditions near residential areas provided the largest catch of rabbitfish (*Siganus* Sp.). The lack of coral cover has an impact on the decreasing availability of fish resources, so that conservation efforts and control of fisheries management that damages coral reef ecosystems are needed.

Key words: target fish species, coral reef cover, fish species composition, Wandos

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 improving the economy, social, culture, politics, region, and environment that can be used as a place for marine tourism [8]. Marine tourism is part of ecotourism with its utilization sources located in coastal areas and its development through a conservation approach [9]. Coral reef ecosystems are one of the important ecosystems in tropical waters as a place for feeding, nursery and spawning ground and are very rich in plasma

nutfah. In coral reef ecosystems, there is a process of forming a very complex food chain and network involving various organisms [10].

Previous research related to coral reef cover and catches has been conducted by [11] who found live coral cover ranging from 21-56.5% with damaged to good categories in the waters of Lemukutan Island. Other researchers such as [12] obtained coral cover ranging from 5.9-51.8% in the waters of Harapan Island, Seribu Islands with catches dominated by reef fish (Neoglyphidodonmelas) which are algae-eating fish.

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 [13]. This research is very interesting and important to do because of the very high intensity of fishing in the coral reef area which is the center of the world's coral triangle in supporting biodiversity and fisheries productivity at the research location. However, in reality, the community has difficulty obtaining catches due to damage to the coral reefs. This study aims to analyze the relationship between coral reef cover and target 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 [14], [15]. The length of the transect used is 50 m, which is installed parallel 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 [15]. The condition of coral reefs is estimated using the percentage approach of live coral reef cover with condition categories [16], [17].

$$Ni = \frac{Li}{L} \times 100 \%$$

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) [18]. The criteria for assessing live coral cover are 75-100% very good, 50-74.9% good, 25-49.9% moderate and 0-24.9% 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 [19], namely,

$$KJ = \frac{ni}{N} \times 100$$

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 species from all transects, the species, number, cover value and status of coral reef cover were found (Table 1). The coral reefs found consisted of *Coelastreaaspera*, *Acropora* and *Stichodactylagigantea* (*sea anemone*) species. *Acropora* was the most common species found for each station and the least was *Stichodactylagigantea* and was found only at stations three and five. However, the cover status for all species of coral found was in the poor

cover category. The results of the analysis of coral reef cover based on the level of cover according to the for each station obtained values in the **poor** cover category (Table 1).

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

Stations	Species of coral reefs			Amount	Covers value	Covers status	Number of fish (individulas)
	Ca	A	Sg				
1	8	10	0	18	0,18	Poor	2
2	6	8	0	14	0,14	Poor	9
3	4	7	2	13	0,13	Poor	2
4	12	16	0	28	0,28	Poor	7
5	6	8	3	18	0,18	Poor	43
6	13	14	0	27	0,27	Poor	3
Amount	49	63	5	118	1,18		66

Where: Ca = *Coelastreaaspera*, A = *Acropora*, Sg = *Stichodactylagigantea*

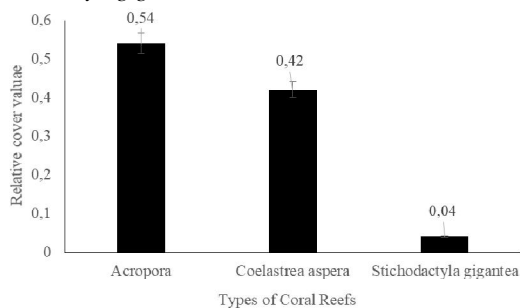


Figure 1. Relative cover values based on coral **species**

Figure 1 shows that the number of corals of the *Acroporaspecies* reached 63 (0.54%) and dominated, followed by *Coelastreaaspera*. *Acropora* and *Coelastreaaspera* were found at all stations, while *Stichodactylagigantea* 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. The dominance of certain corals is an indication that there are environmental factors that do not support coral growth, such as temperature, salinity, depth, currents and tides. [20] revealed that environmental factors affect coral reefs such as sedimentation will inhibit zooxanthellae for photosynthesis which will inhibit coral growth. [21] revealed that current factors also affect coral reefs because they can carry sediment on the surface or at the bottom of the water. [22] argued that health disorders also play a role in inducing coral disease.[23] that the growth of living corals is more diverse, indicating that environmental conditions are more favorable for the growth of many types of coral.

Poor 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. Poor 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. Poor coral cover percentage, as an indicator of low coral complexity, low live coral diversity, so that no type of coral dominates [24]. Low live coral cover can be caused by natural factors and artificial factors caused by the activities of the surrounding community around the waters which have an impact on the balance of the coral reef ecosystem [25].

The *Acroporaspecies* 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, *Stichodactylagigantea* (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.

[26] argues that environmental changes such as the impact of sedimentation in waters can affect coral growth by covering the surface of the polyps, causing death, decreasing growth rates, and reducing water clarity, thus disrupting the physiological processes of corals, especially in the process of photosynthesis, and causing corals to expend large amounts of energy to clean sediment from the surface.

3.2 Composition of fish catch types

There were 66 fish caught during the research for all stations using handlinefishing gear, consisting of 10 species of fish target 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).

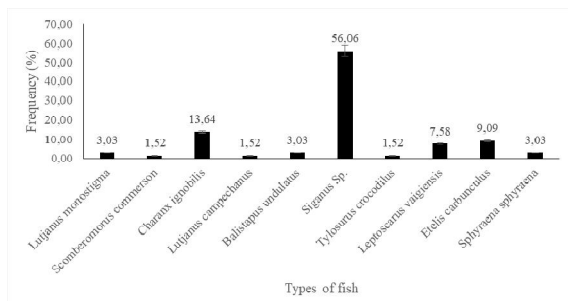


Figure 2. Composition of fish species caught during the research

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 (*Siganus* sp), followed by station four at eight fish, dominated by six fish (*Charaxnignobilis*) 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 being tested using the two-sample t-test assuming equal variances showed that stations one, two, three and four were fishing areas that were no different from station five, which was a station close to residential areas with a calculated $t_{\text{calculated}} < t_{\text{table}}$ ($0.0492 < 0.1565$). Stations one, two, three and four with different fishing area criteria were different from station six, which was a tourist area with a $t_{\text{calculated}} < t_{\text{table}}$ ($15.8750 > 6.3882$). Likewise, stations five and six obtained different catches with a $t_{\text{calculated}} < t_{\text{table}}$ ($322.8750 > 6.3882$). This shows that community activities at each station contribute to the amount of fish caught. [27] argues that coral reefs are the most significant factor influencing fish catches.

The condition of coral reef cover for all stations is classified as poor 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 carried out by the community, regulations related to management or because of the presence of dominant species. [28] revealed that the abundance and diversity of reef fish species depend on live coral cover, substratum diversity, and structural diversity and the area of coral reefs.

Rabbitfish (*Siganus* sp) are more commonly caught at station five with coral reef conditions 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 (*Siganus* sp). 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 it is easier to catch them. [29], [30] argue that the catches obtained in coral areas are the result of a positive relationship between coral fish and their habitat, which is caused by the functional aspects of the structure and composition of the habitat which provides shelter and food for coral fish. Damage to coral reef ecosystems contributes to a decline in biodiversity and socio-economics for coastal communities [31].

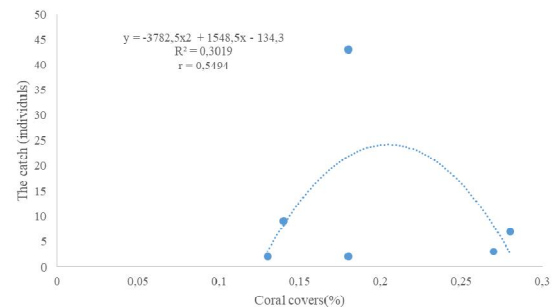


Figure 3. Correlations between coral reef cover and fish catch

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 (R^2) 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 (*Siganus* Sp). There is a positive relationship between coral cover and fish catches.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

REFERENCES

- Handayani M & 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>
- 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>
- 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>.
- Hadi TA, Muhammad A, Giyanto, Prayudha B, Johan O, Budiyo 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
- 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
- Suharsono. Coral reef management in Indonesia. Inauguration oration of Research Professor, Marine Biology - LIPI. 2007. 112 p. <https://supiorikab.go.id/profil/sejarah>
- 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.
- 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 Journal*. 2013. 1: 49-60.
- Wainwright PC, & Bellwood DR. Ecomorphology of Feeding in Coral Reef Fishes. *Coral Reef Fishes*. 2002. p.33–55
- Tuwo A. Coastal and Marine Ecotourism Management: Ecological, Socio-Economic, Institutional and Regional Facilities Approaches. Brilliant International Publishers. 1st printing. 2011. Surabaya
- 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/jtlb.v2i1.6625>
- Rizqy M, Ade Y, & Fahreza OS. Analysis of Coral Cover Condition Using Line Intercept Transect (LIT) Method in Harapan Island Waters, Seribu Islands. Bachelor thesis, Brawijaya University. 2023. URI: <http://repository.ub.ac.id/id/eprint/205348>
- 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=Gy2OUW0AAAJ&citation_for_view=Gy2OUW0AAAJ:SeFeTyx0c_EC
- Veron JEN. Coral of The World Volume 11. 2002. Australian Institute of Marine Science. Australian. <https://www.aims.gov.au/sites/default/files/New%20species%20described%20in%20Coral%20of%20the%20World.pdf>
- United Nation Environment Protection. Coral reef observation in change. Science Marine Australia. 1993. https://www.un.org/esa/dsd/resources/res_pdfs/ga-66/inputs/australia.pdf
- Nurhasinta, Umroh dan Syari IA. Abundance of Chaetodontidae and Pomacentridae fish in the coral reef ecosystem of Ketawai Island

- and GusungAsam Island, Central Bangka Regency. *Maspari Journal: Marine Science Research*, 2019. 11(2): 97-114. DOI: <https://doi.org/10.56064/maspari.v11i2.9476>
17. Odum TH. *Systems Ecology: An Introduction*. GadjahMada University Press. 1992. Yogyakarta
 18. 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
 19. Fachrul MF. *Bioecological Sampling Methods*. 2007. PT. BumiAksara. Jakarta.
 20. Luthfi OM, Agung RM, Sontodipoero MR. Skeleton microstructure of *Poriteslutea* in Skeleton Microstructure of *Poriteslutea* in KondangMerak ,Malang, East Java. 2017. AIP Conference Proceedings.
 21. Supriyadi, Hidayati N, Isdianto A. Analysis of Surface Ocean Current Circulation and Sediment Distribution. 2017. Proceedings of the 3rd National Seminar on Marine Affairs and Fisheries, September, 175–181
 22. Luthfi OM, Rosyid A, IsdiantoA.,JauhariA, Setyohadi,D. The compromised health of coral at South Java Sea : Study area Prigi Bay The Compromised Health of Coral at South Java Sea : Study Area Prigi Bay. 2018. AIP Conference Proceedings
 23. 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>
 24. Thovyan AI, Sabariah V, Parenden D. Percent Cover Coral Reef at PasirPutih Waters in Manokwari Regency. *Jurnal Sumberdaya Perikanan Indopasifi*. 2017. 1(1), 67-80. www.ejournalfpikunipa.ac.id
 25. Lalang, Riska, Ilham AT, Maharani. Percentage Cover and Mortality Index of Coral Reefs in Pomalaa Waters, Southeast Sulawesi. *Indopacific Aquatic Resources Journal*. 2022. 6(3): 205-214. <https://doi.org/10.46252/jsai-fpik-unipa>.
 26. Buhari N, Himawan MR, Jefri E, Paryono P, Rahman I, Damayanti AA. Current Condition of Coral Cover Percentage During the Covid-19 Pandemic in Gili Air, GiliMatra Marine Tourism Park, West Nusa Tenggara. *Journal of Science Technology and Environment*, 2021: 7(2), 238–247. <https://doi.org/10.29303/jstl.v7i2.276>
 27. 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>
 28. 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
 29. 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
 30. Ulfah M, Fazillah MR, Turnip IN, Seragih A. Temporal Study of Coral Fish Communities (2014-2018) in the Waters of Mesjid Raya and PeukanBada 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>
 31. Tanjung A. *Experimental Design* (3rd Revised Edition). Tantaramesta Publishers. Bandung: 2014. Indonesian Directory Association.