Journal of Coastal and Ocean Sciences *e-issn: 2746-4512*
Volume 6 No. 2, May 2025: 108-113 *p-issn: 2745-4355*

Abundance of Chaetodontidae Family Reef Fish and Coral Reef Condition in the Sikuai Island Area, West Sumatra

Bella Yosefa[1*], Thamrin[1], Afrizal Tanjung[1]
[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
Corresponding Author: bella.yosefa3347@student.unri.ac.id

Received: 7 April 2025; Accepted: 6 May 2025

ABSTRACT

Coral reefs are massive piles of sediment from calcium carbonate produced by the phylum cnidaria, class Anthozoa, and order Madreporaria, with the addition of calcareous algae and other organisms that produce calcium carbonate. One group of biota that lives in association with coral reefs and plays a vital role in the coral reef ecosystem is the Chaetodontidae fish. The taking of the Chaetodontidae family as research material is because the coral fish of the Chaetodontidae family are indicator fish for coral reef health that can assess, monitor and predict the condition of coral reefs. Given the importance of the function and the existence of coral reefs. This study aimed to determine the condition of coral reef cover, analyze the abundance of reef fish in the Chaetodotidae family, and determine the relationship between coral reef cover and the abundance of reef fish in the Chaetodotidae family. This study was conducted in December 2024 in Sikuai Island, West Sumatra. This study used survey methods, such as UVC (underwater visual census) and UPT (underwater photo transect). The research location was divided into three stations in the southern part of Sikuai Island because the southern part is relatively protected from large waves during the west wind season. Station I is next to Sirandah Island, Station II is in the harbour area, and Station III is in the abandoned ship area. The analysis showed that the highest percentage of coral cover was found at Station III, namely 45.13%, and the lowest rate was found at Station I, 6.47%. The calculation of reef fish abundance showed that the highest abundance of reef fish was found at station III, namely 5000 ind / ha and the abundance of reef fish at station I was 6.47%.

Keywords: Reef Fish, Sikuai Island, Coral Cover

1. INTRODUCTION

Indonesia has long been known as a coastal country where the livelihoods of its people depend on fisheries and marine resources. Therefore, coastal communities must protect marine ecosystems. One of the most unique marine ecosystems in the world is the coral reef. Healthy coral reefs serve as feeding grounds, spawning grounds, and nurseries for various marine organisms. Coral reefs can also be used as tourist attractions and as barriers against waves and erosion.

According to Rahmita et al. (2021), coral reefs are one of the characteristic ecosystems in tropical regions, known for their high organic productivity and biodiversity. The most important biological component of coral reefs is stony corals (Scleractinia), whose skeletons are made of calcium carbonate. Healthy coral reefs are those that can grow and develop rapidly, forming extensive areas on the seabed.

The collection of fish from the Chaetodontidae family as research material was because Chaetodontidae fish are indicator fish for coral reef health, which can assess, monitor, and predict the condition of coral reefs. Given the importance of the function and the existence of coral reefs, indicator fish are types of fish that strongly associate with coral habitats. Chaetodontidae fish are the species most strongly associated with coral. They are susceptible to changes and damage to coral reefs because these fish depend on the food sources and shelter provided by coral (Suharti et al., 2018).

The association of fish with coral reefs is due to the growth structure of coral reefs, which provides habitat for fish (Rusman, 2021). Reef fish are generally more abundant in coral reef ecosystems that are still in good condition, and the condition of reef fish will decline if the coral reefs are unhealthy, meaning that there is a positive correlation between coral reef quality and the abundance of reef fish of the

Chaetodontidae family. Reef fish have low mobility and, therefore, require coral reefs to sustain their functions in specific areas that are maintained (Gea, 2018).

Due to the lack of accurate data on the abundance of reef fish of the Chaetodontidae family and the condition of coral reefs in the waters around Sikuai Island, the author was interested in conducting research in this area. The availability of accurate data will be necessary for future management. Sikuai Island is located in Bungus District, West Sumatra, with geographical coordinates of 1°7'39.07 "S, 100°21'9.1" E. Administratively, the island is part of the Bungus Teluk Kabung subdistrict, Padang City, West Sumatra province. The island is inhabited, and the local community currently uses it as a tourist destination. As such, there are several human activities carried out there. These activities are feared to impact the Chaetodontidae family of reef fish.

2. RESEARCH METHOD

Time and Place

This study was conducted in December 2024 in the waters of Sikuai Island, West Sumatra.

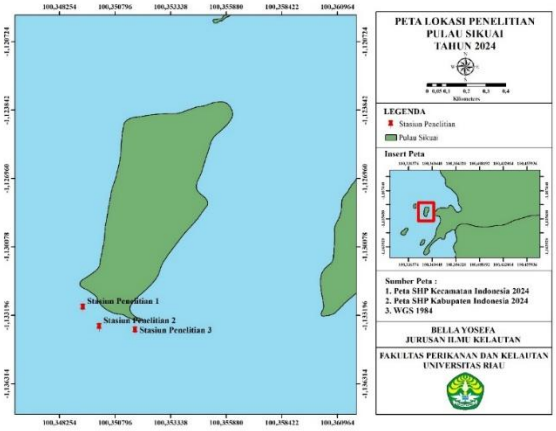

Figure 1. Research location

Method

Research stations were determined using a survey method with skin diving equipment. The research location was divided into three stations in the southern part of Sikuai Island because the southern part of the island is relatively protected from large waves during the west wind season. Station I is located next to Sirahdah Island, Station II is located in the port area, and Station III is located in the abandoned ship area (Figure 1).

Procedures

The Underwater Visual Census (UVC) method is used to quantify fish numbers, which has high consistency in assessing the species of reef fish encountered so as not to cause significant bias (English et al., 1994). This method describes the fish found within a 2 x 50-meter transect with three stations and a depth of 6 m. The abundance of each fish species is counted with a monitoring distance of 1 m on the left and right sides of the transect (English et al., 1997). Before data collection begins, the area is allowed to return to normal (calm) for approximately 15 minutes after the transect is set up so that the fish can become accustomed to the presence of divers. The coral reef fish data obtained were recorded using a counting board and by direct observation. To complete the data, observations were also made through photographs taken underwater. Data collection for coral reef fish of the family Chaetodontidae was repeated three times to obtain accurate results. Data collection was conducted during the day because this fish species is active during the day (diurnal) (Pratama, 2021).

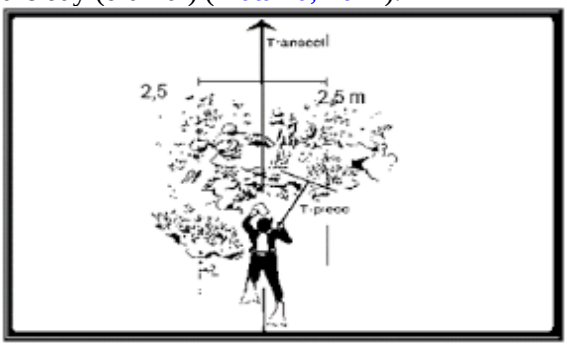

Figure 2. Underwater Visual Census (UVC) method

Coral Cover Data Collection

Coral reef data collection was conducted using the Underwater Photo Transect (UPT) method (English et al., 1997), where transect lines were installed parallel to depth contours aligned with the coastline along a 50-m stretch at the exact location as the coral fish data collection. The transects were installed by observing the uneven seabed contours, such as elongated and lateral contours. Observations were made by recording the shapes of coral growth and abiotic groups that touched the transect according to the values on the tape measure. The recording used a slate, referring to the coral life form. This study was conducted at three different stations, where each data collection point produced 50 coral photographs

for analysis, with a total of 150 photographs to be analyzed. The photographs were then analyzed using the Coral Point Count with Excel extensions (CPCe) software to obtain quantitative data (Kohler & Gill, 2006).

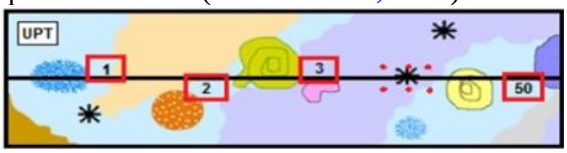

Figure 3. Underwater Photo Transect (UPT) method

Coral Fish Abundance Analysis

Fish abundance is the number of fish found per unit area of the transect. Odum (1971) explains that coral fish abundance is calculated using the following formula:

$$Xi = \frac{xi}{A}$$

Explanation:
Xi = Abundance of fish species i
xi = Number of fish species i
A = Transect area (individuals/m^2)

Coral Reef Cover Analysis

The underwater photographs taken at each 1.5-line transect interval were analyzed to obtain quantitative data based on the underwater pictures produced by the UPT (Underwater Photo Transect) method. Data analysis was performed on each frame by selecting random sample points. This technique is an application of sampling, where the population consists of all biota and substrates in the photo frame, while the samples are randomly selected points on the photo. In this way, the data recorded only includes the biota and substrate located precisely at the positions of the points randomly determined by the CPCe software. The criteria for assessing coral reef condition are based on the percentage of live coral cover, categorized as follows: very good: 75- 100%; good: 50% - 74.9%; average: 25- 49.9%; poor: 0- 24.9%

Coral cover can also be estimated using the percentage of coral cover approach with condition categories from Gomez et al. (1988). The formula used is:

$$ni = \frac{li}{L} \times 100\%$$

Description:
ni = Percentage of coral cover (%)
li = Length of lifeform type i
L = Length of 50 m transect

Analysis of the Relationship between Coral Fish Abundance and Coral Reef Cover

The data obtained from sampling were presented in tables and analyzed descriptively using simple linear regression equations. The analysis was performed using Microsoft Excel. Then, the following simple linear equation formula was used to measure the direction and strength of the relationship between coral cover and reef fish.

$$Y = a + bX$$

Description:
Y = Diatom abundance (cells/L)
a and b = Regression constants and coefficients
X = Oil content (ppm)

The general equation of simple linear regression in Tanjung (2014) will produce the following relationship: 1) Positive linear, a relationship that shows that the higher the independent variable (X), the higher the value of the dependent variable (Y). 2) Negative linear, a relationship that shows that the higher the value of the independent variable (X), the lower the value of the dependent variable (Y).

The strength of the relationship can be seen from the correlation coefficient (r) value, with the following categories: r = 0-0.25 means a weak relationship; r = 0.26-0.50 means a moderate relationship; r = 0.51-0.75 means a strong relationship, and r = 0.76-1.00 indicates a very strong or perfect relationship.

3. RESULT AND DISCUSSION

Water Quality

The water quality measurements included temperature, brightness, flow velocity, salinity, and pH. The results of these measurements on Sikuai Island are shown in Table 1.

Based on the results of observations, the values of temperature, brightness, current velocity, salinity, and pH were found to be relatively similar. The temperature in the waters around Sikuai Island ranged from 30.1 to 30.8ºC. The brightness of the waters ranged from 6.5 to 6.7%. The current speed in the waters ranged from 0.04 to 0.12 m/s. Salinity in the waters ranged from 31 to 32 ppt. Meanwhile, pH ranged from 8.63 to 8.67.

According to Government Regulation No. 22 of 2021, the optimal salinity for coral growth is between 33–34 ppt. Although coral reefs can survive outside this range, their growth is less optimal than at normal salinity levels. The

salinity at the coral reef study site ranges from 31 to 32 ppt (Patty & Akbar, 2018), meaning that corals can grow there, but their growth is not optimal. Temperature remains ideal for coral reef growth and development at the study site, ranging from 29 to 30°C.

In addition to salinity and temperature, current also plays a crucial role in coral reef growth by supplying nutrients to coral polyps and cleaning corals of external deposits. Good current conditions for coral reef growth are < 20 cm/second or 0.2 m/s (Rizal et al., 2016), and the current speed at the study site is 0.04–0.16 m/second. The speed at Sikuai Island is relatively low due to its protection by surrounding islands. Water clarity significantly influences coral reef growth. According to Government Regulation No. 22 of 2021, water clarity is a key parameter in coral growth. For coral reef growth and development, the ideal temperature ranges between 25 to 28°C (Patty & Akbar, 2018), meaning that good water clarity for coral reef growth is <5 m. As shown in the table above, the water clarity around Sikuai Island is highly suitable for coral reef growth. pH measurements ranged from 8.63 to 8.67. According to the KLHK (2004), the optimal pH range for coral reefs is between 7 and 8.5.

Table 2. Water quality of Sikuai Island

Station	Temperature (ºC)	Brightness (%)	Current speed (m/s)	Salinity (ppt)	pH
I	30,40	6,5	0,05	32	8,65
II	30,8	6,7	0,12	31	8,67
III	30,1	6,7	0,04	31	8,63

The abundance of the Chaetodontidae Family of Coral Fish

Based on the analysis of the abundance of coral reef fish of the Chaetodontidae family, the highest abundance was found at station III, namely 5000 ind/ha, and the lowest abundance at station I, namely 1500 ind/ha. A comparison of the abundance of coral reef fish of the Chaetodontidae family can be seen in Figure 4.

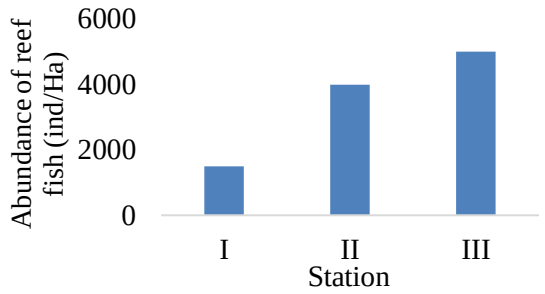

Figure 4. The abundance of reef fish of the Chaetodontidae family

There are four species of reef fish belonging to the Chaetodontidae family found in the waters of Sikuai Island, including Zebra (*Chaetodon striatus*), Yellowtail (*C. flavescens*), Redhead (*C. auriga*), and Big-eye butterflyfish (*C. ocellicaudus*). Based on research conducted by Amrullah et al. (2020), in the eastern waters of Sikuai Island, 27 individuals of coral reef fish of the Chaetodontidae family were found, 18 individuals in the southeastern waters of Sikuai Island, and 13 individuals in the western waters of Sikuai Island, with a total of 58 individuals of coral reef fish in the utilization zone.

Fish species were identified using Allen's (1997) identification book. The results of the identification of indicator fish species found 23 species from the Chaetodontidae family, with a total number of individuals per species of 97 individuals. This is similar to the research by Setiawan et al. (2013) in the coral reef waters of Bunaken National Park; out of 30 indicator fish species found, the species *Hemistaurichthys polylepis* was found at all research stations.

Coral Reef Cover Condition

Based on the results of the analysis, the coral cover condition in the waters around Sikuai Island was classified as moderate and poor. The highest percentage was found at station III at 45.13%, while the lowest was at station I at 6.47%. Based on these percentages, the average live coral cover was 32.22%, which falls into the moderate category according to the coral reef condition assessment criteria (Efendi et al., 2021). A comparison of coral cover percentages can be seen in Figure 5.

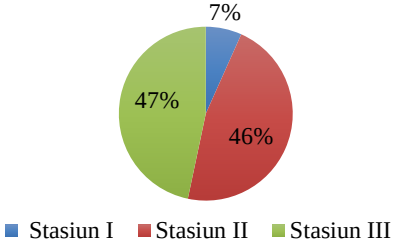

Figure 5. Percentage of coral reef cover

The coral reef ecosystems of the three stations on Sikuai Island, based on the condition of the substrate cover, consist of live coral, algae, macroalgae, turf algae, dead coral, sand, and silt. The percentage of coral cover at each station and depth varies. The percentage of live coral cover at Station I is 6.47%, Station II is 45.07%, and Station III is 45.13%. Classified the coral reef coverage condition as moderate. The deeper the water, the lower the percentage of coral coverage, which is consistent with one of the limiting factors of coral coverage: depth.

According to Panggabean & Setyadji in Rahmita et al. (2021), the high percentage of live coral cover from Spada is due to the lack of human activity and the influence of limiting factors and supporting factors of water parameters that are still in normal status. According to Category Benthic Life Form, live coral cover in each category has a different percentage at each depth criterion. Coral cover at various depths at each station provides a specific picture of the status and condition of coral reefs at Malalayang Beach and Bunaken Island.

Relationship Between the Abundance of Chaetodontidae Family Reef Fish and Coral Reef Cover

The analysis results obtained a simple linear regression equation: y = 77.69x + 996.57, with an R^2 value of 0.9238 and a correlation coefficient of r = 0.9661 (Figure 6). According to Tanjung (2014), a positive linear relationship indicates that as the value of the independent variable (X) increases, the dependent variable (Y) also increases. This shows that as the percentage of coral cover increases, the abundance of coral fish of the Chaetodontidae family also increases in the waters.

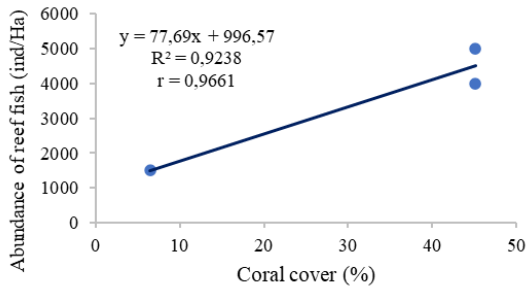

Figure 6. Relationship between the abundance of the Chaetodontidae family of reef fish and coral cover

The regression analysis results show that the percentage of live coral cover significantly affects coral fish, accounting for 92.38%. At the same time, errors and other factors influence the remaining percentage. Based on Figure 5, a positive y-value indicates a strongly positive relationship between coral cover and coral fish. According to Rahmita et al. (2021), the regression results explain that the correlation coefficient (r) value is 0.9611, indicating a very strong or perfect relationship. Coral reefs and coral reef fish have a close relationship because coral reefs are one of the primary habitats for various coral reef fish species. It can be seen that coral reef fish have a strong relationship, meaning that the stronger the correlation between coral reef fish and live coral cover, the greater the influence on coral cover. The presence of coralfish indicates that the coral reef is in good condition. The higher the live coral cover value, the higher the coral fish density value.

Based on the research conducted by Yuni (2022), the results showed 101 individuals from 11 species of Chaetodontidae and two genera (genus Chaetodon and Heniochus). The highest abundance was found at Station II (38 individuals/125 m2), followed by Station I (32 individuals/125 m2) and Station III (31 individuals/125 m2). The percentage of coral cover at Station I was categorized as good (50.8%), Station II as moderate (36%), and Station III as poor (14.18%). At each Station, the abundance of Chaetodontidae fish was positively correlated with the percentage of coral cover on Sikuai Island.

4. CONCLUSION

The condition of coral cover in the waters around Sikuai Island is classified as moderate to poor. The highest percentage was found at station III, at 45.13%, while the lowest was at station I, at 6.47%. The highest coral fish abundance was found at Station III at 5,000 ind/ha, and the lowest was at Station I at 1,500 ind/ha. The simple linear regression analysis results yielded a value of r = 0.9611, indicating a strong positive relationship between coral cover and coral fish abundance, where higher coral cover correlates with greater coral fish abundance in the area.

REFERENCES

Allen, G.R. (1997). *Marine Fishes of Tropical Australia and South East Asia*. A Field Guide for Angler and Diver.Western Australia Museum.

Amrullah, M.Y., & Rahmadani, W. (2020). Kondisi Ikan Karang Famili Chaetodontidae di Kawasan Zona Inti dan Zona Pemanfaatan Terbatas Taman Pulau Kecil Kota Padang. *Jurnal Pengelolaan Sumberdaya Perairan*, 4(1).

Efendi, H.M.F., Yuniarti, Y., Syamsudin, M.L., & Ihsaan, Y.N. (2021). Pore Water Nutrient Profile in the First and Second Transitional Season in Teluk Ciletuh, Sukabumi District, West Java. *World Sci. News,* 153: 43–54.

English, S., Wilkinson, C., & Baker, V. (1994). *Survey Manual for Tropical Marine Resources*. Australian Institute of Marine Science, Townsville.

English, S., Wilkinson, C., & Baker, V. (1997). *Survey Manual for Tropical Marine Resources*. Australian Institute of Marine Science, Townsville.

Gea, Y.H. (2018). *Hubungan Ekosistem Terumbu Karang dengan Komunitas Ikan Karang di Pulau Unggeh, Kecamatan Badiri, Kabupaten Tapanuli Tengah.* Universitas Sumatera Utara. Medan

Gomez, E.D., & Yap, H.T. (1988). *Monitoring Reef Conditions.* In: Kenchington, R.A., & Brydget ET. Hudson editors. Coral Reef Management Handbook. UNESCO Regional Office for Science and Technology for South East Asia. Jakarta. 187-195.

KLHK. (2004). Keputusan Menteri Negara Lingkungan Hidup no: 51 tahun 2004 tentang Baku Mutu Air Laut. *Deputi Menteri Lingkungan Hidup: Bidang Kebijakan dan Kelembagaan LH Jakarta*. Retrieved April 17, 2025.

Kohler, K.E., & Gill, S.M. (2006). Coral Point Count with Excel extensions (CPCe): A Visual Basic Program for the Determination of Coral and Substrate Coverage using Random Point Count Methodology. *Computers & Geosciences,* 32(9): 1259-1269.

Odum, E.P. (1971). *Dasar-Dasar Ekologi*. Cetakan ke-3. Gajah Mada University Press, Yogyakarta.

Patty, S.I., & Akbar, N. (2018). Kondisi Suhu, Salinitas, pH dan Oksigen Terlarut di Perairan Terumbu Karang Ternate, Tidore dan Sekitarnya. *Jurnal Ilmu Kelautan Kepulauan*, 1(2): 1-10

Pratama, N. (2021). *Kelimpahan Ikan Karang Indikator dan Kondisi Terumbu Karang di Perairan Pulau Poncan, Sibolga.* Universitas Riau.

Rahmita, R., Efriyeldi, E., & Thamrin, T. (2022). Hubungan Kondisi Tutupan Karang dengan Kepadatan Megabentos di Pulau Pandan Provinsi Sumatera Barat. *Jurnal Zona*, *6*(1): 28-37.

Rizal, S., Arief, P., & Henky, I. (2016). Tingkat Tutupan Ekosistem Terumbu Karang di Perairan Pulau Terkulai. *Jurnal Repository UMRAH*.

Rusman, R. (2021). *Komposisi Jenis serta Kepadatan Ikan Karang dan Megabenthos pada Ekosistem Terumbu Karang Alami dan Transplantasi Karang di Pulau Bonetambung Makassar*. Universitas Hasanuddin.

Setiawan, F., Kusen, J.D., & Kaligis, G.J. (2013). Struktur Komunitas Ikan Karang di Perairan Terumbu Karang Taman Nasional Bunaken, Sulawesi Utara. *Jurnal Perikanan dan Kelautan Tropis*, 9(1): 13-18.

Suharti, R., Saktiawan, K.Y., Rachmad, B., Triyono, H., & Zulkifli, D. (2018). Kajian Bioekologi Ikan Karang Chaetodontidae sebagai salah Satu Indikator untuk Mendeteksi Kondisi Ekosistem Terumbu Karang di Perairan Taman Nasional Kepulauan Togean, Sulawesi Tengah. *Jurnal Kelautan dan Perikanan Terapan (JKPT)*, 1(1): 12-21.

Tanjung, A. (2014). *Rancangan Percobaan (Edisi Revisi 3).* Tantaramesra. Bandung. 108 p.

Yuni, Z. (2022). *Hubungan Kelimpahan Ikan Karang Famili Chaetodontidae dengan Persentase Tutupan Karang Hidup di Pulau Sikuai*. Universitas Andalas.