Physical Sciences, Life Science and Engineering Volume: 2, Number 2, 2025, Page: 1-9

Coral Reefs Condition and Fish Abundance in Gilimanuk Waters, Jembrana Regency, Bali Province

Fuad Feisal Safli*, Yusrudin, Sumaryam

Universitas Dr. Soetomo

DOI:
https://doi.org/10.47134/pslse.v2i2.377
*Correspondence: Fuad Feisal Safli
Email: fuadfeisalsafli@gmail.com

Received: 14-03-2025
Accepted: 21-03-2025
Published: 31-03-2025

Abstract: Coral reefs are complex marine ecosystems consisting of corals (Anthozoa), algae and other organisms (Barnes, 1987). They have an important role in maintaining the balance of marine ecosystems and provide habitat for many species of fish and invertebrates (Odum, 1993). The method used in the coral reef condition survey is the Underwater Photo Transect method. This method is a method for monitoring coral reef conditions. This method is a development of the Point Intercept Transect (PIT), Line Intersect Transect (LIT), and Rapid Reef Assessment (Towing) methods. According to the results of the study, location 2 has the highest percentage of live coral cover category of 16.77%, Furthermore, at location 1, the percentage of live coral was 13.21%, Based on the Decree of the Minister of Environment No. 4 In 2001, it was shown that the coral conditions at both points 1 and 2 were in the poor category. The abundance of coral fish in the Drinking Waters at station I point I has 5 species with an abundance of 46 individuals and an abundance of 0.46 (individuals/m3). Point II station I has 6 species of fish with 52 individuals and an abundance of coral fish 0.52 (individuals/m3).

Keywords: Coral Reefs, Fisheries, Gilimanuk Waters

Introduction

Coral reefs are complex marine ecosystems consisting of corals (Anthozoa), algae and other organisms (Barnes, 1987). They have an important role in maintaining the balance of marine ecosystems and providing habitat for many species of fish and invertebrates (Odum, 1993). Coral reefs have several unique characteristics, such as complex structures and high biodiversity (Hughes et al., 2018). Indonesia has the largest coral reefs in the world, reaching 15% of the total global coral reef area (Tomascik et al., 1997). Coral reefs in Indonesia have high economic value, with fisheries production reaching trillions of rupiah (KKPR, 2020). In addition, coral reefs also have high cultural and ecological value. Coral cover is the percentage of coral reef area covered by living coral (GCRMN, 2016). High coral cover indicates the health of coral reefs and the ability of the ecosystem to support marine life. Coral cover is also influenced by factors such as climate change, overfishing and habitat

destruction. The relationship between coral cover and fisheries production is very close. Healthy coral reefs can increase fisheries production (FAO, 2018). Therefore, it is important to maintain the sustainability of coral reefs and their ecosystems to support the national economy.

Coral reefs are usually found in shallow waters in tropical and subtropical regions between 32 degrees north latitude and 32 degrees south latitude, which is the limit of coral growth and survival. This ecosystem is usually found in tropical waters and usually grows in sunlight along the coast or to a depth of about 50 meters below sea level. However, some coral reef species can survive in the deep sea without light. (I Gusti & Oktiyas, 2017).

Reef-forming corals can only grow optimally in certain areas, such as around islands, in waters with little sediment, or on the western side of continents that are less susceptible to cold currents from Antarctica. Coral reef areas are widely distributed horizontally but are limited vertically by depth. Coral growth, in terms of coverage and growth rate, tends to decrease with increasing depth. The main factors that influence this vertical distribution include light intensity, oxygen content, temperature, and water transparency (I Gusti & Oktiyas, 2017).

Indonesia is known as the center of coral reef diversity. The waters around Sulawesi are estimated to be the center of world coral diversity and one of the areas of origin of modern corals. There are about 590 species of coral in Indonesia, classified into 80 genera. There are 113 species of Acropora found worldwide, 91 of which are found in Indonesia. Corals thrive and reach their peak diversity in the waters of Sulawesi, Maluku, Halmahera, Bali, West Nusa Tenggara, Aru and Kei Islands, and are spread almost evenly around these islands (Aziz, 1996).

According to Schmitt & Sluka (2002), coral reef ecosystems, especially coral reef fish communities are divided into 2 groups, namely groups that are always found on coral reefs and those that are not found on coral reefs. Its function is as a place for coral fish to find food, breed, and seek protection from predators. To ensure the sustainability of coral reef fish reproducing generatively through the spawning process. There are four groups of spawning fish based on patterns.

Coral reefs are complex marine ecosystems that play an important role in maintaining the balance of marine ecosystems and providing habitat for many species of fish and invertebrates. Indonesia has the largest coral reefs in the world, reaching 15% of the total global coral reef area, with high economic value and fisheries production reaching trillions of rupiah. The unique characteristics of coral reefs include complex structures and high biodiversity, as well as the ability to adapt to environmental changes. However, coral reefs

face challenges such as climate change, overfishing and habitat destruction, which affect coral cover and fisheries abundance. This study was conducted to identify environmental conditions that include coral reefs and fisheries in Gilimanuk waters.

Methodology

This research was conducted in Penginuman Waters, Gilimanuk Village which took place in December 2024. Data collection was carried out at 1 point, with 1 point having 2 different places. The method used in the coral reef condition survey is the Underwater Photo Transect method. This method is a method for monitoring coral reef conditions. This method is a development of the Point Intercept Transect (PIT), Line Intersect Transect (LIT), and Rapid Reef Assessment (Towing) methods. This method was developed to obtain more complete information related to monitoring coral reef conditions.

a. Collection of Coral Cover Percentage

The location of coral reef data collection is carried out directly based on one station with two survey points. Data collection on coral reef cover uses underwater photography transects (UPT). The technical procedures for data collection are as follows

1. Determine the location point using GPS.
2. Take photos of the above-water environment and take the desired station.
3. Install a buoy as a marker for the zero point above the surface.
4. Stretch a 50-meter roll meter and the diver's position is on the left side on land from the starting point to the end
5. Underwater documentation of the condition of the reef habitat that is included in the frame in a zigzag manner with information on the odd points the frame position is above and the even points the frame position is below to the end point.
6. Data collection in the field is carried out by diving using SCUBA diving equipment. Data collection using the UPT (Underwater Photo Transect) method is carried out by taking underwater photos using an underwater digital camera.

b. Reef Fish Data Collection

We collected data on reef fish using the underwater visual counting method on line transects. The transects extended 50 meters parallel to the coastline and helped describe the coral reef area (reef flat). The transects were made using diving equipment. The observation limits for reef fish were 2.5 meters to the left and 2.5 meters to the right and 3 or 5 meters below the water surface.

Result and Discussion

The waters in Gilimanuk have varying depths, with substrates dominated by sand and gravel. These waters support a variety of marine life, including fish, molluscs, and coral reefs, which are important for the local ecosystem. Coral growth depends on the condition of the aquatic environment which is not always stable and changes due to disturbances caused by both natural factors and human activities. One of the main factors that limits coral growth is temperature. Temperature fluctuations can have a major impact on the survival of coral and other organisms.

Table 1: Water Quality at Observation Point

No	Parameter	Category			Source
		Station		Quality standards	
		1	2		
1	Temperature (°C)	29	29	26- 30	PPPRI No 22 Tahun 2021
2	Brightness (m)	3	5	7	PPPRI No 22 Tahun 2021
3	Salinity (ppm)	33	33	33-34	PPPRI No 22 Tahun 2021
4	PH	7.2	7.1	6.5- 8.5	PPPRI No 22 Tahun 2021

The results of data processing using CPCe software obtained the percentage of coral cover categories at points with percentage values as follows.

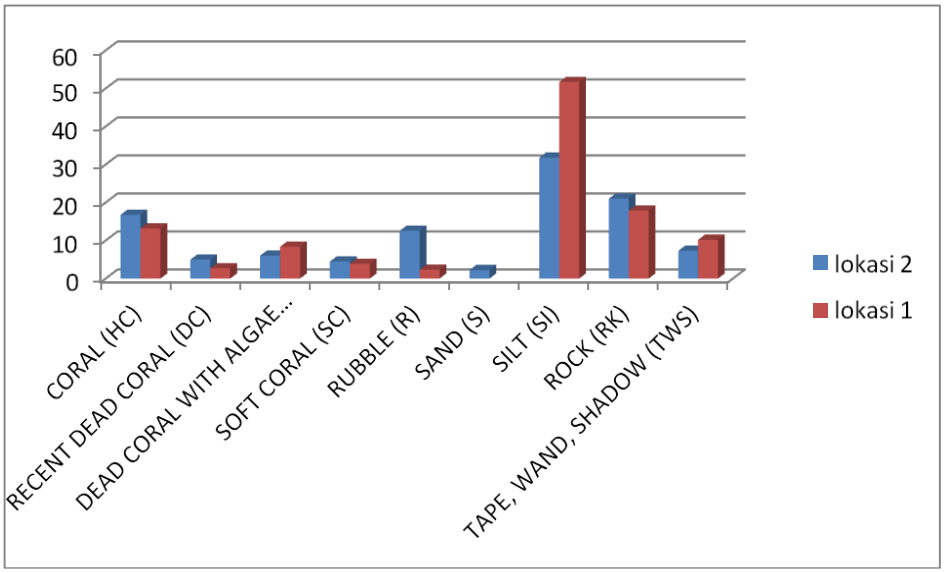

Figure 1. Percentage (%) of Coral Reef Cover

The condition of the coral reefs at the location in the Penginuman Waters, Gilimanuk Village was carried out by conducting an assessment based on the results of the CPCe. The condition of the coral reefs at each point is presented in the table below:

Table 2: Coral Reef Conditions

Point	Percentage (%) Live Coral Cover	Category
1	13.21	poor
2	16.77	poor
average	14.99	poor

Based on the Decree of the Minister of Environment No. 4 Year 2001 The table above shows that the condition of the coral at point 1 is in the bad category with a value of 13.21%, and point 2 is in the same category, namely bad at 16.77 where the research location is in the many fishing activities and ship activities that cause poor coral growth and very poor coral cover.

Table 3: Abundance of Coral Fish

No	Type of Coral FIsh	Station I	
		Point 1	Point 2
1	*Acanthurus auranticavus*		11
2	*Siganus javus*	6	7
3	*Amphiprion tricinctus*	14	17
4	*Chrysiptera springeri*	7	5
5	*Abudefduf vaigiensis*	15	9
6	*Chromis caudalis*	4	3
	Total	46	52
	Abundance	0.46	0.52

Based on the results of the research conducted by the author in the Gilimanuk waters, Jembrana district, there were several fish caught in the research, are Acanthurus auranticavus, Siganus javus, Amphiprion tricinctus, Chrysiptera springeri, Abudefduf vaigiensis, Chromis caudalis. The abundance of coral fish in the Penginuman Waters with points 1 and 2 indicate that the condition of the coral fish is still not good.

Discussion

Gilimanuk waters are an important location for fishing activities, with many fishermen depending on their livelihoods here. Wave heights in these waters range from 0.25 to 2 meters, depending on weather conditions and location. The temperature at the observation point ranges from 26 to 30 degrees Celsius. According to the Decree of the Minister of Environment Number 51 of 2004, the optimal temperature for coral reef growth is between 28 to 30 degrees Celsius, so the measured temperature is still within a good range. However,

if the temperature exceeds the permitted limit, coral bleaching can occur. Salinity at the survey location was 33-36%, within the normal range for coral reef growth. This was reported by Pangaribuan et al. Reported. (2013) stated that coral growth and development can be maintained even when salinity is in the range of 25-40%. The pH value at all monitoring points was 7, which complies with the Regulation of the Minister of Environment No. 1000. According to Law Number 51 concerning Sea Water Quality Standards Including Coral Reefs is 7 to 8.5.

The graph shows that Percentage (%) of Coral Reef Cover location 2 has the highest percentage of live coral cover category of 16.77%, dead coral of 4.97%, Dead Coral With Algae of 6.03%, soft coral of 4.49% the rest is dominated by rubble 12.56%, Sand 2.24%, Silt 31.81%, Rock 21.04% and also Tape, Wand, Shadow of 7.31%. It can be seen from the coral growth shape diagram above, that this observation location has uneven coral cover. Furthermore, at location 1, the percentage of live coral was 13.21%, dead coral 3.8%, Dead Coral With Algae 7.2%, soft coral 4.17%, the rest was dominated by rubble 7.44%, Silt 51.68%, Rock 17.88% and also Tape, Wand, Shadow 10.20%.

The table 2 shows that the condition of the coral at point 1 is in the bad category with a value of 13.21%, and point 2 is in the same category, namely bad at 16.77 where the research location is in the many fishing activities and ship activities that cause poor coral growth and very poor coral cover.

The types of coral fish identified in the Penginum Waters are Acanthurus auranticavus, Siganus javus, Amphiprion tricinctus, Chrysiptera springeri, Abudefduf vaigiensis, Chromis caudalis. The abundance of coral fish in the Penginuman Waters with points 1 and 2 indicate that the condition of the coral fish is still not good. Acanthurus auranticavus has a characteristic with a basic color of black and has a special marker with a white line between the body and tail. Acanthurus auranticavus has a maximum length of 45 cm with an age of up to 30 years. Juvenile Acanthurus auranticavus usually lives among soft corals at a depth of approximately 2 meters. Siganus javus has a characteristic motif on its body with a snout on its mouth like a rabbit. Siganus javus is often found in Indo-Pacific waters and many in the waters north of Java. Siganus javus usually lives in groups of approximately 10 individuals in shallow waters, brackish waters, coral reefs and rocks. Amphiprion tricinctus is a species of reef fish that belongs to the Pomacentridae family. Amphiprion tricinctus or commonly called threeband anemonfish has a combination of three colors on its body, namely black, orange and white.

Threeband anemonefish is a fish that is often found in coral reef areas and is a type of oviparous fish. Chrsiptera springeri is a species of coral fish that belongs to the

Pomacentridae family. Chrsiptera springeri has a characteristic body that is blue on the body and a yellow color difference on the fish's tail. Chrsiptera springeri usually lives in groups on rocks or on coral reefs. The maximum body length of Chrsiptera springeri fish is 8 cm. Abudefduf vaigiensis has the common name pacifiv sergeant. The characteristics of this fish have a gray color with 5 black lines starting from the back of the head to the last line at the base of the tail. The upper part is slightly yellowish. The maximum length of this fish can reach 20 cm. The habitat is in the flat reef area to coral slopes and rocky areas. Chromis caudalis is a species of coral fish that comes from the Pomacentridae family. This fish has the common name whitespotted devil. The characteristics of Chromis caudalis have a brown color with bright blue spots all over its body. The tail fin to the base of the tail is creamy white, the maximum length can reach 10cm. This fish is often found swimming in lagoon areas and clear coral reefs with depths of up to 40m, not infrequently it can also be found in mixed areas with coral rubble and dead coral.

Conclusion

From this study, it was found that the condition of the coral reef ecosystem in Penginuman Waters is quite bad, as seen from the percentage of coral reef cover at the Research location point I of 13.21%, and 16.77%, this shows that the condition of the coral reef in Penginuman Waters is in the bad category. The condition of the Gilimanuk waters is not good because in addition to being close to residential areas, the Gilimanuk waters are also a slightly oily water area because of the place where the oil ship is moored. The types of reef fish identified in Penginuman Waters are Acanthurus auranticavus, Siganus javus, Amphiprion tricinctus, Chrysiptera springeri, Abudefduf vaigiensis, Chromis caudalis and the abundance of reef fish in Penginuman Waters with points 1 and 2 indicate that the condition of the reef fish is still not good.

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