



Proceeding SYMBION (Symposium on Biology Education)

<http://seminar.uad.ac.id/index.php/symbion>

2540-752X (print) | 2528-5726 (online)



Community structure and abundance of coral fish in the Pulau Panggang Ward Area, Seribu Islands Marine National Park, DKI Jakarta

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ARTICLE INFO

Article history

Submission Dec 10th, 2022

Revision May 10th, 2023

Accepted May 17th, 2023

Keyword

Coral Fish

Panggang Island Village

Thousand Island

ABSTRACT

Reef fish community is a biotic component of the coral reef ecosystem that can be utilized as a marine biological resource. Coral fish make the coral reef ecosystem their habitat in shelter, feeding ground and nursery ground. The existence and diversity of reef fish is determined by the condition of the coral reefs. The research in Panggang Island Village, Seribu Islands Marine National Park, DKI Jakarta at a depth of 7 meters. The purpose of this study was to determine the community structure and abundance of reef fish in Panggang Island Village. The method used in this research is a belt transect. The results of field observations showed that the water quality in Panggang Island Village including Panggang Island, Pramuka Island, Semak Daun Island, Kotok Besar Island, Air Island and Gosong Karang Lebar was still within normal limits for the growth and development of reef fish. The composition of reef fish in Panggang Island Village consists of 21 families, 60 genera and 108 species. The highest abundance was found on Air Island while the lowest was found on Bushleaf Island. The most dominant tribe is the Pomacentridae tribe. The reef fish that have the highest abundance are *Pomacentrus lepydogenys* and *Cirrhitilabrus cyanopleura*.

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Introduction

Indonesia has the greatest wealth and biodiversity in the world. Among all ecosystems, the sea is one of the biggest contributors to the abundance of existing biological resources with around 17.500 islands owned making the Indonesian Archipelago an ideal place for coral growth. It is recorded that the total area of Indonesia's coral reefs reaches 85.707 km² or about 14% of the world's coral reefs¹. In addition, the richness of Indonesia's biological resources is

also reflected in the abundance of reef fish species, reaching approximately 2.057 species, as well as various other types of marine animals and plants².

Reef fish community is a biotic component of the coral reef ecosystem that can be utilized as a marine biological resource. Coral fish are fish that can live from juvenile to adult in coral reefs³. The existence of reef fish on the reef is closely related to the physical condition of the coral reef. Coral fish make the coral reef ecosystem their habitat in shelter and a place to find food (feeding ground). According to Nybakken the existence and diversity of reef fish is determined by the condition of the coral reefs, this is because in the coral reef ecosystem coral fish are organisms that are found in large numbers⁴. Reef fish includes resources that can be restored, preserved and developed such as mangroves, coral reefs, seaweed and marine fishery resources.

Fisheries in the Thousand Islands also depend on reef fish resources. Data for 2000 stated that the main livelihood of the Thousand Islands community was as fishermen who made reef fish the main target of catching⁵. The condition of coral reef fisheries in the Thousand Islands has begun to decline due to strong fishing pressure. The Seribu Islands fishery production from 1976 to 1994 showed a significant increase, causing a tendency for overfishing⁶.

Reef fishing activities that are not managed wisely have the potential to damage coral reef resources and the reef fish resources themselves. In the management of coral reef and coral fish resources, comprehensive data and information are needed as a basis for consideration in policy making. However, data and information on reef fish resources in the Pulau Panggang Village itself is still very limited. The purpose of this study was to determine the community structure and abundance of reef fish in Panggang Island Village. The research results obtained are expected to be used as a reference in the management of fish and coral reef resources in the Panggang Island Village area.

Method

The research was conducted on 6 islands located in Panggang Island Village, namely Panggang Island, Pramuka Island, Semak Daun Island, Kotok Besar Island, Air Island and Gosong Karang Lebar, Seribu Islands Marine National Park, DKI Jakarta Observations were made at the research location as many as 6 stations in the Pulau Panggang Village area. The observation location was chosen to get a snapshot that is representative of the Panggang Island Village area.

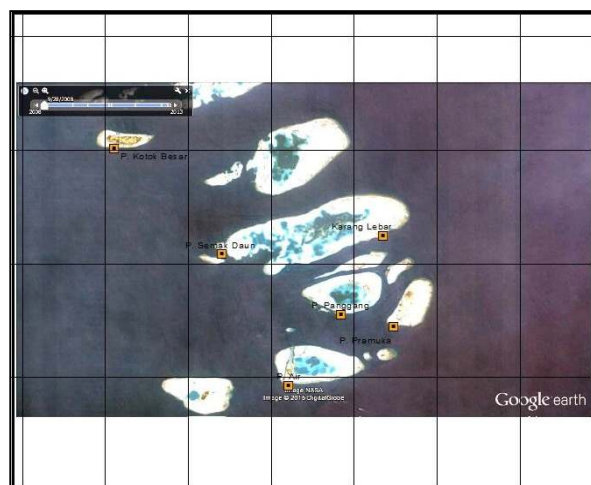


Fig 1. Research Locations

Recording is done on the type and number of reef fish. Identification was carried out to the lowest possible species or taxonomic level using guidebooks from Kuitert and Tono-zuka, Kuitert and Debelius, Randall⁷⁻⁹. Observations were also carried out with underwater videos and photos using underwater digital cameras by assistant to facilitate the process of identifying reef fish. Recording was also carried out on environmental parameters in the waters around the data collection station, measurements were made at sea level at each observation station. The physical and chemical parameters measured included: Brightness level measurement, salinity level measurement, current measurement, dissolved oxygen level measurement.

Observations were made on the reef slopes at an average depth of 7 m using a belt transect¹⁰ (Figure 2). Observation of reef fish communities was carried out by visual census using a belt transect 20 m long and 5 m wide with 4 observation units at each research station¹¹. Observations were made during the day, so that the target for observation was limited to diurnal fish (fish that are active during the day).

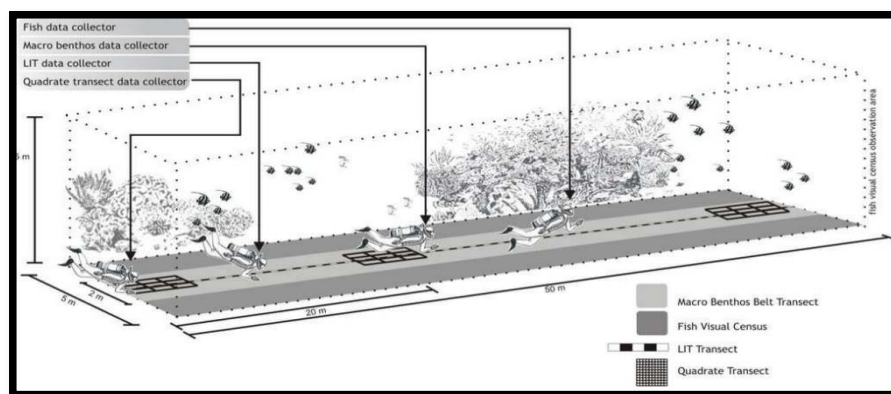


Fig 2. Method *Belt Transect* (Transect Belt)¹²

Data analysis

1. Abundance community selected

The abundance of selected communities can be calculated by the formula Odum, et al¹³:

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

Information :

Xi = Abundance community selected i-th (individuals per m^2);

ni = Total number of communities selected at the station observation i -th ;

A = Transect area observation

2. Index Shannon-Wiener diversity (H')

The diversity index (H') that is commonly used is the Shannon-Wiener index which is suitable for random communities on a large scale where the total number of species is known Ludwig and Reynolds¹⁴, with the formula:

$$H' = - \sum Pi \ln Pi \quad Pi = n/N$$

Information :

H' = index diversity ;

S = amount reef fish taxa ;

pi = proportion amount individual fish species.

The criteria for the diversity index are if $H' \leq 2.0$: low diversity; $2.0 < H' \leq 3.0$: moderate diversity and $H' > 3.0$: high diversity.

3. Index evenness (E)

The formula used is Ludwig and Reynolds¹⁴:

$$E = \frac{H'}{H'_{maks}}$$

Information :

H' max = index diversity maximum = ln S.

range used “_” in index uniformity is $0.0 < E \leq 0.5$: community depressed ; $0.5 < E \leq 0.75$: community labile and $0.75 < E \leq 1$: community stable.

4. Index dominance (D)

The formula used to determine the dominance index Ludwig and Reynolds¹⁴ is:

$$D = \frac{S}{\sum_{i=1}^S P_i^2}$$

Information :

D = Index Simpson dominance , has range $0.0 < D \leq 0.5$: dominance low ;

$0.5 < D \leq 0.75$: moderate dominance and $0.75 < D \leq 1$: high dominance.

Results and Discussion

A. Conditions of Aquatic Physical and Chemical Parameters

Growth and reproduction of reef fish influenced by several factors, among other factors physics, chemistry, that can influence conditions of reef fish. Factor physics and chemistry that can influence condition of reef fish are parameters of temperature, pH, salinity, speed current, brightness and oxygen dissolved.

Table 1. Physical and chemical parameters waters on each station

Location	Temperature (°C)	pH	Salinity (PSU)	Current speed (m/s)	Brightness (m)	Oxygen dissolved (ppm)
Panggang Island	30.06	8	32	0.04	11	6.6
Pramuka Island	29.8	8	32	0.07	12	6.97
Semak Daun Island	29.6	8	27	0.14	9	7.28
Kotok Kecil Island	29.4	8	31	0.08	8	7.18
Air Island	29.4	8	30	0.04	9	6.83
Gs. Karang Lebar	29.6	8	29	0.03	10	7.83
Average	29.64	8	30.16	0.06	9.83	7.11

The obtained temperature value with an average of 29.64 °C with highest temperature is on the island Roast ie 30.06 °C and temperature the lowest is 29.4 °C on Kotok Kecil Island and Air Island. Organism waters like fish or shrimp capable life good on range temperature 20-30°C. Change temperature below 20°C or above 30°C causes fish to experience stress followed by a decrease power digest. Most organism sea characteristic poikilothermic (temp body is greatly affected temperature the mass of water around it) so temperature is one very important factor in regulate life processes and dissemination organisms¹⁵. Obtained seawater temperature still in accordance with standard raw quality for various marine biota based on Ministry of Environment Decree No. 51/2004 para reef coral on the range 36-40° C and can tolerate at 20° C¹⁶. It is very good because reef fish are very related with reef coral, and can support reef fish life as the place take refuge, seek eat nor for develop breed.

Degree value acidity (pH) in all station same, i.e. 8.0. The results of pH measurements show that pH conditions in the waters Island thousand still in limit norm, namely 7-8.5¹². Obtained salinity by 27-32 PSU, based on score raw quality ranged from 33-34. Obtained salinity are below standard raw seawater quality, possibly caused enough many fresh water runoff to Islands Thousand¹². Speed average current, that is, 0.06 m/s, velocity current highest is on the island Bush leaves, namely 0.14 m/s and the lowest located in Gosong Karang Lebar, that is of 0.03. Speed current influenced by strong winds and slight tides. The more stay away area mainland Java island, speed current will the more weakened⁶.

Brightness level ranges from 8-12 m with an average of 9.83 m. Average brightness show that Ward Island Roast condition its waters still enough fine. Light can affect the fish at the moment spawning and at the larval stage Total light also affects power live and act behavior of fish larvae¹⁷. Oxygen value solute obtained range between 6.6-7.83 ppm. Oxygen dissolved in the ideal water is 5-7 ppm. If not enough from that so risk fish death will the more high.

B. Reef Fish Composition

Coral fish recorded in the Kelurahan Island Roast consists of 21 families, 60 genera and 108 species. A total of 6 points station observation a number of tribe that has abundance highest that is from Ethnic group *Pomacentridae*, *Labridae*, *Caesionidae*, *Apogonidae*, *Chaetodontidae* and *Siganidae*. Composition ethnic group *Pomacentridae* dominate in all island the place observation. Water Island Represents island that has abundance ethnic group The tallest *Pomacentridae*. this due to location this there is many reef the branching coral which is the the place stay from ethnic group this. Tribal fish *Pomacentridae* is a fish with abundance *the* most and is a resident fish that has Act in demand territorial and activities s far from source food and place take shelter.

Ethnic group *Labrids* is one tribe found , because ethnic group *Labrids* also entered in the major fish group that has abundance high in the area reef coral . Ethnic group this is zooplankton eaters and live in columns waters at a depth of 2 to 20 m with size reach 5-30 cm. Abundance ethnic group *labridae* on each island observation state that condition very good environment for growth feed from reef fish.

Ethnic group *Chaetodontidae* is a fish with sufficient abundance many found on each station observation. Ethnic group this is the most found on the Island Grilled and Burnt Broad Coral. Ethnic group this is an indicator fish algae and animal eaters coral so that existence is indication condition reef coral. Ethnic group this many found in conditions reef good coral, presentation cover high coral , and many areas _ there is crustaceans which are food for fish from the tribe this. Tribal fish *Chaetodontidae* are carnivorous fish polyp coral so that could made indicator fertility ecosystem reef coral¹¹.

C. Abundance Reef Fish Community

Abundance the most found on Water Island meanwhile Lowest found on the Island Bush leaves (Figure 3). on the rate tribe, reef fish community in Kelurahan Island Roast dominated by fish from ethnic group *Pomacentridae* with more composition of 60% of all the fish found in observation. At the species level, the highest abundance was *Pomacentrus lepydogenys* and *Cirrhilabrus cyanopleura*. The abundance of 10 types of reef fish in Panggang Island Village (Figure 4) is mostly inhabited by reef fish from the tribes *Pomacentridae*, *Labridae* and *Caesionidae*. The abundance at each location was also dominated by the *Pomacentridae* tribe .

Environmental conditions that are still in good condition support the growth of corals, especially branching corals which are shelters for the *Pomacentridae* tribe. According to Nanami, et al., branching corals are the most dominant form of coral growth in the Thousand Islands¹⁸. In addition, the level of brightness at each station which is quite good affects the growth of plankton, the more light the higher the ability of plankton to photosynthesize and

reproduce. The abundance of plankton will affect the abundance of fish because plankton is the main food for reef fish, especially the tribe of *Pomacentridae*.

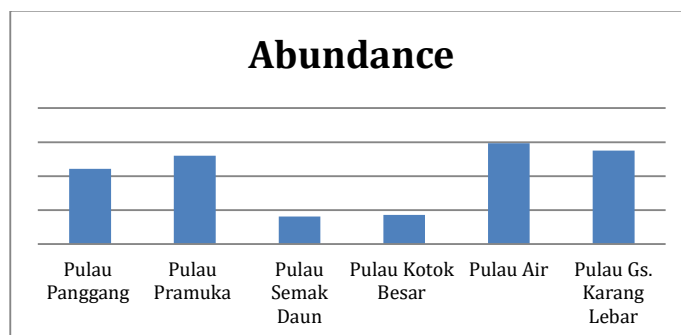


Fig 3. Abundance at each point station observations in the village Island Bake. Island thousand .

Pomacentridae and *Labridae* tribes are indeed very abundant and their dominance is very high^{12,19}. Both types of fish are found in abundance in the water column on the reef slopes because the water column contains a lot of plankton which is the main food for these fish. *Labridae* have a wide range of habitats so that these fish do not have strong associations with various habitats and are always found in coral reef ecosystems. *Labridae* and *Pomacentridae* fish have medium to high resilience, which means they can double their respective populations in less than 15 months⁷.

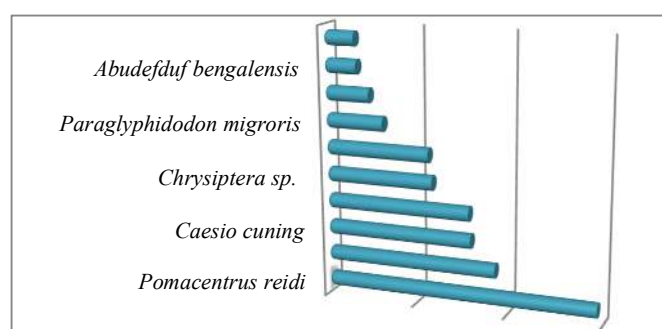


Fig 4. Ten of the highest abundance of reef fish in the Panggang Island District.

D. Index Shannon-Wiener diversity (H')

From the analysis results (Figure 5) it can be seen that the value of diversity ranges from 2.16 to 3.43 with an average value of 2.73. The location with the highest diversity index was Semak Daun Island with a value of 3.43 while the lowest diversity index was Gosong Karang Lebar with a value of 2.16. From these data the diversity index in Panggang Island Village is included in the medium to high category. The high index of species diversity is due to the fact that each species has a balanced role in the community. The value of the diversity index is influenced by the abiotic conditions at each observation station. In addition, it can also be influenced by the availability of food from reef fish and also the condition of the coral reefs at each observation station.

Semak Daun Island has the highest species diversity than the others. This is because Semak Daun Island has diverse coral reefs with a good percentage of coral cover so that there are more and more reef fish in that location. This is reinforced by Setyawan, et al., and Utomo, the percentage value of hard coral cover on Semak Daun Island has increased from the bad category with a percentage of 24.7% to the medium category with a percentage value of 42%^{20,21}. The improved condition of the coral reefs on Semak Daun Island will affect the

presence of reef fish, which have a greater chance of breeding opportunities at the station. Differences in the abundance of coral cover will affect the abundance of reef fish, especially those that have a strong association with live coral.

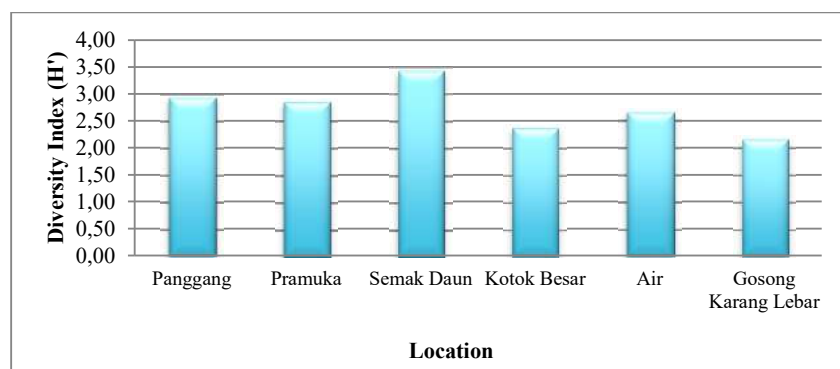


Fig 5. Comparison of reef fish diversity index.

E. Index evenness

Index equality in the Village Island Roast including in category community labile, ie $0.5 < E \leq 0.75$ except Island Bush Leaves that have score index uniformity of 0.8 incl in community stable (Fig. 6). this caused Island Bush Leaf have diversity high kind compared with station other.

Causal factors its small difference Among index uniformity in each station observation is circumstances quality almost waters same. Quality measured waters show relative difference small and whole still in limit tolerance for growth and reproduction of the same reef fish good at every station observation.

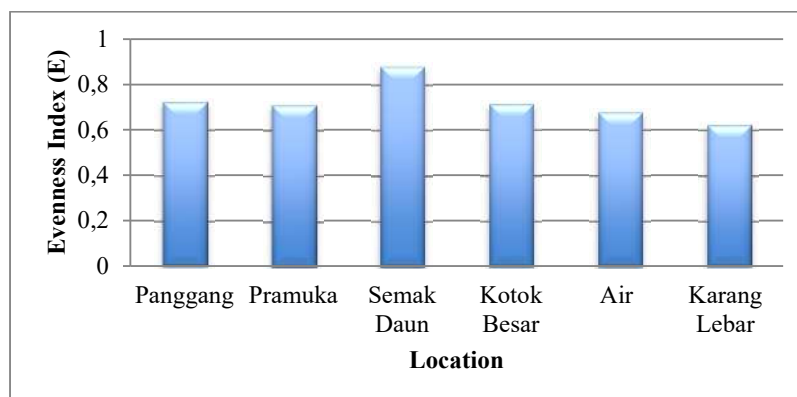


Fig 6. Comparison of the evenness index of reef fish.

F. Index Dominance

The high evenness index is directly proportional to the low dominance index value at each observation station. The link between evenness index values and dominance index values can be seen in several islands which are observation stations. The more even the distribution of reef fish species, the less dominance of a species in a location. This is consistent with the results obtained that the dominance index value at each observation station is included in the low category with a dominance index value of ≤ 0.5 (Figure 7).

The dominance index obtained from all observation stations is in the low category. This indicates that the condition of the distribution of reef fish in the Panggang Island Subdistrict is in a fairly balanced condition, differences are found in the abundance of different individuals

at each observation station depending on the water conditions at each station. At several observation sites it was found that there were several species that were the most abundant, namely *Pomacentrus alexanderae* on Air Island. *Pomacentrus reidi* is an abundant species on Pramuka Island.

In Gosong Karang Lebar, *Caesio cuning* was found in quite abundant quantities. In the Thousand Islands, several of these species are abundant populations of reef fish which are found in rock crevices and yellowtail fish are usually found in groups on the slopes of the coral reefs⁸.

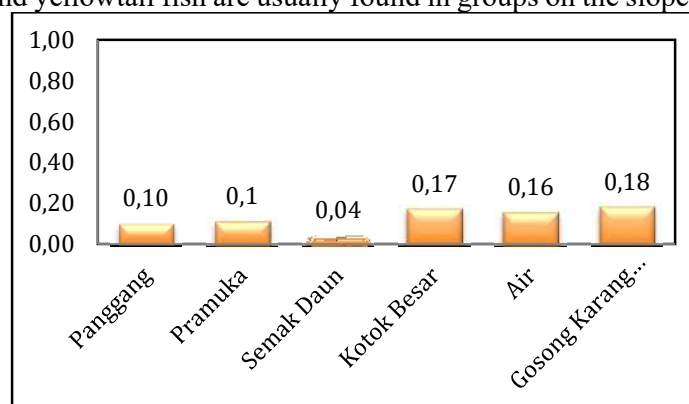


Fig 7. Comparison of reef fish dominance index

Conclusion

Based on results research that has done in Ward Island Roast so could pulled conclusion that quality waters in the Village Area Island Roast still in condition good for growth and reproduction of reef fish. In the Village Area Island Roast There are 21 families, 60 genera and 108 species of reef fish. The most dominant tribe is ethnic group Pomacentridae. Abundance the most found on Water Island meanwhile Lowest found on the Island Bush leaves. Reef fish that have abundance highest is *Pomacentrus lepydogenys* and *Cirrhilabrus cyanopleur*. Structure community and abundance of reef fish in the Kelurahan Area Island Roast still in good condition for growth and development of reef fish. this still fulfillment enough feed as well as circumstances waters sea in the area this still in normal limits.

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