



International Journal of Multidisciplinary Research and Growth Evaluation.

Abundance and diversity of reef fish species in the Core Zone of Tinabo Kecil Taka bonerate national park selayar islands

Abd. Wahab R^{1*}, Abdul Rauf², Kamil Yusuf³

¹ Student, Department of Marine Science, Indonesian Muslim University, Makassar, Indonesia

^{2,3} Lecturer, Department of Marine Science, Indonesian Muslim University, Makassar, Indonesia

* Corresponding Author: **Abd. Wahab R**

Article Info

ISSN (online): 2582-7138

Impact Factor: 5.307 (SJIF)

Volume: 05

Issue: 01

January-February 2024

Received: 02-12-2023;

Accepted: 04-01-2024

Page No: 463-467

Abstract

The abundance, diversity, and dominance of reef fish vary in each island cluster, resulting in different reef fish distribution. The purpose of this study was to assess the abundance, diversity, and dominance index of reef fish species in the core zone of Tinabo Kecil Island, Selayar Islands. This study used an underwater visual enumeration method approach (*Underwater Visual Census*). The results showed three categories of reef fish, namely indicator, target, and major fish, with 18 families, 94 species, and 817 fish individuals identified. Based on the analysis, it was found that the fish population abundance index value was 0.60 ind/m², diversity was 4.17 (high category), and dominance was 0.02 (low category).

DOI: <https://doi.org/10.54660/IJMRGE.2024.5.1.463-467>

Keywords: reef fish, dominance index, diversity index, diversity indeks, takabonerate

Introduction

Coral reefs in recent decades have experienced drastic degradation / decline in quality. Damage to coral reefs occurs both due to human activities and due to natural processes (Jompa, *et al.*, 2005). One of the factors that trigger the degradation of coral reefs in various regions is the increase in water temperature caused by climate change. Suroso (2012) asserts that rising sea water temperatures have caused widespread damage to coral reefs, high seawater temperatures trigger a reaction to pressure called coral bleaching, which is the loss of coral color caused by degradation of Symbiodinium populations (*symbiotic zooxanthellae*) and / or algae pigments and make them vulnerable to disease and death.

The existence of reef fish is closely related to the availability of coral reef resources as habitat. The abundance of species and individuals is high, varied color patterns make this group of fish as a complement to the panoramic beauty of coral reef areas (Hukom, 1994) ^[11].

The abundance and diversity of reef fish species vary in each island cluster with the dominant form of growth and physical conditions of coral reefs on each island are different, these conditions cause the distribution of reef fish to vary. However, the decline in the quality of coral reefs due to global warming and anthropogenic impacts has affected the condition of reef fish populations, based on this it is necessary to conduct research on the abundance and diversity of reef fish species.

Tinabo Kecil Island and its surrounding waters, geographically located at 121°4'44.539" E 6°34'0.849" S. This area is designated as a core zone as a protection of pristine coral reef ecosystems with very high coral fish diversity. In addition, this area is found protected marine life such as turtles, clams and napoleons and kharsimmatic fauna in the form of ghost pipefishes with the Latin name *Syngnathiformes solenostomus*. This location is close to the guard post so that interference / threat from humans is relatively low. The designated area as the core zone is 720 ha (Taka Bonerate, B. T. 2018).

The condition of coral reef ecosystems in these waters is classified as pristine. Percentage of coral cover in the category of severely damaged. Although categorized as severely damaged, the diversity of reef fish is very high, amounting to 140 species with an abundance of reef fish of 15,191 individuals / ha.

Major fish groups that are seen dominating on each side of the reef are from the families Pomacentridae, Labridae, Ostraciidae, Diodon and Apogonidae (Taka Bonerate, B. T. 2018). The purpose of this research is: Knowing the abundance of reef fish species in the core zone of Tinabo Kecil Island. Knowing the diversity of reef fish species in the core zone of Tinabo Kecil Island. Knowing the Dominance Index of reef fish species in the core zone of Tinabo Kecil Island.

Research Methods

Data collection of reef fish at the research station was carried out using the underwater visual enumeration method (*Underwater Visual Census*) based on English *et al.*, (1994)^[7]. The way this method works is that the transect or roll meter is stretched along 70 meters parallel to the coastline at a depth of 7 meters consisting of a transition of 20 meters for each repetition with a transition gap of 5 m so that there are 3 repetitions and the width of the observation area is 5 meters, namely 2.5 meters on the right and 2.5 meters on the left so that the total area of observation area is 350 m² (English *et al.* After the transect or roll meter is installed, reef fish observation starts from the starting point (zero point). Recording reef fish data by identifying the type of reef fish encountered (for fish species recognized at the time of observation).

Fish abundance indicates the number of individual reef fish found per unit area of observation. According to Odum (1971)^[21] in Pustika (2011),

The abundance of reef fish was then classified by Djamali and Darsono (2005)^[6] in the categories of very abundant (>50 heads), abundant (20-50 heads), less abundant (10-20 heads), rare (5-10 heads) and very rare (1-5 heads).

The diversity index (H') is used to obtain a population picture through the number of individuals of each type in a community (Odum 1971)^[21],

To see the value of the dominance index in reef fish species, the Shonnon-Wiener dominance index (Odum 1971)^[21] is used, the criteria for the diversity index are if $H' \leq 1$ low diversity, $1 < H' \leq 3$ medium diversity, and $H' > 3$ high diversity.

Results and Discussion

The identified types of reef fish are divided into three groups, namely indicator fish, major fish and target fish (Dartnall & Jones, 1986). These groupings can help in understanding ecosystem dynamics and can also be used for reef fish resource management. The results of observations made at the research location were obtained as many as 18 families

Reef fish observations were carried out at two observation location stations, on Tinabo Kecil Island there were 94 species of reef fish from 18 different families, with the number of reef fish individuals found as many as 817 fish individuals. In Table 2 the most indicator fish categories are found, namely there are 8 families including Acanthuridae, Balistidae, Chaetodontidae, Ephippidae, Muranidae, Pomacentridae, Scaridae, Scorpionidae whose habitats are on coral reefs. The indicator fish family feeds on algae, zooplankton or debris, therefore the indicator fish category as a parameter is good or not coral reef ecosystems, as it is known that fish are very closely related to the fertility of coral reefs and at the time of data collection at the observation location there was low tide because it had entered the east wind but it was still in stable condition. While the least category is found in major fish with 4 families, including Holocentridae, Labridae, Ostraciidae, and Pomacentridae with various colors commonly called ornamental fish that have habitats on coral reefs but these fish tend to be active at night

The results of observations of the most number of species found at station 1 and station 2 are the Pomacentridae Family (27 species) which comes from the Major fish category while the small number of species found at the observation location comes from the Ephippidae Family (1 species), Muranidae (1 species), Scorpionidae (1 species), Labridae (1 species) from the indicator fish category, and the Ostraciidae family (1 species) from the major fish category, The number of reef fish species is based on the category of reef fish with the highest and lowest numbers.

The family Pomacentridae, known as *damsel fish*, has a variety of different colors individually and locally for the same species. Some species are herbivorous, omnivorous or plankton-eating. *Damsel fish* lays its eggs on a bottom guarded by male fish. Included in this group are anemone fish (*Amphiprioninae*) that live in association with sea anemones. In particular, *C. amboinensis* species have the most number of fish found at station 1 and station 2 of the observation site, this species is a rather fat fish and is known as a fast and unapproachable swimmer. Its habitat is usually on large rocks in the area and coral reefs and *A. ocellaris* species are fish with their habitat also tend to coral reefs that are usually clustered, have a prominent color and are very recognizable when diving. Their diet is also diverse, generally eating algae and plankton, they can also consume small invertebrates.

The type of reef fish located on Tinabo Kecil Island, Taka Bonerate National Park, Selayar Islands Regency is still in very good condition. The number of reef fish species based on their categories can be seen in Figure 1.

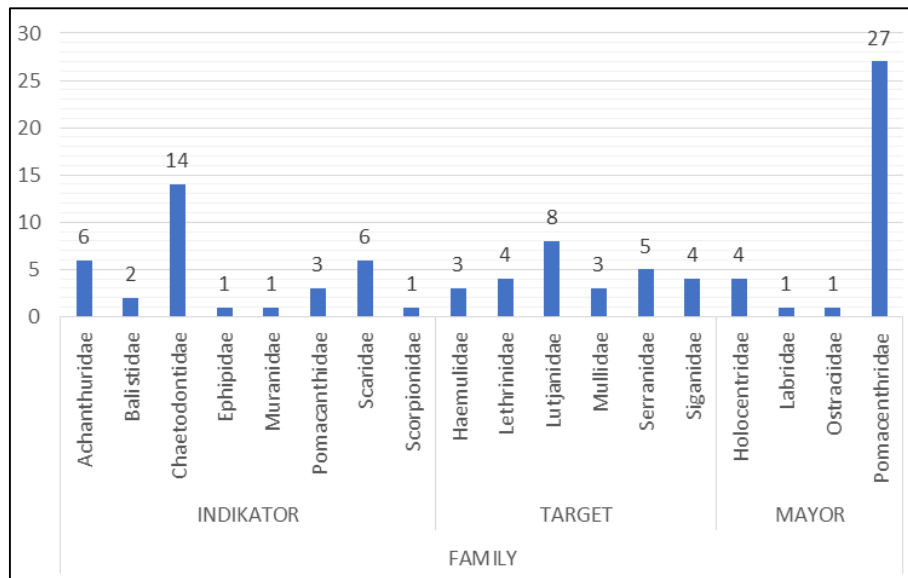


Fig 1: Family and Number of Reef Fish Species

Based on the figure above, the comparison of the number of reef fish species obtained at the observation location, the number of species obtained in the indicator fish category was 34 species from 8 families, target fish as many as 27 species from 6 families and major fish as many as 33 species from 4 families.

The abundance of reef fish is the number of reef fish found at an observation site per unit area of the observation transect (Labrosse, 2002)^[18]. Based on the results of observations, the abundance of reef fish at stations 1 and 2 on Tinabo Kecil Island ranges from 1.16 – 1.17 ind/m². Abundance of reef fish according to their category.

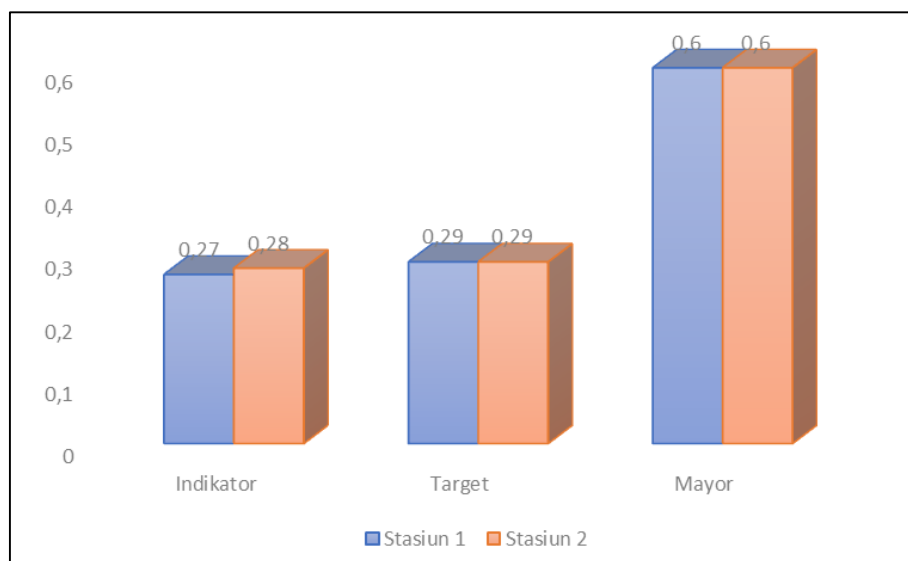


Fig 2: Results of Calculation of Reef Fish Abundance Index

Based on the graph above, it can be seen that the highest abundance level is obtained in the Major fish category where at stations 1 and 2 an abundance of 0.6 ind / m² is obtained and in the Target fish category has the same abundance value at stations 1 and 2 of 0.29 ind / m², while the lowest abundance is obtained in the Indicator fish category with a value of station 1 of 0.27 ind / m² and at station 2 of 0.29 ind / m².

Habitat quality or poor environmental conditions often result in lower numbers of species. Healthy coral reef growth and high water clarity have the potential to support diverse fish populations in both numbers and individual diversity. The movement of water masses such as ocean currents is able to clear coral reefs of sediment. In general, the state of coral reefs on Tinabo Kecil Island is strongly influenced by the

existing sediment levels, which can have an impact on reef fish populations, as reflected in the presence of reef fish groups as markers.

Each observation station has reef fish structural conditions that can be said to be similar, it can be seen from the Diversity Index (H') on the island of Tinabo Kecil has almost the same range of values. At station 1 the value of the Diversity Index of the indicator fish group is 1.14 and at station 2 the value of the Diversity Index is 1.13. While at station 1 and station 2 the value of the Diversity Index of the target fish group has the same value of 1.16, then at station 1 the value of the Diversity Index of the major fish group is 1.85 and at station 2 the value of the diversity index is 1.89. From the percentage of diversity index growth, it can be concluded that station 1 and station 2 have almost the same range of diversity values,

with the highest level of diversity obtained by major fish groups then target fish and indicator fish. The value of the Diversity index shows that the condition of the reef fish community on Tinabo Kecil Island is in a fairly good condition. The condition of this reef fish community is influenced by the condition of coral reef cover. In addition, fishing activities are not carried out on Tinabo Kecil Island because it is a core zone.

The level of dominance index must pay attention to the quality of waters, thus allowing it to be used as a habitat for reef fish. The health condition of coral reefs also affects the composition of reef fish species, besides that ecological factors in the waters provide opportunities for various types of fish to be associated. Current conditions also affect the surrounding environment. The high or low level of this dominance index reflects the state of the reef fish community in a location. When a high dominance index value often signifies the dominance of one species over another. Significant dominance of a single species can result in

vulnerability or stress on ecosystems or communities (Odum 1971) [21].

The dominance index of reef fish at both stations illustrates the difference with the range of station 1 values, the dominance index in the indicator fish group of 0.0020 and at station 2 the dominance index value of 0.0021. While at station 1 and station 2, the dominance index value of the target fish group has the same value, which is 0.0026. Furthermore, at station 1 the dominance index value of the major fish group was 0.020 and at station 2 the dominance index value was 0.017. From the percentage of dominance index growth, it can be concluded that at station 1 and station 2 the level of dominance is low. This explains that there are no dominant reef fish species. If the dominance index value is below 0.5, it indicates low dominance.

The value of the Abundance Index, Diversity Index and Dominance of reef fish categories found in the waters of Tinabo Kecil Island can be seen in Figure 3.

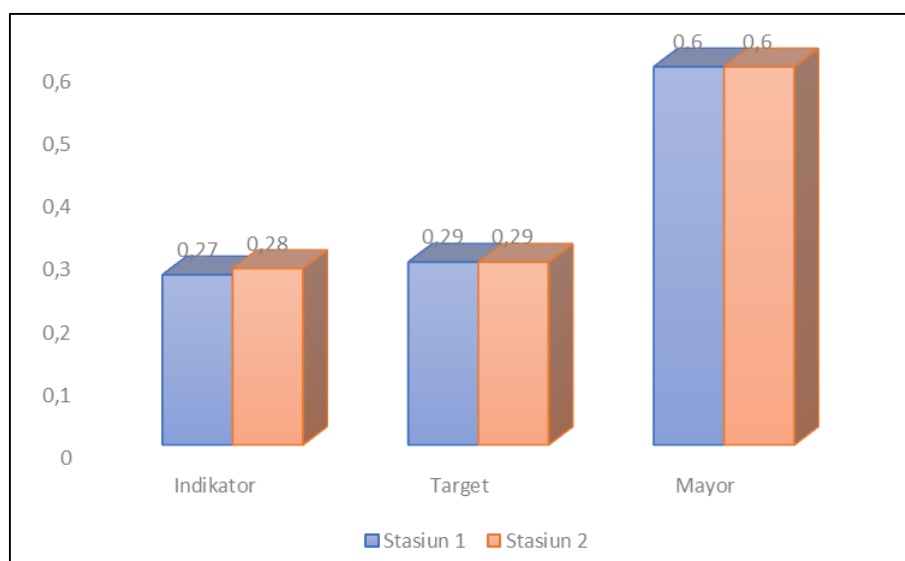


Fig 3: The Index of Abundance, Diversity and Dominance in Tinabo is small

Based on the results of data with the underwater visual enumeration method (*Underwater Visual Census*), 3 categories of reef fish were found. Coral reef ecosystems that have two indicators, namely Abundance and Diversity of coral reef fish that make up various types of activities such as predation, competition and interaction. The abundance of reef fish in SPTN region I Tinabo Kecil Concentrated species in the Major Fish Category in habitats in the core zone of Tinabo Kecil due to the endurance of these species is better than other species. In addition, the category of reef fish is resistant when in tidal conditions or clear water, able to adapt to sun exposure and stable coral conditions where a large population of reef fish in one area makes reproduction much better. Other categories of reef fish also associate and build diversity in conservation habitats such as Indicator Fish and Target Fish. The Diversity Index in the high category, this illustrates that the role and distribution of fish species in the observation location are balanced and there is no dominance of certain types in each fish habitat in the coral reef ecosystem. The category of the level of diversity of a biota is inversely proportional to the level of dominance as we know in the high category while the Dominance Index obtained is very low. In

addition, Diversity and Dominance Index are closely related where the higher the value of the Diversity index, the Dominance Index will decrease due to the fewer biota that dominate at an observation location.

Conclusion

Based on the results of reef fish research at two stations in the waters of Tinabo Kecil Island, Taka Bonerate National Park, the following conclusions can be drawn:

1. **Reef Fish Abundance:** The reef fish population abundance index in the region reaches a value of 0.60 ind/m². This reflects the number of individual reef fish present per unit area of water.
2. **Reef Fish Diversity:** The diversity of reef fish populations, measured by an H' value of 4.17, is in the high category. This shows the diversity of reef fish species that inhabit these waters.
3. **Reef Fish Dominance:** The dominance of reef fish populations, expressed with a C value of 0.02, is classified as low. That is, there are no types of reef fish that dominate significantly, so that the diversity of reef fish species is maintained.

References

1. Aktani U. Model of the Relationship Between Coral Reef Conditions and Reef Fish on Semak Daun Island, Thousand Islands [dissertation]. Bogor: Bogor Agricultural University, 1990.
2. Allen. Reef Fish Identification-Tropical Pacific. Florida: New World Publications, 2003, 482.
3. Aziz AW. Study of Abundance and Diversity of Reef Fish Families Pomacentridae and Labridae on Reef Flat Areas in the Waters of Barrang Lompo Island [dissertation]. Makassar: Hasanuddin University, 2004.
4. Bell D, Galzin R. Influence of live coral cover on coral reef fish communities. *Marine Ecology*, 1984.
5. Dahuri R. A New Paradigm of Marine-Based Indonesian Development. Scientific Oration Manuscript Inauguration of Permanent Professor of Coastal and Marine Resources Management. Bogor Agricultural University, 2003.
6. Djamali A, Darsono P. Field Technical Guidelines for Reef Fish Research in Coral Reef Ecosystems. Jakarta: Center for Scientific Documentation and Information-LIPI, 2005.
7. English S, Wilkinson C, Baker V, editors. Line intercept transect. In: Survey manual for tropical marine resources. Townsville: Australian Institute of Marine Science, 1994.
8. English S, Wilkinson C. Survey Manual for Tropical Marine Resources. Townsville (AU): Australian Institute of Marine Science, 1997.
9. Hill J, Wilkinson C. Methods for ecological monitoring of coral reefs: A Resource for Managers, ver 1. Townsville: Australian Institute of Marine Science, 2004.
10. Hukom FD. Ecostructure and spatial-temporal organization of reef fish in Ambon Bay waters [dissertation]. Bogor: Bogor Agricultural University Postgraduate Program, 1998.
11. Hukom FD. Community Structure and Spatial Distribution of Reef Fish (Family Pomacentridae) in Derawan Islands Waters, East Kalimantan. Jakarta: Balitbang Biology, Puslitbang Oceanology LIPI, 1994.
12. Elderly. Study of the condition and potential of seagrass ecosystems as a marine life care area. *Indonesian Journal of Aquatic and Fisheries Sciences*, 2005.
13. Koesobiono. Marine Biology. Bogor: Faculty of Fisheries, IPB, 1981.
14. Krebs CJ. Ecology: The Experimental Analysis of Distribution and Abundance 3rd ed. New York (US): Harper & Row Publisher, 1985.
15. Kuitert RH. Tropical Reef-Fishes of the Western Pacific Indonesia and Adjacent Waters. Jakarta: Gramedia Pustaka Utama, 1992.
16. Kuitert RH, Tonozuka T. Indonesian Reef Fishes. Australia: Zoonetics, 1992.
17. Labrosse P. Underwater Visual Census Survey. Proper and Implementation. Noumea New Caledonia: Secretariat of the Pacific Community, 2002.
18. Labrosse P, Michel K, Jocelyne F. Underwater Visual Fish Census Surveys: Proper use and implementation. Reef Resources Assessment Tools, 2002.
19. Lieske E, Myers R. Reef Fishes of the World. Hong Kong: Periplus Edition, 1994.
20. Matsuda AK, Amoka C, Uyeno T, Yoshiro T. The Fishes of the Japanese Archipelago. Jepang: Tokai University Press, 1984.
21. Nybakken JW. Marine Biology, an ecological approach. Jakarta: PT. Gramedia Main Library, 1992.
22. Odum EP. Fundamentals of ecology 3rd edition. Jogjakarta: Gajah mada University Press, 1993.
23. Odum EP. Fundamental of Ecology 3rd ed. Toronto: W.B. Saunders, 1971.
24. Paniska A, Samiaji J, Thamrin. Abundance Of Coral Fish Species And The Condition Of Coral Reefs In The Waters Of The Tikus Island, Bengkulu City. *Asian Journal of Aquatic Sciences*. 2020; 3(1):20-28.
25. Pustaka. Conditions and Potential of Reef Fish Communities in the Kayoa Islands Area, South Halmahera Regency, North Maluku. Maluku, 2011.
26. Sulistiani T. Succession of reef fish communities at coral reef rehabilitation sites on Coconut Island, Thousand Islands [thesis]. Bogor: Bogor Agricultural Institute, 2010.