TYPE ABUNDANCE AND RELATIVE ABUNDANCE OF MACROZOOBENTOS IN THE INTERTIDAL ZONE OF MARABATUAN ISLAND, KOTABARU INDONESIA

ABSTRACT

The structure of macrozoobenthos communities plays a crucial role in aquatic ecosystems because most of them are in the second or third trophic level. Components of macrozoobenthos community structure include species and abundance, species diversity index, species uniformity index, dominance index. The research aims to analyze species abundance and relative abundance of macrozoobenthos in the intertidal zone of Marabatuan Island, Kotabaru, Indonesia. The research location is on Marabatuan Island, Pulau Sembilan District, Kotabaru Regency, South Kalimantan Province. The highest relative abundance (KR) was at station 3, namely the species Ophiocoma erinaceus, from the Asteroidea class, the second highest value was at station 2 with the species Holothuria atra and at station 1 of the same species, namely Holothuria atra from the Asteroidea class. The lowest relative abundance was at station 1 of the Linckia laevigata species. The Diversity Index (H') of macrozoobenthos at all stations is in the medium criteria.

Keywords: Macrozoobenthos, abundance, Marabatuan Island, Kotabaru

I. INTRODUCTION

The intertidal zone is an area in the sea that is influenced by land. This zone has physical and chemical elements that facilitate optimal growth and development of the organisms in it. Nyabakken (1988) states that the intertidal zone is the coastal area located between the highest tide and the lowest tide, this area represents the transition from ocean conditions to land conditions. The intertidal zone covers a very wide area and is an area with the greatest variation in environmental factors compared to other sea areas. That is why the diversity of organisms in this zone is very high. One example of biota that can be found in the intertidal zone is macrozoobenthos (Triatmojo et al., 2018).

The structure of macrozoobenthos communities plays a crucial role in aquatic ecosystems because most of them are at the second or third trophic level, while others play an important role in the process of mineralization and recycling of organic material, both from waters and land. Components of macrozoobenthos community structure include type and abundance, species diversity index, species uniformity index, dominance index (Saputri et al, 2021).

Marabatuan Island is an island located in the administrative area of Pulau Sembilan District, Kotabaru Regency, South Kalimantan Province. Geographically, it is located at 4° 22′ 13″ south latitude, 115° 48′ 20″ east longitude and has an area of 3,415 km2. This island consists of two villages, namely, Tengah Village and Tanjung Nyiur Village. The livelihood of the residents is fishing and some grow bananas, sweet potatoes and cloves. The coastal area in Pulau Sembilan District is an important location for the development of living creatures such as macrozoobenthos.

Royyandi (2020) Analysis of the relationship between macrozoobenthos abundance and mangrove forest density and environmental parameters in Bawah Layung Village, Kurau District with results. Correlation analysis of the relationship between macrozoobenthos and environmental parameters obtained the following results: for the parameters temperature, salinity, substrate pH and total organic matter are known has a strong influence, while dissolved oxygen has a low influence and water pH has a very low influence on the abundance of macrozoobenthos. Based on the results of correlation analysis with mangrove density, it is known that there is a positive relationship with a very strong influence on the abundance of macrozoobenthos.

Water quality parameters have a significant impact on the distribution, abundance and diversity of macrozoobenthos in aquatic ecosystems. Good water quality will support the diversity of macrozoobenthos species, characterized by the diversity of macrozoobenthos species that live in the area so that more species will be able to live and reproduce, and can increase the diversity of aquatic ecosystems. This research was conducted in order to provide scientific and useful information for the

general public who read it. The research aims to analyze the species abundance and relative abundance of macrozobenthos in the intertudal zone of Marabatuan Island, Kotabaru, Indonesia.

2. RESEARCH METHOD

The research location is on Marabatuan Island, Pulau Sembilan District, Kotabaru Regency, South Kalimantan Province.

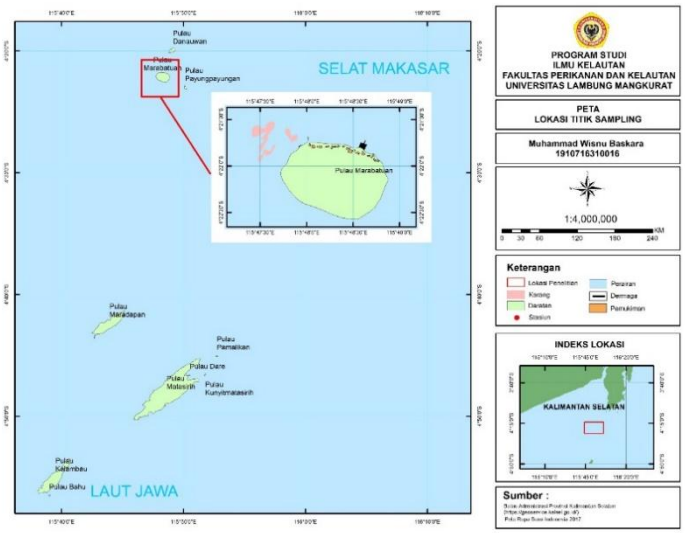

Figure 1. Map of research locations

Sampling was carried out at 3 observation stations with the criteria which can be seen in list 1 as follows:

List 1. Research Locations

No.	Location	Place	Information
1	Station 1	Port Area	Represents fishermen and port activities that have an impact on changes in water quality.
2	Station 2	Residential Settlemennts	Represents community activities and household industries which also have an impact on changes in water quality.
3	Station 3	Natural	Far from residential areas and community activities so it can represent a natural aquatic ecosystem.

Data analysis

a. Type Abundance

The abundance of macrozoobenthos species is obtained from the number of individuals per unit area (ind/m²). Based on the Species Abundance formula (Yasman, 1998):

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

Where:

A = Abundance (amount ind/ m^2)
*x*i = Number of individuals to -i
*n*i = The total area of the quadrant -i found

b. Relative Abundance

The relative abundance of individual macrozoobenthos can be calculated using the Shannon-Wiener equation (Brower et al., 1990).

$$KR = \frac{ni}{N} \text{x } 100\%$$

Where:

KR = Relative Abundance
ni = Number of Individuals of Each Type
N = Total Number of Individuals

3. RESULTS AND DISCUSSION

Abundance of Macrozoobenthos Types and Relative Abundance

The results of calculating species abundance and relative abundance of macrozoobenthos in the intertidal zone of Marabatuan Island waters are presented in Table 1, Table 2, and Table 3.

Table 1. Results of Macrozoobenthos Abundance Index Analysis at Station 1

No	Class	Species	Number of Individuals	Abundance (Ind/m^2)	KR (%)
1	Gastropoda	*Monodonta labio*	20	0.8	8.4
2		*Tectus virgatus*	6	0.24	2.5
3		*Conomurex luhuanus*	7	0.28	3.0
4		*Cyprea tigris*	5	0.2	2.1
5		*Orania rosadoi*	14	0.56	5.9
6		*Fissurella barbadensis*	25	1	10.5
7		*Littoraria scabra*	17	0.68	7.2
8		*Neothais marginatra*	11	0.44	4.6
9		*Cerithidea mazatlanica*	4	0.16	1.7
10		*Lambis lambis*	5	0.2	2.1
11		*Nerita semirugosa*	8	0.32	3.4
12		*Nerita plicata Linnaeus*	6	0.24	2.5
13		*Nerita fulgurans*	10	0.4	4.2
14		*Nassarius obsoletus*	14	0.56	5.9
15	Crustasea	*Geocarcinus ruricola*	7	0.28	3.0
16		*Gonodactylaceus falcatus*	4	0.16	1.7
17		*pilumnus vespertilio*	11	0.44	4.6
18		*Panulirus Homarus*	5	0.2	2.1
19		*Pagurus minutus*	22	0.88	9.3
20	Holothuroidea	*Holothuria atra*	30	1.2	12.7
21	Asteroidea	*Linckia laevigata*	1	0.04	0.4
22	Ophiuroidea	*Ophiocoma erinaceus*	5	0.2	2.1
	Total	**22**	**237**	**9.48**	**100**

(Source: Primary Data, 2023)

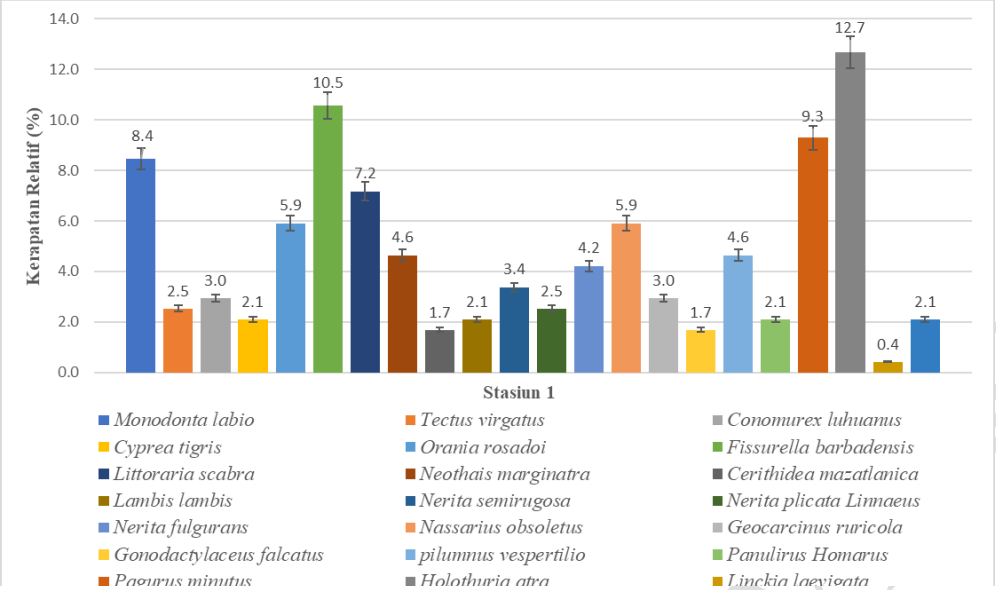

Figure 2. Graph of Relative Abundance of Macrozoobenthos at Station 1

From the data in the table above, it is known that at station 1, which is also representative of the Harbor area, the number of macrozoobnethos found was 237 individuals with a total of 22 species and an abundance of 9.4 ind/m2. The most common macrozoobenthos individuals were found from the Holothuria atra species with a relative abundance (KR) value of 1.2%. The reason for the high number of Holothuria atra species is because at the research location, the type of beach is a rocky coral beach with a dominant substrate texture of coarse sand. So that it makes it a comfortable habitat to live in for the species of Holothuria atra. In accordance with the statement from Nontji (1993) in Darsono (1995) Holothuria atra is the most common group of echinoderms. The most common habitats are found on coral reefs, sand substrates, hard substrates, crunchy substrates and muddy substrates. Tampubolon et al., (2019) added that suitable habitat can enable sea cucumber organisms to obtain food and hide from predators. Coral habitat or coral fragments can be used by sea cucumbers as a place of protection and as a potential source of food.

The lowest relative abundance (KR) value at station 1 of the Linckia laevigata species was 0.04%. The low number of Linckia laevigata was thought to be because this species is difficult to find because it tends to live solitary or solitary lives. Sasongko (2020) states that Linckia laevigata or better known as the blue sea star is a type of asteroid which has a single body, with a shape like a star, and lives a solitary life.

Table 2. Results of analysis of species and relative abundance of macrozoobenthos at Station 2

No	Class	Species	Number of Individuals	Abundance (Ind/m^2)	KR (%)
1	Gastropoda	*Monodonta labio*	13	0.52	4.2
2		*Tectus virgatus*	5	0.2	1.6
3		*Ocinebrina aciculate*	4	0.16	1.3
4		*Conomurex luhuanus*	8	0.32	2.6
5		*Cyprea tigris*	8	0.32	2.6
6		*Orania rosadoi*	10	0.4	3.2
7		*Fissurella barbadensis*	18	0.72	5.8
8		*Littoraria scabra*	6	0.24	1.9
9		*Neothais marginatra*	8	0.32	2.6
10		*Cerithidea mazatlanica*	7	0.28	2.3
11		*Lambis lambis*	7	0.28	2.3

12		*Nerita semirugosa*	17	0.68	5.5
13		*Nerita plicata Linnaeus*	11	0.44	3.5
14		*Nerita fulgurans*	20	0.8	6.5
15		*Nassarius obsoletus*	13	0.52	4.2
16		*Conus magus Linnaeus*	8	0.32	2.6
17		*Cypraea arabica*	4	0.16	1.3
18	Crustasea	*Geocarcinus ruricola*	4	0.16	1.3
19		*Gonodactylaceus falcatus*	6	0.24	1.9
20		*pilumnus vespertilio*	16	0.64	5.2
21		*Panulirus Homarus*	5	0.2	1.6
22		*Charybdis feriatus*	2	0.08	0.6
23		*Pagurus minutus*	22	0.88	7.1
24	Holothuroidea	*Holothuria atra*	42	1.68	13.5
25	Asteroidea	*Linckia laevigata*	8	0.32	2.6
26	Ophiuroidea	*Ophiocoma erinaceus*	38	1.52	12.3
	Total	**26**	**310**	**12.4**	**100**

(Source: Primary Data, 2023)

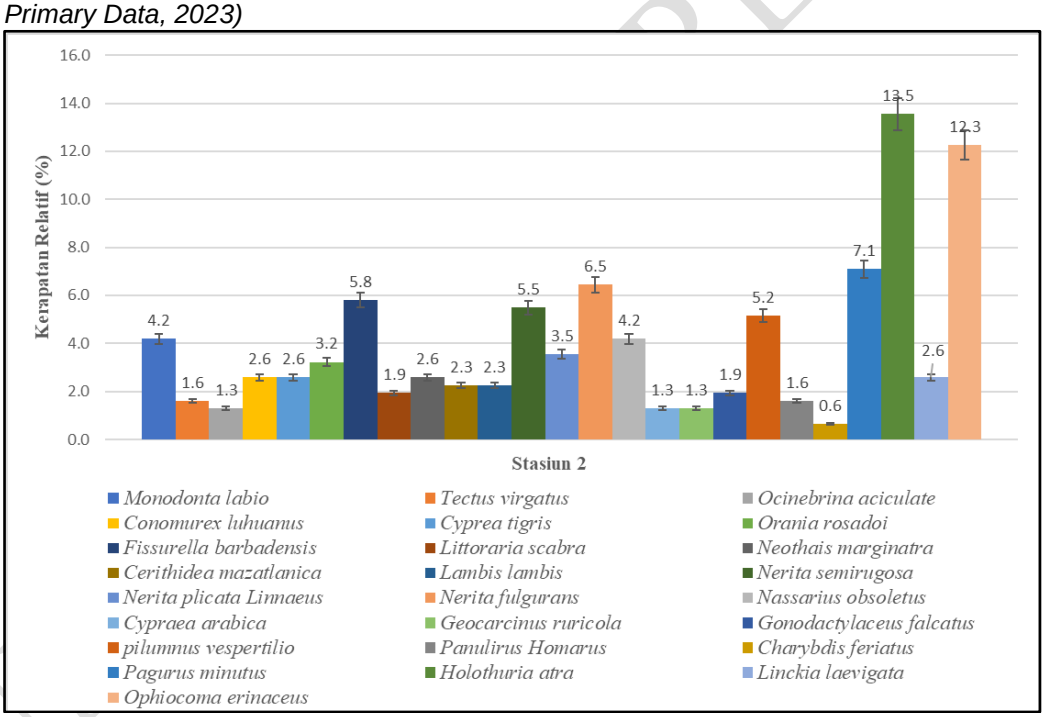

Figure 3. Graph of Relative Abundance of Macrozoobenthos at Stage 2

From the results of the data in the table above, it is known that at station 2, as an area that represents residential areas, the number of macrozoobenthos found was 310 individuals with a total of 26 species with a species abundance value of 12.4 individuals/m2. The relative abundance (KR) that is most often found is the Holothuria atra species, the same as at station 1 because the habitat is ideal for the Holothuria atra species to live in. with an abundance reaching 13.5%.

The lowest relative abundance (KR) was found in the species Charybdis feriatus with a value reaching 0.08%. This low value is a result of Charybdis feriatus being difficult to find because it often hides in coral fragments and hard substrates and its agile movements make it difficult to find. Water quality is also good as a determinant of the existence of Charybdis feriatus. According to Kurnia (2014), unfavorable water quality conditions such as low water salinity make it an uncomfortable habitat to live in. The salinity preference for good crabs is between 20 - 35 PSU.

Table 3. Results of analysis of species and relative abundance of macrozoobenthos at Station 3

No	Class	Species	Number of Individuals	Abundance (Ind/m^2)	KR (%)
1	Gastropoda	*Monodonta labio*	45	1.8	13.3
2		*Tectus virgatus*	3	0.12	0.9
3		*Cyprea tigris*	9	0.36	2.7
4		*Fissurella barbadensis*	35	1.4	10.4
5		*Littoraria scabra*	23	0.92	6.8
6		*Neothais marginatra*	17	0.68	5.0
7		*Cerithidea mazatlanica*	6	0.24	1.8
8		*Nerita semirugosa*	12	0.48	3.6
9		*Nerita plicata Linnaeus*	15	0.6	4.4
10		*Nerita fulgurans*	18	0.72	5.3
11		*Cassidula aurisfelis*	12	0.48	3.6
12		*Ellobium aurisjudae*	7	0.28	2.1
13		*Nassarius obsoletus*	16	0.64	4.7
14		*Erosaria Helvola*	5	0.2	1.5
15		*Conus magus Linnaeus*	6	0.24	1.8
16		*Cypraea arabica*	4	0.16	1.2
17	Crustasea	*Geocarcinus ruricola*	10	0.4	3.0
18		*Pagurus minutus*	15	0.6	4.4
19	Asteroidea	*Holothuria atra*	12	0.48	3.6
20	Ophiuroidea	*Ophiocoma erinaceus*	68	2.72	20.1
	Total	**20**	**338**	**13.5**	**100**

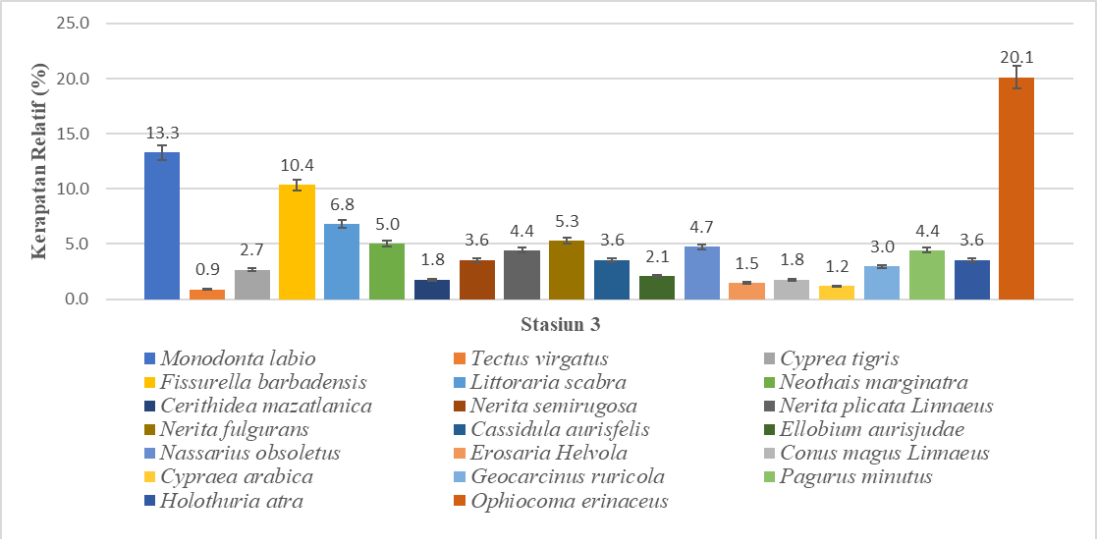

Figure 4. Graph of Relative Abundance of Macrozoobenthos at Stage 2

From the results of the data in the table above, it is known that station 3 is quite different from stations 1 and 2. This station represents a natural area or is far from human activity which could

potentially disrupt the existing ecosystem. The number of macrozoobenthos found is also the highest of stations 1 and 2. with a total of 338 individuals but the total species found was only 20 species, not as many as stations 1 and 2 with a species abundance value of 13.5 individuals/m2. The most frequently found relative abundance (KR) was the Ophiocoma erinaceus species with an abundance of 20.1%. Ophiocoma erinaceus tends to group together and use hard substrates as shelter and a place to find food. At station 3, the Beach type is dominated by volcanic rock and coral and sandy substrate which is ideally inhabited by Ophiocoma erinaceus. Setiawan (2018) stated that species from the Ophiuroidea class tend to cluster in areas where there are sandy rock substrates, macroalgae and seagrass. Ophiocoma erinaceus likes areas with sandy rock substrates and usually hides in rock crevices and behind large rocks to survive harsh sea waves. From the phenomena found, Ophiocoma erinaceus always occupies areas that are flooded or damp and protected from exposure to direct sunlight, especially at low tide during the day. This is the way these organisms protect their bodies from physical stress.

The lowest relative abundance (KR) was found in the Tectus virgatus species with a species abundance value reaching 0.12%. This low value is the result of Tectus virgatus which is difficult to find because this type of snail usually lives between coral breaks, dead coral and coral gaps in coral reefs in intertidal to shallow subtidal areas and is active at night (Arbi, 2009). Naturally, the population density of Lola snails in a body of water is influenced by several factors, including the type of substrate, availability of food, the strength of the waves or waves, and the depth of the water (Choirudin et al, 2007).

From the three stations, it can be seen that station 2 is the station that has the highest number of species compared to the other stations with 26 species found. What can be seen in Figure 5 is the graph of the number of macrozoobenthos species below:

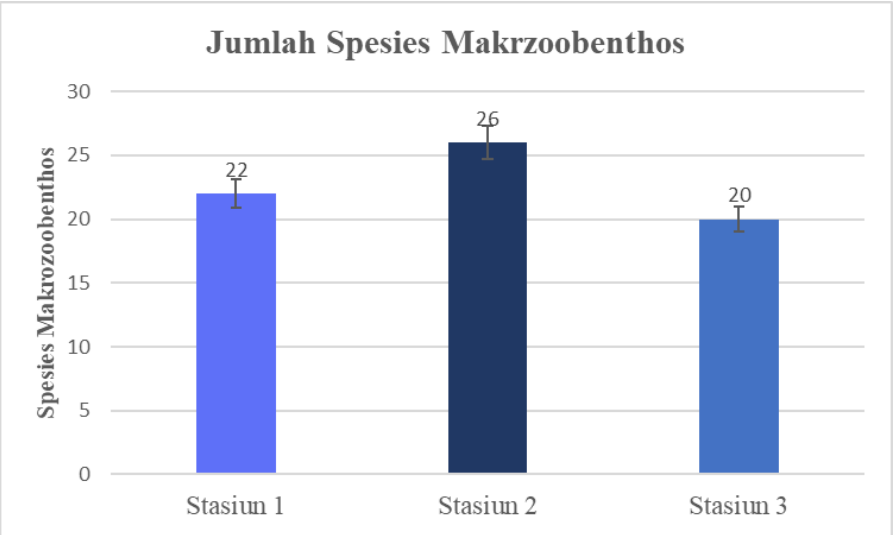

Figure 5. Graph of the number of macrozoobenthos

Station 2 is an area that represents residential areas which make this place a source of activities for the people of Marabatuan Island, such as storing unsuitable fishermen's catches such as rotten fish and disposing of used food, allegedly because this place has quite high food availability for macrozoobenthos. The dumping of organic waste into the sea can be a food source for several macrozoobenthos species at the bottom of the waters. The ability of macrozoobenthos to eat decomposed organic matter, including food remains that enter the water, can be a source of additional nutrition and help fulfill nutrients and support the sustainability of the aquatic ecosystem at that location.

As explained by Sanodri (2016), the entry of various wastes from anthropogenic activities into waters has very complex consequences. If this waste is not processed properly, it can harm aquatic biota such as benthos. Apart from that, this waste is also a source of organic material that enters the water. Some of the organic material that enters the waters will settle to the bottom of the waters. Organic material contained in sediment is the main food source, especially for macrozoobenthos which are deposit feeders and filter feeders. According to Fajri (2013) The amount of organic material in waters also influences the existence of macrozoobenthos, the higher the organic material content in waters, the higher the abundance of macrozoobenthos..

And the lowest number of macrozoobenthos species was at station 3 with the number of species found being 20 species. Station 3 is a station that represents a natural area or an area far from human activity. The reason for the small number of species found at this station is thought to be due to the characteristics

of the coast which is dominated by large volcanic rocks which make this place only suitable for habitation by several macrozoobenthos species that are attached to the substrate. According to Setiyowati, (2018) Gastropods can live by sticking and burying in water. and from the species Ophiocoma erinaceus which uses a hard substrate for shelter and foraging for food.

4. CONCLUSION

The highest relative abundance (KR) was at station 3, namely the species Ophiocoma erinaceus, from the Asteroidea class, the second highest value was at station 2 with the species Holothuria atra and at station 1 of the same species, namely Holothuria atra from the Asteroidea class. The lowest relative abundance was at station 1 of the Linckia laevigata species. The Diversity Index (H') of macrozoobenthos at all stations is in the medium criteria.

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