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Echinoderms Diversity and Abundance in Gunung Kidul Beach Yogyakarta

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Abstract

Echinoderms are one of marine invertebrate animals that have an important role, as a recycle of nutrients in the functioning of ecosystems. Echinoderms usually appear in the intertidal zone of the coast. The existence of echinoderms in the intertidal zone is affected by external and internal factors. This study aims to determine the level of abundance and diversity of Echinoderms in the intertidal zone in the Krakal and Drini coastal areas, Gunung Kidul, Yogyakarta. Data were collected using transect method. The main transect along 50 meters was divided into 5 sampling points, and the distance between sampling points was 10 meters. After that, each point was taken for 3 observation plots with an area of 1x1 meters and the distance between plots is 5 meters. The results showed that, the diversity index on the krakal coast had a higher value (0.139) when compared to the Drini coast (0.129). Calculation of echinonderm abundance index shows that the Drini beach location has a high abundance value when compared to the abundance value at the Krakal beach loc ation. The parameter measurement results can be seen that both the pH and temperature parameters on both the Krakal and Drini coast have values that correspond to the optimum parameter in the waters.

Keywords: Echinoderms; Diversity; Abundance; Krakal Coast; Drini Coast

INTRODUCTION

Echinoderms are one of marine invertebrate animals that have an important role in the functioning of ecosystems (Supono et.al., 2014). Echinoderms have a role as nutrient recycling (Triana et al., 2015). It can be used as a parameter (bioindicator) quality in marine waters (marine ecosystems) (Jalaluddin, 2017). Echinoderm habitat is beach and sea to a depth of 366 m. In addition, echinoderm can live in a variety of habitats such as reef flat zones, algal growth areas, seagrass beds, live coral colonies and dead coral colonies (Yusron, 2009). Echinoderms are very common in sandy areas, especially those that are overgrown with seaweed (Aziz, 1996). One area that has an environment like this is the area of Krakal and Drini Beach Gunung Kidul, Yogyakarta.

The intertidal zone of Krakal and Drini Beach has different types of substrates, both whether it is sandy, muddy, or rocky. The intertidal zone in the area occupies a very wide area, and when sea water reaches the lowest ebb, the length of the dried water base can reach hundreds of meters. This condition is utilized by the local coastal community in search of marine animals to meet their daily needs. The growth of marine biota in the coastal intertidal zone is very high, due to this area being a place of life, shelter, and a place to look for food. In addition, environmental conditions in this area are very favorable for the growth of marine biota because of the support of marine physical, chemical and biological factors. Soemodhiharjo (1990) revealed that marine physical-chemical factors including salinity, pH, currents, temperature, and ever-changing brightness greatly affect the life of organisms in coastal intertidal zones. Furthermore, Rowe & Doty (in Hasan, 2004) said that another important factor influencing the distribution of Echinoderms is the average topography of an island. Density of marine animals depends on temperature, salinity, and pressure. In addition, Aziz (1996) revealed that the condition of the substrate and habitat largely determines the distribution of Echinoderms.

The existence of Echinoderms in the Gunung Kidul area, especially in the Krakal and Drini Coast areas, has not yet been identified and is well known for its habitat trends, so research is needed to determine the diversity and abundance in the intertidal zone of the Krakal and Drini beach of Gunung Kidul, Yogyakarta.

MATERIALS AND METHODS

Materials and tools

The equipment used in this study were pH meter to measure the pH of seawater, a thermometer to measure water temperature, a flakon bottle to place Echinoderms that have not been identified, 70% alcohol as a

preservative for echinoderms, a rope for making transects, stakes as a barrier, gauge for measuring, scissors, tweezers and stationery.

Determination of transect and sampling

The transect used in this study is the comb transect. The use of comb transects is due to the highest echinoderms in the intertidal zone. Each area of the research site is made of a main transect with a length of 50 meters. Then the main transect is divided into 5 sampling points, the distance between the sampling points is 10 meters. After that, each point was taken 3 observation plots with an area of 1x1 meters and the distance between plots 5 meters.

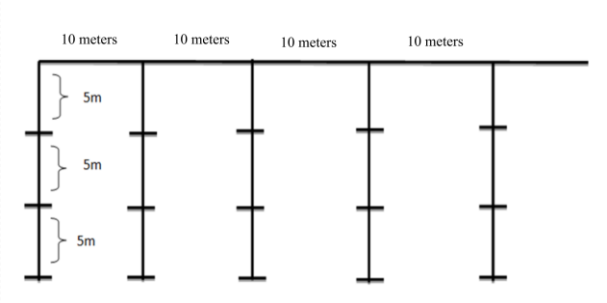

Figure 1. Transect and sampling design.

Calculation of Echinoderms Diversity and Abundance

Calculation of the diversity of echinoderms on the Krakal and Drini coast used a diversity index. The diversity index formula is (Shannon and Wienner, 1963):

$$H' = \sum pi \log pi$$

H' : Shannon Wiener Diversity Index
Pi : ni/N = Relative Abundance of Species

H' < 1 : Low diversity and low community stability
1 < H'< 3 : Medium diversity and stable community
H' > 3 : High diversity and high community stability

Meanwhile, to determine the abundance of types of echinoderms performed calculations with abundance index. The formula is as follows (Rahma and Fitriana, 2006):

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

D : The abundance of individual species i
Ni : Number of individuals of the i-th species
A : Sampling plot area

RESULT AND DISCUSSIONS

Table 1. Number of species of Echinoderms phylum.

No	Species	Krakal Beach	Drini Beach
1	*Ophiotrix sp*	594	876
2	*Echinometra sp*	58	85
3	*Holothuria sp*	1	0
4	*Crinoidea*	1	0

Based on the results of research conducted there were 4 types of species found on Krakal beach. Whereas 2 types of species found on the Drini coast. The species most commonly found in the Krakal coast and the Drini coast are the *Ophiotrix sp*. This is because the Ophioridea class can be found starting from the intertidal area to a depth of more than 6500 meters (Stohr, et al., 2012). The abundance index of phylum echinoderms on Krakal and Drini beaches can be seen in figure 2.

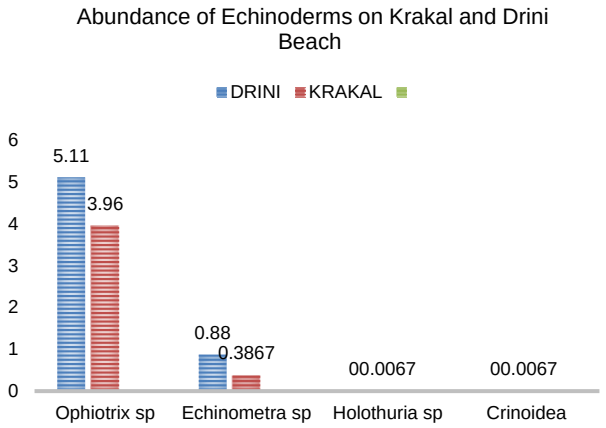

Figure 2. Graph of the abundance of Echinoderms on the Krakal and Drini beach.

The results of the calculation of the abundance index of echinonderms on both beaches show that Ophiuroidea and echinoidea are the most abundant class of echindermata found. When viewed from the substrate, Krakal and Drini beaches are beaches composed of coral. The abundance of corals on both coasts causes the abundance of echinoderms. According to Yusron (2016) states that the Ophiuroidea Class and Echinodea Class are generally found in flat reef areas. Both of these classes are commonly found on flats as a place to hide and find food in the rocks. Likewise, research conducted by Sugiarto and Supardi (1995) which states that Ophiuroidea and echinoidea are a class of phylum Echinoderms have a tendency to attach to corals. In addition, Ophiuroidea and Echinodea classes have the ability to grip rocks and be able to refrain from waves so that they are able to adapt in coral areas (Aziz, 1996).

It is contrast to the Holothuridea class which is very rarely found on Krakal and Drini beaches. This is because species in this class prefer habitats that are always inundated. Meanwhile, based on observations on both beaches at low tide, the water content in the intertidal area is very small. These conditions make the cause of at least Holothuridea species found. According to Aziz (1996) Holothuridea occupy habitats that are always flooded even at low tide, and for their life, these animals prefer clear water habitats and are relatively calm. Crinoidea species are also very few found, this is because Crinoidea usually live in coastal areas (Yusron, 2016). While the research location does not pass through the edge.

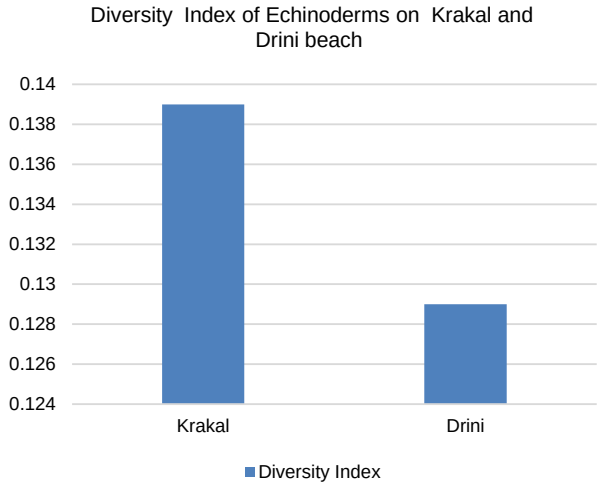

Figure 3. Graph the Diversity of Echinoderms on the Krakal and Drini beach.

From this diagram it can be seen that waters on the Krakal coast have a higher diversity index (0.139) when compared to waters at the Drini coast (0.129). The difference in diversity obtained on the two beaches can be influenced by several internal and external factors. According to (Shannon and Wienner, (1963), the diversity of echinoderms on the Drini and Krakal beaches can be categorized as low because the results of the calculation of H 'is less than 1. The low diversity of echinoderms on the krakal and drini beaches indicates that the productivity level at both beaches is very low, so it can be said that the ecosystems on both coasts are unstable. The imbalance of ecosystems on the two beaches can be seen from the presence of a very dominant individual, the Ophiothrichidae family.

Table 2. Results of Measurement of Environmental Parameters on Krakal and Drini Beach.

Parameter	Krakal Beach	Drini Beach	Parameter Stability
pH	8	8	7,5-8,6
Temperature	30ºC	27ºC	20ºC-30ºC

Temperature measurements on the Drini and Krakal beaches are 27º C and 30º C. The results of temperature measurements on both beaches are still classified as the optimum temperature that allows echinoderms to live and develop properly. Thus echinoderms can be found abundantly on the coast of Krakal and Drini. The good temperature for the life of Echinoderms is 20º C - 30º C (Aziz, 1998).

The pH value describes the acidity and alkalinity intensity of a waters which is indicated by the presence of hydrogen ions. The value of the pH range in the study is still relatively good for seawater parameters. The results of pH measurements at the drini and krakal beaches are 8. The measurement results are in accordance with research conducted by Romimohtarto and Juwana (2007) where the pH of sea water in Indonesia varies between 6.0-8.5. As according to Aziz (1996), a good pH value for the life of Echinoderms is 7.5-8.6.

From the parameter measurements it can be seen that both the pH and temperature parameters at both the Krakal and Drini coast have values that correspond to the optimum parameter theory in the waters. This allows the existence of other factors that influence the differences in the results of the diversity of Echinoderms on the Krakal and Drini beaches. Based on observations, there are more seaweed on the Krakal beach compared to the Drini beach. The amount of seaweed in an ecosystem will affect the number of echinoderms. Krakal Beach with a large amount of seaweed has few echinometra species compared to the Drini beach. The results of this study are in accordance with research conducted by Maila (2017) which states that the amount of seaweed in an ecosystem is negatively correlated with the amount of *Echinometra sp*.

CONCLUSIONS

The diversity index on the Krakal coast has a higher value (0.139) when compared to the waters on the Drini coast (0.129). While the calculation of echinondermal abundance index shows that the Drini beach location has a high abundance value when compared to the abundance value at the Krakal beach location. From the results of parameter measurements, it can be seen that both the pH and temperature parameters at both the Krakal and Drini coast have values that correspond to the optimum parameter theory in the waters. interaction with biotic factors in the form of seaweed found in both locations still shows a range of tolerance that can support the life of Echinoderms.

REFERENCES

Aziz, A. 1996. Habitat dan zonasi fauna Echinodermata di ekosistem terumbukarang. Oseana 1. 24(2): 33-43.

Aziz, A. 1998. Pengaruh tekanan panas terhadap fauna Echinodermata. JurnalOseana, 13(3): 125-132

Brower JE, & Zar JH. 1977. Field and laboratory methods for general ecology. WM. J. Brown Company Publ, Iowa. p.288.

Hasan, S. 2004. *Kepadatan dan Pola Distribusi Echinodermata di Zona Intertidal Pantai Pulau Ternate.* Media Ilmiah MIPA.

Jalaluddin & Ardeslan, 2017. Identifikasi dan Klasifikasi Phylum Echinodermata di Perairan Laut Desa Sembilan Kecamatan Simeulue Barat Kabupaten Simeulue. Jurnal Biology Education, Vol 6 No, Page 82-97

Rahma, Yulia & Fitriana. 2006. *Keanekaragaman dan Kemelimpahan Makrozoo-benthos di Hutan Mangrove Hasil Reha-bilitasi Taman Hutan Raya Ngurah Rai Bali.* Jurnal Biodiversitas Vol. 7, No. 1. Hal: 67-72.

Romimohtarto, K. & Juwana, S. 2007. Biologi Laut: Ilmu Pengetahuan tentang Biota Laut. Jakarta: Djambatan: 540 pRowe, F. E. W. and J. E. Doty. 1977. *The Shallow-Water Holothuirans of Guam*. Micronesia.

Shannon C. E., & Wiener. 1963. The mathematical theory of communications. Univ. Illinois. Urbana. p.117.

Soemodhiharjo. 1990. *Teluk Ambon. Ambon:* Balai Penelitiandan Pengembangan Sumberdaya Laut (LIPI) Ambon.

Sugiarto, H. & Supardi 1995. Beberapa catatan tentang bulu babi marga Diadema. *Oseana* 20(4): 35

Triana R, dkk, 2015. *Identifikasi Echinodermata di Selatan Pulau Tikus, Gugusan Pulau Pari, Kepulauan Seribu, Jakarta.* (Jurnal Pros Sem Nas Masy Biodis Indon). Vol 01 No. 03. Program Studi Biologi, Universitas Al Azhar Indonesia. Jakarta

Yusron, E. 2009. *Keanekaragaman Jenis Ekhinodermata Di Perairan Teluk Kuta, Nusa Tenggara Barat*. Makara, Sains, Vol. 13: 45-49.

Yusron, E. 2010. Keanekaragaman Species Ekhinodermata di Perairan Likupang, Minahasa Utara, Sulawesi Utara. ILMU KELAUTAN (Indonesian Journal of Marine Sciences) Juni *2010*. vol. 15 (2) 85-90

Yusron. 2016. Struktur Komunitas Ekhinodermata (Asteroidea, Ophiuroidea, Echinoidea Dan Holothuroidea) Di Perairan Taman Nasional Wakatobi Sulawesi Tenggara. *Jurnal Ilmu dan Teknologi Kelautan Tropis, Vol. 8, No. 1, Hlm. 357-366*