

## COMMUNITY STRUCTURE OF ECHINODERMS IN THE COASTAL WATERS OF SUNGAI NIPAH PESISIR SELATAN REGENCY

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### ABSTRACT

Echinoderms are thorn-skinned invertebrates such as sea stars, snake stars, sea urchins, sea cucumbers, and sea lilies. Echinoderms are marine animals that act as cleaners for the marine environment, especially the coastal environment. This research was conducted in September 2021 in the coastal waters of Sungai Nipah, Pesisir Selatan Regency, West Sumatra Province. The purpose of this study was to determine the structure of the echinoderm community which includes species, abundance, relative abundance, diversity, uniformity, dominance, and distribution patterns. The method used in this research was a survey method, to determine the observation station using a purposive sampling technique. Based on the research results, the species of echinoderms found in the coastal waters of Sungai Nipah Village are *Holothuria scabra*, *H. atra*, and *Ophiocoma scolopendrina*. The abundance of echinoderms obtained ranged from 7,407–11,481 ind/ha. Echinodermata diversity has an average of 1.13 which belongs to the medium category. The uniformity of echinoderms has an average of 0.13 which is included in the category of very low species uniformity. The average value of dominance is 0.51 which means that there are species that dominate in these waters. The distribution pattern of echinoderms in the coastal waters of Sungai Nipah is uniform.

**Keywords:** Echinoderms, Abundance Diversity, Uniformity, Dominance, Distribution Pattern

### 1. INTRODUCTION

Sungai Nipah is a village located in Nagari Painan Selatan, Pesisir Selatan Regency, West Sumatra Province. Nipah River has a beautiful beach, white sand, small waves, clear, fish resources, coral, coastal vegetation dominated by coconut trees, and various other coastal ecosystems, and is inhabited by many marine biotas, one of which is the phylum Echinodermata. Echinodermata habitats are waters with coral, sand, and seagrass substrates.

Echinodermata abundance and diversity are strongly influenced by biotic factors and abiotic factors that are interrelated with each other in each region, as well as interactions between various species that make up the system<sup>1</sup>. Community structure has several characteristics, namely abundance,

diversity, uniformity, dominance, and distribution patterns. Uniformity is the composition of each individual of a species contained in a community. The uniformity index is a good estimate to determine dominance in an area<sup>2</sup>.

The dominance found in an area shows the presence or absence of competition in the utilization of resources and environmental conditions of the waters. Distribution patterns are defined as the arrangement of population members in units of time and space. The substrate of the water bottom determines the distribution in a body of water because in the substrate there are food sources<sup>3</sup>.

The declining environmental quality of Sungai Nipah Village Beach, caused by tourism activities and the presence of several fishing settlements around the

beach, can result in echinoderms that occupy the area being disturbed so that the community structure changes. This is related to changes in environmental quality and habitat characteristics. Therefore, it is necessary to conduct research related to Echinodermata community structure in the waters of Sungai Nipah Beach

## 2. RESEARCH METHOD

### Time and Place

This research was conducted in September 2021 in the coastal waters of Sungai Nipah Village, Pesisir Selatan Regency, West Sumatra Province (Figure 1).



Figure 1. Map of research locations

### Methods

The method used in this research is the survey method, by making observations and sampling directly into the field. Determination of the observation station was carried out using a purposive sampling technique by observing the environment around the observation location of the research object.

### Procedure

Echinodermata sampling is based on predetermined plots. Each plot d was divided into 9 subplots where each subplot had an area of 1 m x 1 m, but only 3 of the 9 subplots were taken as sample areas, so there were 27 subplots per station. Sediment sampling was conducted using a pipeline. Sediment samples were taken in each plot, resulting in 27 sediment samples. To identify echinoderms that have been

found, the book "The Shore Ecology of the Tropical Pacific"<sup>4</sup> was used. The data obtained were presented in tables and graphs and discussed descriptively. To compare the abundance of echinoderms between stations analyzed using the ANOVA test.

## 3. RESULT AND DISCUSSION

There are 3 species of echinoderms found in Sungai Nipah Beach, namely *Ophiocoma scolopendrina* (Ophiuroidea class), *H.scabra*, and *H.atra* (Holothuroidea class).

Echinodermata abundance at Sungai Nipah Beach ranged from 7407-11481 ind/ha. The highest average abundance of echinodermata is found at station III, which is  $11481 \pm 3395$  ind/ha, while the lowest average abundance is obtained at  $7407 \pm 4207$  ind/ha at station II (Figure 2).

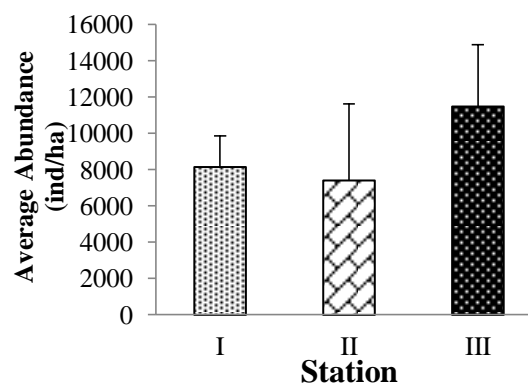
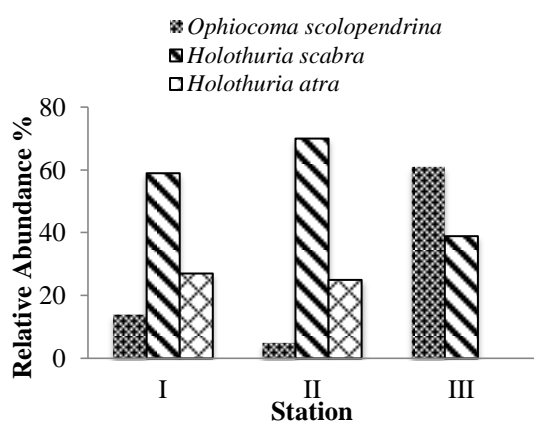


Figure 2. Abundance of Echinodermata

The Holothuroidea class at stations I and II has a high abundance, where this class can live in areas with small currents, areas overgrown with sea grass plants, and prefers relatively calm waters. Sea cucumbers generally prefer clear waters, fine sandy bottom, or sand mixed with mud with seagrass plants and seaweed<sup>5</sup>.

Based on Figure 3, shows that *H.scabra* is found in various habitats such as seagrass, sand substrate, and sandy gravel, even found on hard substrates such as coral reefs, dead corals, and rocks. The high number of sea cucumber species is due to their ability to survive in various

habitats, so they have many opportunities to develop<sup>6</sup>.



**Figure 3.** Relative abundance of echinoderms

*Holothuria atra* is found in sandy substrate areas and areas overgrown with seagrasses. This type of sea cucumber has a life habit that always protects itself from sunlight by immersing its body in sand. Species from the Holothuroidea class like sand substrates and muddy sand and utilize grains of sand to avoid sunlight, the sand attached makes the body temperature low<sup>7</sup>. *O. scolopendrina* likes areas with sandy substrates, sandy gravel, and sandy stones. *O. scolopendrina* likes sandy rock substrate areas and usually hides in rock crevices and behind large rocks to survive harsh sea waves<sup>8</sup>. Furthermore, the diversity, uniformity, and dominance of Echinodermata can be seen in Table 1.

**Table 1.** Diversity, uniformity, and dominance of Echinodermata

Station	Diversity (H')	Uniformity (E)	Dominance (D)
I	1,35	0,14	0,44
II	1,08	0,11	0,56
III	0,96	0,14	0,53
Average	1,13	0,13	0,51

Based on Table 1 the average value of the diversity index is 1.13 included in the medium category, where there is 1 station that has a low diversity value at station III, but in general, the diversity of all stations is included in the medium category. The uniformity index value is 0.13 where the

uniformity of the types of organisms in these waters is not balanced. The average value of the dominance index obtained is 0.51 which means that there are species that dominate in these waters.

The highest diversity index at station I, is because it has a sandy substrate and there is a large expanse of coral reefs, where sea cucumbers really like this substrate as their habitat. The lowest diversity is found at station III, where the distribution of individuals is uneven and the aquatic environment is under considerable pressure, this is due to the rocky substrate and coral fragments. A community has high species diversity if the community is composed of many species, while if the community is composed of very few species, and if only a few species are dominant, then the diversity is low<sup>9</sup>.

The uniformity index is included in the low category where the uniformity of organism types or the distribution of individuals is not balanced because there is one dominating species. The inability of echinoderms to adapt is also one of the causes of low Echinodermata uniformity, such as not being able to compete for space or food. If the smaller the uniformity index value, the distribution of the number of individuals of each species is not the same or the community is dominated by certain species. The greater the value of the uniformity index in the community, the greater the species uniformity, meaning that the abundance of each species can be said to be the same or not much different, and in the community there is no dominance<sup>10</sup>.

The dominance index obtained includes a high value, where in the Echinodermata community structure there are species that dominate other species. The dominance index value obtained states that the condition of the Echinodermata community structure is in an unstable state, and there is ecological pressure, namely the pressure that occurs between the biota and the environment in which it lives. The greater the dominance index value obtained, the greater the dominance of one

species in the population. Conversely, the smaller the dominance index value indicates that there is no dominant

species<sup>11</sup>. Echinodermata Distribution Pattern can be seen in Table 2.

**Table 2.** Echinodermata distribution pattern

Station	N	$\sum x$	$\sum xi^2$	Index Morisita	Pattern Distribution
I	9	22	68	0,9	Uniform
II	9	20	58	0,9	Uniform
III	9	31	125	0,91	Uniform

Based on Table 2 shows that the value of the distribution pattern at each station is not much different, station I and Station II have a morisita index value of 0.9, while the morisita index value at Station III is 0.91. This value indicates that the distribution pattern of Echinodermata species in these waters is uniform. Echinodermata distribution patterns between stations in the waters of Sungai Nipah Beach obtained the same morisita index value which is less than 1, this indicates that the species distribution pattern is classified in the uniform category. The difference in distribution patterns is determined by the number of populations of each species during the data collection period, and the uniform distribution pattern is due to the number of populations of each species found in smaller numbers. According to Bahri<sup>12</sup>, the distribution pattern is influenced by habitat type which includes physic-chemical factors of water as well as food and adaptability of a biota in an ecosystem.

#### 4. CONCLUSION

Echinodermata species found in the waters of Sungai Nipah Beach are from the Ophiuroidea class and Holothuroidea class. Class Ophiuroidea 1 species is *O.scolopendrina*, Class Holothuroidea 2 species are *H.scabra* and *H.atra*. The highest abundance of echinoderms is found at station III which is 11481 ind/ha and the lowest abundance is found at station II which is 7407 ind/ha. The diversity index obtained is classified in the medium category, which means that the waters are experiencing moderate pressure (disturbance) in these waters. The uniformity index value obtained is in the low category, where the distribution of individuals in these waters is not balanced. The dominance index value obtained states that there are species that dominate other species in these waters. The Echinodermata distribution pattern obtained is in a low category, where the distribution pattern of Echinodermata species in these waters is uniform.

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