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THE STRUCTURE OF SEA CUCUMBER COMMUNITY OF HOLOTHUROIDE CLASS OF THE SUGI ISLAND WATERS NIUR PERMAI VILLAGE MORO DISTRICT KARIMUN REGENCY

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ABSTRACT

Sea cucumbers from the Holothuroidea class are spineless and soft-bodied animals like cucumbers. This research was conducted in March 2021 in Niur Permai Village, Moro District, Karimun Regency, Riau Islands Province. This study aims to determine the structure of the sea cucumber community in the waters of Sugi Island, Niur Permai Village. The method used in this research is the survey method. Sampling was done purposive sampling, by determining 3 (three) stations. The results of the research on sea cucumber community structure in the waters of Sugi Island, Niur Permai Village found 4 (four) species, and the most common family found was from Stichopodidae including *Stichopus horrens*, *S.hermanni*, *S.ocellatus*. Based on the calculation of the highest abundance value found at station III, namely 900 ind/ha found in coral and seagrass areas, while the lowest abundance value at station II, namely 7.66 ind/ha found in muddy sand areas. Diversity index values (H') ranged from 1.37-1.94 with a uniformity index (E) ranging from 0.69-0.97 and a dominance index (C) ranging from 0.27-0.29. The overall distribution pattern of sea cucumber class Holothuridea is clustered. Based on the analysis of sediment organic matter in the waters of Sugi Island, Niur Permai Village, the highest average value is 2.85% and the lowest percentage is 2.08%. The results of the analysis of the sediment fraction at each station are gravel sand. Water quality parameters measured in the research location have good environmental conditions for sea cucumber life.

Keywords: Sea cucumber, Sugi islands, Holothuroidea.

1. INTRODUCTION

The sea cucumber is a soft-bodied marine animal that is elongated like a cucumber. This animal is included in the Holothuroidea class of the Echinodermata phylum which is a spineless and soft-bodied or spiny animal[1]. The sea cucumber Holothuroidea class is one group of marine biota that is specific and easily recognized. The body shape of sea cucumbers in general is cylindrical, extending from the tip of the mouth towards the anus (orally-aborally). Sea cucumbers are found in habitats that are always below the lowest tide line. Habitats with coral sand bottoms overgrown with seagrass are places where sea cucumbers live[2].

Sea cucumbers have both ecological and economic roles. Ecologically, sea cucumbers are included in the food web and act as deposit feeders. So that it can process the substrate it occupies. In addition, it plays a role as a food provider in the form of larval eggs and sea cucumber Juana for predatory marine biota around animals[2]. Meanwhile, economically sea cucumbers act as food ingredients that have a very high nutritional content. In dry conditions, sea cucumbers contain 82% protein, 1.7% fat, 8.9% water content, 8.6% ash content, and

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4.8% carbohydrates. Apart from being a food ingredient, sea cucumbers are also used as medicine for heart, kidney, anemia, diabetes, and anti-tumor diseases[1].

Several studies on Sea Cucumber (Holothuroidea) Community Structure have been conducted, such as in Southeast Maluku waters on Kai Island by Yusron & Widianwari[3], Natuna Beach by Mansur[4], in the waters of Tanjung Kelit Senayang Village, Lingga by Hasbullah[5], and Juanga Waters, Morotai Island Regency by Alwi et al.[6].

Regarding the structure of the sea cucumber community in the waters of Sugi Island, Niur Permai Village, there is no clear information about the structure of the sea cucumber community in the waters of Sugi Island, Niur Permai Village, so this research needs to be done to obtain clear information about the structure of the sea cucumber community which includes species, diversity, uniformity, dominance, and distribution patterns in the waters of Sugi Island, Niur Permai Village. The results of this study are expected to provide information on the structure of the Holothuroidea class sea cucumber community found in the waters of Sugi Island, Niur Permai Village, Moro District, Karimun Regency.

2. RESEARCH METHOD

Time and Place

The research was conducted on 23 March 2021. Holothuroidea class sea cucumber sampling was carried out in the waters of Sugi Island, Niur Permai Village, Moro District, Karimun Regency (Figure 1).

Methods

The method used in this research is a survey method, by making observations and sampling directly into the field. Determination of the observation station is done by purposive sampling technique.

The sampling of sea cucumbers (Holothuroidea) was taken directly from within the 5 x 5 m plots^2 using a hand or small shovel of all sizes. A sampling of sea cucumbers was carried out in 4 plots measuring 5 x 5 m^2 and put into labeled plastic samples. Furthermore, observations, sample measurements, and identification of sea cucumber species (Holothuroidea) were carried out in the laboratory.

Sediment sampling was conducted at the same location as the sea cucumber sampling. Sampling is done using a small scoop. Sediment samples are taken ±500 g, and then the sample is put into a plastic bag and labeled. Sediment sampling was carried out at the same location as the sea cucumber sampling.

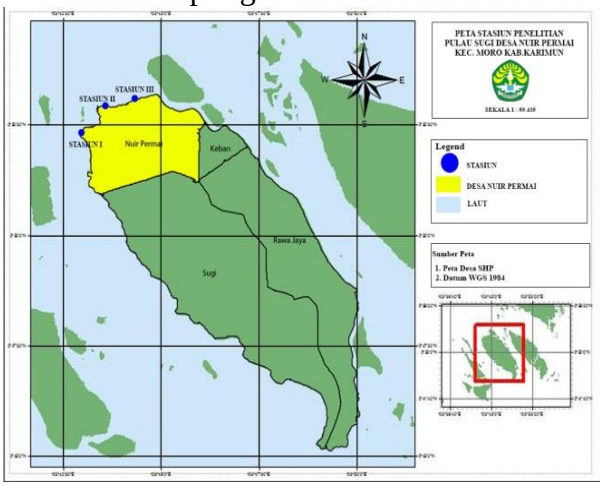


Figure 1. Research location map

Parameters observed

Calculation of sea cucumber abundance

Abundance is the number of individuals per species. The abundance of sea cucumbers of the Holothuroidea class was calculated using the formula Sukmiwati et al.[7]

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

Description:

Di = The density of the i-th individual species (ind/m^2)
ni = Number of individuals of the i-th species obtained
A = Plot area of the i-th species found (m^2)

Diversity

The diversity index used is the Shannon-Winner index[8]:

$$H' = -\sum_{i=0}^{s} pi \, Log_2 \, pi$$

Description:
H' = Shannon- Wiener diversity index
pi = ni /N (proportion of the i-th species)
ni = number of individuals of each i-th species
N = total number of individuals
S = number of species

Uniformity

The uniformity index used can be calculated using the formula[8]:

$$E = \frac{H'}{Log_2 s}$$

Description:
E : Uniformity index
H' : Species diversity index
S : Number of species

Dominance

The dominance index used can be calculated using the Simpson formula[8].

$$C = \sum_{i=1}^{s} \left(\frac{ni}{N}\right)^2$$

Description:
C = Dominance index
ni = Number of individuals of each species
N = Total number of individuals
S = Number of individuals captured

Similarity Index

To determine the species similarity index of the two communities, it was calculated based on Odum[8]:

$$IS = \frac{2C}{A+B} \times 100\%$$

Description:
IS = Index of species similarity
C = The same number of species in both areas
A = Number of species in the rehabilitation area
B = Number of species in natural areas

Distribution Pattern

The distribution of sea cucumbers was calculated using the Morisita dispersal index formula[8]:

$$Id = n\left[\frac{\sum x^2 - \sum x}{(\sum x)^2 - \sum x}\right]$$

Description:
Id = morisita dispersion index
N = total number of sampling units
N = total number of individuals contained in n plots
ΣX^2 = squared number of individuals per plot

Total Suspended Solid (TSS)

To determine the total amount of suspended solids, a calculation was made using the formula according to the BSN[9].

$$TSS\ (mg/l) = \frac{(A-B)\ x\ 1000}{V}$$

Description:
A = weight of filter and residue after heating (g)
B = weight of blank filter paper (g)
V = sample volume (ml)

Sediment Type

The handling of sediment samples follows procedures that refer to Rifardi[10], namely the analysis of sediment grain size for the sand and gravel fraction using the wet sieving method, for the mud fraction analyzed by the pipette method, the procedure by drying the sample in a cup containing wet samples dried in a 105 ° C oven (one day). Samples were weighed and then given 3-5% hydrogen peroxide solution to taste.

Calculations are based on the proportion of particle size content of gravel, sand, and silt. Surface sediments are classified according to Sheppard diagrams. The components are the percentage of gravel, sand, and silt that make up the sediment. Each sediment sample is plotted as a point within or along the sides of the diagram, depending on its grain size-specific composition.

Organic Matter Content

Analyzing the content of organic matter in sediments is done by the Loss on Ignition method[11]:

$$(\%)= \frac{a-c}{a-b}\ x\ 100\%$$

Description:

a = Weight of cup and sample after drying at 105^{o} C (g)
b = Weight of the cup (g)
c = Weight of cup and sample after combustion at 550^{o} C (g)

Data Analysis

Data were analyzed using statistical analysis. Data on sea cucumber abundance, species diversity index, species uniformity index, dominance index, and distribution pattern were collected and presented in the form of tables, figures, and graphs which were then discussed descriptively. To compare the abundance of sea cucumbers of the Holothuroidea class between stations was analyzed using the ANOVA test.

3. RESULT AND DISCUSSION

Overview of Research Location

Geographically, Niur Permai Village is an area located in Moro District, Karimun Regency, Riau Islands Province. Astronomically, the Moro District area is located between 0°40'51" to 0°54'45" North latitude and 103°37'17" to 103°58'43" East longitude. Astronomically, the land area of the islands of Moro Sub-district is located between 0°40'51" to 0°54'45" North latitude and 103°37'17" to 103°58'43" East longitude, the area of Niur Permai Village has a land area of 17.57 km^2. Geographically, Niur Permai Village is directly bordered by the North bordering Terong Island Village, the South bordering Rawa Jaya Village, the East bordering Keban Village, and the West bordering Sugie Village.

At the research location, researchers conducted research at 3 stations where station I is near the Niur Permai beach area or called Manik Island which is in the reef area, station II is in the waters of Jaga Island which is in the muddy sand area and station III is located on Dog Island in the coral and seagrass area. Many community activities are found at stations I and II where at station I, people walk along the beach to take things of economic value to the community where one of them is sea cucumbers, and at station II a point where people try to fish using boats and some people dive to find biota in the sea while at station III there has not been found much community activity.

The temperature at the research site ranged from 27-28 °C suitable for sea cucumber life. This temperature is a suitable temperature for sea cucumber life as stated by Masruroh[12] that a good temperature for sea cucumber life ranges from 26-31 °C.

Water Quality

The measured water environment parameters include temperature, salinity, pH, and dissolved oxygen. The results of quality measurements in the waters of Sugi Island, Niur Permai Village can be seen in Table 1.

Table 1. Average water quality in Moro District, Karimun, Riau Island

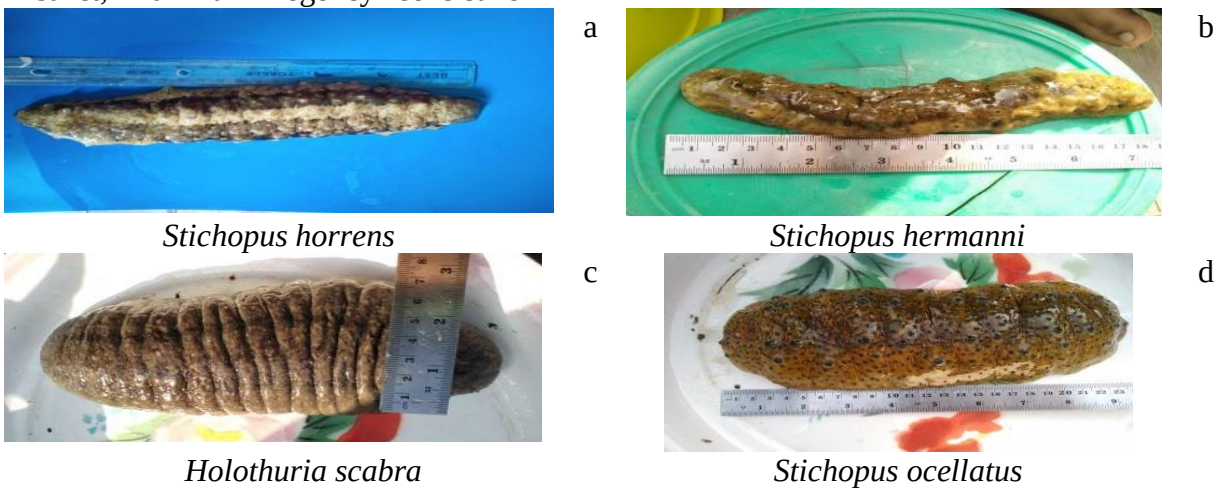
Parameters	Unit	St. I	St. II	St.III
Temperature	ºC	27	27	28
Salinity	$^{0}/_{00}$	29	28	28
pH	-	7	8	8
DO	mg/l	5,6	5,5	5,5

Water quality parameters show that each parameter obtained at each station is almost no big difference. The results of temperature measurements in these waters were obtained at 27-28^{0} C, with the pH of the waters ranging from 7 - 8. The salinity of the waters obtained ranged from 29 - 28 ppt. The highest DO measurement is at station III with 5.6 mg/l.

Type of Sea Cucumber

Based on the results of analyses and observations, 4 (four) types of sea cucumbers were obtained from the Stichopodidea and Holothuriidea families

with the genus Stichopus and Holothuria. Sea cucumber species found in the waters of Sugi Island, Niur Permai Village, Moro District, Karimun Regency consist of 4 (four) types, namely: *Stichopus horrens, S.ocellatus, S.hermanni,* and *Holothuria scabra* (Figure 2).



Stichopus horrens *Stichopus hermanni*

Holothuria scabra *Stichopus ocellatus*

Figure 2. Type of sea cucumber

Sea Cucumber Abundance

The highest abundance of sea cucumbers was found at station III while the lowest was at station II. The average abundance of sea cucumbers can be seen in Figure 3.

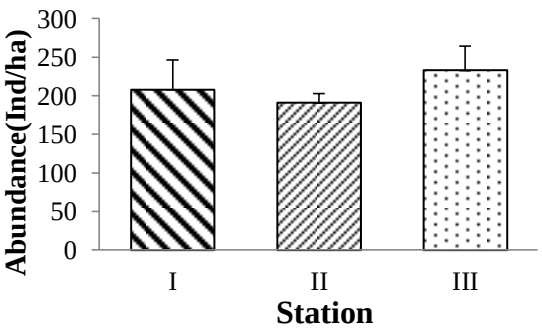


Figure 3. Mean abundance of sea cucumber

Figure 3, it can be seen that the results of the calculation of sea cucumber abundance values have varying values at each station. Where the highest density value is found at station III which is 900 ind/ha, while the lowest density value at station II is 766.66 Ind/ha. While the density between stations analyzed using a one-way ANOVA test obtained a significance value of 0.394 which indicates the density between stations is not significantly different. This indicates that the low abundance at station II occurred due to human activities that take sea cucumbers. Holothuroidea itself has economic value. So the exploitation activity (hunting) against this type tends to be high, and as a result, the population of both types of Holothuroidea is reduced. This is following the statement of Handayani et al.[13], Holothuroidea has a very important role both ecologically and economically, economically Holothuroidea class can be used as a source of food, medicine, and cosmetic ingredients.

Based on the research that has been done, researchers found that the abundance between stations is not significantly different. Both based on environmental conditions and substrate content at each station found similarities, but what distinguishes community activity where at stations I and II, community activity is high to reduce the abundance at stations I and II where it should be at stations I and II higher sea cucumber abundance than station III. Conditions like this are similar to research conducted by Handayani et al.[13] where it was found that sea cucumber catches were sold and also used as materials where this high activity resulted in low sea cucumber abundance. Research by Irawan & Andy[14] found that low abundance was due to the capture by the surrounding community for

sale considering sea cucumbers are one of the biotas that have high economic value. Research by Wati[15] found that community activity has a high effect on abundance.

Relative Density of Sea Cucumber Species

The relative abundance value (%) of sea cucumbers is known that the species of *Holothuria scabra* and *Stichopus hermanni* have the highest abundance value around 28%, while the lowest density value is in *S.ocellatus* around 20% (Figure 4).

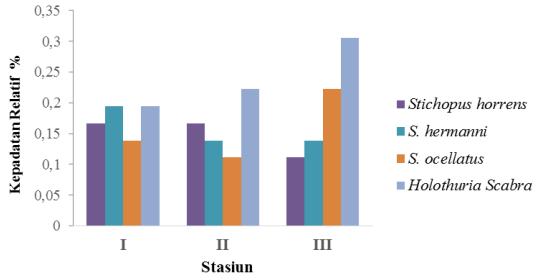


Figure 4. Relative abundance of sea cucumber species in the waters of Sugi Island, Niur Permai Village

Diversity Index (H'), Uniformity Index (E), and Dominance Index (C) of Sea Cucumber

Diversity index (H'), uniformity (E), and dominance (C) are index studies that are often used to determine the condition of the aquatic environment based on biological components can be seen in Table 2.

Table 2. Diversity Index (H'), diversity index (E), and dominance index (C) of sea cucumbers

Station	(H')	(E)	(C)
I	1,94	0,97	0,27
II	1,58	0,79	0,29
III	1,37	0,69	0,30

Based on the results of the calculation, the value of the diversity index (H') ranged from 1.37-1.94 with a uniformity index (E) ranging from 0.69-0.97, and a dominance index (C) ranging from 0.27-0.29.

The diversity index (H') can be interpreted as a systematic depiction that describes the structure of the community and can facilitate the process of analyzing information about the variety and number of organisms. In addition, the diversity and uniformity of biota in a body of water is highly dependent on the number of species in the community. The more species found, the greater the diversity, although this value is highly dependent on the number of individuals of each species[16].

Based on the research conducted, it was found that the level of sea cucumber diversity from station I to station III was only at a moderate level. The low level of Holothuroidea diversity is thought to be a result of the smaller number of species and the presence of individuals that are more numerous, resulting in an imbalance in the ecosystem. According to Muhtadi et al.[17], diversity includes two important things in the scope of diversity the number of species in a community and the abundance of each type. As a result, the smaller number of species and the variation in the number of individuals causes low diversity. In addition, this can also be caused by human activity. The presence of Holothuroidea becomes one of the livelihood targets of residents who work as fishermen. The opinion of Darsono[1], the main threat to Holothuroidea is the occurrence of overexploitation. Overfishing usually occurs in Holothuroidea economic value, the impact of excessive market demand resulting in overfishing on Holothuroidea economic value.

The uniformity index is the composition of each individual of a species in a community. The uniformity index is a good predictor of dominance in an area. If one or more species are more abundant than others, the uniformity index will be low. Mandela et al.[18] stated that if the uniformity index value exceeds 0.7, it indicates a high degree of community uniformity.

Based on the research conducted, it was found that the level of sea cucumber uniformity from station I to station III was

mostly at a high level. Uniformity which is classified into the high category indicates that the state of the water is in a condition that is still good for the survival of Holothuroidea. This is following the opinion of Wati[15] which states the uniformity index ranges from 0-1. If the uniformity index is less than 0.4 then the ecosystem is in a depressed condition and has low uniformity. High uniformity indicates that the difference between the numbers of species is more uniform and characterizes the waters in good condition.

Dominance is expressed as the species richness of a community and the balance of the number of individuals of each species. The dominance index is used to describe the mastery or dominance of certain species in a location[19]. The dominance index value provides an overview of the dominance of species in an ecological community that can explain a fish species more (dominant) during data collection. Based on the research conducted, it was found that the dominance level of sea cucumbers from station I to station III was mostly at a low level. A low dominance index value is considered good for the ecosystem (stable). Conversely, a high dominance index value can disrupt the ecosystem because there are species that dominate[14].

Distribution Pattern

Based on the value of the distribution pattern, the distribution pattern between research stations obtained the same results, namely the value of Id> 1, which means that the distribution pattern is clustered.

The calculation results obtained from the pattern that all sea cucumber species have a clustered distribution pattern. This clustering pattern supports the argument presented by Lagio et al.[20] that sea cucumbers are found to live in groups that aim to protect each other.

The distribution of each sea cucumber species obtained from the calculation of the distribution pattern index in each area can be seen in Table 3.

Table 3. Distribution pattern at each station

Stasiun	Transek					
	1		2		3	
	n	X^2	n	X^2	n	X^2
I	8	64	7	49	9	81
II	7	49	8	64	11	121
III	10	100	8	64	8	64
Σ	25	625	23	529	28	784
ΣX^2-N	138		108		182	
N(N-1)	600		506		756	
Id	2,760		2,561		2,889	

Most sea cucumbers have a clustered distribution pattern. According to Nirwana et al.[21], clustered distribution patterns are caused by the influence of certain environmental parameters so that sea cucumber species can adapt to these conditions. In addition, the clustered distribution pattern is caused by the presence of other animals as predators.

Based on research conducted by researchers, researchers found that sea cucumber species both at station I to station III were found to live in groups where researchers this is due to sea cucumber species found to have a match in existing environmental parameters such as substrate, temperature, acidity, dissolved oxygen and this is also a protection mechanism from predators around sea cucumbers where in the research area not only sea cucumbers are found but also other marine biota. This is following research by Matrutty et al.[22] where sea cucumber species do tend to form groups and are rarely found living alone.

Such conditions are also following research by Martoyo et al.[23]; Marcelien & Eoh[24], where the pattern of distribution is clustered due to self-protection from other animals that are predators so that sea cucumbers live in groups to protect each other. When referring to research conducted by Nirwana et al.[21]; Irawan & Andy[14], the clustered distribution pattern can be caused by the influence of certain environmental parameters so that sea cucumber species can adapt to these conditions.

4. CONCLUSION

Based on the results obtained during the research in the waters of Sugi Island, Niur Permai Village, it can be concluded that: 1) the type of sea cucumber obtained as a whole consists of 4 species and 2 families. 2) The highest abundance of sea cucumber species is *H.scabra.* 3) Diversity values were found to be medium diversity (H'), high uniformity (E), and low dominance (C). The overall distribution pattern of sea cucumbers of the Holothuroidea class is classified as clustered.

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