THE RELATIONSHIP OF AQUATIC PHYSICAL CHEMICAL FACTORS WITH THE DIVERSITY OF SECUUMS (Holothuroidea) IN THE BEACH OF PIA VILLAGE MALUKU DISTRICT

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ABSTRACT

This study aims to determine the relationship between the physical and chemical factors of the waters (Temperature, Salinity, pH, Dissolved Oxygen) and the diversity of sea cucumbers (holothuroidae) in the coastalwaters of Pia Hamlet. The method used is the Belt Transect method. Analysis of diversity data using the Shannon-Winner diversity index formula then to determine the functional relationship between sea cucumber diversity and physical and chemical factors of waters was carried out using simple linear regression and multiplelinear regression. The results showed that 1 class, 2 orders, 2 families, 3 genera with 5 species, namely *Holothuria atra, Holothuria leucopsilota, Holothuria scabra, Bohadschia argus* and *Synapta maculate*. The diversity index value is low with an average value of 0.7214. The temperature measurement results ranged from 28.04°C-30.16°C. Salinity measurement results ranged from 31.21-32.26 ‰. The results of pH measurements ranged from 6.80-7.41. Dissolved oxygen measurement results ranged from 5.96-6.40 mg/L. The results of simple regression analysis showed that dissolved oxygen had a relationship and had a significant effect on sea cucumber diversity. The results of multiple regression analysis explained that salinity and dissolvedoxygen, if tested together, had a strong relationship and had a significant effect on sea cucumber diversity.

Keywords: *sea cucumbers, diversity*

INTRODUCTION

The sea is a habitat for various kinds of aquatic organisms. The sea has enormous potential as a provider of food sources for humans. The Maluku Sea is one of the waters that has a high diversity of marine biota, so the Maluku Sea also has the potential to provide food for humans. Marine resources that are commonly used bythe people of Maluku are marine biota that live in tidal areas (intertidal zones). such as fish, shrimp, lobster, seacucumbers and clams (Rumahlatu et al, 2008). Sea cucumbers belong to the phylum Echinodermata of the class Holothuroidae. Sea cucumbers live inthe intertidal zone to a depth of 40 meters, prefer sandy substrates and are associated with coral reef and seagrass ecosystems (Satria et al, 2014). Sea cucumbers have a role both ecologically and economically in marine ecosystems.Ecologically, sea cucumbers act as deposit feeders so that they can process the substrate they occupy. Apart from that, sea cucumbers also function as a balancer in the food chain by providing food in the form of eggs, larvae and juvenile sea cucumbers for the predatory marine biota around them. The general predators for sea cucumbers are large starfish, crabs and the *Tonna perdix* group of gastropods (Satria et al, 2014). Economically, sea cucumbersact as food ingredients that have high economic value because they contain very high nutrients. Under dry conditions, sea cucumbers contain 82% protein, 1.7% fat, 8.9% water content, 8.6% ash content and 4.8% carbohydrates (Martoyo, 1994). In Maluku waters, sea cucumbers are

found in almost all coastal waters and are spread in almost every island, such as Buntal Island, Saparua Island, Saparua Island, East Seram Islands, Kei Kecil Islands, Banda Islands, Buru Islands, Aru and Tanimbar (Lewerissa, 2009). Pia Hamlet is part of Siri Village Sori Amalatu on Saparua Island, Central Maluku Regency, has wide enough waters, so it can become a habitat for many marine biota including sea cucumbers.

Changes in physical-chemical environmental factors such as temperature, salinity, pH and organic matter content in waters can affect the diversity of sea cucumbers, because sea cucumbers have different adaptation abilities to their environment, causing differences in the way of life and distribution of sea cucumbers (Soemadiharjo, 1993). The condition of the coastal waters of Pia hamlet is quite apprehensive because most of the sea cucumber habitat has been damaged. One of the causes is the activity of residents around the coast. In addition, the population of sea cucumbers around Pia sub-village has decreased due to excessive consumption without any cultivation efforts, and this affects the abundance and diversity of sea cucumbers. Information about the diversity of sea cucumber species and their relationship with the physical and chemical factors in the hamlet of Pia is still not known with certainty, so this research was conducted to determine the diversity of sea cucumbers in the coastal waters of the hamlet of Pia and its relationship with the physical and chemical factors of the waters which include: temperature, salinity, pH, and Dissolved Oxygen.

METHOD
This research is an ecological research with a correlational descriptive research type. The population in this study were all types of sea cucumbers found in the coastal waters of Dusun Pia. The sample is all types of sea cucumbers found in each plot installed in the tidal area of the beach of Pia Hamlet.

Materials
The equipment used in this study was a transect square measuring 10 m x 10 m, tape measure, nylon rope, refractometer, pH meter, mercury thermometer, DO meter, GPS (Global Position System), stationery, camera, and books to identify sea cucumbers refers to Susetiono's references in 2004. The materials used in this study were distilled water, plastic bags, 10% formalin, label paper and tissue.

Procedures
Data collection was carried out by means of direct observation and recording of all research variables in each plot. Data collection was carried out through several stages, as follows: 1) collecting information about the general conditions of the research location, determining the research method and preparing the tools and materials used during the research, 2) making transect lines where in this study 14 transect lines were made with the method The transect belt for each transect is placed in plots measuring 10 m x 10 m which are placed perpendicularly from the shoreline to the edge of the bank, the distance between transects is 150 m, and the number of plots corresponds to the length of the intertidal area, with a total of 108 plots in this study.

Data analysis
Sample identification was carried out at the FMIPA Unpatti Ecology Laboratory by referring to Susetiono's 2004. Physical chemical factors of waters were measured 4 times per week for 1 month. The parameters measured are temperature, salinity, pH and DO (dissolved oxygen). Species diversity of sea cucumbers was analyzed descriptively using the Shanon-Wienner diversity index formula as follows (Ludwig, 1998):

$H' = - \sum Pi \ln Pi$

Where

$Pi = ni/N$

To determine the relationship between the physical and chemical factors of the waters (temperature, salinity, pH, DO) and the diversity of sea cucumbers on the coast of Dusun Pia, it was analyzed using multiple linear regression analysis at a test level of 0.05%.

DISCUSSION RESULT
The physical and chemical conditions of the beach environment of Pia Hamlet are as follows; 1) The results of temperature measurements in the coastal waters of Pia hamlet can be seen in Table 1, which shows the temperature range at the study site ranges from 28.04°C – 30.16°C. The temperature range is still good for the life of sea cucumbers, and it can be seen that the temperature tends to increase, this is influenced by sufficient sunlight penetration. 2) The results of salinity measurements at the study sites ranged from 31.21-32.26 ‰. Salinity in the coastal waters of Pia Hamlet is classified as beach water and mixed water, because it is in the range of ÿ 32‰. According to reference (Sukamwati et al, 2012), this salinity range is still good for sea cucumbers. Salinity on the beach of Pia hamlet is influenced by the location of the beach directly opposite Seram Island so that fluctuations in salinity from oceanic waters tend to occur minimally in the coastal waters of Pia hamlet. 3) The results of pH measurements at the research location can be seen in

Table 2. The pH in the coastal waters of Pia hamlet ranges from 6.8 to 7.41. This pH range is still good for the life of sea cucumbers. The pH range in the sea is small, because the sea is a good buffer against acidic and alkaline conditions. Water conditions that are very alkaline will interfere with the respiration of aquatic organisms, while water conditions that are very acidic will cause the mobility of various heavy metal compounds, especially aluminum ions (Hutauruk, 2009). 4) The results of DO or dissolved oxygen measurements ranged from 5.96-6.40 mg/L. Reference (Gultom, 2004) explains that dissolved oxygen which is good for the life of sea cucumbers is more than 3 ppm. The high dissolvedoxygen at the study site was caused by rainfall during the study and the photosynthesis process of aquatic plants.

Table 1. Results of Measurement of Physical and Chemical Factors in the Waters

Transect	Tempratur (^{0}C)	Salinity (‰)	pH	DO Mg/L
1	28,04	31,42	7.41	6,40
2	28,49	31,24	7.20	6,20
3	29,49	31,54	7.39	6,25
4	30,13	31,27	7.25	6,18
5	29,07	32,21	7.30	6,17
6	30,13	32,26	7.18	6,21
7	29,07	32,01	7.18	6.08
8	29,46	31,62	7.06	6.07
9	29,07	31,88	7.18	6.06
10	29,46	31,33	6.80	6,22
11	29,07	31,27	7.21	6,18
12	30,16	31,87	7.21	5.96
13	30,15	31,26	6.89	6,23
14	29,62	31,56	7.22	6,24

From the results of this study, 5 species of sea cucumbers were found in Pia hamlet beach which can be seen in Table 2. The results of the analysis of the diversity index of sea cucumbers in Pia hamlet beach waters were 0.7214.According to (Odum, 1971), if the diversity index is zero then the community consists of a single species (some species dominate). The diversity value will be close to the maximum if the species are evenly distributed. So it can be said that the value of diversity in the waters of Pia Hamlet is low. The diversity index value in Pia hamlet is low because only a few species of sea cucumbers are found on the beach of Pia hamlet, and the type *Holothuria atra* dominates the coastal waters of Pia hamlet.

Table 2. Types of Sea Cucumbers Found at Dusun Pia Beach

Ordo	Family	Genus	Spesies	∑ Ind
Aspidohirotida	Holothuriidae	Holothuria	Holothuria Atra	582
			Holothuria leucospilota	155
Apodida	Synaptidae	Bohadschia	Holothuria scabra	8
		Synapta	Bohadschia argus	7
			Synapta maculata	19
			Total	771

Correlation between Physical and Chemical Factors in Aquatic Sea Cucumber Diversity.
The results showed that DO or dissolved oxygen made the most effective contribution to the diversity of sea cucumbers (Table 4). However, the Anava results show that if the chemical physical parameters are tested together,there is no linear relationship between the physical and chemical factors of the waters and the diversity of sea cucumbers (Table 3). There is no significant relationship between the physical and chemical factors of the waters (temperature, salinity, pH, DO) together with the diversity of sea cucumbers because the conditions of the physical and chemical factors of the waters tend to be the same. This condition is due to the fact that the beach of Pia hamletis directly opposite Seram Island, so it is possible that fluctuations in the physical and chemical factors of the waters rarely occur.

Table 3. Anava summary of the relationship between the diversity of sea cucumbers and the physical and chemical factors of the waters

Parameter	R	R2	F signf (p)
Temperature, Salinity , pH, DO	0.7034	0.2703	0.1493
Temperature & DO	0.6748	0.3569	0.0353
Salinity & DO pH	0.6628	0.3375	0.0414
& DO	0.5734	0.20684	0.1111

Meanwhile, if the pH is tested together with dissolved oxygen, there is no linear relationship between pH and dissolved oxygen with the diversity of sea cucumbers. This is in accordance with reference (Sukmiwati et al, 2012), which states that when a decrease in temperature occurs due to reduced sun intensity, the process of photosynthesis decreases and CO_2 gas increases so that the pH of the waters becomes acidic. On the contrary. Salinity and temperature, when tested together with dissolved oxygen, the results show that there is a linear relationship between salinity and Do and the diversity of sea cucumbers, as well as temperature and DO with the diversity of sea cucumbers. According to (Wijayanti, 2007), the solubility of oxygen can decrease due to increasing water temperature and salinity.

Table 4. Results of the Analysis of the Effective Contribution of each Independent Variable (Temperature, Salinity, pH, DO) to dependent variable (Sea Cucumber Diversity Index)

Parameter	Temperature (%)	Salinity (%)	pH (%)	DO (%)	Total (%)
Sea Cucumber Diversity	18	6	7	38	69

Reference (Ludwig, 1988) states that in general, the relationship between two species occurs because both species choose or avoid the same habitat. Both species generally have the same biotic and abiotic needs and one or both species have something in common with each other, either in the form of attraction or repulsion. Reference (Soegianto, 1994) adds that there are a number of biotic and abiotic factors that influence the relationship between species in a community.

CONCLUSION

Based on the results of the study, it can be concluded that the physical and chemical conditions of the waters of Dusun Pia Beach are still in a good range for the life of sea cucumbers. Five types of sea cucumbers were found in the coastal waters of Pia Hamlet: *Holothuria atra, Holothuria leucospilota, Holothuria scabra, Bohadschia argus* and *Synapta maculata*. The diversity index value of sea cucumbers is low, namely 0.7214. The regression results show that temperature, salinity and pH have a weak relationship to sea cucumber diversity, while DO has a strong relationship to sea cucumber diversity. If the four parameters tested together do not have a significant relationship, but if temperature and salinity are tested together with DO, then there is a significant relationship with the diversity of sea cucumbers.

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