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Abudance Of Sea Cucumber (*Holothuroidea*) in Seagrass Density In The Waters Of The Coast of Mertasari, Subdistrict Of Denpasar, Bali

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ABSTRACT

This research did at Mertasari Beach, West Sanur Village, South Denpasar Region, Bali in august 2018. The purpose of this research is to know about abudance and kin of sea cucumber species more over analisys relation between sea cucumber and lush of seagrass at different place in Mertasari Beach. The method that used for this research is survey method with 1m x 1m kuadrate transect tools with 3 times survey repeated, and the result found 3 kind of seagrass species, *Thalassia hemprichii*, *Enhalus acoroides*, and *Cymodocea rotundata* with highest lushness is *Enhalus acoroides* 93,77 stands/m^2. Sea cucumber that found is 82 individuals from *Holothuria atra* and *Synapta maculata* species with each persentage 100% species *synapta maculata* in station 1. *Holoturia atra* with 3,1% in station 2, and *Synapta maculata* species 93,5%. Average of uniformity is 0,15 low category, and dominance 0,94 with high category. The analisys of the highest organic substance is in station 3 with 11,94% with medium and substrate sand type. Value of correlation between sea cucumber and lussnes of seagrass that has value r = 0,94, therefore correlation between sea cucumber abundance and seagrass density in Mertasari beach in strong category.

Keywords : Mertasari Beach, seagrass, sea cucumber, abundance, community structure, correlation

1. INTRODUCTION

Sea cucumbers one of the species which is part of Fillum Echinodermata from *Holothuroidea* class. This species is important part of food chain as deposit feeder and suspension feeder. From sea cucumber ecology with the function helping organic decompotition process which is in sedimentation and lease nutrition into chain food (Darsono 2003).

Sea cucumber founded in above of lowest tide evironment, topography, and dryness level from coral on the location is big affected rom sea cucumber distribution on that location. Evironment based on sands reef with seagrass is place for sea cucumber. Several types of sea cucumber which is live in boulders area and arround live coral (Darsono 2007).

Abudance of seagrass vegetation has big relation with teripang because condition on that region will protect seagrass rom wave slamming. More over seagrass vegetation builded evironment of sea cucumber rich with detritus, plankton, protozoa which is main source food for sea cucumber. That the condition of them are favorite food of sea cucumber (Nurlukman 2012). Therefore, this research purpose is knowing abudance and any kind o species of sea cucumber on the water of Mertasari beach and relation between abudance of sea cucumber with lussnes level of different seagrass.

2. METHODS

This research held on August 2018 in water on Mertasari Beach, Sanur Kauh Village of South Denpasar region Bali. In coordinate station 1: 115.819265^{o} BT, 8.424685^{o} LS, station 2: 115.151058^{o} BT, 8.424647^{o} LS, and station 3: 115.151989^{o} BT, 8.424398^{o} LS. This research held with survey method which is cover by measure with physic and chemistry water parameter (pH, deep, salinity, dissolved oxygen, temperature). Held with in situ method as much three time repeater and the highest sediment properties analysis processes again by Kummod sotfware. The measure containt of organic substance in substrate did with Lost of Ignition Method.

Collecting sample held in seagrass vegetation while the lowest tide using quadratic transect from every station consist of 3 transec with 5 meters (Figure 1). Every transect consist of 10 plot using quadrat transect. That the size 1m x 1m which is divided into nine part. Based on nine part transect 5 of them are in observation there is in every corner (4 pieces) and one in center (Figure 2). In every part of observation counted amount and kind of seagrass for knowing density level.

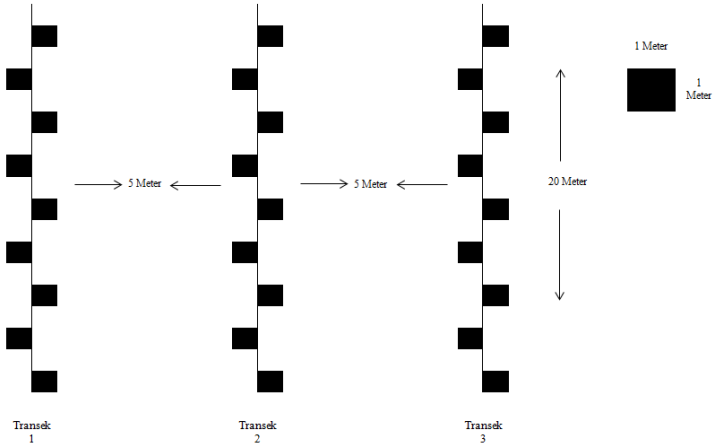

Figure 1. Observation Transect

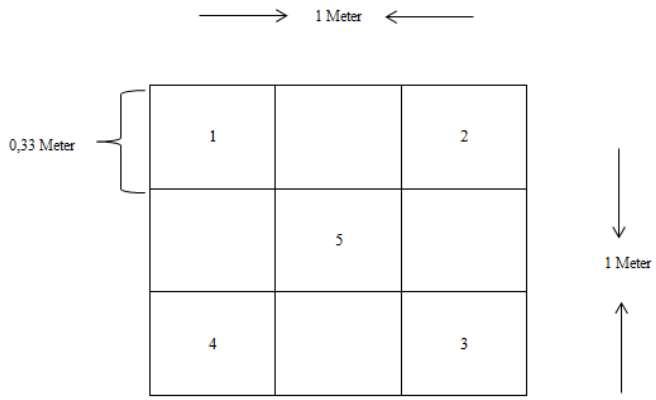

Figure 2. Transect for observation density of seagrass

Seagrass sample which is in kuadrate transect that identification using Seagrass Monitoring Guide books from Rahmawati 2014. Value of density species counter using formula (Bengen 2000) :

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

Explanation :
Di : Amount of individuals divided by unit area
Ni : Amount of individuals in a quadratic transect
A : Area of quadratic transects (m^2)

Collecting sea cucumber data held after count and nothed total seagrass individual finished. From every plot (transect kuadrate) find sea cucumber with free collection method which is collect all species of sea cucumber then identification of species with noted amount of sea cucumber. Sea cucumber then identification using General Guidelines for the Identification and Monitoring of Sea Cucumber Guide Books (Directorate of Marine Biodiversity Concervation and Diversity 2015). Abudance of sea cucumber using formula (Odum 1994):

$$K = \frac{\text{Amount of individual species}}{\boldsymbol{Area\ of\ observation}}$$

Index of uniformity species count with formula (Odum 1971):

$$E = \frac{H'}{H'\,maks}$$

Explanation :
E : H' maks : ln S

S : Total of species

With criteria :

E < 0,4 = Low population uniformity

0,4 < E < 0,6 = Moderate population uniformity

E > 0,6 = High population uniformity

Index of dominance count with Simpson formula (Magurran 1987 in Yuniarti 2012):

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

Explanation : C = Dominance index

ni = Total of species

N = Total of individual

0< C < 0.5 = Nothing dominates

0.5 < C < 1= There are types that dominate

C = 0 = No species dominate other species or cummunity structures in a stable condition.

Pearson correlation analysis is used to determine the relationship between two variables expressed by the correlation coefficient. The analysis was carried out using Pearson correlation analysis formula (Sarwono 2006).

$$rxy = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{n(\sum X^2 - (\sum X)^2)(\sum Y^2 - (\sum Y)^2)}}$$

Explanation :

r = Correlation coefficient between variables x with y

X = Seagraas density

Y = Sea cucumber abudance

N = Amount of data

C = 1 =That dominate other species or unstable community structures

The criteria used to facilitate the interpretation of the strength of the relationship between the two variables are as follows (Sugiyono 2007):

0,00 – 0,19 = Very low relation
0,20 – 0,39 = Low relation
0,40 – 0,59 = Moderate relation
0,60 – 0,79 = Strong relation
0,80 – 1,00 = Very strong relation

3. RESULTS AND DISCUSSION

3.1 Physical and Chemical Parameters

Based on the results of the study obtained values of physical and chemical parameters as follows:

Table 1. Physical and Chemical Parameters

Number	Parameter	* Quality standard value	Station		
			1	2	3
1	Temperature (^oC)	28-29	29 - 30	28 – 30	28 - 29
2	Depth (cm)	-	20 - 35	20 - 40	30 - 43
3	Salinity (ppt)	33 – 34	31 - 32	31 - 33	32 - 33
4	pH	7,0 -8,5	7,5 – 8,2	7,5 – 8,1	7,5 – 8,3
5	Dissolved Oxygen (mg/l)	>5	5,6 – 6,1	5,9 – 6,5	6,3- 6,7
6	Total Organic Substance (%)	-	7,72	9,92	11,94

Explanation * : The value of the standard quality of sea water for seagrass biota Ministry of Environment of evirontment number 51of 2004.

1. Temperature

The results of direct measurements in the field got temperature data at the three stations ranging from 28-30^{o}C. The lowest temperature got at station 3 is 28-29^{o}C, while the highest temperature is at station 1 which is 29-30^{o}C (Table 1).

Based on the measurement results, the temperature range is still within the optimal tolerance for sea cucumbers and seagrass. The water temperature at station 1 and station 2 is higher than the criteria of the Kepmen LH 2004 quality standard, while at station 3 the temperature value is in accordance with the Kepmen LH 2004 quality standard which states that the ideal temperature for seagrass growth is around 28-29^{o}C, and according to Martoyo et al. (2006) the ideal temperature range for sea cucumber growth and development is between 24-30^{o}C.

2. Depth

The depth range at the study site ranges from 20 to 43cm. The highest depth is at station 3, which is 43cm, which is dominated by the seagrass species Enhalus accoroides. The depth got in this study is the ideal depth for sea grasses in the optimal photosynthesis process supported by shallow waters with sufficient light penetration. At this station, sea grasses flourish and the number of sea cucumbers are found more. Sea cucumbers always occupy areas that are inundated with sand, but will move if the waters experience drought during low tide to areas that are still inundated, especially to the growth of algae and seagrass (Aziz 1981).

3. Salinity

Salinity values got at the three observation stations ranged from 31 to 33 ppt (Table 1). The ability of seagrass to tolerate salinity varies, the optimum salinity value for seagrass is 35 ppt, but seagrass has a salinity tolerance of 10-40 ppt (Dahuri 2013). Whereas sea cucumbers like waters with 26-33 ppt salinity with optimum salinity around 32,0-35,0 ppt (Kordi 2010). Based on the data got, the salinity value is still within the normal limits of seagrass and sea cucumbers to grow.

4. pH (Power of Hydrogen)

pH in coastal waters with seagrass biota according to the Minister of Environment Number 51 of 2004 has a standard value of 7-8,5. The pH value at each station has almost the same value, which is between 7,5-8,3. This value is still relatively suitable for seagrass and sea cucumber habitats.

5. Dissolved Oxygen (DO)

Dissolved Oxygen values at the three observation stations ranged from 5,6 to 6,7 mg/L. The highest Dissolved Oxygen value is at station 3 with values ranging from 6,3-6,7 mg/L, then station 2 with values ranging from 5,9-6,5 mg/L, and station 1 with values ranging from 5,6-6,1 mg / L. According to the Minister of Environment Decree No. 51 of 2004, DO waters are optimal for seagrass survival is over 5 mg/L. This means that the three observation stations are classified under ideal conditions for the growth and development of seagrass.

6. Total Organic Substance

The results of the analysis of organic material content can be seen in the following table 2.

Table 2. Value of Total Organic Substance in Sediments

Number	Location	Total Organic Substance	
		(%)	Criteria
1	Station 1	7,72	Medium
2	Station 2	9,92	Medium
3	Station 3	11,94	Medium

As Reynold (1971) explained, the criteria for organic substance in sediments are very high: > 35, high: 17-35, moderate: 7-17, low: 3,5-7, and very low <3,5. Based on these criteria, the content of organic substance found in the seagrass area at the observation station is classified as a moderate with a value of 7,72% to 11,94%. The low organic substance at station 1 is because the gravel sand substrate at this station cannot bind the organic substance properly. According to Efriyeldi (1997) sediments that have relatively larger particles contain less organic substances. But the sediment in small particles contains more organic substance. This statement is reinforced by the opinion of Sanusi and Putranto (2009) which states that the texture of sediments can affect the amount of organic content that settles. Thus the finer the texture of sediment in seagrass ecosystems, the amount of an organic substance that settles more and more.

3.2 Substrate

Based on the analysis of sediment grain size, the following substrate types are obtained:

Tabel 3. Substrate Type

Number	Location	Substrate
1	Station 1	Gravel sand
2	Station 2	Sand slightly gravel
3	Station 3	Sand

If the composition of the substrate is associated with the abundance of sea cucumbers in each station, then sea cucumbers are more often found in the sand substrate. At station 1 which has a gravel sand substrate found only 4 individual sea cucumbers of the *Synapta maculata* type. In contrast to Station 2 and Station 3, wherein each station there are 2 types of sea cucumbers, namely *Synapta maculata and Holothuria atra*. This identifies that most of

the sea cucumbers like fiber substrate like sand, because in this sea cucumber it is easier to get its food source. Sand has a capacity to keep nutrients and water that is not very good but good infiltration and aeration (Nybakken 1992). Based on observations of the number of sea cucumbers that live in the sand substrate, shows that this substrate is good in correlating with the circulation of water that regulates humidity also supplies oxygen and nutrients.

3.3 Seagrass Density

The results of data collection on seagrass density at three stations found three species namely *Thalassia hemprichii*, *Cymodocea rotundata*, and *Enhalus acoroides*.

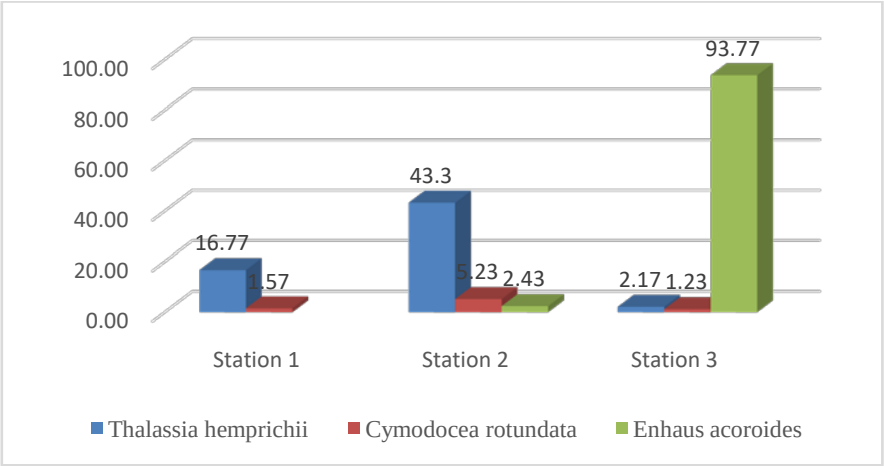

Figure 3. Chart of Seagrass Individual Density of Each Type

Based on Figure 3, the highest density value at station 3 is *Enhalus acoroides* which is 93,77 ind/m^2. The high seagrass density at station 3 is in accordance with Arthana's (2004) statement which states that the species commonly found on the Sanur beach is *Enhalus acoroides* and this species has a high tolerance for developing on the Sanur beach. This type of seagrass *Enhalus acoroides* has thicker, wider, and longer leaves, so it has a larger photosynthetic space for each individual. *Thalassia hemprichii* was found at three stations with the highest density of 43,3 ind/m^2 at station 2. While *Cymodocea rotundata* types were found in all three stations, but with a small number, that is at station 1 as much as 1,57 ind/m^2, station 2 as much as 5,23 ind/m^2, and station 3 as much as 1,23 ind/m^2. Dahuri et al. (1996) in Arthana (2004) states that the distribution of seagrasses depends on several factors, namely (with depth <10m), temperature (28-30^{o}C), salinity (10-40 ppt), substrate (40% of coarse and fine silt deposits)), and current speed (around 0,5 m/s). Soft and white sands mixed with dead coral fraction, this type of substrate is a strong indicator of the location of

the seagrass *Thalassia hemprichii* and *Cymodocea rotundanta* species. This type of substrate also helps establish strong roots for seagrass *Thalassia hemprichii* and *Cymodocea rotundata*.

3.4 Sea Cucumber Abudance

The result rom three station that found two kinds of sea cucumber *Synata maculata* and *Holothuria atra,* which is from two kinds different that is *Holothuria* and *Synapta*. The data below are abudance sea cucumber in every research station.

Table 4. Sea Cucumber Abundance at Each Station

Station	Individual	Sea Cucumber Abundance (ind/m^2)	
		Synata maculata	***Holothuria atra***
1	4	0,13	
2	32	1,03	0,03
3	46	1,43	0,1

Sea cucumber abundance at station 1 is 0,13 ind/m^2 with the total number of individuals found is 4 individuals obtained from the *Synapta maculata* species (Table 4). At station 2 species found were *Holothuria atra* as much as 0,03 ind/m^2, and *Synapta maculata* as much as 1,03 ind/m^2. At station 3, *Holothuria atra* species were found at 1,4 ind/m^2 and *Synapta maculata* species at 0,1 ind/m^2.

The number of species of sea cucumber Synapta maculata found on the coast of Mertasari is because of the type of sea cucumbers, including non-economic species and the public also knows that these species are including sea cucumbers. The high abundance of sea cucumbers at Station III, allegedly because of water physical chemistry factors such as DO, temperature, pH, salinity, brightness, type of substrate, and the content of organic matter in sediments that are still stable so it can support the existence of sea cucumbers.

3.5 Index of Uniformity and Dominance of Sea Cucumber Species

Table 5. Uniformity and Dominance Index of Sea Cucumbers

Station	Uniornity	Dominance
1	0	1
2	0,11	0,94
3	0,35	0,88

The highest uniformity index was found at station 3 with a value of 0,35 and the lowest uniformity index value was found at station 1 which was 0. Based on the category of uniformity this value was classified as low and indicated the unity of community unity. A stable community shows that the ecosystem has a high diversity, there is no dominant species, and the number of individuals is evenly distributed.

The highest dominance index value is found in station 1 with a value of 1 based on the category of dominance index which is high, which means there are species that dominate other species so that the community structure is unstable and there is no uniformity of species at the station. While the lowest dominance index value is found at station 3 with a value of 0.88, this value indicates the dominating type of pillar.

3.6 Relationship of Sea Cucumber Abundance with Seagrass Density

The results of the analysis of the density of Seagrass data with an abundance of sea cucumbers get a correlation coefficient (r) of 0,94. This value is close to 1 which means that statistically shows that there is a relationship between seagrass density different from the abundance of sea cucumbers in the waters of the Mertasari coast included in the very strong category.

At station 1 the density value of seagrass *Thalassia Hemprichii* was 16,77 ind/m^2 and seagrass *Cymodocea rotundata* was 1,57 ind/m^2 with the least amount of sea cucumbers, different from station 3 with the level of seagrass density of *Thalassia Hemprichii* of 2,17 ind/m^2, seagrass *Cymodocea rotundata* at 1,23 ind/m^2, and *Enhalus acoroides* at 93,77 ind/m^2 found sea cucumbers with higher numbers and species.

The condition is estimated because the habitat at station 3 is preferred by sea cucumbers. At station 3 it has a high density of seagrass and is covered by a species of seagrass *Enhalus acoroides* which morphologically have wide and long leaf shapes that protect sea cucumbers from excessive light intensity or from predators. According to Martoyo et al. (2006) the more lush seagrass conditions will be more fertile waters, the abundance of microorganisms such as plankton, detritus, bacteria, foraminifera, and others will be higher where they are the main food for sea cucumbers besides seagrass pieces / litter content and organic substances in the mud or sand (substrate).

4. CONCLUSION

The results of the study showed that seagrass found in Mertasari beach comprised 3 types namely *Thalassia hemrichii, Enhalus acoroides, and Cymodocea rotundata* with the type of seagrass that dominated, *Enhalus acoroides*. Whereas the sea cucumber that was found consisted of 2 types namely *Holothuria atra and Synapta maculata*. With the highest abundance of sea cucumber species found at station 3 with the dominant species were 43 individuals *Synapta maculata*. The correlation between seagrass density with sea cucumber abundance is very strong, thus the higher the density of seagrass, the higher the abundance of sea cucumbers on the coast of Mertasari.

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