International Journal Of Health Medicine and Current Research
E - ISSN : 2528 - 3189
P - ISSN : 2528 - 4398

International Journal of Health Medicine and Current Research
Vol. 3, Issue 03, pp.1039-1043, September, 2018

DOI:
10.22301/IJHMCR.2528-3189.1039

Article can be accessed online on:
http://www.ijhmcr.com

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF HEALTH MEDICINE AND CURRENT RESEARCH

HOLOTHUROIDEA ASSOCIATION WITH SEAGRASS IN AMETH COASTAL WATERS, NUSALAUT, CENTRAL MOLUCCAS

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ARTICLE INFO

Article History:
Received 27th July, 2018
Received in revised form
05th Agustus, 2018
Accepted 06th September, 2018
Published online 30th September, 2018

Key words:
Holothuroidea, Seagrass, Association, Nusalaut.

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ABSTRACT

The research is aimed at determining the association of the Holothuroidea with Seagrass in Ameth Coastal Waters, Nusalaut, Central Moluccas. The placement of the transect line was based on the presence of Seagrass beds in the coastal waters. Holothuroidea and seagrass sampling were performed on the same transect, using the quadrant transect with plots in the size of 1x1 m. There were three Holothuroidea species; *Holothuria atra, Holothuria leuscopilota*, and *Synapta maculata* found from each plot of scattered observation. Meanwhile, there were 7 species of seagrass were found namely *Cymodocea rotundata, Halodule pinifolia, Halodule uninervis, Syringodium isoetifolium, Enhalus acoroides, Halophila ovalis,* and *Thalassia hemprichii*. The result shows that all species of Holothuroidea were associated with all species of Seagrass. Type of associations between Holothuroidea and Seagrass were positive and negative.

Citation: Deli Wakano[1*], Dece Elisabeth Sahertian[2], 2018 "Holothuroidea Association With Seagrass In Ameth Coastal Waters, Nusalaut, Central Moluccas", *International Journal of Health Medicine and Current Research*, 3, (03), 1039-1043.

INTRODUCTION

Indonesia is the largest archipelagic country in the world with a total of 17,508 islands. Its coastline is 81,000 km while its sea area is 5,8 million km (75% of its total territory). Indonesia lies along the equator and supports a high level of biodiversity one of them is Seagrasses [1].

Seagrass beds are marine flowering plants, have leaves, produce seeds and grow by rhizome extension. They are found in mud bottoms, and shallow sandy clear seawaters [2]. Seagrasses provide shelter to an incredibly diverse

community of invertebrate animals, one of them is Echinoderms. Echinoderms are found in many different habitat; reef flat zone, algae growth area, Seagrass beds, live and dead coral reef especially from Holothuroidea class.

Some ecological studies conducted by Hartati (2002); Yusron and Susetiono (2006), reported the presence of Holothuroidea as the inhabitant of Seagrass beds which has important ecological function particularly the *Synapta maculata* species from ordo apodida as it help to recycle nutrients, breaking down detritus and other organic matter after which bacteria can continue the degradation process which can become food source for some other types of Holothuroidea [3].

Ameth Village in Nusalaut, Central Moluccas has the potential for various sea biodiversity especially Seagrass ecosystem. Visually, the location possesses abundant and diverse Seagrass vegetation.

Seagrasses ecological functions are as primary producers, recycling nutrients, stabilizing the sea bottom and providing food and habitat for other marine organisms including Holothuroidea. They help protect Holothuroidea bodies from sunlight and predators. Holothuroidea is an important element in Seagrass ecosystem either in biomass or its role in energy flow, by producing nutrients in food chain enables Holothuroidea to coexist and associate with Seagrasses [4].

Researches on species association are quite limited and existing ones only focus on community in general such as community structures, composition and biodiversity. Thus, the researchers have the need for conducting research on species association to provide more information on Holothuroidea which association with Seagrass which is quite limited at the moment due to the lack of previous research on the subject.

The aim of the research is to find out Holothuroidea association with Seagrass in Ameth Coastal Water, Nusalaut, Central Moluccas.

METHOD AND PROCEDURE

The research takes place in Ameth Village Coastal Water, Nusalaut, Central Moluccas by using 10% of the total seagrass area as the sample of the research (32, 024 m^2). Materials used in the research are alcohol 10%, label paper, tissue, plastic bag and rubber band.

The sample area is divided into three stations. The stations are 10,674 m^2 in length and the distance between two stations is 100 m. Each station comprises of 6 transects and the distance between two transects is 50 m. The Transects are 50 m in length. The Transects are placed perpendicular to the coastline starting from the highest to the lowest tide.

Seagrasses observation is conducted within similar plot to that of Holothuroidea in each transect. It is done by taking both Seagrasses and Holothuroidea then putting them in a plastic bag. The samples are to be preserved using alcohol 10% for further species identification. Seagrasses and Holothuroidea samples identification is conducted at Biology Laboratorium in UPT Balai Konservasi Biota Laut Ambon. Seagrasses identification is based on [5] whereas Holothuroidea based on [6]. Besides, environment parameter is also measured which includes temperature, salinity, pH, and soluble oxygen.

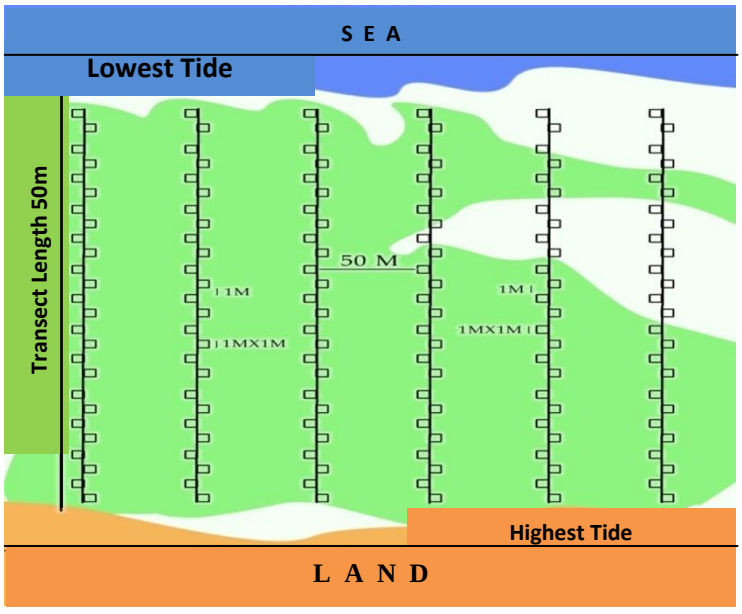

Figure 1. Transects and Plots for Sampling Purpose

DATA ANALYSIS

The collected data is analysed by using correlation table (2x2) as suggested by Soegianto (1994); Mueller-Dombois and Ellenberg (1974) in [7] or also known as Contingency Table as shown below:

Table 1. Contingency Table

Species A	Species B		Total
	Presence	Absence	
Presence	A	b	a + b
Absence	C	d	c + d
Total	a + c	b + d	N = a + b + c + d

Notes :

Species A = Seagrass species
Species B = Holothuroidea species
a = Total plot with both species presence
b = Total plot with species A
c = Total plot with species B
d = Total plot with both species absence
N = Total observation plot

Furthermore, in order to find out whether there is association or not, chisquare formula below is used:

$$X^2 \frac{N(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)}$$

If X^2 statistic/calculated value is compared to X^2 table critical value with degrees of freedom (df)=1, with α = 0,05 then X^2 table critical value = 3,84. If X^2 calculated value $\geq$ table critical value, then there is association, and if X^2 calculated value $\leq X^2$ table then there is not any association. Stated that to find out the type of association, the following formula is used [8,9] :

$$E(a) = \frac{(a+b) \times (a+c)}{N}$$

If a > E(a), then the type of association is positive which means that both species are more likely to share the same habitat rather than solitary and the opposite is true if the value of a< E(a), the type of association is negative which means that both species are more likely not to share the same habit or solitary [8].

RESULT AND DISCUSSION

Based on the calculation correlation by using contingency table and chi-square test, the association between Seagrass and Holothuroidea can be seen as follow:

Table 2. Chi-square Value and Types of Association between Seagrass and Holothuroidea in Ameth Coastal Water.

No	Holothuroidea Species	Seagrass Species	X^2 Value	a	E(a)	Association Type
1	*Holothuria atra*	*Cymodocea rotundata*	115.85**	164	109.6	+
		Halodule pinifolia	78.52**	37	83.28	-
		Halodule uninervis	56.44**	108	69.52	+
		Syringodium isoetifolium	55.75**	41	79.69	-
		Enhalus acoroides	117.94**	151	94.43	+
		Halophila ovalis	29.28**	31	57.62	-
		Thalassia hemprichii	80.26**	147	100.75	+
		Cymodocea rotundata	84.98**	15	104	+

				0		
2	*Holothuria leucospilota*	*Halodule pinifolia*	66.09**	37	78.97	-
		Halodule uninervis	39.03**	99	67.28	+
		Syringodium isoetifolium	78.11**	25	70.16	-
		Enhalus acoroides	60.66**	13 1	90.96	+
		Halophila ovalis	18.31**	40	61.38	-
		Thalassia hemprichii	71.06**	14 3	70.38	+
		Cymodocea rotundata	127.20**	18 5	126.6	+
3	*Synapta maculata*	*Halodule pinifolia*	94.55**	45	97.00	-
		Halodule uninervis	63.12**	11 2	71.29	+
		Syringodium isoetifolium	98.22**	33	85.46	-
		Enhalus acoroides	89.61**	16 0	109.5	+
		Halophila ovalis	48.44**	26	60.12	-
		Thalassia hemprichii	99.48**	18 4	60.12	+

Notes : X^2 Value : Chisquare Value; a: total of plots in which the two species are found together, ** there is an association between the two species; + : Positive Association; - : Negative Association; Table X^2 (5%) : 3,84.

The association between Holothutoidea and Seagrass species can be shown by the value of X^2. If X^2 calculated value is greater than X^2 table then there is association between those two species. Table 2 shows that there three species of Holothuroidea which associate with all types of Seagrass found in the location of the research.

Based on the observation on the location of the research, the association between Holothuroidea and Seagrass is interspecific association. Interspecific association is determined by the presence and absence of Holothuroidea and Seagrass. The result from the data analysis shows that there is tendency for Holothuroidea and Seagrass to associate and coexist instead of growing solitary. The result also shows that there are 12 pairs positive association while the rest 9 pairs have negative association.

The association between Holothuroidea and Seagrass is due to similar biotic and abiotic environment which cover food, temperature, pH, salinity, DO, and substrate. In general, the association between Holothuroidea and Seagrass is because they share a lot in common. They are attracted to something similar and also avoid the same thing [10].

Three species of Holothuroidea shows the ability to coexist with Seagrasses and further generate mutually simbiotic relationship. *Synapta maculata* which is found in sandy substrate around seagrasses area has similar habitat to that of Seagrass species *Cymodocea rotundata*. Similarity on where they grow is one of the triggering factor that create the association between them.

Synapta maculata species associates with *Cymodocea rotundata* and resulted in simbiotic relationship. The Seagrass species provide food fro *Synapta maculata* in the form of epiphyte which attached to Seagrass leaves and detritus around the Seagrass. Besides providing food for *Synapta maculata*, Seagrass leaves also protect *Synapta maculata* from predator such as crab, sea urchin, starfish. Seagrass will be benefited from epiphyte change and other advantages such as sediment changes, nutrition level, and productivity [11].

Holothuria leucospilota associates with *Halodule uninervis*. *Holothuria leucospilota* attached its body to seagrass leaves to protect it from sunlight which used for photosynthesis [12]. Due to its ability to protect itself from excessive sunlight enable this species to lower its temperature, and belongs to negative phototaxis organism [13].

Positive association is mutualistic. Mutualistic relationship is a form of association where two species benefit each other [14]. Seagrass leaves enables Holothuroidea to attach its body and at the same time protect the species from its predator for instance, crab, sea urchin, and starfish. Moreover, Seagrass obtain energy or nutrition from organic matter decomposition. Thus, Seagrass is essential to Holothuroidea sustainability [15].

There are 9 pairs of Holothuroidea and Seagrass species in the table which shows negative (-) association. *Synapta maculata* and *Haludole pinifolia* generate negative value in terms of association from the association table. They were found to be solitary and at different plot. Seagrass distribution affect the presence of Holothuroidea. Vast distribution of Seagrass will attract higher presence of Holothuroidea and the

opposite is true. A relatively low Seagrass distribution is observed from *Halodule pinifolia, Syngrodium isoetifolium* and *Halopila ovalis*. These three Seagrass species are grown only in nearby offshore area with high intensity of sunlight which support better sunlight penetration for photosynthesis purpose. Looking at their morphology, they also have smaller leaves compared to other Seagrasses. These condition and characteristics made *Synapta maculata, Holothuria atra*, and *Holothuria leuscopilata* to be found separately within different plot with the last three Seagrasses, the very reason for the negative association.

CONCLUSIONS

1. Overall, there are three species of Holothuroidea which associate with Seagrasses in Ameth Village Coastal Water.
2. Positive and negative type association are found. Positive (+) association is observed between *Synapta maculata* and *Cymodocea rotundata*, *Synapta maculata* and *Thalassia hemprichii*, *Synapta maculata* and *Enhalus acoroides*, *Holothuria atra* and *Cymodocea rotundata*, *Holothuria leucospilota* and *Cymodocea rotundata*, *Holothuria atra* and *Thalassia hemprichii*, *Holothuria leucospilota* and *Enhalus acoroides*, *Synapta maculata* and *Halodule uninervis*, *Holothuria atra* and *Halodule uninervis*, *Holothuria leucospilota* and *Halodule uninervis*.
3. Negative (-) association is observed between *Holothuria leucospilata* and *Syringodium isoetifolium*, *Synapta maculata* and *Halopila ovalis*, *Holothuria atra* and *Halopila ovalis*, *Holothuria leucospilota* and *Halopila ovalis*, *Synapta maculata* and *Syngrodium isoetifolium*, *Holothuria atra* and *Syngrodium isoetifolium*, *Synapta maculata* and *Halodule pinifolia*, *Holothuria atra* and *Halodule pinifolia*, *Holothuria leucospilota* and *Halodule pinifolia.*

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