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The suitability of seagrass ecological function for the survival of the bivalvia on the East Coast of Lombok, Indonesia

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The suitability of seagrass ecological function for the survival of the bivalvia on the East Coast of Lombok, Indonesia

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Abstract. The presence of seagrass in coastal waters has an ecological contribution to marine life's sustainability, such as bivalves. This study aims to assess the structurer bivalves communities associated with seagrass and the relationship between seagrass communities' structure and the environment against an abundance of bivalves—the Collected data using transect lines and squares. The data analysis used descriptive statistical analysis. Besides, a regression analysis was carried out between the seagrass community's structure and its environment with the abundance of bivalves. This study found 40 species of bivalves that include 11 families (Veneroidae, Arcidae, Mytilidae, Cardidae, Pinnadae, Pteriidae, Mactridae, Donacidae, Pectinidae, Tellinidae, and Lucinidae). The next, *Anadara antiquata* has an abundance of top 1.43 ind/m², and *Atrina vexillum* , *chlamys luculenta* , and *Fragum unedo* are the lowest of 0.003 ind/ m². Simultaneously, the analysis results showed that the value of $R^2 = 0.42$ between the abundance of bivalves with the substrate's depth. Values are different between seagrass closing with a lot of bivalves, wherein $R^2 = 0.80$. However, R 2 = 0.36's value between the abundance of bivalves with a density of seagrass. Of the three parameters, the closure of seagrass is a parameter that can be used to identify the wealth of bivalves' wealth in the location of the study.

Keywords: Community of seagrass, Abundance bivalves, Substrat and Survival of bivalves

1. Introduction

Coastal ecosystems, including seagrass ecosystems, are unique and specific ecological systems and require specific management to provide maximum benefits for the community [1, 2]. Seagrass beds are critical marine ecosystems and can provide food, habitat, and nursery areas for several species, shellfish, and sea turtles [3, 4]. The seagrass ecosystem is one of the three main ecosystems in coastal areas and has socio-ecological functions beneficial to humans [5]. The abundance and density of crops in an area are influenced by environmental factors such as temperature, light, salinity, depth, bottom substrate, and seawater movement: waves, currents, and tides [6, 7]. The high density of seagrass species is closely related to the number of marine species found and possibly closely related [8, 9].
Bivalves have an essential role in the aquatic environment, namely as bioindicators of environmental health and water quality and a source of food for other animals [10, 11]. For humans, mollusks are a

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source of nutritious food, as medicine, as an industrial base material; for example, Bivalvia shells can be used as shirt buttons [12]. This shows that the active life that pitches so her interaction between seagrass and bivalves is interdependent in the breed's growth process d a breed [13]. Their interaction causes the active itas humans are increasing, many people take advantage of the region to carry out various activities, one of which is travel. Direct or indirect tourist activities will damage tourist areas, for example, trampling on the substrate, causing damage to the site. This can affect the water quality in the study location so that it can indirectly affect the diversity of bivalves because the diversity of bivalves in the seagrass ecosystem can illustrate how the water conditions in the study location. Therefore, it is necessary to conduct research on the suitability of seagrass's ecological function for the preservation of bivalves in the study location. This research is based on the management or conservation of seagrass for the shellfish community's sustainability and other marine biotas, such as in the study locations and other locations.

2. Materials and Methods

2.1. Research sites

The research location is the southern coastal area of Lombok Island (Figure 1). The research was carried out from March 2019 - September 2019. Environmental conditions in the research location along the coast have relegated mangrove vegetation areas revegatasi [14,15]. In addition, this research's location is the catchment area of traditional fishermen and is currently starting to be used as a natural coastal tourism object and marine cultivation [16, 17,18].

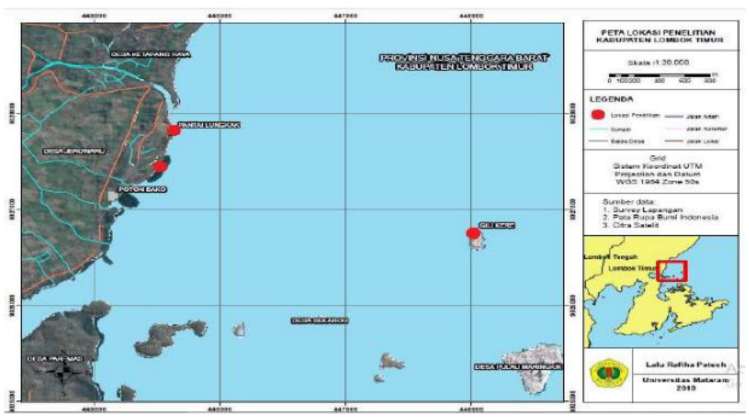

Figure 1. Map of research locations in Poton Bakau Beach, Lungkak and Gili Kere, East Lombok.

2.2. Data Collection and Analysis

This type of research is descriptive and exploratory, with the main focus being making comprehensive descriptions. Retrieval of research data using the transect line and quadratic methods. Data were collected at the lowest low tide. The transect line used is to follow the intertidal area's length perpendicular to the coastline and the square area measuring 1 x 1 m^2. The distance between each square on the transect line is 10 meters. Sampling for each square was carried out using the free collection. Samples embedded in the substrate were taken by digging the substrate to a depth of 10 cm. Samples that are sampled in squares are immediately identified and counted. Sample identification is based on [19] book entitled *Compendium of Seashells worldwide* and reports on relevant studies' results. All samples were photographed for documentation. Environmental parameter assessment, which is the object of observation, is a Physico-chemical environment parameter that is thought to have contributed to seagrass presence in the study location. The research data that has been collected is then tabulated based on the data source and the nature of the data. The tabulated data is then analyzed, and the stages of data analysis are as follows:

a. Seagrass density analysis
Species density to calculate by formula from [20].
Relative density is the ratio between the number of individual species and the total number of individuals of all species, aiming to determine the percentage density per species inall species' total numbers [20].
b. abundance of Bivalves
Calculation of the abundance or density of Bivalves using the formula by [21].
c. Linear regression
to see the relationship between seagrass density and abundance of bivalves, the regression equation is as follows:

$$Y = a + bX$$

3. Results and Discussion

3.1. Types of Seagrass

The coastal waters of Lungkak, Poton Bakau, and Gili Kere found nine kinds of seagrass, which were grouped into six genera and two families, namely Potamogetonaceae and Hydrocharitaceae. These types of seagrass, namely *Halopila ovalis*, and *Thalassia hemprichii* were found in the three locations, and for the kinds of *Syringodium isoetifolium*, *Cymodocea serulata*, *Cymodocea rotundata,* and *Halopila ovalis were* found in Lungkak and Gili Kere waters, and for the kinds of seagrass *Enhalus acroides were* found in Poton and Gili Kere, and for the kinds of *Halodule pinifolia, Halodule uninervis*, and *Halophila spinulosa are* only found in Lungkak waters. The recorded types of seagrass are presented in (Table1).

Table 1. Types of seagrass found in Lungkak, Poton Bakau and Gili Kere, East Lombok.

No.	Seagrass type	Location		
		Lungkak	Mangrove Potons	Gili Kere
1	*Halodule pinifolia*	√	_	_
2	*Uninervis halodule*	√	_	_
3	*Cymodocea serulata*	√	_	√
4	*Syringodium isoetifolium*	_	_	√
5	*Cymodocea rotundata*	√	_	√
6	*Halopilla ovalis*	√	√	√
7	*Halophila spinulosa*	√	_	_
8	*Enhalate acroides*	_	√	√
9	*Thalassia hemprichii*	_	√	√

Information: (√) = found, (-) = not found

3.2. Composition and Density of Seagrass

The average number of seagrass found in Gili Kere ranged from 2.7 - 117.8 ind/m². The highest average number of seagrass species was *Cymodocea rotundata,* and the lowest was *Syringodium isoetifolium*. The average number of seagrass found in Lungkak ranged from 0.8 to 153 ind/m² with the highest number of species being *Halodule pinifolia* and the lowest being *Enhalus acroides*. The location of Poton Bako found the highest kind of seagrass is *Enhalus acroides* and the lowest is *Halophila ovalis,* with an average number ranging from 6.2 - 59.4. The average recorded species of seagrass can be seen in (Table 2).

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Table 2. Average number of seagrass species found in Lungkak, Poton Bakau and Gili Kere waters, East Lombok.

No.	Location	Types of Seagrass	Average number (ind / m²)	SE
1	Gili Kere	*Cymodocea rotundata*	117.8	1.7
		Enhalus acoroides	16.7	1.8
		Halophila ovalis	10.9	0.3
		Cymodocea serulata	13.7	0.3
		Isoetifolium syringodium	2.7	0.4
		Thalassia hemprichii	6	1
2	Lungkak	*Halodule pinifolia*	153	5.8
		Uninervis halodule	6.3	0.04
		Halophila ovalis	20.7	1.9
		Cymodocea rotundata	0.13	0.2
		Cymodocea serulata	17	1.4
		Isoetifolium syringodium	6.3	0.4
		Thalassia hemprichii	17.1	2.7
		Enhalus acoroides	0.8	0.4
3	Poton Bako	*Halophila ovalis*	6.2	0.7
		Thalassia hemprichii	7.3	0.6
		Enhalus acoroides	59.4	1

SE = Standard Error

3.3. Abundance of Bivalvia Species at the Study Site

Pelecypoda (Bivalvia) is a class within the phylum Molluscs, which includes all shellfish. The main characteristic of bivalves has a shell that is as close as possible [22]. The research results on bivalve species at the study location were 40 species belonging to eleven families. The family with the highest number of species is the Veneroidae family. The existence of a diversity of bivalves species in the study site is evidence of the association of bivalves with seagrass. Also, it can be an ecological indicator of the function of seagrass as a habitat for bivalves. The number of kinds of bivalves found in this study was higher than the kinds of bivalves found in the survey on Pannikiang Island, Barru Regency, totaling 14 species [23].

Many types and numbers of individuals found at each station are due to a large number of local communities' exploitation with an uncontrolled exploitation intensity, especially for bivalves that have high economic value [24]. The difference in relative density at each observation station is influenced by water quality. The life of benthic organisms is influenced by environmental conditions, both physical, chemical, and biological (temperature, salinity, pH, organic matter content in sediments). The spread of bivalves is closely related to the condition of the waters where the organism was found [25]. The composition of the number of bivalve species in the study location is greater with other studies on seagrass beds (Table 3), such as in Ela-Ela Beach Sekotong, West Lombok, Indonesia, there are 6 species [26], inBarung Toraja Sumenep Madura 8 species and 8 families [27], and on the Algarve coast of South Portugal there are 25 species and 9 families [28]. The composition of the number of bivalve species associated with seagrass illustrates that there are differences both regionally and globally. In this regard, flora and fauna, including epiphytes associated with seagrasses, such as fish and macrozoobenthic communities, are influenced by seagrass's different structural complexity and not specific physicochemical features [29].

Table 3. The number of individuals and abundance of bivalves at each study location.

No.	Types of Bivalves	Station			Total (ind/m^2)
		Gili Kere	Lungkak	Poton Bako	
1	*Donax faba*	0	0.03	0	0.03
2	*Mactra grandis*	0	0.08	0	0.08
3	*Tapes sulcaris*	0.01	0.21	0	0.22
4	*Meretrix meretrix*	0	0.01	0	0.01
5	*Modiolus philipinarum*	0	0.09	0	0.09
6	*Tapes literatus*	0.009	0.19	0	0.199
7	*Anadara granosa*	0	0.13	0.04	0.17
8	*Mactra nitide*	0	0	0.15	0.15
9	*Lioconcha fastigiata*	0.05	0.01	0.05	0.11
10	*Gafrarium pectinatum*	0.07	0.17	0.09	0.33
11	*Lucinoma heroica*	0	0	0.06	0.06
12	*Paphia gallus*	0.03	0	0	0.03
13	*Belcheri tapes*	0.06	0	0	0.06
14	*Anadara antiquata*	0.17	1.04	0.22	1.43
15	*Pinctada imbricata*	0.05	0	0	0.05
16	*Perna viridis*	0.59	0	0	0.59
17	*Pinna muricata*	0.04	0	0	0.04
18	*Paphia undulata*	0.04	0	0	0.04
19	*Gafrarium dispar*	0.05	0	0	0.05
20	*Trachhycardium flavum*	0.01	0	0	0.01
21	*Katelysia marmorata*	0.01	0	0	0.01
22	*Tellinella staurella*	0.01	0	0	0.01
23	*Protapes gallus*	0.01	0	0	0.01
24	*Politita Pesaureus*	0.003	0	0	0.003
25	*Marcia recens*	0.07	0	0	0.07
26	*Lioconcha castrensis*	0.01	0	0	0.01
27	*The simpson pitar*	0.01	0	0	0.01
28	*Circe tumefacta*	0.07	0	0	0.07
29	*Atrina vexillum*	0.003	0	0	0.003
30	*Chlamys luculenta*	0.003	0	0	0.003
31	*Mactrinula depressa*	0	0.03	0	0.03
32	*Symphony Idas*	0	0.03	0	0.03
33	*Pitar pellucidaus*	0	0	0.01	0.01
34	*Pitar subpellicidus*	0	0	0.02	0.02
35	*Samela jecunda*	0	0	0.24	0.24
36	*Pitar fulminates*	0	0	0.07	0.07
37	*Samele australis*	0	0	0.04	0.04
38	*Fragum unedo*	0	0	0.003	0.003
39	*Codakia tigerina*	0	0	0.13	0.13
40	*Gafrarium tumidum*	0	0	0.73	0.73

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3. 4. Relationship between Bivalves and Seagrass

Bivalve species at each location of seagrass beds can be explained by using the attributes of seagrass (density, substrate depth, and seagrass cover). The presence of bivalves in the seagrass beds was analyzed using a *linear* regression model. The results of the analysis showed that the value of $R^2 = 36\%$. Based on the value of R^2 such that the number density of seagrass or stands of seagrasses can explain the number of bivalves that exist in the location of seagrass is not too high, or the number of stands of seagrass contributes little to the presence of bivalves at each location of seagrass. The next model of the relationship of the density parameter seagrass abundance of bivalves is shown in (Figure 2).

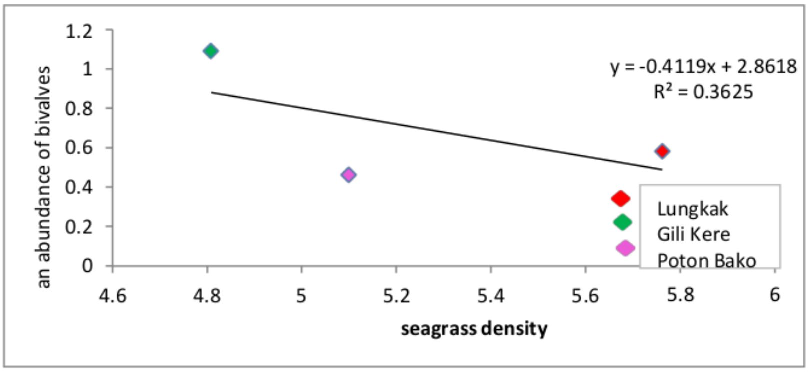

Figure 2. Graph of the relationship between seagrass density and abundance of bivalves in Lungkak, Poton Bakau, and Gili Kere, East Lombok.

Another seagrass parameter to explain the association of Bivalvia with seagrass beds is seagrass cover. The value of $R^2 = 80\%$; this value indicates a strong link between the abundance of bivalves with the closing of seagrass. Furthermore, the relationship model of the parameter of seagrass cover with the abundance of bivalves is shown (Figure 3).

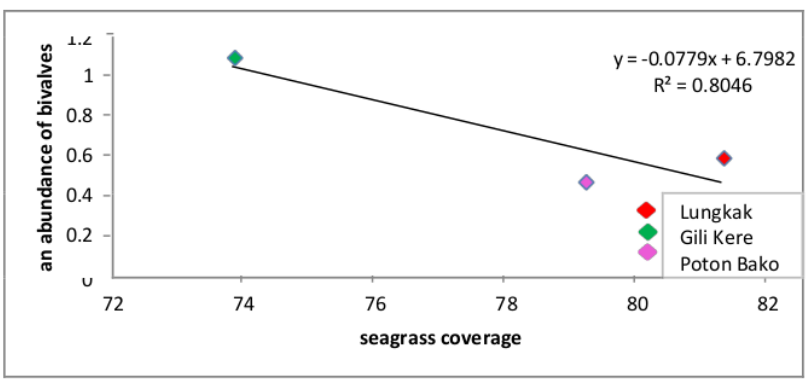

Figure 3. Graph of relationship between seagrass cover and abundance of bivalves in Lungkak, Poton Bakau and Gili Kere, East Lombok.

The regression analysis between the depth of the substrate seagrass abundance of bivalves obtained $R^2 = 42\%$. In this case, the seagrass substrate's depth parameter is not good enough to explain the presence of bivalves in the seagrass beds. However, the regression equation (Figure 4) shows that the greater the seagrass substrate's depth value, the greater the abundance of bivalves.

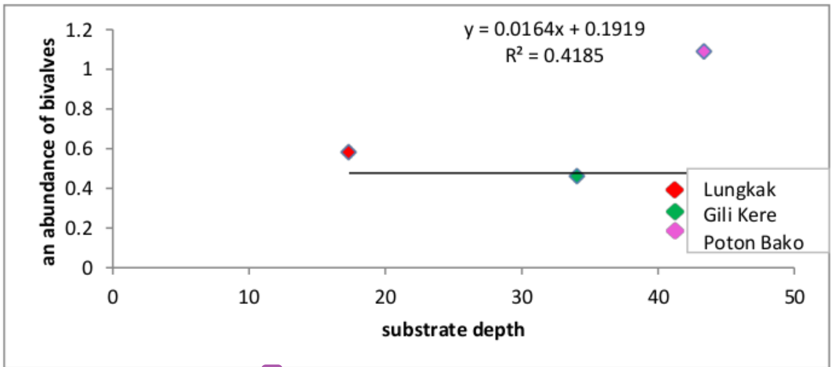

Figure 4. Graph of the relationship between the depth of the seagrass substrate and the abundance of bivalves in Lungkak, Poton Bakau, and Gili Kere, East Lombok.

Attributes seagrass (density of seagrass, seagrass depth of the substrate, and closure) to explain bivalves' presence, such as that described above, have different contributions. The difference in the contribution of each seagrass parameter can be seen from the results of the analysis of the contribution of each parameter of the seagrass. The correlation coefficient from the study results shows that seagrass cover has the highest contribution to bivalve abundance, and the smallest is the seagrass density. The contribution of each of these parameters can explain the response of Bivalves to the presence of seagrass and the response of Bivalves to the density of seagrass from each type of seagrass, especially those with small morphology such as *Syringodium isoetifolium* and *Halodule pinifolia,* which have a different effect from types of seagrass which have large morphology such as *Enhalus acroides*. This difference in seagrass morphology is thought to have contributed to the low-density contribution to the number of species and individuals of Bivalves. However, each of these seagrass attributes has contributed to the number of bivalves that gather in the seagrass beds. In this case, the seagrass's presence in the study location is a determining factor for Bivalvia's *Survival,* or the sustainability of Bivalvia resources is very dependent on the presence of seagrass.

4. Conclusion

Based on research that has been done in the waters of Lungkak Beach, Poton Bakau, and Gili Kere, it can be concluded that the species with the highest abundance are *Anadara antiquata* with a value of 1.43, and the lowest are *Atrina vexillum, Chlamys luculenta,* and *Fragum unedo* with a value of 0, 00 3. While it is, the results of an analysis of regression showed, the value of $R^2 = 0.42$ between the abundance of bivalves with the depth of the substrate. Values are different between the closing of seagrass with an abundance of bivalves, wherein $R^2 = 0.80$. However, the value of $R^2 = 0.36$, between the abundance of bivalves with a density of seagrass, where the closure of seagrass is a parameter that can be used to identifies the wealth of species of bivalves in the location of the study.

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