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The Potential of Seagrass Ecotourism as an Indicator of Conservation in the Coastal Waters of East Lombok

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Abstract: The East Lombok coast was developed for fisheries and tourism. The fishery aspect that is being developed is marine cultivation and has contributed as a source of livelihood for local communities and from the social aspect, it functions to maintain the safety and comfort of the environment. Besides, from an ecological aspect, it has benefits in preventing damage to marine ecosystems due to the use of tools and materials that are not environmentally friendly. The utilization model of the marine environment is still traditional which is oriented only to goods and not to environmental services. On the other hand, the development of nature tourism is becoming superior in the southern coastal area of Lombok Island. It spreads the seagrass ecosystem in the coastal area of Lombok across all tourist sites. However, the utilization is only from products such as fish and marine biota which have economic value. Therefore, it is necessary to innovate the utilization of the ecosystem services aspect of the field as a natural tourist attraction with the concept of ecotourism. The concept of ecotourism is a utilization model that does not interfere with natural systems or ecological systems. The uniqueness of the seagrass ecosystem with other ecosystems is its relationship with the local community tradition called "Madak". Therefore, conceptual formulations and innovations are needed in integrating the cultural values of local communities in the development of seagrass ecotourism on the southern coast of Lombok Island. The purpose of this research is to describe the ecotourism potential of seagrass beds in the study location. The results showed that the ecotourism potential of seagrass beds in the study locations included seagrass internal as seagrass beds and the diversity of seagrass species, especially from inhalers acroides and Caemodecea. Another potential is the seagrass environment for the diversity of Echinodermata and Bivalvia species which can be a tourist object favored by many tourists. Besides, the seagrass environment provides a snorkeling tourism object at high tide to enjoy the diversity of fish species and other marine organisms that use eagrass as a place to find food. The conclusion from the research is that seagrass beds in the study location are a new tourism object for tourists who come to visit the southern coastal areas of East Lombok.

Keywords: Ecotourism; Seagrass beds; Biodiversity preservation

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Introduction

Seagrass is a flowering plant (angiosperms) that consists of a sheath of leaves, creeping stems (rhizome), and roots. Seagrass is a typical shallow marine ecosystem in water and sand-substrate, seagrass is a group of plants belonging to the alisma tales nation which adapts to saltwater. Seagrass beds can only form in shallow marine waters (less than three meters) but the bottom is never open from the water (always inundated) (blanchard et al., 2017). Seagrass in waters can comprise one species (mono species) or a mixture (multi-species), seagrass beds, and has a very important ecological role for fisheries because it is the primary habitat for associated biotas such as fish, echinoderms, bivalves, and others. Rappe et al., 2013; davey, 2017). In

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one condition, seagrass beds form a community that is a habitat for various types of marine animals. This seagrass community can also slow down the movement of water, there are even types of seagrass residents around the coast that can consume that. The existence of the seagrass ecosystem is still not widely known by the general public and academics when compared to other ecosystems such as coral reefs and mangroves. Even though these ecosystems in the coastal area are a single system in carrying out their ecological functions (Whitfield, 2017; Maxwell et al., 2017). This process has implications for the high productivity of waters and creates a balance in the food chain (Unsworth et al., 2014). Good and ideal marine productivity will become a potential coastal area/area for fishermen/ communities as a fishery location which is a source of human activities related to the management and utilization of aquatic biological resources.

Threat towards sustainability seagrass (seagrass) can be derived from fishing, fishers threats to the sustainability of seagrass can come from fishers, especially boiling fishers, or os fishers, shrimp, and crab fishers. Erebus fishers are groups of small fishers who catch fish in the seagrass and estuarine areas using mini trawl fishing gear. The characteristic of this fisher is that he catches at high tide and low tide, the number of members ranges from 2 to 3 people and if it catches them at night, they do not use lights. The next group of small fishers is or is fishers, namely fishers who catch fish at high tide and low tide with the highest water depth to the chest. The characteristic of this fisher is that the number of members of each group is an average of three people and in one family. The fish got are not much different from the fish got by boiling fishers. The third category of small fishers is fishers who catch shrimp and crabs (prawns and crabs). This fishers group comprises small shrimp catchers and small crab catchers. The threat of damage to seagrass in the study location is not only from fishers who catch fish in the seagrass area, another threat comes from non-fishers who use the seagrass area continuously every month in searching for marine biota that has consumption values such as mollusca, sea cucumbers, sea-urchin, seagrass, and others. Utilization of the seagrass area by the community every month for an average of five days, starting from 13 to 17 every month.

The coastal waters of east lombok are the catchment area for traditional fishers whose conditions are often not under the cost of the fishers' catch. Many small fishermen have changed their professions to become hunters of marine life such as sea cucumbers, see-urchins, and seahorses and the conditions are now very rare (setiawan et al., 2014; syukur et al., 2017). One thing they have developed as a source of new livelihoods is marine cultivation and has contributed effectively to protecting seagrass beds and coral reef ecosystems at a local scale (syukur et al., 2016). However, most of them have limitations in developing marine cultivation because of cost constraints. Therefore, it requires program innovation that is oriented to be a source of livelihood and plays a role in protecting marine life and its ecosystem.

A program that can be a solution and rational based on environmental potential in the southern coastal area of lombok island is the development of ecotourism. In this case, the potential that has not been developed is the tourism services for the seagrass beds. The potential of the seagrass meadow ecosystem is in all locations of coastal attractions on the coast of east lombok. Besides, it relates the uniqueness of the seagrass beds to a local tradition called "madak". The tradition of the local community to the location of the seagrass beds has become a strength in the development of seagrass ecotourism as an additional tourist attraction. It can describe the comfort and safety of visiting the location of the seagrass beds. Besides, the purpose of seagrass ecotourism is to preserve the function of the seagrass ecosystem, education, and the economy of the local community.

The condition of the marine environment with its ecosystem that is still relatively good, such as the seagrass ecosystem is quite relevant to the development of its utilization through the concept of ecotourism. This is intended so that the use of only goods produced, such as fish, can develop with the use of environmental services that provide environmental beauty and a variety of types of macrobenthos that cannot be obtained at other tourist locations. Besides, they cannot separate seagrass tourism on the island of lombok from the traditions of the local community (Madak). Both of these are conceptual strengths in the development of seagrass tourism in the coastal waters of east lombok. Research is needed as scientific information about the potential development of seagrass ecotourism from the ecological and traditional aspects of the local community (Madak).

The specific aim of this study is to map the ecotourism potential of seagrass beds as an ecological aspect. The urgency of this research is the importance of a significant change in the utilization of coastal ecosystems that are exploitative to those that are conserved in nature for the welfare of the community and protecting biodiversity. The benefits of this research are: (1) ecological aspects are ensuring sustainability, (2) economic aspects, new sources of sustainable local community livelihoods, (3) education, preservation of seagrass ecosystems that can become natural laboratories, and (4) social, developmental

tools. The social potential of local communities applies to environmentally sustainable development.

Method

They researched from May - Nov bucket in 2019, and the research site is on the coast southeast Lombok (Figure 1). The stages in this research are first to determine the sampling location and second to conduct an assessment of tourism development.

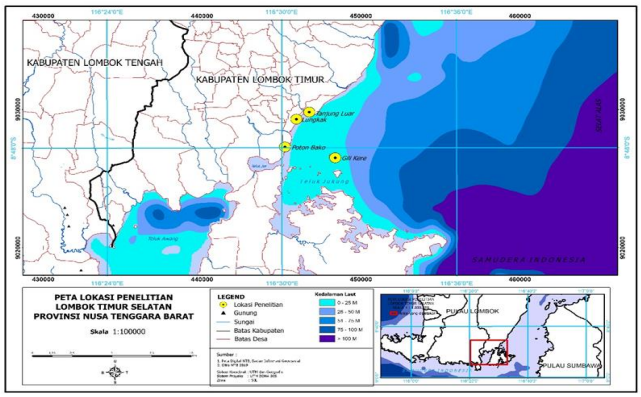


Figure 1. Map of the Research Location

Procedures

The data in this study were collected through surveys and observations. Furthermore, data collection is divided into two stages, the first is data collection Echinodermata fauna and environmental conditions, the second is data about the perception of the local community on ecotourism. Fauna data were collected using the transect method in permanent quadrants with a standard size of 2m x 2m. It places the transects perpendicular to the coastline to the sea, and the interval between the transects is 50 m. Fauna observed quadrant and the only living organism that considered. Identification of species of Echinodermata done directly and unidentified species stored in formalin 4% and the identification is done in laboratory Biology University Mataram. Meanwhile, the assessment of environmental conditions includes dissolved oxygen (DO), salinity, pH, temperature, nitrate, and phosphate.

The next data that has been collected is about the perceptions of local communities and ecotourism actors (operators and tourists). The assumption is that respondents can provide opinions and information to fill knowledge needs in the development of seagrass ecotourism. This, according to stakeholder theory is a useful perspective to address several important problems in interpreting phenomena across different disciplines. Besides, they as sources of information have extensive and relevant experience by the topic and problem. Therefore, the respondents needed in this study are those who know the natural environment of seagrass and/or the seagrass ecosystem.

The criteria of respondents as informants in this study are different for each group. Operators as respondents are the criteria are those who have experience as an orphanage tour operator at the study location for at least 5 years. While the local population as the respondent has the following criteria: 1) registered as members of society and live in a village at each study site, 2) aged over 35 years. The tourist respondent group. Apart from the three groups of respondents, in this study community leaders and/or formal leaders key informants. Collecting research data using questionnaires, interviews, and in-depth discussions. The method used was purposive sampling, and the number of respondents from each group was determined proportionally.

Data analysis

All data obtained from respondents were analyzed using descriptive statistics. Furthermore, the abundance of Echinoderms species is expressed as the number of individuals per species per square meter. Diversity analysis, Echinodermata species using the Shannon-Wiener index (H') and the evenness index (E). Types of biota that were obtained in Identification for Bivalvia and mollusca guided by Abbot book (2000). Whereas for Mollusca identification using the FAO book The Living Marine Resources of Western Central Pacific Volume 1 (Carpenter, 1998) and Indonesian Snails and Shells (Indonesia Shells) (Dharma, 1988), Identification Echinodermata based on the book Monograph of Shallow Water Indo-West Pacific Echinoderms (Clark and Rowe, 1971). As well as for other biota using reports of the results of relevant studies.

Result and Discussion

Species composition and Seagrass Cover on Location Research

The results of the study found nine types of seagrass in all sampling locations. Lungkak Beach found nine species of seagrass. Poton Bako found eight species of seagrass, and the lowest number of species was found in Gili Kere, namely seven species of seagrass. Types of seagrass at the study site (Table 1). Furthermore, 6 species of seagrass were found in all locations, including *Cymodocea rotundata, Cymodocea serrulate, Enhalus acroides, Halodule pinifolia, Halophila ovalis, and Syiringodium isoetifolium*. Meanwhile, 3 species of seagrass were found in one location, namely *Halophila spinulosa* in Lungkak, and *Halophila minor*. Furthermore, from the three sampling locations, it was found that the highest seagrass cover was 82.16% in

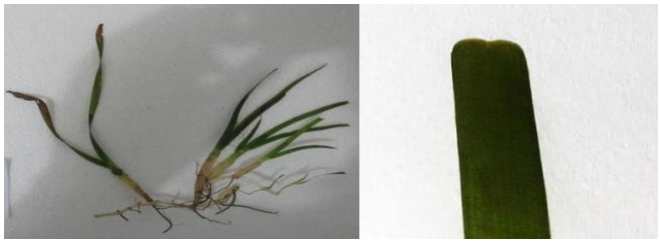
Lungkak and the lowest was 75.33% in Gili Kere (Table 1). Research in the waters of Gili Maringke, East Lombok, found 18 species with seagrass cover ranging from 39.60% to -59.60% (Rizal, 2001). Batuhampar Beach reported 6 species with Seagrass covering less than 30% (Kuspiadi, 2001).

Table 1. Potential Maps of Seagrass in six Sampling Locations in Study Sites

Location	Species L Amun	Number of Species	% Cover of Seagrass ± SD
Gili Kere	Cymodocea rotundata Ascherson & Schweinfurth in Ascherson, 1870 Cymodocea serrulate (R.Brown) Ascherson & Magnus in A scherson, 1870 Enhalus acoroides (Linnaeus f.) Royle, 1839 Halodule pinifolia (Miki) Den Hartog, 1964 Halophila ovalis (Robert Brown) Hook f. 1858 Syringodium isoetifolium (Ascherson) Dandy, 1939 Thalassia hemp richii (Ehrenberg) Ascherson, 1871	7	75.33 ± 9.0
Lungkak	Cymodocea rotundata Ascherson & Schweinfurth in Ascherson, 1870 Cymodocea serrulata (R. Brown) Ascherson & Magnus in Ascherson, 1870 Enhalus acoroides (Linnaeus f.) Royle, 1839 Halodule pinifolia (Miki) Den Hartog, 1964 Halodule uninervis (Fors scal) Ascherson in Boissier, 1882 Halophila ovalis (Robert Brown) Hook f. 1858 Syringodium isoetifolium (Ascherson) Dandy, 1939 Thalassia hemprichii (Ehrenberg) Ascherson, 1871 Halophila spinulosa (R. Brown) Ascherson, 1875	9	82.16 ± 2,3
Poton Bako	Cymod ocea rotundata Ascherson & Schweinfurth in Ascherson, 1870 Cymodocea serrulata (R. Brown) Ascherson & Magnus in Ascherson, 1870 Enhalus acoroides (Linnaeus f.) Royle, 1839 Halodule pinifolia (Miki) Den Hartog, 1964 Halodule uninervis (Forsskal) Ascherson in Boissier, 1882 Halophila ovalis (Robert Brown) Hook f. 1858 Syringodium isoetifolium (Ascherson) Dandy, 1939 Thalassia hemprichii (Ehrenberg) Ascherson, 1871	8	79.5 ± 3.0

Description of types of seagrass

1. Cymodocea rotundata



(a) (b)

Figure 1. (a) *Cymodocea rotundata* (b) Leaf tips in the shape of the letter m (Rawung *et al.,* 2018)

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Cymodoceaeceae
Genus : Cymodocea
Species : Cymodocea rotundata

General Description

This species has straight, long leaves and has one middle leaf bone that does not stand out and a perfectly closed leaf sheath. The tip of the leaves of *Cymodocea rotundata is* in the shape of the letter m (Figure 2 (b)), the edges of the smooth leaves are not serrated. The average leaf length was 94.27 mm, the average leaf width was 5.00 mm and the distance between nodes was 28.36 mm. Roots grow on rhizomes that spread horizontally and lengthwise. In this area, *Cymodo cea rotundata* grows on the sand substrate.

2. Cymodocea serrulata

(a) (b

Figure 2. (a). *Cymodocea s errulata* (b). serrated leaf edges (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alism atales
Family : Cymodoceaceae
Genus : Cymodocea
Species : *Cymodocea serrulata*

Description

Cymodocea serrulata has leaf shape like a straight line. In the sand substrate, the average leaf length was 97.52 mm, the average leaf width was 10.46 mm and in the sand substrate coral fragments had an average leaf length of 76.47 mm, the average leaf width was 10.56 mm, on the leaves. There are brown lines that extend like horizontal lines, the leaves form a triangle. The tip of the leaves of *Cy modocea serrulata* forms a semicircle, the edges of the leaves are serrated and has 1 leaf bone. *Cymodocea serrulata* has smooth rhi zoma with an average distance between nodes on the sand substrate of 38.28 mm and an average of 33.45 mm on the sand substrate. Shoots grow on each rhizome node, there are 2-5 leaves on each shoot. A scar appears which is a development of the leaf midrib that forms a ring along the stem. *Cymodocea serrulata* in this area grows on sand and rubble substrate.

3. Enhalus acoroides

(a) (b)

Figure 3. (a). *Enhalus acroides* (b). serrated leaf edge (Rawung *et al.,* 2 018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Hydrocacharitaceae
Genus : Enhalus
Species : *Enhalus acoroides*

Description

Enhalus acoroides is one of the seagrass which has a large morphology. Enhalus acoroides has black hair that grows on rhizomes (Figure 3 (b)) and has many roots. The tip of this plant leaf has serrations. *Enhalus acoroides* in this area grows on the substrate of sand, muddy sand and coral reef sand.

4. Halodulle pinifolia

(a) (b)

Figure 4. (a). *Halodulle pinifolia* (b). The tips of the leaves are rounded and the presence or absence of teeth (Setiawan *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alisma tales
Family : Cymodoceaceae
Genus : Halodule
Species : *Halodule pinifolia*

Description

Halodulle pinifolia has one leaf vein in the middle of the leaf. Leaves 4.6-5.2 cm long and 0.2 cm wide. Stems are short, curved rhizomes with a smooth surface , yellowish-white in color. Root fibers are brown. The results of Irawan's research (2010) show differences in leaf size with a length of up to 20 cm, a width of 1 to 2 mm. Newmaster *et al ,.* (2011) added that *Halodule pinifolia* has creeping rhizomes, white to pale brown; long, erect shoots; flat and long leaves. This type of seagrass is found mostly in sheltered and semi-exposed bays, coral reefs, in swimming pools, as well as in locations subject to waves.

5. Halodulle uninervis

(a) (b)

Figure 5. (a). *H alodulle uninervis* (b). The tip of the leaf is trident-shaped (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Cymodoceaceae
Genus : Halodule
Species : *Halodule uninervis*

Description

The uninervic halodule has rhizomes that are small and white in color. *The halodule uninervis* has a characteristic leaf bone that is not more than three, a characteristic feature of this species is the tip of the leaf which is shaped like a trident. The average leaf length is 37.83 m m and the average leaf width is 2.22 mm. Uninervis halodules in this area grow on muddy sand substrates.

6. Halophila decipiens

(a)

Figure 6. (a). *Halophila decipiens* (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopside
Order : Alismatales
Family : Hydrocharitaceae
Genus : Halophila
Species : *Halophila decipiens*

Description

It is fast growing, and is a pioneer breed. Commonly found on muddy substrates, can be the dominant species in intidal areas and can grow to a depth of 25 meters. Bone leaves no more than 3-rounded leaf tip, the tip like a saw. *Halophila decipiens* has thin rhizomes that extend near the surface of sand or mud, with a root at each knot to hold the plant in place. The barely stemmed leaves grow in pairs from a knot with a pair of scales at the base. Paddle-shaped leaves and has a smooth jagged edges and the length is 25 millimeters (0.98 inches) and a width of 6 mm (0.24 i NCI) . *Halophila decipiens* is a species pantropis are found in tropical regions of the Indian Ocean and the Pacific Ocean and the western Atlantic European waters. Although often found at depths of less than 30 meters (98 feet) it sometimes appears as deep as 8 5 meters (279 feet) and can be found in areas of low salinity .

7. Halophila ovalis

(a) (b)

Figure 7. (a). *Halophila ovalis* (b). The middle bones of the leaves are colored (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Hydrocharitaceae
Genus : Halophila
Species : *Halophila ovalis*

Description

Halophila ovalis has leaves that pair with small petioles that grow on small white rhizomes. The leaves are oval in shape and have more than eight leaf bones. In this area, there are several Halophila ovalis leaves which are blackish red in color following the middle bone. *Halophila ovalis* in this area grows on rubble sand and muddy sand substrates.

8. Typholium iso syringodium

(a) (b)

Figure 8. (a). *Isotifolium syringodium* (b). The edges of the leaves are pointed (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Cymodoceaceae
Genus : Syringodium
Ice species : *Syringodyum isoetifolium*

Description

Syringodium isoetifolium has long leaves and has a characteristic cylindrical leaf shape and a pointed leaf tip (Figure 8. (b)) arising from smooth rhizomes. Rhizoma thick, clear nails with alternating brown color and veiled and thick roots. *Syringodium isotifolium* in this area grows on rubble sand and muddy sand substrates.

9. Thalassia hemprichii

(a) (b)
Figure 9 . (a). *Thalassia hemprichii* (b). Rhizoma segmented (Rawung *et al.,* 2018).

Classification

Kingdom : Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Alismatales
Family : Hydrocharitaceae
Genus : Thalassia
Species : *Thalassia hemprichii*

Description

Thallasia hemprichii is characterized by a distinct rhizoma which is segmented (Figure 9 (b)). The tip of the leaf is semicircular with smooth leaf edges that are not serrated. The average leaf length of the muddy sand substrate was 79.80 mm and the average leaf length on the substrate of coral fragments was 77.57 mm. *Thalassia hemprichii* in this area grows on muddy sand substrate and rubble sand substrate.

Potential Fauna in Seagrass Fields in the Study Site

Research on the potential of seagrass beds at the study site is focused on the presence of fauna that can support the development of seagrass potential to support ecotourism development. Therefore, in this study, observations have been made on fauna, including:

A. Echinodermata

The results of the research on the East Lombok Coast obtained 14 species from the Echinodermata phylum consisting of 4 classes and 10 families as presented in Table 2.

Table 2. Types of Echinoderms found on the East Lombok Coas

No.	Research Location	Class	Family	Species
1	Gili Kere	Aster oidea	Oreaster idae	*Protoreaster nodosus*
			Oreasteridae	*Culcita Sp*
			Archasteridae	*Archaster typicus*
			Ophidiasteridae	*Linckia laevigata*
			Toxopneustidae	*Tripneusteus gra tila*
		Echinoidea	Temnopleuridae	*Mespilia globulus*
			Diadematidae	*Diadema ca lamaris*
			On ademati dae	*Diadema setosum*
		Holothuroidea	Synaptidae	*Synapta maculate*
			Holothuriidae	*Holothuria leucospilota*
			Holothuriidae	*Holothuria atra*
		Ophiuroidea	Ophiocomidae	*Ophiocoma scolopendrina*
2	Lungkak	Asteroidea	Oreasteridae	*Protore aster nodosus*
		Echinoidea	Toxopneustidae	*Tripneusteus gratila*
			Diadematidae	*Diadema setosum*
		Holothuroidea	Synaptidae	*Synapta maculate*
			Holothuriidae	*Holothuria atra*
3	Poton Bako	Asteroidea	Oreasteridae	*Protoreaster nodosus*
		Echinoidea	Toxopne ustidae	*Tripne usteus gratila*
			Diadematidae	*Diadema setosum*
			Diadematidae	*Echinotrix diadema*
		Holothuroidea	Synaptidae	*Synapta maculata*
			Holothuriidae	*Holothuria atra*
			Holothuriidae	*Holothuria scabra*

Relative Abundance of Echinoderms on the East Lombok Coast

The results of the research along the transect line obtained 14 species of the *Echinodermata phylum*, namely *Protoreaster nodosus, Tripneusteus gratila, Archaster typicus, Diadema calamaris, Synapta maculata, Diadema setosum, Mespilia globulus, Holothuria leucospilota, Ophiocoma scolopendrina, Linckia laevigata, Echinotrix diadema*, and *Holothuria scabra*. Of these 14 species, 1270 individuals were obtained, of which the Diadema setosum species from the Echinoidea class were the most common and the *Archaster typicus, Mespilia globulus, Synapta maculata, Holothuria leucospilota, Ophiocoma scolopendrina, Linckia laevigata, Holothuria atra, Culcita sp, Echinotrix species*. and *Holothuria scabra* were the least species found, as shown in Table 3.

Table 3. Echinoderms found along transect lines in East Lombok coastal seagrass

Echinod ermata type	Abundance (Ind / m²)					
	Gili Kere		Lungkak		Poton Bako	
	Ki (Ind / m²)	*KR (%)*	*K i (Ind / m²)*	*KR (%)*	*Ki (Ind / m²)*	*KR (%)*
Protoreaster nodosus	0.97	40.84	0.01	0.68	0.18	24.15
Tripneusteus gratila	0.32	13.37	0.31	32.19	0.26	35.37
Archaster sp	0.05	2.17	-	-	-	-
Diadema calamaris	0.11	4.58	-	-	-	-
Synapta sp	0.19	8,07	0.07	6.85	0.12	15.6 5
Diadema se t Osum	0.54	22.65	0.55	56.85	0.12	16.67
Mespilia globulus	0.02	0.84	-	-	-	-
Holothuria leucospilota	0.03	1.33	-	-	-	-
Ophiocoma scolopendrina	0.05	2.17	-	-	-	-
Linckia laevigata	0.03	1.08	-	-	-	-
Holothuria atra	0.03	1.08	0.03	3.42	0.03	4, 42
Culcita s p	0.02	0.84	-	-	-	-
Echinotrix diadema	-	-	-	-	0.02	2.72
Holothuria scabra	-	-	-	-	0.01	1.02

Diversity of Echinoderms on the East Lombok Coast

Based on the results of data analysis, the diversity of echinoderms in general in the seagrass ecosystem on the coast of East Lombok in each location showed a moderate diversity index, namely Gili Kere with an H 'value of 1.76. Lungkak Beach shows a moderate species diversity index with an H 'value of 1.01, Poton Bako shows an H' value of 1.58. For more details, the diversity index for each station can be seen in Figure 10.

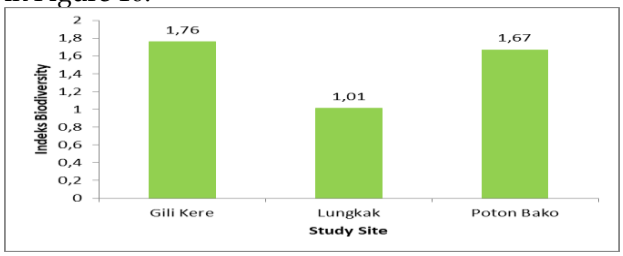


Figure 10. The diversity index value of Echino dermata found in the East Lombok Coastal seagrass ecosystem

Distribution Pattern of Echinoderms on the East Lombok Coast

The distribution pattern of seagrass shows that the seagrass species has a uniform and group distribution pattern. The variation of the dispersion index in each species indicates a different level of grouping of each species. As shown in table 4.

Table 4. Distribution pattern of echinoderms in seagrass on the coast of East Lombok

No.	Types of Echinoderms	Location		
		G ili Kere	Lungkak	Poton Bako
1	*Protoreaster nodosus*	5.80	-0.10	2.20
2	*Tripneusteus gratil a*	0.58	1.46	4, 89
3	*Archaster sp*	-0.03	-	-
4	*Diadema calamaris*	0.03	-	-
5	*Synapta sp*	0.19	-0.03	0.85
6	*Diadema setosum*	1.76	4.78	0.98
7	*Mespilia globules*	-0.04	-	-
8	*Holothuria leucospilota*	-0.04	-	-
9	*Ophiocoma scolopendrina*	-0.03	-	-

No.	Types of Echinoderms	Location		
		G ili Kere	Lungkak	Poton Bako
10	*Linckia laev igata*	-0, 04	-	-
11	*Holothuria atra*	-0.04	-0.09	-0.06
12	*Culcita sp*	-0.04	-	-
13	*Echinotrix diadema*	-	-	-0.11
14	*Holothuria scabra*	-	-	-0.13

Echinoderm association index with seagrass in East Lombok Coast

Based on the results of data analysis, the echinoderms found in the seagrass ecosystem on the East Lombok coast were all positively associated. As in table 5.

Table 5. Echinoderm association index with seagrass in the study location

No.	Location	Ji	E (a)	Xcount	Xtabel	Association
1	Gil i Kere	0.75	14 5,9	144,438	3.84	There are associations
2	Poton Bako	0.6	126.3	125,063	3.84	There are associations
3	Lungkak	0.6	47.3	46,008	3.84	There are associations

Linkage of Echinodermat a with Seagrass

1. Relationship between seagrass density and abundance of echinoderms

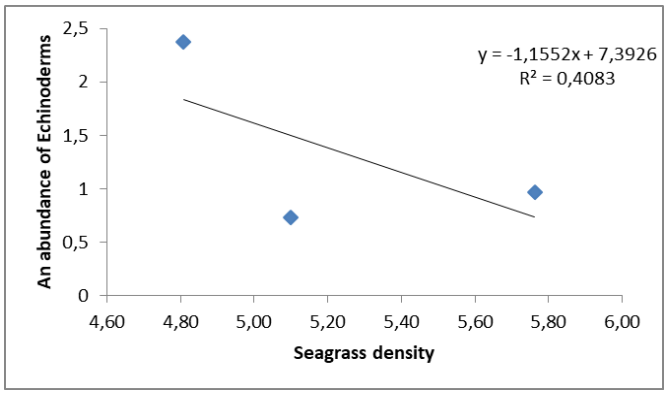


Figure 1 1 . Graph of salt density with abundance of echinoderms

2. The relationship between the depth of the seagrass substrate and the abundance of echinoderms

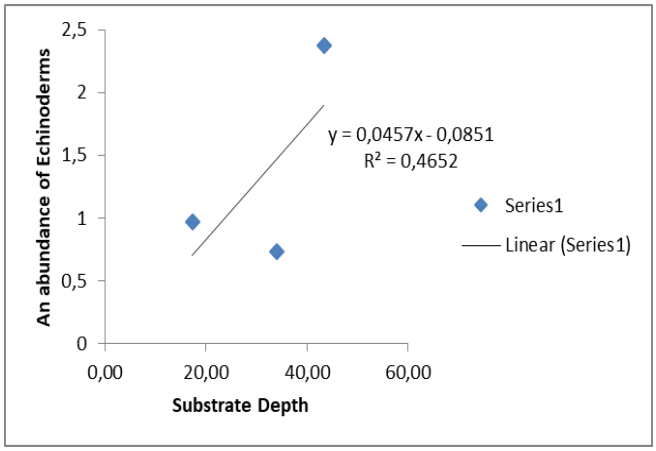


Figure 12 . Graph of substrate depth with abundance of echinoderms

3. Relationship between Seagrass Cover and Number of Species

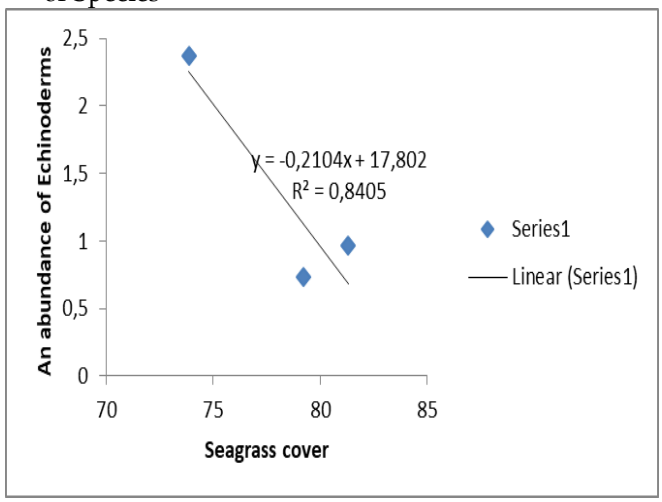


Figure 1 3 . Graph of seagrass cover with echinoderm abundance

The attributes of seagrass (density, depth of seagrass substrate, and seagrass cover) to explain the presence of echinoderms as described above have different contributions. The difference in the contribution of each seagrass parameter can be seen from the analysis of the contribution of each parameter of the seagrass. The correlation coefficient from the results of the analysis showed that seagrass cover had the highest contribution to echinoderm abundance and the smallest was the depth of the seagrass substrate. The contribution of each of these parameters can explain: (1) the response of echinoderms to the presence of seagrass and (2) the response of echinoderms to the seagrass density of each type of seagrass, especially those with small morphology such as those of *Syringodium isotifolium* and *Halodule pinifolia* which have a different effect from the types of seagrass has a large

morphology like that of the type *Enhalus acoroides*. The difference factor in seagrass morphology is thought to have contributed to the low-density contribution to the number of species and individuals of Echinoderms. However, each of these attributes of seagrass has contributed to the number of echinoderms that gather in the seagrass bed. In this case, the presence of seagrass in the study location is a determining factor for Echinoderm's survival.

B. Bivalvia

Number and Species of Bivalves

The bivalve class animals found in Lungkak, Poton Bakau, and Gili Kere waters consist of 20 species belonging to 9 families. The nine families include *Veneroidae, Arcidae, Mytilidae, Cardidae, Pinnadae, Pteriidae, Mactridae, Donacidae* and *Lucinidae*. Veneroidae has 9 species which include *Lioconcha fastigiata, Gafrarium pectinatum, Tapes literatus, Tapes sulcaris, Paphia undulate, Gafrarium dispar, Paphia gallus, Tapes belcheri* and *Meretrix meretrix*. Arcidae has 2 species which include *Anadara antiquate* and *A. granosa. Mytilidae* has 2 species which include *Perna viridis* and *Modiolus philipinarum*. Cardidae has 1 species which includes *Trachhycardium flavum*. Pinnadae has 1 species, namely *Pinna muricata*. Pteriidae has 1 species, namely *Pinctada imbricate*. Mactridae has 2 species which include *Mactra nitida* and *M. grandis*. Donacidae has 1 species, namely *Donax faba*. Lucinidae has 1 species, namely *Lucinoma heroica*. The types of bivalves recorded are presented in (Table 6).

Table 6. Species of bivalves found in Lungkak Waters, Poton Bakau and Gili Kere, East Lombok

Phylum	Research sites	Class	Family	Species
Mollusca	Gili Kere	Bivalvia	Veneroidae	*Lioconchafastigiata*
				Gafrariumpectinatum
				Tapes literatus
				Paphia undulate
				Gafrariumdispar
				Paphiagallus
				Tapes belch eri
			Arc idae	*Anadaraan tiquata*
			Mytilidae	*Pernaviridis*
			Cardidae	*Trachhycardiumflavum*
			Pinnadae	*Pinna muricata*
			Pteriidae	*Pinctada imbricate*
	Lungkah k		Veneroidae	*Tapes literatus*
				Tapes sulcaris
				Meretrixmeretrix
			Arcidae	*Anadaragr anosa*
			C ardidae	*Usphilipinarum modiol*
			Mactridae	*Mactragrandis*
			Donacidae	*Donaxfaba*
	Poton Bako		Veneroidae	*Lioconchafastigiata*
				Gafrariumpectinatum
			Arcidae	*Anadaraantiquata*
			Mactridae	*Mactranitida*
			Lucinidae	*Lucinoma heroic*

The bivalves found in Lungkak, Poton Bakau, and Gili Kere waters consist of 9 families, where the family with the highest number of species is in the Veneroidae family. Each family has almost the same number of species, namely an average of 1 species. The number of bivalves found in this study was higher than the bivalves found in the study on Pannikiang Island, Barru Regency, totaling 14 species (Hamsiah, 2006).

Bivalves galore

The abundance of bivalves for Donax faba with a value of 0.03 ind / m2, Mactra grandis with an abundance value of 0.08 ind / m2, Tapes sulcaris an abundance value of 0.087 ind / m2, Meretrix meretrix with an abundance value of 0.013 ind / m2, Modiolus philipinarum with an abundance value of 0.093 ind / m2, Tapes literatus with a value of 0.06 ind / m2, Anadara granosa with a value of 0.213 ind / m2, Mactra nitida with a value of 0.10 ind / m2, Lioconcha fastigiata with a value of 0.05 ind / m2 , Gafrarium pectinatum with a value of 0.08 ind / m2, Lucinoma heroica with a value of 0.06 ind / m2, Paphia gallus with a value of 0.026 ind / m2, Anadara antiquate with a value of 0.125 ind / m2, Pinna muricata and Pinctada imbricata have an abundance value The same, namely

with a value of 0.043 ind / m2, Paphia undulata with a value of 0.034 ind / m2, and Gafrarium dispar having an abundance value of 0.029 ind / m2, Perna viridis has an abundance value of 0.591 ind / m2 and Trachhycardium flavum has an abundance value as much as 0.014 ind / m2. The number of types of bivalves can be seen in (Table 7).

Table 7. Number of bivalves found in Lungkak, Poton Bakau and Gili Kere waters, East Lombok

No.	Types of Bivalves	Station			Ki (ind / m ²)
		Gili Kere	Lungkak	Mangrove Potons	
1	*Donax faba*	0	5	0	0.03
2	*Mactra grandis*	0	12	0	0.08
3	*Tapes sulcaris*	0	13	0	0.087
4	*Meretrix meretrix*	0	2	0	0.013
5	*Modiolus philipinarum*	0	14	0	0.093
6	*Tapes literatus*	21	9	0	0.06
7	*Anadara granosa*	0	32	0	0.213
8	*Mactra nitide*	0	0	41	0.10
9	*Lioconcha fastigiata*	18	0	20	0.05
10	*Gafrarium pecti natum*	25	0	35	0 , 08
11	*Lucino ma heroica*	0	0	24	0.06
12	*Paphia gallus*	9	0	0	0.026
13	*Belcheri tapes*	18	0	0	0.051
14	*Anadara antiquate*	32	0	65	0.125
15	*Pinctada imbricata*	15	0	0	0.043
16	*Perna viridis*	207	0	0	0.591
17	*Pinna muricata*	15	0	0	0.043
18	*Pa phia undulate*	1 2	0	0	0.034
1 9	*Gafrarium dispar*	10	0	0	0.029
20	*Trachhycardium flavum*	5	0	0	0.014
Total		387	87	185	1 , 822

The relative abundance reached 55% where the highest type of bivalvia was Perna viridis with a value of 53, 49% and the lowest type of abundance was Trachhycardium flavum with a value of 1.29%. The value of the relative abundance of bivalves can be seen in. Table 7 shows that the relative density values of each type of bivalve do not differ significantly. Bivalves Anadara antiquate species has a relative abundance value of 21.705%, Anadara granosa has a relative abundance value of 36.78%, Gafrarium pectinatum has a relative abundance value of 12.69%, Modiolus philipinarum has a relative abundance value of 16.09%, Mactra nitide has a relative abundance value of 22.16%, Tapes literatus has a relative abundance value of 7.885% and Tapes sulcaris has a relative abundance value of 14.94%, Mactra grandis has a relative abundance value of 13.79%, Lioconcha fastigiata has a relative abundance value of 7.73%, Lucinoma heroica has a relative abundance value of 12.97%, Donax faba has a relative abundance value of 5.75%, Paphia gallus has a relative abundance value of 2.33%, Meretrix meretrix has a relative abundance value of 2 , 30%, Tapes belcheri has a relative abundance value of 4.65%, Trachhycardium flavum has tilapia i relative abundance is 1.29%, Pinna muricata and Pinctada imbricate have a relative abundance value of 3.88%, Paphia undulate has a relative abundance value of 3.10% and Gafrarium dispar has a relative abundance value of 2.58%. The small number of species and the number of individuals found at each station is due to exploitation by the local community in large numbers with an uncontrolled exploitation intensity, especially for bivalves that have high economic value.

Diversity, Uniformity and Dominance of Species

The diversity index (H ') in the three research locations is low, the uniformity index (E) is high to low and the dominance index (D) is low. The three index values are presented in (Table 8) below and the value of each index can be seen in Table 8.

Table 8. Diversity index, uniformity index, and dominance of bivalves in Lungkak, Poton Bakau and Gili Kere, East Lombok.

Location	Index		
	Biodiversity (H ')	Uniformity (E)	Dominance (D)
Lungkak	1, 705	0.8 76	0.0 1 1
Mangrove Potons	1, 522	0, 946	0.0 05
Gili Kere	1,759	0, 708	0.0 03

Based on the calculation of the diversity index (H ') that has been carried out, the highest diversity is found in Gili Kere with a value of 1.759. The highest uniformity index (E) was in Poton Bakau with a value of 0.946 so it was classified as a high category. The highest dominance index is obtained in Lungkak waters with a value of 0.011 which is classified as the low category, which means that no species dominates.

Association of Bivalves and seagrass

The association of bivalves in seagrass beds in the waters of Lungkak, Poton Bakau, and Gili Kere varies greatly in each species, certain types of bivalves are associated with certain types of seagrass as well. The result of the study was that the association of bivalves in various types of seagrass was obtained based on the respective Jaccard index values obtained can be seen in (Table 9).

Table 9. Bivalves and seagrass associations in Lungkak waters, Poton mangroves, and Gili Kere, East Lombok.

Location	Jaccard Index (JI)	Hope (E .A)	Xcount	Xtabel	Association
Gili Kere	147	14406	1 4113.5	3.84	there is an association
Mangrove Potons	73	6497	6351.8 2	3.84	there is an association
Lungkak	24	1272	1224.4 5	3.84	there is an association i

Based on table 9, it is explained that the bivalve species with seagrass are associated with each other. The type of association between bivalves and seagrass is classified as a negative association, this is because species do not coexist more often than independent expectation values.

Distribution pattern of bivalves in East Lombok

The distribution pattern of bivalves in East Lombok is divided into 2 types, namely, there are uniform and group which is seen based on the value of the Morisita dispersion index calculation results can be seen in more detail in (Appendix 6). The distribution pattern of bivalves in Lungkak waters is classified as uniform and clustered, the distribution pattern in Gili Kere shows a uniform and clustered distribution pattern, and the distribution pattern on Poton Bakau Beach shows the average species are clustered, more details are presented in (Table 10).

Table 10. Distribution pattern of bivalves in the waters of Lungkak, Gili Kere, and Poton Mangrove, East Lombok.

No.	Types of Bivalves	Location		
		Lungkak	Gili Kere	Mangrove Potons
1	*Donax faba*	-0.1467	-	-
2	*Mactra grandis*	4,795 1	-	-
3	*Tape s sulcaris*	0.4244	-	-
4	*Meretrix meretrix*	-0.2300	-	-
5	*Modiolus philipinarum*	0.5315	-	-
6	*Tapes literatus*	0.075 4	29,815	-
7	*Anadara granosa*	3,8154	-	-
8	*Mactra nitide*	-	-	27.1041
9	*Lioconcha fastigiata*	-	0.025	5,2489
10	*Gafrarium pecti natum*	-	29.81 5	17.6923
11	*Lucinoma heroica*	-	-	12,7903
12	*Anadara antiquate*	-	49,708	62.9412
13	*Belcheri tapes*	-	14,808	-
1 4	*Perna viridis*	-	2135	-
1 5	*Paphia gallus*	-	0.449	-
1 6	*Pinna muricata*	-	9,872	-
1 7	*Pa phia undulate*	-	3,640	-
1 8	*Gafrari um dispar*	-	3 , 640	-
19	*Trachhycardium flavum*	-	9,872	-
20	*Pinctada imbricata*	-	14,808	-

Information: (-) = No bivalves were found at that location

The results showed that the distribution patterns of bivalves tended to be clustered and less uniform. Based on the results of the distribution pattern calculation, it was found that the individual distribution patterns were quite grouped in bivalves. This even distribution pattern according to Odum (1993) occurs because of the collection of individuals as a strategy in responding to changes in weather and seasons, as well as changes in habitat and reproductive processes. Meanwhile, some types of bivalves show a uniform distribution pattern due to individual competition, thus encouraging even distribution of space (Riniatsih & Widianingsih, 2007).

Relationship between Bivalves and Seagrasses

Bivalve species at each location of the 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 this analysis indicate that the R2 value of seagrass density with an abundance of bivalves is 36%. Based on the R2 value, the number of seagrass density or stands of seagrass can explain the number of bivalves in the seagrass bed location is not too high or the number of stands of seagrass has little role in the presence of bivalves at each location of the seagrass bed

a. Relationship between seagrass density and abundance of Bivalves.

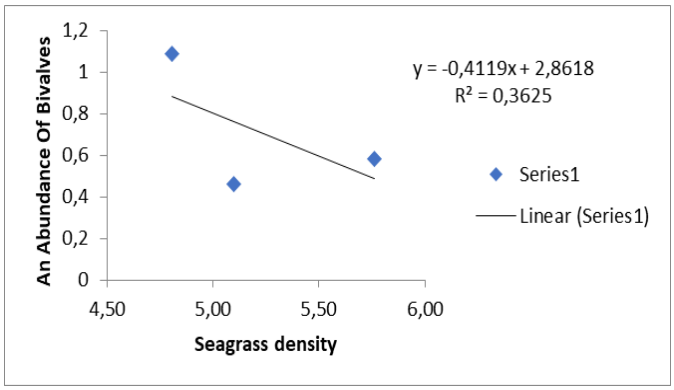


Figure 1 4 . Graph of the relationship between seagrass macaques and the abundance of bivalves in Lungkak, Poton Bakau and Gili Kere, East Lombok. Source: Processed Excel data (2019)

Another parameter of seagrass to explain the relationship between Bivalvia and seagrass is the seagrass cover. The value of R ² are diperole h between the closing of seagrass with an abundance of bivalves by 80%.

b. Relationship of seagrass cover parameters with bivalve abundance

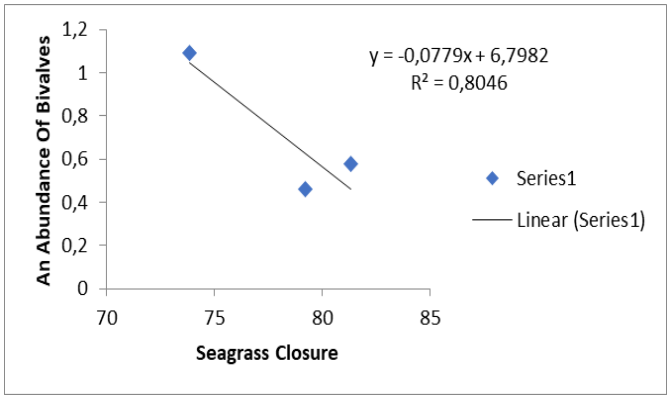


Figure 15. Graph of relationship between sea grass cover and abundance of bivalves in Lungkak, Poton Bakau and Gili Kere, East Lombok. Source: Processed Excel data (2019)

The results of regression analysis between the depth of the seagrass substrate and the abundance of bivalves were obtained R2 of 42%. In this case, the depth parameter of the seagrass substrate is not good enough to explain the presence of bivalves in the seagrass beds. However, the regression equation (Figure 16) shows that the greater the depth value of the seagrass substrate, the greater the abundance of bivalves.

c. Relationship of substrate depth parameters with Bivalvia
abundance

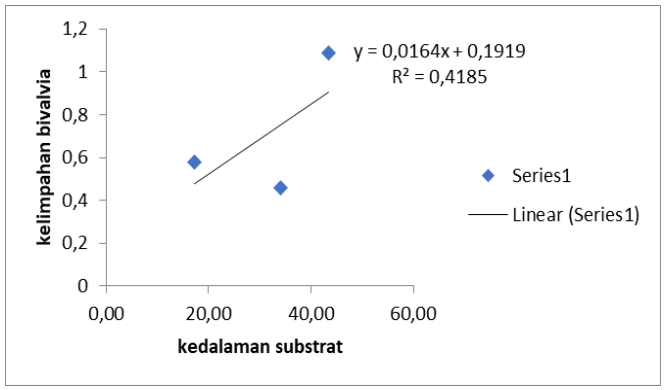


Figure 16. Graph of the relationship between the depth of the seagrass substrate and the abundance of bivalves in Lungkak, Poton Bakau and Gili Kere, East Lombok. Source: Processed Excel data (2019)

Environmental Conditions in East Lombok Waters

Environmental parameter measurements are carried out at each observation station. The environmental factors observed were pH, salinity, depth, and temperature of the waters and the substrate of the environment. The results showed that the environment was still suitable for the survival of aquatic organisms, including Bivalves. The results of measuring environmental parameters at the research location can be seen in (Table 11).

Table 11. Environmental parameters in the waters of Lungkak, Poton Bakau and Gili Kere, East Lombok..

No.	Parameter	Location		
		Lungkah k	Poton Bako	Gili Kere
1	Temperature (° C)	24.59 ± 0.65	2 4, 44 ± 0.32	24.79 ± 0.41
2	Salinity (ppt)	27.3 ± 2.56	29.66 ± 0.45	31.92 ± 0.92
3	pH	7.1 0 ± 0.03	7, 11 ± 0.09	7, 11 ± 0.09
4	Su bstrat	Muddy sand	Sandy mud	Gritty
5	Depth	2.25 ± 1.21	5.03 ± 1.00	4.45 ± 1.41

Based on the measurements that have been made, it can be seen that the temperature at Lungkak is 24.59 ^{o}C. The temperature in Poton Bakau is 24.44 ^{o}C. On Gili Kere, the temperature is 24.79 ^{o}C. According to the Decree of the State Minister for the Environment No. 51 Regarding Sea Water Quality Standards for Marine Biota states that a good temperature for the survival of marine life for seagrass is 28-30 ^{o}C.

Salinity measured in the range 27.3 - 31.92 ppm. According to the Decree of the State Minister for the Environment No. 51 Concerning Sea Water Quality Standards for Marine Biota states that the salinity for seagrass ecosystems is around 33 - 34 ppm. The results of the salinity measurement carried out can be concluded that the salinity in the waters of Lungkak, Gili Kere, and the waters of Poton Mangrove Beach, East Lombok are classified as natural because they are still below the water quality standard. From the results of the study, an average of each study location has a pH value of 7. For a good pH measure for the survival of gastropods/bivalves, it ranges from 6.8-8.5 (Gundo, 2010). So it can be said that the pH in the study area is good for the survival of gastropods and bivalves.

Tourist Visit to Seagrass Ecotourism Sites in Study Sites

Seagrass in intertidal areas has different environmental dynamics from other environments, which is caused by tidal events. The results of surveys and interviews with respondents indicate that nature tourism is the choice of tourists visiting the research location. It is further explained that the seagrass bed as a tourist attraction is different from other tourist objects, especially for traveling. This is due to differences in tidal times, such as in April - September when you can see seagrass above sea level between 13.00 - 18.00 Central Indonesian Time (WITA) and October - March between 06.00 - 08.00 WITA. The respondent's next explanation was that each month on the 14th to 17th of the Islamic month (March-September) when seagrass began to appear on the surface of the water was different for each day. The 14th was able to enjoy seagrass beds and the diversity of related biota starting ± 13.00 WITA. Furthermore, on the next date ± plus one hour 30 minutes, and so on. Meanwhile, the time for seagrass is ± 2 hours - 3 hours. Therefore, the time factor is an important point in utilizing the ecological services of seagrass as a tourist attraction.

Observations during the study period indicated that the average number of respondents visiting the seagrass sites was different for each location. Gili Kere an average of more than 100 people/day. The tourist objects that give tourists the satisfaction of visiting seagrass sites are not the same (Figures 17 and 18). The results obtained based on respondents' preferences are 51% to enjoy starfish, especially those who have children and the lowest is snorkeling and others at 14.14% (Figure 19). Furthermore, before deciding to travel to the seagrass site, the factor that the respondents identified as the main thing for visiting the study site was the availability of coastal tourism. Furthermore, respondents revealed that after they were in the new location, they made choices to enjoy nature tourism including the location of seagrass at low tide, snorkeling at high tide, fishing, and so on.

Protoreaster nodosus

Kingdom : Animalia
Phylum : Echinodermata
Class : Asteroidea
Order : Valvatida
Family : Oreasteridae
Genus : Protoreaster
Species : Protoreaster nodosus

Archaster typicus

Kingdom : Animalia
Phylum : Echinodermata
Class : Asteroidea
Order : Valvatida
Family : Archasteridae
Genus : Archaster
Species : *Archaster typicus*

Linckia Laevigata

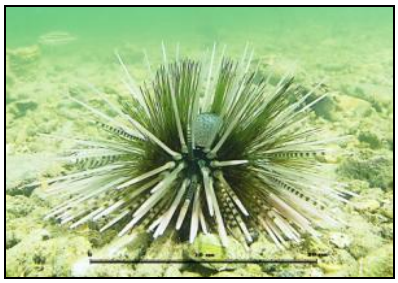
Kingdom : Animalia
Phylum : Echinodermata
Class : Asteroidea
Order : Valvatida
Family : Ophidiasteridae
Genus : *Linckia*
Species : *Linckia laevigata*

Culcita sp

Kingdom : Animalia
Phylum : Echinodermata
Class : Asteroidea
Order : Valvatida
Family : Oreasteridae
Genus : Culcita
Species : *Culcita sp*

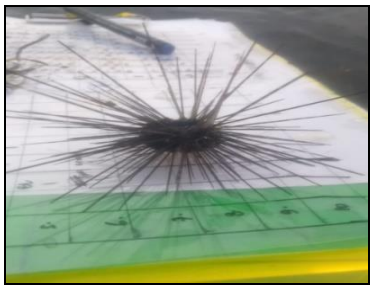
Tripneusteus gratila

Kingdom : Animalia
Phylum : Echinodermata
Class : Echinoidea
Order : Temnopleuroida
Family : Toxopneustidae
Genus : Tripneusteus
Spesies : *Tripneusteus gratila*



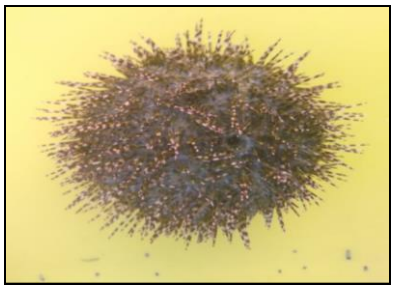
Diadema calamaris

Kingdom : Animalia
Phylum : Echinodermata
Class : Echinoidea
Order : Diadematoida
Family : Diadematidae
Genus : Echinothrix
Species : *Echinotrix calamaris*



Diadema setosum

Kingdom : Animalia
Filum : Echinodermata
Class : Echinoidea
Ordo : Diadematoida
Family : Diadematidae
Genus : Diadema
Species : *Diadema setosum*



Mespilia globulus

Kingdom : Animalia
Filum : Echinodermata
Class : Echinoidea
Ordo : Temnopleuroida
Family : Toxopneustidae
Genus : Mespilia
Spesies : *Mespilia globulus*

Echinotrix diadema

Kingdom : Animalia
Phylum : Echinodermata
Class : Echinoidea
Order : Diadematoida
Family : Diadematidae
Genus : Echinothrix
Species : *Echinotrix diadema*

Synapta sp

Kingdom : Animalia
Phylum : Echinodermata
Class : Holothuroidea
Order : Apodida
Family : Synaptidae
Genus : Synapta
Species : *Synapta maculata*

Holothuria leucospilota

Kingdom : Animalia
Phylum : Echinodermata
Class : Holothuroidea
Order : Aspidochirotida
Family : Holothuriidae
Genus : Holothuria
Species : *Holothuria leucospilota*

Holothuria atra

Kingdom : Animalia
Phylum : Echinodermata
Class : Holothuroidea
Order : Aspidochirotida
Family : Holothuriidae
Genus : Holothuria
Species : *Holothuria atra*

Holothuria scabra

Kingdom : Animalia
Phylum : Echinodermata
Class : Holothuroidea
Order : Aspidochirotida
Family : Holothuriidae
Genus : Holothuria
Species : *Holothuria scabra*

Ophiocoma scolopendrina

Kingdom : Animalia
Phylum : Echinodermata
Class : Ophiuroidea
Order : Ophiurida
Family : Ophiocomidae
Genus : Ophiocoma
Species : *Ophiocoma scolopendrina*

Anadara granosa

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Arcidae
Famili : Arcidae
Genus : Anadara
Species : *Anadara granosa*

Anadara antiquate

Kingdom : Animalia
Filum : Moluska
Kelas : Bivalvia
Ordo : Pteriomorpha
Famili : Arcidae
Genus : Anadara
Spesies : *Anadara antiquata*

Donax faba

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Cardiida
Famili : Donacidae
Genus : Donax
Species: *Donax faba*

Mactra grandis

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Mactridae
Genus : Mactra
Species: *Mactra grandis*

Modiolus philipinarum

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Mytilida
Famili : Mytilidae
Genus : Modiolus
Species: *Modiolus philipinarum*

Meretrix meretrix

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneridae
Genus : Meretrix
Species: *Meretrix meretrix*

Paphia gallus

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneroidea
Genus : Paphia
Species: *Paphia gallus*

Paphia undulate

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneroidea
Genus : Paphia
Species: *Paphia undulate*

Tapes sulcaris

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneridae
Genus : Tapes
Species: *Tapes sulcaris*

Perna viridis

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Mytilida
Famili : Mytilidae
Genus : Perna
Species: *Perna viridis*

Tapes belcheri

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneroidea
Genus : Tapes
Species: *Tapes belcheri*

Tapes literatus

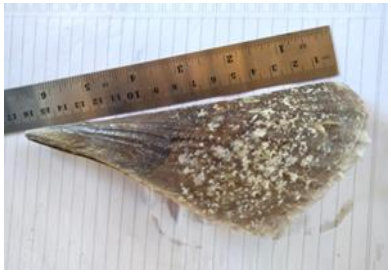
Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneroidae
Genus : Tapes
Species: *Tapes literatus*

Gafrarium dispar

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Veneroidea
Genus : Gafrarium
Species: *Gafrarium dispar*

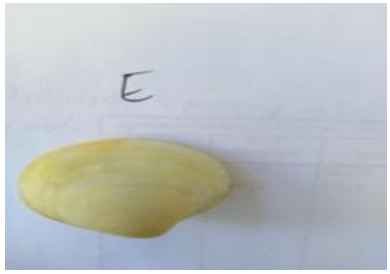
Trachhycardium flavum

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Cardiida
Famili : Cardiidae
Genus : Trachhycardium
Species: *Trachhycardium flavum*



Pinna muricata

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Ostreida
Famili : Pinnidae
Genus : Pinna
Species: *Pinna muricata*

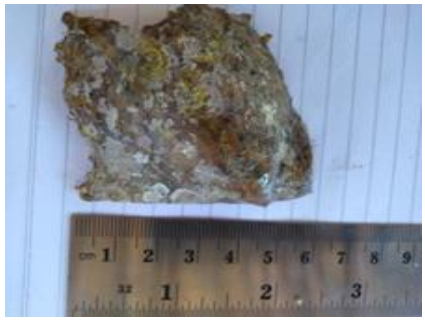


Mactra nitida

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Venerida
Famili : Mactridae
Genus : Mactra
Species: *Mactra nitida*

Lucinoma heroica

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Lucinida
Famili : Lucinidea
Genus : Lucinoma
Species: *Lucinoma heroica*



Pinctada imbricata

Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Ostreida
Famili : Pteriidae
Genus : Pinctada
Species: *Pinctada imbricata*

Figure 17. Species diversity of echinoderms and bivalves in the seagrass beds at the study site

Figure 18 . Ecotourism attraction at the research location

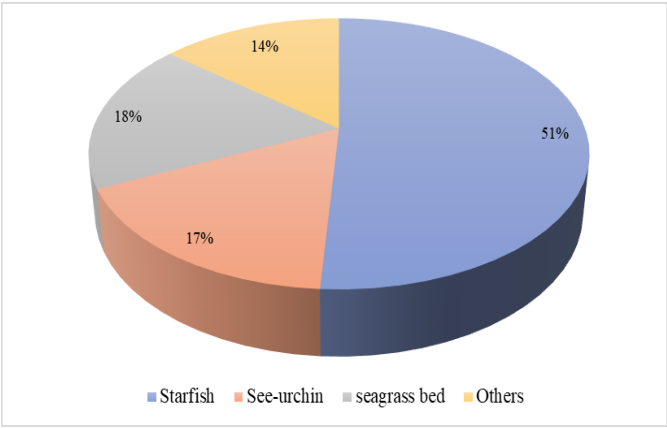


Figure 19.% Number of respondents and their reasons for visiting seagrass beds

Ecotourism Contributes to Local Local Life and Seagrass Conservation

Tourism is generally understood as activities that are beneficial for economic growth, education, and environmental preservation. Another aspect is providing employment and entrepreneurship opportunities as a strategy to stimulate economic growth at local, regional, and national levels. The results of in-depth interviews with community leaders and formal figures (village heads), tourism has contributed to the economy of the local community. For example, they can provide food, drink, and rental equipment for couplings, buoys, and more. Besides, they provide transportation tools such as boats and they immediately act as operators as in East Lombok, namely Tanjung Luar and Lungkak.

Ecotourism, according to respondents, has increased the income level of residents. Livelihood change is adaptation of local communities to take advantage of tourism activities. They get additional income from selling handicrafts, food ingredients, and fish to visitors. Also, coconut plantation owners receive income from selling young coconuts either directly to visitors or indirectly to swords that provide drinks to visitors. All respondents agree that eco-tourism has improved their livelihoods economically. In this case, ecotourism has brought economic benefits to local communities. However, ecotourism has little benefit to the local population, recommended for benefit-sharing mechanisms and increased community participation in ecotourism (Shoo and Songorwa, 2013)

Ecotourism is a tourism activity that relies on the preservation of natural resources. Here, the biodiversity that provides ecosystem services is safe and secure when people protect it. Here, the conservation of biodiversity and its ecosystems has a direct relationship with improving the livelihoods of local communities (Imanishimwe et al., 2018). The results of the research on the knowledge of respondents, especially most local people, namely 57% know about the conservation, 28% are moderate and only 15% know in a low category. Some of the conservation practices identified by respondents are in protecting the marine environment from the threat of bombing and garbage disposal. Respondents further explained the application of local norms known as "awik-awik" in the management of marine natural resources and their ecosystems.

The protection practice that has been carried out by the community under the coordination of the village government is the application of sanctions for those who carry out activities that have been prohibited in

the agreement, for example regarding bombing to catch fish, and other fishing methods that damage the environment in the waters the coast. This has a significant effect on the conservation of the marine environment, particularly coastal waters in the study area. Regarding the conservation of the marine environment, all respondents agree, because they have more economic benefits from ecotourism activities. Local people who benefit financially from eco-tourism encourage them to comply with conservation measures. Meanwhile, this model applies to the concept of eco-village which emphasizes that they integrate community activities with natural characteristics. Therefore, ecotourism activities are optimally carried out through community participation programs in ecotourism, so that there is increased awareness and education that will affect the livelihoods of local communities (Rijal and Sapkota, 2015)

Conclusion

Seagrass has provided various species of marine life. Echonoderms in the seagrass location in the study location consisted of four classes, namely Asteroidea, Echinoidea, Holothuroidea and Ophiuroidea. Ehinodermata in the field of seagrass is evidence of the ecological role of seagrass in the marine environment. The potential of faunal echinoderms in seagrass is a seagrass ecological service which has economic value. The use of seagrass ecological services is for the development of ecotourism on the south coast of East Lombok. Ecotourism in the study area has contributed to the livelihoods of local communities. Another thing that is very influential is the growing awareness of local communities in environmental preservation. Therefore, strengthening the capacity of local communities needs special attention, so that ecotourism development can reach its goals more quickly.

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