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Seawater Pollution Level and Biodiversity Diversity in Tarahan Island, Serang, Banten

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ABSTRACT

Coastal ecosystems are transitional areas between land and sea with high biodiversity. However, currently coastal ecosystems are experiencing complex changes, many developments and activities in coastal areas cause indirect damage. One of the impacts is the entry of pollutants from land into the sea, such as heavy metals, pesticides and organic waste, which can disrupt the balance of marine biodiversity. This study aims to analyze the diversity of biodiversity and the level of seawater pollution in Tarahan Island, Serang, Banten. The method used was purposive sampling for water sampling, cryptic biota and seagrass. Biota identification was done visually using scientific references such as the World Register of Marine Species (WoRMS), while the level of water pollution was measured through Biochemical Oxygen Demand (BOD) and Total Suspended Solid (TSS) analysis.

INTRODUCTION

Coastal ecosystems are transitional areas between land and sea with high biodiversity. However, currently coastal ecosystems are experiencing complex changes, many developments and activities in the coastal ecosystem area make the ecosystem damaged. One of the impacts of ecosystem damage is the anthropogenic impact of inputs from land in the form of dissolved nutrients and excessive sediment, as well as the activities of coastal communities that cause a lot of damage to coastal ecosystems.

The entry of pollutants from land into the sea, such as heavy metals, pesticides and organic waste, can disrupt the ecological balance of waters (AF Allifah et al., 2022). Indonesian waters are tropical waters and this is one of the influences on coral reefs compared to subtropical waters, coral reefs in tropical waters are more vulnerable to temperature and pollution (Hoegh-Guldberg et al., 2017). Based on (Government Regulation No.19 of 1999; Hamuna et al., 2018) on the Control of Marine Pollution and/or Destruction that marine pollution is the entry or inclusion of living things substances, energy, and/or Based on Government Regulation of the Republic of Indonesia Number 19 of 1999 on the Control of Marine Pollution and/or Destruction that marine pollution is the entry or inclusion of living things, substances, energy, and or other components into the marine environment by human activities so that its quality drops to a certain level that causes the marine environment is not in accordance with quality standards and / or its function.

Tarahan Island is one of the islands in Indonesia located in the banten area, precisely located in Bojonegara District, Serang Regency, Banten. Tarahan Island is a coastal area that has a good ecology. However, this area is adjacent to an industrial area and intensive port activities that raise concerns about environmental pollution. This condition has the potential to affect the marine ecosystem with damage to coral reefs, decreased water quality which will have a direct impact on the life of marine biota. Marine pollution has resulted in many dead corals in the coastal areas of tarahan island, although the coral has died, coral skeletons and chunks such as crevices, holes or small spaces are still useful for various cryptic biota to hide from both predators and changing water conditions and provide high diversity and productivity of cryptic biota (Tawakkal et al., 2017).

Seagrass ecosystem is one of the ecosystems located in shallow waters. Seagrass ecosystems play an important role in the health of other coastal ecosystems, especially in coral reef ecosystems, and also have important benefits in the ecological system of coastal areas by providing nutrients that are important for the fertility of marine and coastal aquatic environments (Anggada et al., 2024). Decreased water brightness, either due to increased turbidity or high nutrient inputs, is the main cause of seagrass loss worldwide. Natural factors include strong waves and currents, storms, earthquakes and tsunamis. On the other hand, human activities that contribute to the reduction of seagrass areas include coastal reclamation, dredging and sand mining, and pollution (Dwiputra et al., 2025).

Seagrass ecosystem health is an important indicator of overall coastal ecosystem health. An important analysis in seagrass ecosystems is the INP (Index of Importance). The Index of Importance is an indicator of the role of species in the community. INP is the sum of relative density, relative frequency and relative dominance. The greater the INP value, the greater the role of ecosystem types in the community, and vice versa (Rawana et al., 2023). Therefore, this study aims to analyze biodiversity and the level of seawater pollution in Tarahan Island, Serang, Banten.

LITERATURE REVIEW

Coastal ecosystems are transitional areas between land and ocean that consist of various major ecosystems such as mangrove forests, seagrass beds, and coral reefs, which interact with each other and provide important environmental services for human life and the sustainability of biodiversity (Utina et al., 2018). The existence of coastal ecosystems is vital in maintaining the stability of the marine environment, but their condition is now increasingly threatened by anthropogenic pressures. Anthropogenic pressure is any form of disturbance to the environment that comes from human activities, either directly or indirectly (Liu et al., 2022). In the coastal context, anthropogenic pressures include infrastructure development, coastal reclamation, port activities, mining, and the discharge of industrial and domestic waste into the sea. These activities cause the introduction of various substances that then disturb the balance of marine ecosystems and reduce the quality of coastal habitats (AF Allifah et al., 2022). If not handled properly, these pressures will degrade water quality.

Declining water quality due to pollution has a direct impact on the marine ecosystem. According to Government Regulation of the Republic of Indonesia Number 19 of 1999, marine pollution is defined as the entry of living things, substances, energy, and/or other components into the marine environment by human activities that cause water quality to decrease until it is not in accordance with quality standards and functions. to determine the level of pollution, BOD (Biochemical Oxygen Demand) and TSS (Total Suspended Solid) tests can be carried out. BOD is the biological oxygen demand required by microorganisms (usually bacteria) to break down organic matter aerobically (Santoso et al., 2017). while TSS is a suspended material that causes turbidity of water, especially by soil erosion or erosion carried by water bodies (Rinawati et al., 2016).

Cryptic biota and seagrasses are two components of coastal ecosystems that have an important role in reflecting the health of the aquatic environment. Cryptic biota are small benthic organisms that live hidden in the crevices of substrates such as dead corals, and can serve as biological indicators of environmental disturbances, such as pollution or changes in habitat structure (Moira et al., 2020). Meanwhile, seagrasses are flowering plants (Angiosperms) that thrive in shallow marine waters, forming expanses known as seagrass beds. This ecosystem is very important for coastal waters because it has high primary productivity and plays an important role in maintaining the sustainability and diversity of marine organisms (Riniatsih, 2016), serving as a vital habitat for various biota. This ecosystem is very vulnerable to marine pollution due to agricultural, industrial, and household waste entering the coastal area. Such pollution can cause increased water turbidity and reduced light penetration, thus inhibiting the photosynthesis process of seagrasses and reducing their productivity (Tangke, 2010).

METHOD

Time and Location of Research

This research was conducted in the southern waters of Tarahan Island, Margagiri, Bojonegara District, Serang Regency, Banten, and started on April 26 - May 20, 2025. Water sampling and biota identification were conducted along the route from Grenyang Harbor, Puloampel District, Serang Regency, Banten, to Tarahan Island to obtain a comprehensive picture of water quality conditions in the study area. Identification and data processing were carried out at the Biotechnology Laboratory, Faculty of Agriculture, Sultan Ageng Tirtayasa University. The map of the research location can be seen in Figure 1.

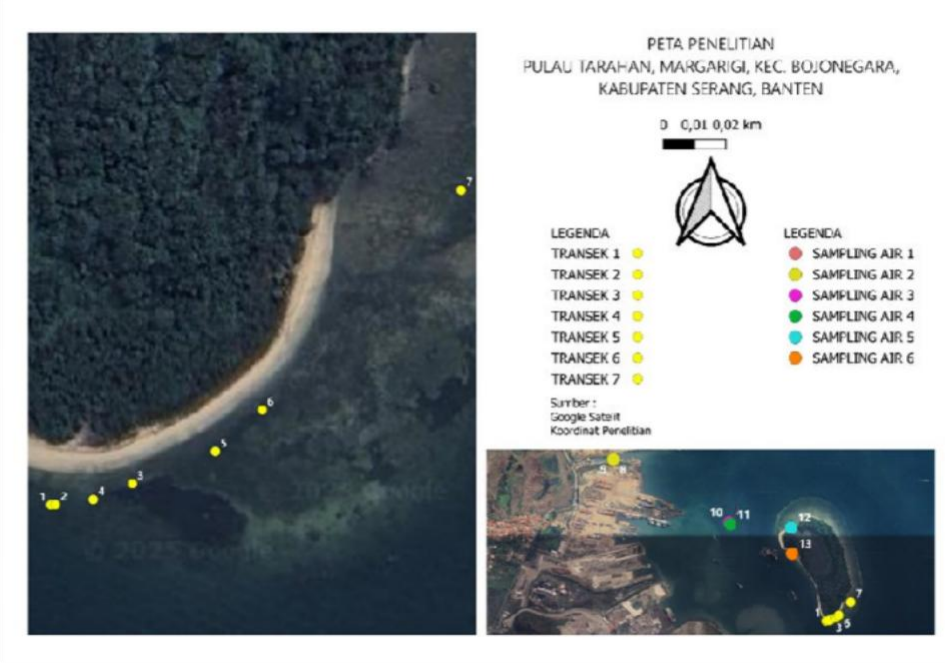

Figure 1. Research Location Map

Tools and Materials

In this study, various equipment used for field data collection and laboratory analysis. For field data collection, stationery and waterproof paper were used to record information on environmental conditions and the presence of seagrass species. Transects measuring 50 cm × 50 cm were used as sampling tools to estimate seagrass cover and abundance. Geographical coordinates of each observation station were recorded using Global Positioning System (GPS). Documentation of field conditions and biota was done using a cell phone camera. Buckets were used to collect corals from the field which were then further analyzed in the laboratory. In the laboratory, corals that have been taken will be broken to retrieve the cryptic biota inside using a chisel tool. Trays and buckets are used in the observation process, while black cloth is used as a background when photographing biota for identification purposes. For the measurement of water pollution parameters, a DO meter was used for dissolved oxygen measurement. The BOD process also involved the use of measuring cups and chemicals. Total Suspended Solid (TSS) measurements were made using millipore filter paper, which after filtration was dried in an oven and weighed to determine the weight of suspended substances. The materials used in this study included various supporting equipment for sample collection and preservation. Water samples were taken using clean used energy drink bottles, and one of the water bottles was dripped with $MnSO4$ solution and 2 ml Alkali iodide solution for analysis of water quality parameters such as Biochemical Oxygen Demand (BOD). Meanwhile, cryptic biota obtained from corals were put into small plastic cups, then dripped with clove oil as an anesthetic and alcohol as a preservative. Gloves were used during the coral and biota collection process to maintain the safety and cleanliness of the samples.

Data Type

This study used two types of data, namely primary data and secondary data. Primary data were obtained directly through field sampling activities, which included seagrass cover and abundance data, as well as cryptic biota data obtained from coral breaking results in the laboratory after being collected using buckets in the field. Primary data also included water quality parameters taken using used energy drink bottles, with the addition of lugol's solution to one of the samples for BOD analysis. In addition, documentation was done using a cell phone camera, and the coordinates of the observation locations were recorded with the help of GPS. All of this primary data was collected during the ongoing research activities,

Meanwhile, secondary data were obtained from various sources that supported the identification and interpretation of primary data. The main sources of secondary data include the World Register of Marine Species (WoRMS) for taxonomic confirmation of biota, relevant scientific journals as theoretical basis and comparison of results, marine species identification books especially cryptic biota, and various trusted websites that provide scientific information on seagrass ecosystems and their associated organisms.

Sampling Method

The sampling method used was purposive sampling. According to (Kusumaatmaja et al., 2016), purposive sampling is a method of sampling deliberately based on certain considerations, with the assumption that the samples taken can represent the population and ecosystem conditions at the sampling site. The collection and recording of seagrass species and cryptic biota as carried out simultaneously with water sampling, including along the route from Grenyang Port to Tarahan Island.

Water sampling was carried out using kratindeng bottles with a capacity of 150 ml. Two kratindeng bottles were used to collect water samples for two main parameters, namely TSS and BOD. During sampling, no air bubbles were present in the bottles. Each bottle was labeled according to the parameter. Water samples were stored in a cool box to maintain water quality before analysis in the laboratory.

Cryptic organisms were collected from dead coral substrates by observing and collecting small organisms found in crevices, cavities, or under dead corals. Sampling was done manually using tweezers, chisels, and plastic trays. Organism samples were fixed using 70% alcohol, 2 drops of clove oil, and labeled with a code for identification in the laboratory. Identification was done with the aid of a microscope and by referring to literature and taxonomic databases such as the World Register of Marine Species (WoRMS).

Seagrass sampling was conducted using the square transect technique. A total of seven square transects measuring 50 x 50 cm were purposively placed in locations with seagrass cover, from the first area where seagrass was found until seagrass was no longer visible. In each square, the seagrass species, percentage of coverage per species, and leaf and root samples were recorded for further analysis. Seagrass species identification was carried out using references from SeagrassNet and Seagrass-Watch. The data observed included density, frequency, and coverage of seagrass species.

Research Procedure

Water pollution identification is conducted through Biochemical Oxygen Demand (BOD) analysis by measuring dissolved oxygen (DO) levels in water samples. The first step is to record the initial DO value using a dissolved oxygen meter. Next, before adding 2 ml of $MnSO_4$ and alkaline iodide solution to the water sample to preserve its oxygen content, measure the dissolved oxygen first. After that, the sample is added with manganese sulfate solution, potassium iodide, and starch. The chemical reaction of the three solutions is added every five minutes to ensure the formation of a precipitate. After the reaction time is complete, the final DO value is measured again. The BOD value is calculated from the difference between the initial DO and the final DO, reflecting the amount of oxygen used by microorganisms in breaking down organic matter in the water.

The Total Suspended Solid (TSS) level was identified using Millipore filter paper. Water samples were filtered using filter paper that had been dried and weighed beforehand (W1). After the filtration process, the filter paper that had collected the suspended particles was dried in an oven at 105°C for 1–2 hours. Next, the paper is cooled in a desiccator for 15–30 minutes before being weighed again (W2). The TSS value is obtained from the difference in weight of the filter paper before and after filtration, and the result is expressed in mg/L.

The identification of cryptic biota present on coral reefs is carried out through visual analysis of photographic documentation. This identification process is based on scientific references, including marine taxonomic databases such as the World Register of Marine Species (WoRMS), publications in scientific journals, and other reliable identification books. The identification data is recorded in Microsoft Excel, including taxonomic information at the species, phylum, and genus levels for each identified cryptic biota.

Data Analysis

Data analysis in this study was conducted to measure the level of diversity, dominance, and importance of a species in the seagrass community. Data obtained from field surveys will be processed using several ecological statistical formulas as follows:

1. Health Index

This analysis is calculated based on seagrass species richness, seagrass cover, macroalgae cover, epiphyte cover, and water clarity. The formula for calculating seagrass health is based on the equation (Hernawan et al., 2021), which is:

$$IKEL = \left(\frac{St}{Sref}\ x\ 0.2\right) + \left(\frac{Ct}{Cref}\ x\ 0.2\right) + \left(\frac{Wt}{Wref}\ x\ 0.2\right) + \left(1 - \left(\frac{Mt}{Mmax}\right) x\ 0.2\right)$$

$$\left(1 - \left(\frac{Et}{Emax}\right) x\ 0.2\right)$$

Explanation:
St = Diversity of seagrass species observed
Sref = Maximum value of seagrass diversity (9)
Ct = Percentage of observed seagrass coverage
Cref = Maximum percentage of seagrass coverage (100)
Wt = Observed water clarity
Wref = Maximum value of water clarity (2)
Mt = Percentage of observed macroalgae coverage
Mmax = Maximum percentage of coverage (100)
Et = Percentage of epiphyte coverage observed
Emax = Maximum percentage of epiphyte coverage (100)

Based on the Seagrass Ecosystem Health Index (IKEL) value, the status of seagrass ecosystems is categorized into five levels, namely very poor (IKEL value 0 0.36), poor (0.37–0.52), moderate (0.53–0.68), good (0.69–0.84), and very good (0.85–1).

2. Diversity Index (Shannon-Wiener (H′)

The diversity index is calculated using the Shannon-Wiener (H′) formula to determine the level of seagrass species diversity at the study site (Brower et al., 1998). The formula used is:

$$H' = -\sum (P_i\ x\ ln\ P_i)$$

Explanation:
H′ = Shannon-Wiener diversity index

Pi = Proportion of individuals of species i to the total number of individuals of all species (ni/N)
ni = Number of individuals of species i
N = Total number of individuals of all species
ln = Natural logarithm

The criteria for interpreting H′ values are as follows:

H′ < 1 : Low diversity
1≤ H′ ≤3 : Moderate diversity
H ′> 3 : High diversity

3. Dominance Index

This index is used to measure the degree of dominance of one or more seagrass species in a community. The index is calculated using the following formula (Rahfika et al., 2024):

$$\sum_{i=I}^{S} (Pi)^2$$

Explanation:
D = Simpson's Dominance Index
S = Total number of seagrass species found
pi = Proportion of individuals of species i relative to the total number of individuals of all species (pi=ni/N)

The value of D ranges from 0 to 1. A value close to 1 indicates dominance by one or more species, while a value close to 0 indicates no dominance and a more even distribution of species.

4. Importance Value Index (INP)

This index provides a comprehensive overview of the ecological role of each seagrass species in the community. INP is calculated based on three main parameters: relative density, relative frequency, and relative dominance (Walo et al., 2022). The formula for calculating INP is:

$$INP = RDi + RFi + RCi$$

Explanation:
INP = Importance Value Index
RDi = Relative density
Fi = Species frequency

5. Total Suspended Solids (TSS) Testing

The formula used to calculate the Total Suspended Solids (TSS) value is as follows (Hermansyah et al., 2024)

$$TSS = \frac{W_1 - W_0}{v} x\ 1000$$

Expalanation:

W_0 = Weight of the weighing medium containing the initial filter medium (mg)

W_1 = Weight of the weighing medium containing the filter medium and dry residue (mg)

V = Volume of the test sample (mL)

1000 = Conversion from milliliters to liters.

6. Biochemical Oxygen Demand (BOD) Testing:

$$DO = \frac{V\ x\ N\ x\ 8000\ x\ F}{50}$$

Explanation:

DO = Dissolved oxygen content (mg/l) V = Volume of the titrant

N = Titrant normality (0.0125)

F = After obtaining the DO5 result, calculate the BOD value using the formula:

BOD = DO0 – DO5

BOD = Biochemical oxygen demand content (mg/l)

DO0 = Initial dissolved oxygen content (mg/l)

DO5 = Dissolved oxygen content on day 5 (mg/l)

RESULT AND DISCUSSION

1. Seawater Quality Test Results

Water quality assessment in the waters of Tarahan Island was conducted through the measurement of Total Suspended Solid (TSS) and Biochemical Oxygen Demand (BOD). TSS indicates the turbidity of the water, while BOD indicates the need for oxygen to decompose organic matter. Both parameters affect the life of marine biota, including cryptic biota and seagrasses. The measurement results are presented in the following table.

Table 1. Average Values of TSS and BOD

Parameter	Saturite	Average	Measure (PPLH No. 22, 2021)
TSS	Mg/l	377,778	80
BOD	Mg/l	0,783	20

***Total Suspended Solid* (TSS)**

According to (Edward (2003); (Jiyah et al., 2017) suspended solids or Total Suspended Solid (TSS) material is a place for heterogeneous reactions to take place, which functions as the earliest sediment-forming material and can hinder the ability to produce organic substances in a body of water.

In the measurement results, the TSS value in the Tarahan Island waters averaged 377.778 Mg/L, but when compared to the quality standard of seawater for biota by the Ministry of Environment No.51 of 2004 with a quality standard value of 80 Mg/L. High TSS values that exceed the quality standard value indirectly affect the lives of organisms because it will increase turbidity in waters that can affect the process of photosynthesis. In line with research (Wirasatriya, 2011; Budianto et al., 2017), high TSS concentration values can affect the process of photosynthesis and high temperatures on the water surface so that the oxygen released by aquatic plants is reduced and can also reduce fish populations.

***Biology Oxygen Demand* (BOD)**

Based on BOD analysis in the laboratory, it states that the average BOD value is 0.783 Mg/L. However, when compared to the quality standard of seawater for biota by the Ministry of Environment No.22 of 2021 with a quality standard value of 20 Mg/L. This shows that the quality of sea water at the sampling location is still relatively good and safe for the survival of marine biota. Low BOD values indicate that there is relatively little organic matter in the water, so the oxygen demand for the biological decomposition process is also low. This could indicate that the general condition of the waters is still good in terms of organic pollution. High organic matter content in waters has an impact on increasing dissolved oxygen demand (BOD) in waters (Daroini et al., 2020).

2. Cryptic Diversity

Cryptic biota are small benthic organisms that live hidden in the water substrate and can be an indicator of environmental conditions. The following table presents the results of the identification of cryptic biota based on phylum, genus, species, size, and number of individuals found at the research site, as shown in Table 2 below.

Table 2. Cryptic Diversity in Tarahan Island

No.	Code	Filum	Genus	Species	Size (cm)	Total
1	IKN - 149, 156	*Annelida*	*Alitta*	*Alitta succinea*	1-2	2
2	IKN - 143	*Arthropoda*	*Pisidia*	*Pisidia sp.*	2	1
3	IKN - 152, 169, 175,		*Clibanarius*	*Clibanarius*	2-4	8

No.	Code	Filum	Genus	Species	Size (cm)	Total
	177, 182, 186, 188					
4	IKN - 160, 168, 170, 173, 174, 176, 179, 180, 183, 184, 185			*Clibanarius erythropus*	1-2	11
5	IKN - 155, 163		*Pagurixus*	*Pagurixus rubrovittatus*	2-3	2
6	IKN - 157, 158, 161, 172		*Pachygra psus*	*Pachygr apsus marmoratus*	1-2	4
7	IKN - 166		*Penaeus*	*Penaeus Monodon Fabricius*	2	1
8	IKN - 171		*Leptodius*	*Leptodius Sanguineus*	2	1
9	IKN - 178		*Pilumnus*	*Pilumnus hirtellus*	1	1
10	IKN - 181		*Hemigrapsus*	*Hemigrapsus sanguineus*	3	1
11	IKN - 144	*Chordata*	*Gobiidae*	*Acentrogobius caninu*	6	1
12	IKN - 142	*Mollusca*	*Acanthoc ardia*	*Acanthocardia Echinata*	2	1
13	IKN - 145		*Nassarius*	*Nassarius olivaceus*	2	1
14	IKN - 150, 187		*Drupella*	*Drupella rugosa*	2-3	2
15	IKN – 151, 159		*Anadara*	*Anadara granosa*	3	2
16	IKN - 153		*Nerita*	*Nerita sp.*	2	1
17	IKN - 154, 164		*Turbo*	*Turbochrysos tomus*	1-2	2
18	IKN – 165		*Monetaria*	*Cypraea Moneta*	2	1
19	IKN – 147		Dubium	*Dubium Rudolphi*	2	1
20	IKN – 146, 148, 167	*Porcellan idae*	*Petrolisthes*	*Petrolisthes armatus*	1	3

Research on the south coast of Tarahan Island identified cryptic fauna from two main phyla: Annelida and Arthropoda. From the table above, two individuals of Alitta succinea (from the phylum Annelida) measuring 1-2 cm were found. Meanwhile, from the Arthropoda phylum, several species were identified, namely Pisidia sp. (1 individual; 2 cm), Clibanarius humilis (8 individuals), Clibanarius erythropus (11 individuals; 1-2 cm), and Pagurixus rubrovittatus (2 individuals). The total number of individuals found reached 24.

Clibanarius erythropus was the most dominant species. This abundance indicates that the local environmental conditions, such as substrate, salinity and shelter availability, are suitable for its survival. This species is known to have a high tolerance for environmental variation and is able to adapt quickly to tropical coastal habitats. The presence of Alitta succinea also indicates that the substrate in the study area contains sufficient organic matter. This polychaeta is commonly found in soft substrates rich in detritus and plays an important role as a detritivore in the food chain. According to research Tawakkal et al., (2017) which shows that the diversity of cryptic fauna such as centipedes and polychaeta tends to be high in environments that are protected and have complex bottom structures, such as small rocks, dead coral fragments, or underwater vegetation that provide hiding spaces.

Seagrass Types on the Coast of Tarahan Island.

Table 3. Seagrass Types

Type	T1	T2	T3	T4	T5	T6	T7
Enhalus acoroides	v	v	-	-	-	-	-
Thalassiahemprichii	v	-	v	-	-	v	v
Cymodocea rotundata	-	-	-	v	v	-	-

Description: v= Yes; - = No

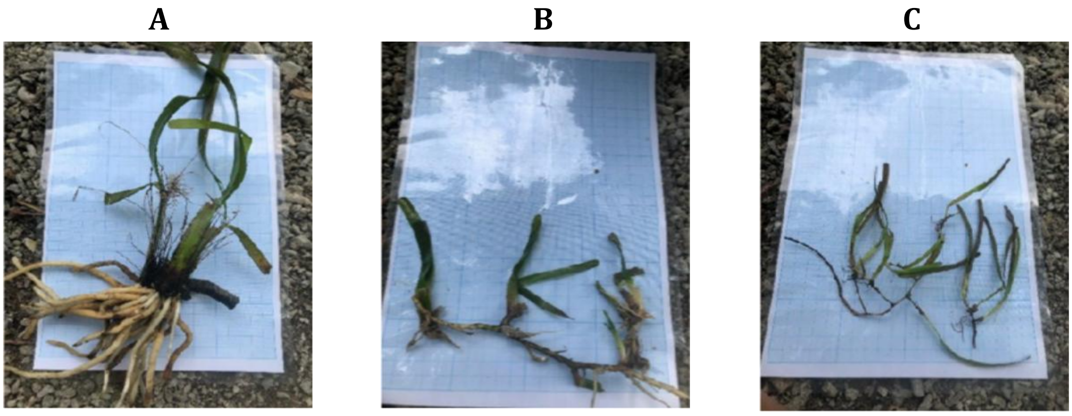

Figure 2. Seagrass species in Tarahan Island: A. Enhalus acoroides; B. Thalassia hemprichii; C. Cymodocea rotundata

Based on observations on the south coast of Tarahan Island, which is part of the coastal area of Banten Bay. This location is characterized by relatively shallow waters with sandy substrate and high brightness, which are ideal conditions for the growth of Thalassia hemprichii and Cymodocea rotundata. With little mangrove vegetation, this type of seagrass will have a high density in areas with sand or sand substrates with coral fragments (Chamidy et al., 2020); Rawung S et al., 2018). In contrast, Enhalus acoroides tends to grow in deeper waters and close to mangrove ecosystems, which may be less available in this observation location.

Based on the data analysis of the data table above shows that there are three types of seagrasses in the southern part of the tarahan island which are dominated by the type of seagrass Thalassia hemprichii with a total of 102, this type is far more dominant and many compared to Cymodocea rotindara which is found as much as 77, and Enhalus acoroides as much as 15, this seagrass is less than other seagrasses.

Seagrass Health Index

The seagrass health index is used to assess the condition of seagrass beds based on several parameters, such as seagrass coverage, epiphyte coverage, macroalgae coverage, substrate type, brightness, and seagrass density. This assessment provides an overview of the quality of the seagrass ecosystem at a given location. Table 4 shows the results of the seagrass health index calculations for Tarahan Island.

Table 4. Seagrass Health Index

TL	TE	TM	S	K	KL	RT	RK	JL	JK
10	50	0	0	2	26	14.29	3.71	*Ea & Th*	
50	75	10	40	0	8	7.143	1.14	*Ea*	
100	25	0	0	2	33	14.29	4.71	*Th*	
75	25	0	25	1	36	10.71	5.14	Cr	0.37
75	50	0	25	1	41	10.71	5.86	75	
100	0	0	0	2	27	14.29	3.86	100	
100	50	0	0	2	23	14.29	3.29	100	
600	275	10	90	10	194			3	
85.71	39.3	1.43	12.9	1.43	27.7				BURUK

Explanation:
TL = Seagrass cover
TE = Epiphyte cover
TM = Macroalgae cover
S = Substrate
K = Brightness
KL = Seagrass density
RT = Average cover
RK = Average density
JL = Seagrass type

IK = Health index

As can be seen from the results of the data analysis in the table above, the average seagrass health index value is 0.368, which is classified as poor according to the seagrass ecosystem health index (IKEL) criteria (Rahmawati et al., 2022; Muhammad et al., 2025). This value is far below the threshold for the moderate category (around 0.6), as explained in the study (Nashih et al., 2024), where IKEL values below 0.5 are categorized as poor, 0.5–0.6 as moderate, and above 0.6 as good. Additionally, while the average seagrass coverage on Tarahan Island is quite high (85.71%), other parameters such as high epiphyte coverage (39.28%), low seagrass density (27.71 individuals per unit area), and the dominance of a single seagrass species (Thalassia hemprichii with an INP of 57.41) indicate environmental stress and community imbalance. Recent studies also confirm that high epiphyte and macroalgae coverage, along with low health index values, are key indicators of poor seagrass ecosystem health, as these conditions signify ecological disturbances and a decline in the seagrass habitat's function as a coastal ecosystem buffer.

Diversity Index, Dominance Index, and INP of Seagrass

An analysis of diversity, dominance, and importance value index (INP) was conducted to determine the structure of the seagrass community on Tarahan Island. These parameters indicate the relative contribution of each seagrass species to the ecosystem as a whole. Table 5 shows the number of individuals, dominance values, diversity indices, and INP of each seagrass species found.

Table 5. Diversity Index, Dominance Index, and INP of Seagrass

Type	Amont	Dominance	Diversity	INP
Enhalus acoroides	15			16.27
Thalassia hemprichii	102	0,4399511	0,9026983	57.41
Cymodocea Rotundata	77			31.09

Based on table 5, the average value of seagrass diversity index in Tarahan Island on the whole transect is with a value of H' 0.903. From the average seagrass diversity index value, it is included in the low diversity index category H' < 1. Low diversity is due to the distribution of the limited number of individuals of each species (S. H. Muhammad et al., 2021). According to (Shannon-Winner, 1kk; Rappe, 2010), that the diversity index (H') consists of several criteria, namely: H' > 3.0 = shows very high diversity, H' 1.6-3.0 = shows high diversity, H' 1.0-1.5 = says medium diversity and H' < 1 = shows low diversity.

A community can be said to have high species diversity if the community is composed of many species and the abundance of the same or almost the same species. Conversely, if the community is composed of very few species and if only a few are dominant then the species diversity is low (Laksamana et al., 2024). The seagrass diversity index in Tarahan Island Waters is in the low category. Overall, there are 3 species observed, namely Enhalus acoroides, Thalassia hemprichii and Cymodocea rotundata. According to (Soegianto 1994: (Laksamana et al., 2024) a community has high species diversity if the community is composed by many species, otherwise if the community is composed by very few species and only a few dominant species, then the species diversity will be low.

Based on Table 5, the dominance index value obtained at the research location was C 0.44. The calculated dominance index value falls into the low dominance index category, i.e., 0.00 < C ≤ 0.50. According to (Fahrul 2007; Walo et al., 2022). Species dominance describes the ability of a plant species to influence its community through its abundance and dominant growth. The low dominance index value on Tarahan Island, Serang Regency, Banten, indicates that the water conditions are still relatively stable, so there is no ecological pressure on the aquatic biota, and no seagrass species dominates others to an extreme degree. Additionally, the difference in numbers between species is minimal, so there is no tendency for dominance by a particular species.

The importance index can describe the role of a seagrass species within a community. Based on the INP calculations in Table 5, the seagrass species with the highest INP value is Thalassia Hemprichii. This indicates that the seagrass species Thalassia hemprichii has the greatest influence or role in the seagrass ecosystem of Tarahan Island. If damage occurs to the seagrass species Thalassia hemprichii, then other seagrass species found on Tarahan Island will be threatened with damage. This is consistent with the statements made by (Fahrul 2007; Fahruddin et al., 2023), that INP is an importance index that describes the importance of vegetation in its ecosystem. If the INP of a vegetation type is high, then that type greatly influences the stability of the ecosystem. The components that determine the magnitude of the INP value are relative frequency, relative density, and relative cover.

CONCLUSION

Based on research conducted on Tarahan Island, Serang, Banten, it can be concluded that the level of marine water pollution, particularly the TSS parameter, remains high with an average value of 377.778 Mg/L, far exceeding the marine water quality standard for biota (80 Mg/L). This high TSS value has the potential to inhibit photosynthesis and reduce fish populations. Meanwhile, the average BOD value of 0.783 Mg/L indicates that the seawater quality is still good and safe from organic pollution. The diversity of cryptic biota on Tarahan Island was identified from the phyla Annelida and Arthropoda, with Clibanarius erythropus as the most dominant species, indicating suitable environmental conditions for its survival. The seagrass health index falls into the poor category (0.368), despite relatively high seagrass coverage (85.71%). However, high epiphyte coverage (39.28%) and low seagrass density (27.71 individuals per unit area) indicate environmental stress. Seagrass diversity on Tarahan Island is low (H' 0.903) with three observed species: Enhalus acoroides, Thalassia hemprichii, and Cymodocea rotundata. The seagrass dominance index was low (0.44), indicating no extreme dominance by any single species. Thalassia hemprichii had the highest Importance Value Index (IVI), indicating its most significant ecological role in the seagrass community on Tarahan Island.

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REFERENCES

AF Allifah, A. N., & Natsir, N. A. (2022). Biota Laut Sebagai Indikator Biologi Dalam Menentukan Status Pencemaran Perairan Tulehu Kecamatan Salahutu Maluku Tengah. *Jurnal Biology Science & Education*, 11, 83–95.

Anggada, R., Riniatsih, I., & Suryono, C. A. (2024). Kajian Indeks Kesehatan Ekosistem Lamun di Padang Lamun Pantai Bandengan dan Pantai Blebak, Jepara. *Journal of Marine Research*, 13(1), 66–72. https://doi.org/10.14710/jmr.v13i1.37818

Brower, J. E., & Zar, J. H. (1998). field and laboratory methods for general ecology. wm. c. brown company.

Budianto Syaiful, & Hariyanto Teguh. (2017). Analisis Perubahan Konsentrasi Total Suspended Solids (TSS) Dampak Bencana Lumpur Sidoarjo Menggunakan Citra Landsat Multi Temporal (Studi Kasus: Sungai Porong, Sidoarjo). *Jurnal Teknik ITS*, 6, 130–135.

Chamidy, A. N., Suryono, C. A., & Riniatsih, I. (2020). Analisis Multivariat Untuk Melihat Hubungan Jenis Sedimen Terhadap Jenis Lamun. *Journal of Marine Research*, 9(1), 94–98. https://doi.org/10.14710/jmr.v9i1.26686

Daroini, T. A., & Arisandi Apri. (2020). Analisis BOD (Biological Oxygen Demand) Di Perairan Desa Prancak Kecamatan Sepulu, Bangkalan. *Jurnal Ilmiah Kelautan Dan Perikanan*, 1, 558–566. https://doi.org/10.21107/juvenil.v1i4.9037

Dwiputra, M. A., Permana, R. D., Syari, C., Purnomo, A., & Vederly, M. (2025). Penentuan Status Padang Lamun Kawasan Ekowisata Mangrove Cuku Nyinyi Desa Sidodadi, Kab. Pesawaran, Provinsi Lampung. *Jurnal Laut Pulau: Hasil Penelitian Kelautan*, 4(1), 1–11. https://doi.org/10.30598/jlpvol4iss1pp1-11

Fahruddin, M., Suriyadin, A., Murtawan, H., Abdurachman, M. H., Setyono, B. D. H., Saputra, A., & Ilyas, A. P. (2023). Struktur Komunitas Lamun di Perairan Ketapang, Lombok Barat. *Journal of Marine Research*, 12(1), 61–70. https://doi.org/10.14710/jmr.v12i1.34537

Hamuna, B., Tanjung, R. H., Maury, H. K., Alianto, dan, & Ilmu Kelautan dan Perikanan, J. (2018). Kajian Kualitas Air Laut dan Indeks Pencemaran Berdasarkan Parameter Fisika- Kimia Di Perairan Distrik Depapre, Jayapura. *Jurnal Ilmu Lingkungan*, 16, 35–43. https://doi.org/10.14710/jil.16.135-43

Hermansyah M. Hapiz, Panca Putri, Y., Arif Setiawan, A., Eddy, S., Jumingin, & Saputra, W. (2024). Uji Padatan Tersuspensi Total (TSS) Pada Sampel Air Limbah Sawit Secara Gravimetri. *Jurnal Ilmu Lingkungan*, 2, 27–33.

Hernawan, U. E., Rahmawati, S., Ambo-Rappe, R., Sjafrie, N. D. M., Hadiyanto, H., Yusup, D. S., Nugraha, A. H., La Nafie, Y. A., Adi, W., Prayudha, B., Irawan, A., Rahayu, Y. P., Ningsih, E., Riniatsih, I., Supriyadi, I. H., & McMahon, K. (2021). The first nation-wide assessment identifies valuable blue-carbon seagrass habitat in Indonesia is in moderate condition. *Science of the Total Environment*, 782. https://doi.org/10.1016/j.scitotenv.2021.146818

Hoegh-Guldberg, O., Poloczanska, E. S., Skirving, W., & Dove, S. (2017). Coral reef ecosystems under climate change and ocean acidification. In Frontiers in Marine Science (Vol. 4, Issue MAY). *Frontiers Media S. A.* https://doi.org/10.3389/fmars.2017.00158

Jiyah, Sudarsono, B., & Sukmono, A. (2017). Studi Distribusi Total Suspended Solid (TSS) Di Perairan Pantai Kabupaten Demak Mengguakan Citra Landsat. *Jurnal Geodesi Undip*, 6(1), 41–47.

Kusumaatmaja Kartika Putri, Rudiyanti Siti, & Churun ’Ain. (2016). Hubungan Perbedaan Lamun dengan Kelimpahan Epifauna di Pantai Lipi, Pulau Pari, Kepulauan Seribu. *Diponogoro Journal of Maquares*, 5, 398–405.

Laksamana Zul Rizky, Jailani, & Taru Paulus. (2024). Keanekaragaman Jenis Mega Gastropoda di Perairan Pulau Miang Besar Kecamatan Sangkulirang Kabupaten Kutai Timur. *Jurnal Tropical Aquatic Sciences*, 3(1), 77–89. https://doi.org/10.30872/tas.v3i1.840

Liu, M., Wei, H., Dong, X., Wang, X. C., Zhao, B., & Zhang, Y. (2022). Integrating Land Use, Ecosystem Service, and Human Well-Being: A Systematic Review. In Sustainability (Switzerland) (Vol. 14, Issue 11, pp. 1–31). *MDPI*. https://doi.org/10.3390/su14116926

Moira, V. S., & Luthfi, O. M. (2020). Organisme Kriptik Crustacea pada Karang Mati (Dead Coral) Pocillopora di Perairan NCF Putri Menjangan, Buleleng, Bali Barat. *Journal of Tropical Marine Science*, 3(1), 47–52. https://doi.org/10.33019/jour.trop.mar.sci.v3i1.1487

Muhammad, I. F., Riniatsih, I., & Suryono, C. A. (2025). Indeks Kesehatan Ekosistem Lamun Pada Pantai Mrican dan Pantai Babakan Kulon, Kemujan, Taman Nasional Karimunjawa. *Journal of Marine Research*, 14(1), 96–104. https://doi.org/10.14710/jmr.v14i1.42597

Muhammad, S. H., Alwi, D., & Fang, M. (2021). Komposisi Dan Keanekaragaman Jenis Lamun Di Perairan Desa Mandiri Kabupaten Pulau Morotai. *Aurelia Journal*, 3, 73–82.

Nashih, M. D. F., Pratikto, I., & Riniatsih, I. (2024). Perbandingan Nilai Indeks Kesehatan Ekosistem Lamun antara Perairan di Pantai Prawean Bandengan dengan Pulau Panjang. *Journal of Marine Research*, 13(1), 100–107. https://doi.org/10.14710/jmr.v13i1.39012

Rahfika, R., Rahman, I., & Paryono, P. (2024). Komposisi Jenis dan Tutupan Lamun di Perairan Dusun Pandanan, Sekotong, Lombok Barat. *Jurnal Sains Teknologi & Lingkungan*, 10(2), 282–295. https://doi.org/10.29303/jstl.v10i2.624

Rappe, R. A. (2010). Struktu Komunitas Ikan Pada Padang Lamun Yang Berbeda Di Pulau Barrang Lompo Fish Community Structure In Diferrent Seagrass Beds Of Barrang Lompo ISLAND. *Jurnal Ilmu Dan Teknologi Kelautan Tropis*, 2(2), 62–73. http://www.itk.fpik.ipb.ac.id/ej_itkt22

Rawana, Wijayani, S., & Masrur, M. A. (2023). Indeks Nilai Penting dan Keanekaragaman Komunitas Vegetasi Penyusun Hutan di Alas Burno SUBKPH Lumajang. *Jurnal Wana Tropika*, 12(02), 80–89. https://doi.org/10.55180/jwt.v12i02.215

Rawung S, Tilaar Ferdinand F, & Rondunuwu Ari B. (2018). Inventarisasi Lamun Di Perairan Marine Field Station Fakultas Perikanan dan Ilmu Kleuatan UNSRAT Kecamatan Likupang Timur Kabupaten Minahasa Utara. *Jurnal Ilmiah Platax*, 6, 38–45.

Rinawati, Hidayat, D., Suprianto, R., & Sari Dewi, P. (2016). Penentuan Kandungan Zat Padat (Total Dissolve Solid dan Total Suspended Solid) Di Perairan Teluk Lampung. *Analit: Analytical and Environmental Chemistry*, 1(01), 36–46.

Riniatsih, I. (2016). Distribusi Jenis Lamun Dihubungkan dengan Sebaran Nutrien Perairan di Padang Lamun Teluk Awur Jepara. *Jurnal Kelautan Tropis*, 19(2), 101–107. www.ejournal2.undip.ac.id/index.php/jkt

Santoso, A. A., Sudarsono, B., & Sukmono, A. (2017). Analisis Pengaruh Tingkat Bahya Erosi Daerah Aliran Sungai (DAS) Bengawan Solo Terhadap Total Suspended Solid (TSS) Di Perairan Waduk Gajah Mungkur. *Jurnal Geodesi Undip*, 6(4), 463–473.

Tangke, U. (2010). Ekosistem Padang Lamun (Manfaat, Fungsi dan Rehabilitasi). *Jurnal Ilmiah Agribisnis Dan Perikanan*, 3(1), 9–29.

Tawakkal, M., Nanda Devira, C., Ulfah, M., Sembiring, A., Maya Kurniasih, E., Meyer, C., Studi Ilmu Kelautan, P., Kelautan dan Perikanan, F., Syiah Kuala, U., Ilmu Kelautan, P., Perikanan dan Ilmu Kelautan, F., & Diponegoro, U. (2017). Komposisi Organisme Kriptik Brachyura (Krustasea) Pada Karang Mati Pocillopora di Perairan Sabang Composition of Brachyura Cryptic Organism (Crustacea) on The Pocillopora Dead Coral in Sabang Island. *Jurnal Ilmiah Mahasiswa Kelautan Dan Perikanan Unsyiah*, 2, 547–555.

Utina, R., Nusantari, E., Katili Abubakar Sidik, & Yowan, T. (2018). Ekosistem dan Sumber Daya Alam Pesisir. CV BUDI UTAMA.

Walo Mellin Yulita, Sondak Calvyn F.A, Paransa Darus Sa'adah Johanis, Kusen Janny D., Joshian N. W. Schaduw, Billy T. Wagey, & Jetty Rangan. (2022). Kondisi Padang Lamun Di Sekitar Perairan Mokupa Kecamatan Tombariri Kabupaten Minahasa. *Jurnal Pesisir Dan Laut Tropis*, 10, 272–284.