

## STRUCTURE OF THE GASTROPODS COMMUNITY IN THE COASTAL WATERS OF DOMBA, PANDEGLANG REGENCY, BANTEN

### Struktur Komunitas Gastropoda di Perairan Pantai Domba, Kabupaten Pandeglang, Banten

Debby Aurelia<sup>1\*</sup>, Donny Juliandri Prihadi<sup>2</sup>, Lintang Permata Sari Yuliadi<sup>2</sup>, Yuniarti<sup>2</sup>, Sabrina Silvi Asyifa<sup>2</sup>, Esther Rosida Gultom<sup>2</sup>, Loise Regina<sup>2</sup>,

<sup>1</sup>Marine Science Study Program, Padjadjaran University, <sup>2</sup>Department of Marine Sciences, Padjadjaran University

Jalan Ir. Soekarno KM. 21, Jatinangor, Sumedang Regency 45363, West Java

\*Corresponding Author: [debby21001@mail.unpad.ac.id](mailto:debby21001@mail.unpad.ac.id)

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#### ABSTRACT

Marine gastropods play an important role in marine ecosystems as one of the parameters that can be used to assess the health of the marine environment. The waters of Domba Beach have a fairly important aquatic community, namely the gastropod community. This study was conducted in the waters of Domba Beach, Pandeglang Regency, Banten, with the aim of determining the abundance of gastropod species and the structure of the gastropod community, including the diversity index, evenness index, and dominance index of gastropods. Gastropod data sampling was conducted using the quadrant line transect method with a quadrant size of 50x50 cm on 11 transects. A total of 19 gastropod species were found, consisting of 12 families and 17 genera. The gastropod with the highest abundance was the species *Clypeomorus bifasciata*. Meanwhile, the species with the lowest abundance were *Conus ebraeus*, *Cymatium muricinum*, *Neverita didyma*, and *Nerita albicilla*. The average diversity index (H') of gastropods at the study site was 2.42, the evenness index (E) was 0.82, and the dominance index (D) was 0.12. This indicates that the gastropod community structure in the seagrass ecosystem of Domba Beach is moderate with high evenness and no dominant species.

Keywords: Abundance, Domba Beach, Ecological indices, Gastropods

#### ABSTRAK

Gastropoda laut memiliki peran penting di ekosistem laut yaitu sebagai salah satu parameter yang dapat digunakan untuk menilai kesehatan lingkungan di laut. Perairan Pantai Domba memiliki komunitas perairan yang cukup penting yaitu komunitas gastropoda. Penelitian ini dilakukan di Perairan Pantai Domba, Kabupaten Pandeglang, Banten yang bertujuan untuk mengetahui kelimpahan jenis gastropoda dan mengetahui struktur komunitas gastropoda yang meliputi indeks keanekaragaman, indeks keseragaman, dan indeks dominansi gastropoda. Pengambilan data gastropoda dilakukan dengan menggunakan metode line transek kuadran dengan ukuran kuadran 50x50 cm pada 11 transek. Hasilnya ditemukan sebanyak 19 spesies gastropoda yang terdiri dari 12 famili dan 17 genus. Gastropoda dengan kelimpahan tertinggi

yaitu spesies *Clypeomorus bifasciata*. Sedangkan untuk kelimpahan terendah adalah spesies *Conus ebraeus*, *Cymatium muricinum*, *Neverita didyma* dan *Nerita albicilla*. Nilai rata-rata indeks keanekaragaman (H') gastropoda di lokasi penelitian adalah sebesar 2,42, indeks keseragaman (E) adalah sebesar 0,82, dan indeks dominasi (D) adalah sebesar 0,12. Hal ini menunjukkan bahwa struktur komunitas gastropoda di ekosistem lamun Pantai Domba tergolong sedang dengan keseragaman tinggi dan tidak ada spesies yang mendominasi.

Kata Kunci: Gastropoda, Indeks ekologi, Kelimpahan, Pantai Domba

## INTRODUCTION

Gastropods are invertebrates belonging to a class of the phylum mollusca. They are detritus-feeding animals, consuming fallen seagrass leaf litter and circulating suspended matter in the water to obtain food (Zul *et al.*, 2024). Gastropods have soft bodies that use their stomachs for locomotion (Haumahu *et al.*, 2023). Marine gastropods are typically found in the intertidal zone to the shallow subtidal zone, and typically live on muddy, sandy, muddy, or rocky substrates (Haumahu *et al.*, 2025).

Gastropods are relatively easy to observe, have slow motility, are abundant in the environment, and have a relatively short life cycle, making them suitable for evaluation in relatively short-term aquatic conditions (Galvani *et al.*, 2023). Ecologically, gastropods are a crucial component of the seagrass ecosystem's food chain, utilizing the epiphytic biomass found on seagrass leaves and the litter on the sediment surface. Economically, these gastropods have commercial value as a supplementary food source, and their shells can also be used as decoration (Wahyuningsih & Umam, 2022).

Domba Beach is an attractive tourist destination also utilized by the local community. The waters of Domba Beach also boast extensive seagrass potential, with the discovery of three seagrass species: *Thalassia hemprichii*, *Cymodocea rotundata*, and *Cymodocea serrulata* (Shofiah *et al.*, 2025). This seagrass ecosystem supports the presence and distribution of gastropods in Domba Beach's waters. Due to its proximity to residential areas, these waters are susceptible to impacts from community activities, such as household activities that generate household waste. These waters are also frequently used for fishing and seaweed farming, and there is an industry in the form of whiteleg shrimp ponds. Apart from that, some of the local people also often use several gastropods for their meat for consumption.

The high level of community activity there can lead to a decline in gastropod populations, which directly impacts their diversity, abundance, and even community structure. However, there is currently no information available regarding the gastropod community in the waters of Domba Beach. Therefore, this study is needed to obtain data on gastropod diversity in the waters of Domba Beach. This study aims to determine the abundance of gastropod species and calculate ecological indices consisting of the diversity index, evenness index, and dominance index of the gastropod community.

## RESEARCH METHODS

### Time and Place

The research was conducted in September 2025. The research was conducted at Domba Beach, Caringin Village, Labuan District, Pandeglang Regency, Banten Province.

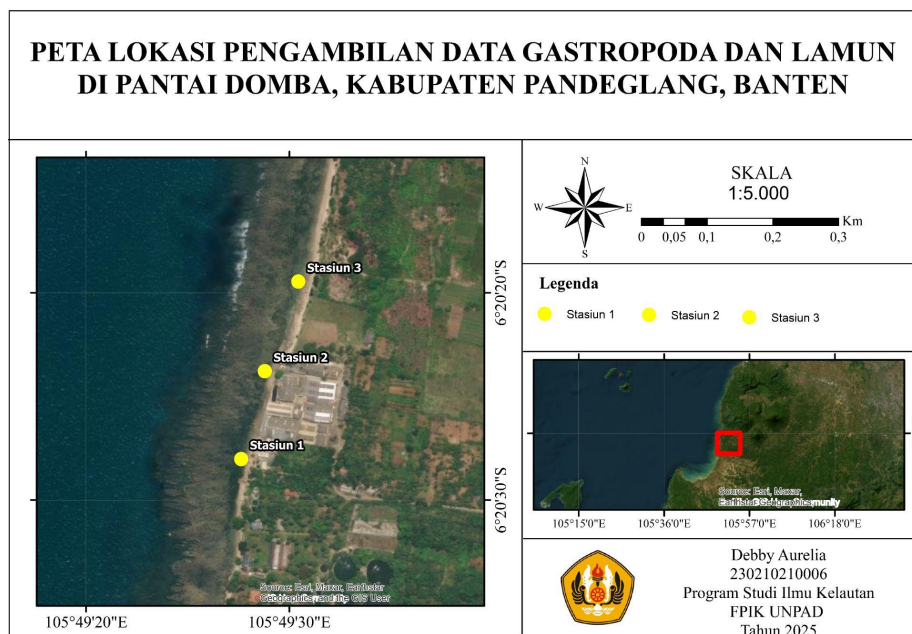


Figure 1. Map of research location

### Tools and Materials

The tools used in this study include: stationery, mobile phones, Hanna Instruments, refractometers, quadrant frames measuring 50 x 50 cm, GPS (Global Positioning System), transect ropes, roll meters, laptops, shovels, sieve shakers, digital scales, trays, and Microsoft Excel software. The materials used in this study include: gastropod and seawater samples taken at the research station, as well as distilled water and 70% alcohol to preserve the samples.

### Research methods

The research was conducted using a survey method with a quantitative approach.

#### Data Collection Methods

##### a. Gastropod Data

The method used to collect gastropod data was the quadrant line transect method, creating three replicated observation paths, each with a transect length of 50 meters and a distance of 25 meters between each transect, resulting in a total area of 50 x 50 m<sup>2</sup>. A quadrat frame was placed on the right side of the transect, spaced 5 meters apart, resulting in a total of 11 quadrats per transect (Rahman *et al.*, 2022).

Gastropod biota was observed within each quadrat frame, observing the gastropods attached to seagrass and the substrate surface. Gastropods were identified using the book "Guidelines for Identification of Recent and Fossil Indonesian Shells" (Dharma, 2005).

##### b. Substrate Data

Sediment sampling was conducted to determine granulometry, or sediment grain size. Sediment for granulometry analysis was collected using a shovel at a depth of approximately 5-10 cm, at several sampling points at predetermined data collection stations (Windarto *et al.*, 2022).

##### c. Water Quality Data

Temperature, DO, and pH were measured using a Hanna Instrument type H198194, while salinity was measured using a refractometer.

## Data Processing and Analysis

### a. Sediment Analysis

To determine the type of sediment, a granulometric analysis was performed. This granulometric analysis was conducted using a sieve method with the aid of a sieve shaker, which will be carried out at the Conservation Laboratory of the Faculty of Fisheries and Marine Sciences. The dry weight of the sediment to be sieved is 100 grams. Sediment grain size data was then processed using GRADISTAT software to obtain the percentage of grains (gravel, sand, silt, and clay) and sediment type based on the Folk (1980) scale.

### b. Gastropod Community Structure

#### 1. Abundance

The formula that can be used to calculate density/abundance is (Matrutty, 2021):

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

Description:

Di : Abundance (ind m<sup>2</sup>)

Ni : Number of individuals of species i

A : Quadrant Area (m<sup>2</sup>)

#### 2. Diversity Index (H')

The calculation of the diversity index of gastropod species can be calculated using the Shannon-Wiener diversity formula (Rizkya, 2012):

$$H' = - \sum (Pi \ln Pi)$$

Description:

H' : Diversity Index

Pi : ni/N

Ni : Number of individuals of each species

N : Number of individuals of all species

#### 3. Dominance Index (D)

To determine the most common gastropod species, we can calculate their dominance index. The Simpson-Odum dominance index formula (1993) is used in (Pradhana *et al.*, 2021).

$$D = \sum \left(\frac{ni}{N}\right)^2$$

Description:

D : Simpson's Dominance Index

Ni : Number of individuals of each species

N : Number of individuals of all species

#### 4. Uniformity Index (E)

The formula used in calculating the Evenness uniformity index is Odum (1993) in (Raiba *et al.*, 2022).

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

Description:

E : Evenness index

H' : Diversity index

H max : Maximum species diversity (lnS)

S : Number of species

## RESULT

### Physical and Chemical Parameters of Water

The physical and chemical parameters of the waters at Domba Beach can be seen in Table 1.

Table 1. Physicochemical parameters of coastal waters of Domba

Parameters	Station			RI PP Quality Standard No.22 Year 2021
	1	2	3	
Temperature (°C)	29,9	30,9	30,7	28-30°C
DO (mg/L)	5,10	5,02	6,88	>5 mg/L
pH	8,21	8,14	8,35	7 - 8,5
Salinity (‰)	29,76	30,12	30	33 - 34 ppt

### Types of Sediment in Domba Coastal Waters

The results of the sediment composition analysis using GRADISTAT software can be seen in Table 2.

Table 2. Results of the sediment composition analysis

Stasiun	Komposisi (%)			Tipe Sedimen
	Gravel	Sand	Mud	
1	3,2	90,9	5,9	<i>Slightly Gravelly Sand</i>
2	2,6	92,8	4,6	<i>Slightly Gravelly Sand</i>
3	1,6	86,9	11,5	<i>Slightly Gravelly Muddy Sand</i>

### Abundance of Gastropod Species

The abundance of gastropod species in the seagrass ecosystem in the waters of Domba Beach can be seen in Table 3.

Table 3. Abundance of gastropod species

No	Nama Spesies	Stasiun			Kelimpahan (Ind/m2)
		1	2	3	
1	<i>Heliacus variegatus</i>	2,66	2,30	3,39	8,36
2	<i>Cerithium punctatum</i>	5,21	3,75	6,06	15,03
3	<i>Cerithium coralium</i>	0,72	0,72	0,84	2,30
4	<i>Clypeomorus batillariaformis</i>	1,81	1,33	2,66	5,81
5	<i>Clypeomorus bifasciata</i>	6,78	5,93	7,63	20,36
6	<i>Rhinoclavis aspera</i>	0,24	-	0,36	0,60
7	<i>Anachis fluctuate</i>	1,81	1,45	1,81	5,09

8	<i>Columbella versicolor</i>	0,72	0,60	0,96	2,30
9	<i>Pictocolumbella ocellata</i>	1,21	1,09	1,81	4,12
10	<i>Conus ebraeus</i>	0,12	-	0,24	0,36
11	<i>Cymatium muricinum</i>	0,12	-	0,24	0,36
12	<i>Mitra (Strigatella) paupercula</i>	0,12	0,96	1,81	4,24
13	<i>Druppela margaticola</i>	1,69	0,84	2,54	5,09
14	<i>Semiricinula muricoides</i>	1,33	0,72	1,69	3,75
15	<i>Neverita didyma</i>	-	0,12	0,24	0,36
16	<i>Nerita albicilla</i>	0,12	-	0,24	0,36
17	<i>Pollia fumosa</i>	0,84	0,72	1,45	3,03
18	<i>Terebralia sulcata</i>	0,48	0,60	1,21	2,30
19	<i>Turbo tumidulus</i>	0,72	0,72	0,96	2,42

### Gastropod Community Structure in Domba Coastal Waters

The structure of the gastropod community in the waters of Domba Beach can be seen in Figure 1.

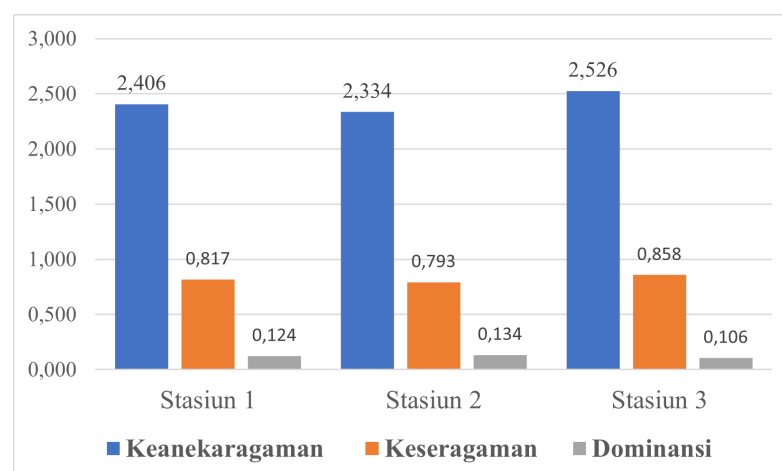


Figure 1. Diversity index ( $H'$ ), uniformity index ( $E$ ) and dominance ( $C$ ) of gastropods in Domba Coastal Waters

## DISCUSSION

### Water Quality of Domba Beach

The water temperature at Domba Beach ranges between 29.9-30.9°C. Temperature is one of the environmental parameters that influences the survival of gastropods. The ideal temperature for gastropod survival ranges between 29-31°C (Honen *et al.*, 2023). This indicates that the temperature at all three stations in Domba Beach waters can be categorized as good for supporting gastropod life. Based on DO measurements in Domba Beach waters, dissolved oxygen values range between 5.02-6.87 mg/L. Dissolved oxygen concentration also affects photosynthesis and respiration activities for gastropods (Sembel *et al.*, 2024). According to Salim *et al.* (2020), the optimal dissolved oxygen concentration for gastropod life ranges between 5-8 mg/L. The higher the dissolved oxygen value in a body of water, the better the quality of the water to support the life of organisms such as gastropods (Farid *et al.*, 2023). The pH of Domba Beach waters ranges from 8.14 to 8.35. According to Wahyuningsih & Umam (2022), pH can also affect gastropod diversity, with higher pH values indicating higher gastropod diversity. The optimal pH range for gastropod life is generally between 7.0 and 8.7

(Jana *et al.*, 2024). Salinity in Domba Beach waters ranges from 29.76 to 30.12. Optimal salinity to support gastropod life ranges from 28 to 34 ppt (Honen *et al.* 2023). Duan *et al.*, (2019) stated that salinity values categorized as good for macrobenthic growth are between 25 and 40‰. Therefore, the salinity values obtained in Domba Beach waters still support the survival of gastropods.

### **Domba Coastal Water Substrate**

Substrate is a crucial part of gastropod life. According to Aba *et al.* (2025), sandy substrates contain very little nutrients, making it easier for gastropods to move from one location to another. The substrate type at stations 1 and 2 was sand with a little gravel, while at station 3 it was muddy sand with a little gravel. Gastropod abundance can be influenced by sediment type. Sand or sandy mud substrates have a high organic matter content because they easily accommodate organic matter compared to locations with gravel or rocky substrates. Habitats with sandy mud substrates are quite favorable for aquatic life, especially snails (Raiba *et al.*, 2022). Sandy substrates also make it easier to filter food compared to muddy substrates (Maulana *et al.*, 2022).

### **Gastropod Species Abundance**

The average abundance of gastropods in the waters of Domba Beach was 28.76 individuals/m<sup>2</sup>, with the highest abundance at station 3 and the lowest at station 2. The high abundance of gastropods at station 3 is due to the location's distance from human activities and shrimp pond waste disposal, and the location is covered by mangroves with a muddy, sandy, and slightly gravelly substrate. This finding aligns with Chusna *et al.* (2017), who stated that mangroves are preferred by gastropods due to their high organic matter content and clayey, muddy, or sandy substrates. The highest abundance of the species was *Cylypeomorus bifasciata* from the Cerithidae family. This high abundance of *Cylypeomorus bifasciata* is thought to be due to its adaptability, tolerance to environmental changes, and its ability to thrive in various types of sediment, which are favorable for its reproduction (Magfiroh *et al.*, 2024). In addition, other species from the same family, such as *Cerithium punctatum*, *Cerithium coralium*, *Rhinoclavis aspera*, and *Cylypeoromus batillariaformis*, have a higher abundance compared to other species. According to Fajeri *et al.* (2020), gastropods from the Cerithidae family are the most common and widely distributed species in aquatic ecosystems due to their good adaptation to various substrate types. The lowest abundance is found in the species *Conus ebraeus*, *Cymatium muricinum*, *Neverita didyma*, and *Nerita albicilla*. These species are generally found on rocky substrates or coral rubble (Novinta & Adharini, 2022). The low abundance of various species is also thought to be due to several environmental factors such as salinity, temperature, pH, currents, tides, sediment type, organic matter in the sediment, and gastropod migration factors (Magfiroh *et al.*, 2024).

### **Gastropod Community Structure**

The biodiversity of aquatic life is highly dependent on the number of species within the community. The more species found, the greater the diversity, although the value is highly dependent on the number of individuals of each species (Duan *et al.*, 2019). High diversity is indicated when the H' value approaches 3, indicating good water conditions. Conversely, if the H' value approaches 0, diversity is low and water conditions are poor (Odum, 1993). The gastropod diversity index at Domba Beach has a value <3, indicating moderate diversity. According to Novinta & Adharini (2022), water pollution can threaten the existence of aquatic biota and reduce environmental quality. However, gastropod diversity at Domba Beach is classified as moderate. This is because the mollusk phylum, which lives at the bottom of the

water, has a fairly broad tolerance to pollution and the ability to accumulate chemical compounds in its body tissues (Wulansari & Kuntjoro, 2018).

The uniformity index values obtained at each observation station vary. Station 1 had a uniformity index value of 0.81, station 2 had a uniformity index value of 0.79, and station 3 had a uniformity index value of 0.85. The average gastropod uniformity index value for each research station was categorized as high and stable (0.82). The analysis of the gastropod uniformity index in the waters of Domba Beach indicated that stations 1, 2, and 3 had high species diversity. This is consistent with Krebs' (1985) statement that a community is considered to have high uniformity and stable if the uniformity index value is  $0.75 < E \leq 1$ . According to Raiba *et al.* (2022), the uniformity index reflects the presence of species distribution patterns and the evenness of ecological balance within a community. A high uniformity index value indicates an even distribution of each species within the ecosystem, good productivity, and low ecological pressure (Chusna *et al.*, 2024).

The dominance index is used to measure the relative strength of one or more species against the overall population in an ecosystem. According to Odum (1993), if the dominance value is close to zero, then no species dominates at that station or the condition is stable. Conversely, if the dominance index value is close to 1, it indicates that there is a dominant species at that station or the condition is unstable. The dominance values obtained at each observation station vary. Station 1 has a dominance index value of (0.12), station 2 has a dominance index value of (0.13), and station 3 has a dominance index value of (0.10). The gastropod dominance index value at each station indicates that there is no dominant gastropod species, this is in accordance with Odum's (1993) statement that no species dominates if the dominance index value is  $0 < C < 0.5$ . If there is no dominant species in an aquatic biota community, then the waters show a stable and balanced condition because there is no single species that dominates the number, so that the biota in the waters is relatively evenly distributed (Suhadi *et al.*, 2020).

## CONCLUSION

A total of 19 gastropod species were found in the waters of Domba Beach, consisting of 12 families and 17 genera. The highest abundance of gastropods was found at station 3 (36.24 individuals/m<sup>2</sup>), and the lowest abundance was at station 2 (21.93 individuals/m<sup>2</sup>). The species with the highest abundance was *Clypeomorus bifasciata*. The species with the lowest abundance were *Conus ebraeus*, *Cymatium muricinum*, *Neverita didyma*, and *Nerita albicilla*. The diversity index at each station was moderate, and no species dominated, with a high and stable evenness index.

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