

# Diversity of Bivalves of the Mollusca Class in the Bandar Gigieng River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency and Its Use as a Learning Media

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**Abstract:** The aim of the research was to determine the level of Mollusca Diversity in the Sungai Bandar Gigieng Hamlet, Peukan Tuha Village, Simpang Tiga District, Pidie Regency. This research was carried out using the linetranssect and quadratic transect methods. The research location was divided into 3 stations, the stations were divided based on environmental conditions in the river, including the condition of the vegetation and activities occurring in the surroundings, then the samples found were identified. Research results the bivalves found in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency consist of 2 orders and 5 species with a total of 102 individuals. The diversity index value of Bivalves in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency is classified as medium, with a diversity index of 1.327555 ( $H'$ ). Learning activities become more meaningful, students become more active and enthusiastic in directly observing types of aquatic invertebrates.

**Keywords:** Diversity; Mollusca; Bivalves; River; Learning Media

## Introduction

Indonesia is a vast archipelagic country, because most of its territory is water. Indonesia is nicknamed a maritime country because its water area is wider than land. The area of Indonesia is approximately 7.81 million square kilometers. Of the total area, the land area is only around 2.01 million kilometers, the sea with an area of approximately 3.25 million square kilometers and the Exclusive Economic Zone (EEZ) with an area of approximately 2.55 million square kilometers (UU, 1983). This means that Indonesia has many ports. Ports are usually located in river waters that lead to the kuala (the place where the river meets the sea). River waters are one of the areas where various human activities take place in order to fulfill their daily needs. Increased human activity in this area can have an impact on water quality and biota communities (Agustiarini, 2021).

In the river waters of Bandar Gigieng Hamlet, there are many aquatic organisms that act as river ecosystems. In this river there are also mangroves and Siapi-api trees. The large number of human activities that occur in the Bandar Gigieng Hamlet River give rise to serious problems related to water pollution, which has a negative impact on the river ecosystem. Through observations, the author witnessed that a large number of residents around the Bandar Gigieng Hamlet River tend to throw rubbish directly into the river. Apart from that, the activities of fishermen who wash their boats or vessels in the river result in oil spills and oil from the process of cleaning fishermen's equipment flowing into the river flow.

River water areas generally contain a lot of Mollusca diversity, the types Bilvalvia (shellfish) and Gastropoda (relatives of snails) are two class groups of Mollusca that are often found in the River Waters of Bandar Gigieng Hamlet. The presence of Molluscadi in

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the waters of the Bandar Gigieng River provides benefits to the local community as an alternative source of income during the west (strong) wind season, most fishermen cannot go to sea, resulting in reduced sources of income and no fish for side dishes. So many residents are looking for types of Bivalves and Gastropods in river waters that can be consumed as a substitute for fish.

The lack of information on the diversity of Bivalvia class Mollusca in the Bandar Gigieng Hamlet River, is the reason why the author believes that this research is important to carry out, because information on Bivalvia class Mollusca Diversity in the Bandar Gigieng Hamlet River area, Peukan Tuha Village, District.

Simpang Tiga Pidie Regency can be used as initial information regarding efforts to preserve Mollusca. The Bivalvia class or often referred to as the Pelecypoda class is one of the prominent classes in the Phylum Mollusca. This class includes interesting organisms such as clams, oysters, mussels and the like, locally this class is better known as shellfish. In its characteristic form, Bivalves have two shells that are tightly fused. They settle on the seabed, some bury themselves in sand or mud, some even concretize themselves in coral rock formations. The breathing process is carried out through gills located in the mantle cavity. When they take a breath, these gills are equipped with vibrating hairs that create a flow of sea water into their mantle. In addition, this process also functions to filter particles in sea water, including plankton as the main food source, while ensuring the supply of oxygen needed for the respiration process. The existence of the Bivalvia class makes an important contribution to the marine ecosystem with its unique role (Wahyuni, 2022).

The aim of this research is to determine the types of Bivalves and the level of Bivalvia Diversity in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency.

## Method

### *Place and Time of Research*

The research location is located in the Sungai Bandar Gigieng Hamlet, Peukan Tuha Village, Simpang Tiga District, Pidie Regency in 2022.

### *Research Subjects and Objects*

The subjects of this research were all the densest bivalves in the Bandar Gigieng Hamlet River. Peukan Tuha Village, Simpang Tiga District, Pidie Regency. The objects taken in this research were all the bivalves found in each quadrat transect on each transect line that had been made in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency.

### *Tools and materials*

The tools and materials used in this research were neat rope, 100 m tape measure, GPS, salinometer, pH meter, digital camera, knife, stationery, identification book, mistal/ruler, wooden stakes, label paper and distilled water.

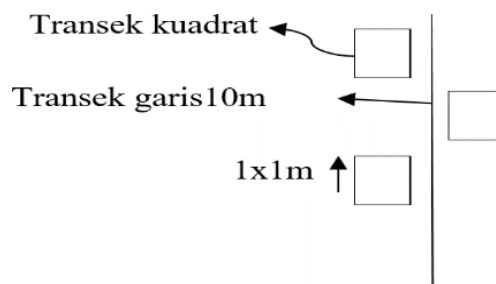
### *Types of research*

The type of research in this research is exploratory, which uses qualitative methods combined with quantitative.

### *Research Procedures*

Collecting research data on Mollusca Diversity Levels in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency was carried out by means of a survey, namely making direct observations at the research location.

This research was carried out using a combination of transect methods, namely the line transect and quadratic transect methods. The research location is divided into 3 stations, the division of stations is based on environmental conditions in the river, including the condition of vegetation and activities occurring nearby. Each station has one transect line drawn perpendicularly for 10 meters. Each line transect is defined as 3 square transects, the transects measuring 1x1 meter which are placed alternately. Determination of sampling points was carried out using the Purposive Sampling method, meaning that samples were taken based on considerations intentionally by researchers (Maretta, 2019)



**Figure 1.** Research Plot

Sampling was carried out on at the lowest tide of river water. Samples were taken 3 times to see the comparison of Mollusca found. Sampling was carried out by taking them directly from each square transect that had been made, for Mollusca that were attached to rocks or wood, they were taken using a knife.

The samples that have been collected are then cleaned and taken home for the identification process. Identification is carried out at the family level, namely based on body structure, shell length, habitat, color, shell pattern, and additional features such as tentacles or eyes as well as special characteristics possessed by the

Mollusca. The identification results are then recorded and documented (Jiménez-Quiroz, 2021)

#### Parameter

The parameter measured in this research is the level of mollusca diversity in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency.

#### Data Analysis Techniques

Research data analysis techniques Level of Bivalvia Diversity in the River, Bandar Gigieng Hamlet, Peukan Tuha Village, Simpang Tiga District Pidie Regency was carried out qualitatively and quantitatively. To determine the level of diversity of Bivalvia class Mollusca, researchers calculated the Mollusca diversity index found at the research location using the diversity index according to Shannon-Wiener. The Diversity Formula according to (H') Shannon-Wiener (Amanda, 2007) is:

$$H' = -\sum_{i=1}^S P_i \ln P_i \quad (1)$$

H' = Diversity Index

Pi = ni/N, the ratio between the number of individuals of the 1st species and the total number of individuals

ni = Total number of individuals of the 1st species N = Total number of individuals

S = Number of types

The diversity index criteria according to Shannon-Wiener are defined as follows:

H' value < 1: low diversity. 1<H'<3: medium diversity. H'>3: high diversity.

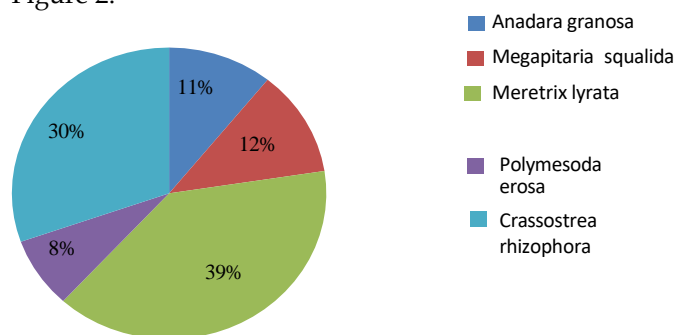
## Result and Discussion

The results of the research carried out three repetitions of sampling carried out in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency, obtained 5 types of Bivalves consisting of 3 orders.

**Table 1.** Types of Mollusca found in the River

Class	Ordo	Spesies	repetition			total
			1	2	3	
Bivalvia	Arcoida	<i>Anadara granosa</i>	3	3	5	11
		<i>Megapitaria squalida</i>	3	5	4	12
	Veneroida	<i>Meretrix lyrata</i>	8	13	19	40
		<i>Polymesoda erosa</i>	4	1	3	8
		<i>Crassostrea rhizophora</i>	9	10	12	31
	Ostreoida					
Total			27	32	43	102

Table 1 and figure 2 show that the most abundant species of bivalves in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency are dominated by the *Meretrix lyrata* species (39%) with a total of 40 individuals, the least numerous species are the *Polymesoda erosa* species (8%). with a total of 11 individuals, both types belong to the order Veneroida. Composition of each type Bivalves found in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency, can be seen in the Figure 2.



**Figure 2.** Diagram of the composition of Bivalves

Description and classification of the types of Bivalves in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency are as follows:

#### a. Ordo Arcoida

##### *Anadara granosa*

*Anadara granosa* or often called blood clams are a type of sea shell that has a very thick shell measuring 3-4 cm, has two shell pieces with a wide hinge, the color varies from white, brown and blackish brown with a serrated, grooved surface pattern (Nadaa, 2021). *Anadara granosa* lives by immersing itself in paired substrates. *Anadara granosa* is often referred to as blood cockles because of the reddish-brown color of *Anadara* meat. This color occurs because of the presence of hemoglobin in the blood. *Anadara granosa* lives in groups and is generally found in substrates that are rich in organic content (Mawardi, 2021).



**Figure 3.** *Anadara granosa*



As stated by (Kadarsah, 2020), many *Anadara granosa* are found in estuarine waterways with The mixture of lumpur and pasir heated to about 300°C will cause *Anadara betina* to become translucent. According to (Bahri, 2020) suitable temperature ranges for bivalvia with temperature ranges between 28°C and 31°C. Suitable temperature is one of the environmental factors that support the existence of *A. Granosa* in the Gigieng River. Likewise with the condition of the river sediment, This causes *A. Granosa* to have a fairly high population in the Gigieng River. The composition of sediment in a particular environment greatly affects the behavior of organisms. Sediments containing dust particles are in great demand by the community, such as blood cockles, because they contain organic materials that are suitable for use as the main food for shellfish (Silaban, 2022).

#### b. Ordo Veneroida

##### 1) *Megapitaria squalida*

*Megapitaria squalida* usually measures 4-6 cm, its shell is sub-elliptical or convex and the surface of this shell is smooth and slippery (Lase, 2021). The shell color of *Megapitaria squalida* is brownish gray. These shellfish live by burying themselves in sand or mud. *Megapitaria squalida*, often known as *gandhi* or *gandhi kerang*, is one of the species found in the Bivalvian class, including the Veneridae family (Bahtiar, 2022). The clam *Megapitaria squalida* (Álvarez-Dagnino, Reproduction of *Megapitaria squalida* (Bivalvia: Veneridae) in the Southeast Gulf of California, Mexico, 2017), also referred to as "callista clam" or "squalid callista," is found along the Pacific coast from Mancora, Peru, to the north of California (Scammon's Lagoon), as well as on both coastlines of the Gulf of California. According to (López-Rocha, Abundance and harvest strategy of three species of clam (Bivalvia: Veneridae) located in new fishing banks in the Gulf of California, 2021), it is a filter-feeder that burrows in sandy sediments from intertidal zones to depths of roughly 160 m (Álvarez-Dagnino, 2017). Its shell can measure 120, 97, and 68 mm in length, width, and height, respectively.

These species are important to the air quality system as filters that help maintain air quality by removing organic particles. Additionally, they provide food and habitat for several predators (Jiménez-Quiroz, 2021). Several studies on *Megapitaria squalida* have been conducted, including on habitat, reproduction, and diversity (López-Rocha, 2021); (Schweers, 2006).



Figure 4. *Megapitaria squalida*

##### 2) *Meretrix lyrata*

Associated with the bottom substrate of the waters, the tofu clam (*Meretrix lyrata*) is a type of estuarine clam that has experienced degradation in the waters of Kendari Bay (Duisan, 2021). The *Meretrix lyrata* shell is fan-shaped with a size of 4-6 cm, the surface texture of the shell is smooth and shiny. *Meretrix lyrata* is also called tofu clam, as the name suggests, this clam is white and has a black silhouette on one side of the shell (Lase, Spesies Kelas gastropoda dan Bivalvia di Muara Saragian Kabupaten Aceh Singkil, 2021). At first glance, *Meretrix lyrata* is similar to *Megapitaria squalida*, maybe some people think these two clams are the same type of clam. *Meretrix lyrata* lives in tidal habitats by burying itself in fine sandy substrates. Like other bivalves, *Meretrix lyrata* are filter feeders that feed on plankton and small organic particles dissolved in the water. They filter their food through gills that also function in gas exchange (Putri, 2021).



Figure 5. *Meretrix lyrata*

##### 3) *Polymesoda erosa*

The shell of *Polymesoda erosa* is oval like a plate with a size of 3-8 cm consisting of two poles which are bilaterally symmetrical, flat at the edges and convex in the middle, the surface of the shell has regular lines or protrusions with a reddish brown color (Rizal, 2022). These clams live buried in mud and are often found in

mangrove areas, therefore these clams are also called mangrove clams. According to (Widianingsih, 2020), the bivalvia *Polymesoda erosa* is exclusively taught in the lumpur dataran that enslaves Muara Zuari. Due to the importance of its nutrients, *Polymesoda erosa* consumption has steadily increased in Goa in recent years. In addition to protein, *Polymesoda erosa* typically contains vitamins, minerals, amino acids, and lemak that are palatable.



Figure 6. *Polymesoda erosa*

### c. *Osteroids*

#### 1) *Crassostrea rhizophora*

*Crassostrea rhizophora* or oysters generally live in colonies, attached to rocks or mangrove/mangrove roots. These oysters measure 3-7 cm, when in a colony the size can reach 25-30 cm. The shape of the shell of *Crassostrea rhizophora* is irregular on the sharp edge of the shell. The shell is made of limestone with a brownish or greenish purple color (Antonio, 2021). Although the size of this species fluctuates according to the environmental conditions in which it lives, it can reach a pretty considerable size. This clam is frequently found in muddy coastal locations because of its ability to stick to hard substrates, such as the roots of mangrove trees, thanks to a feature of its snout that is bent on one side of the shell. In coastal habitats, this species is significant. By purifying the air and giving other organisms a place to live, they support the health of the environment. The health of the aquatic environment can also be determined by this clam.



Figure 7. *Crassostrea rhizophora*

**Table 2.** Mollusca Diversity in the River

Species	amount	Pi (ni/N)	LnPi	PiLnPi	H'
<i>Anadara granosa</i>	11	0.10784	-2.22707	-0.24017	0.24017
<i>Megapitaria squalida</i>	12	0.11764	-2.32238	-0.27322	0.27322
<i>Meretrix lyrata</i>	40	0.39215	-0.91629	-0.35932	0.35932
<i>Polymesoda erosa</i>	8	0.07843	-2.54553	-0.19964	0.19964
<i>Crassostrea rhizophora</i>	31	0.30392	-1.19098	-0.25518	0.25518
Total	102			-1.32755	1.32755

The value of the Bilvania diversity index is influenced by various factors, including the number of species found in greater numbers than other types. Soil substrate and environmental physico-chemical conditions which include water temperature and pH as well as human activities that occur in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency also influence the diversity of Bilvania. Water pH and temperature measurement data as well as research location coordinates can be seen in Table 3.

**Table 3.** Water pH and temperature measurement data as well as research location coordinates

Explanation	Repetition			average
	1	2	3	
Ph of water	6.9	7.0	7.6	7.1
temperature	31	30	32	31
Location	5°20'58"	5°21'1 "	5°21'2 "	
coordinate	LU	LU	LU	
point	96°0'10"	96°0'10"	96°0'12"	
	BT	BT	BT	

Bivalves found in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency are not classified as having a low diversity index value because the types and number of Bivalvia species found are evenly distributed. High species diversity indicates that a community has high complexity, because in communities that have high species diversity there will be species interactions involving energy transfer, predation, competition and niche division which are theoretically more complex. The concept of species diversity can be used to measure the ability of a community to maintain itself stable (community stability) even though there is disturbance to its components (Fitri, 2022). Both biotic and abiotic environmental factors influence the diversity of bivalves in river estuaries. Salinity, sediment grain size, total suspended solids (TSS), temperature, pH, current, water depth, and fundamental substrate properties are a few of the crucial variables. The distribution and diversity of

bivalve species within the environment are influenced by the presence and carrying capacity of these characteristics (Lopes-Lima, 2021); (Atlanta, 2022).

#### d. Its use as a learning media

Direct observation is an additional learning activity for students in the aquatic invertebrate course. Students use the types of gastropods found as objects of observation in learning aquatic invertebrates. Providing new experiences for students because it allows them to explore their own knowledge and see real examples of biodiversity. This process emphasizes direct experience to explore and understand the surrounding nature, which is often easier to understand when students interact directly with the environment. Situations like this enable learning to enrich students' academic experience, making it more relevant so that learning becomes more meaningful.

### Conclusions

Based on the research results, it can be concluded that the types of Bivalves found in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency consist of 2 orders and 5 species with a total of 102 individuals. The diversity index value of Bivalves in the Bandar Gigieng Hamlet River, Peukan Tuha Village, Simpang Tiga District, Pidie Regency is classified as medium, with a diversity index of 1.327555 (H'). Because students interact directly with animals, learning becomes more meaningful, students become more enthusiastic and active

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