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UTILIZATION OF SUJONO BEACH AS A NATURAL LABORATORY FOR IDENTIFICATION OF INVERTEBRATE ANIMALS IN BIOLOGY EDUCATION

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ABSTRACT

This study aims to identify the diversity of invertebrate species in the Sujono Beach area, Lalang Village, Medang Deras District, Batubara Regency. The study, which was conducted on May 27, 2025, used direct observation and survey methods to collect specimens. The collected invertebrates were then identified taxonomically based on morphological, anatomical, physiological, and behavioral characteristics to the phylum, class, and order levels, followed by wet preservation. The results of the study showed significant invertebrate diversity, especially from the Mollusca and Arthropoda phyla. A total of 14 species of Mollusca were identified, including *Anadara antiquata* , *Turritella communis* , and *Placuna placenta* . In addition, 3 species of Arthropods were also found, namely *Macrobrachium rosenbergii* and *Scylla spp.* , and one species of Echinodermata, *Tripneustes gratilla* . The high invertebrate diversity indicates that the environmental conditions of Sujono Beach are relatively well maintained. This study underscores the potential of Sujono Beach as a natural laboratory for biology education, particularly in invertebrate identification, and highlights the importance of sustainable habitat management and conservation efforts to maintain ecological balance and ensure the long-term sustainability of this species.

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Introduction

Batubara Regency is a coastal area on the east coast of North Sumatra, rich in ecosystems such as mangroves, coral reefs, and seagrass beds. Mangrove ecosystems in areas such as Perupuk Village are crucial because they provide various ecosystem services, including coastal protection and biological resources. The rich flora and fauna within the mangrove ecosystem also have high economic value, and if not properly managed, they can damage the ecosystem and ecology of the area (Arwita, 2018). Mangrove ecosystems play a significant role in maintaining the sustainability of the marine environment, including serving as spawning grounds for various marine life, such as shrimp, crabs, shellfish, and other species (Febriyanti, 2023).

However, this area faces serious challenges due to land conversion for fish farms and tourism, resulting in the loss of natural coastal protection. Therefore, sustainable management through rehabilitation, ecotourism development, and community engagement are key strategies for maintaining its sustainability (Rumondang et al., 2024). Damage caused by human activities has prompted rehabilitation efforts through coral transplantation and community training (Susetya et al., 2018). Vegetation analysis shows that despite land cover changes, the area of secondary mangrove forest has increased, although density and species diversity still need to be improved (Ginting et al., 2025). This biodiversity is further reflected in the discovery of 31 species of mangrove-associated organisms and 49 species of waterbirds, both migratory and protected (Hasan et al., 2024; Abdillah et al., 2019).

In Batubara Regency, Sujono Beach has great potential to be used as a natural laboratory, particularly in biology learning. Biology education is expected to provide a means for students to directly observe objects. This laboratory is not limited to school or college buildings, but can also be the surrounding natural environment as a living laboratory (Matondang, 2023). This beach has a substrate that supports the existence of various coastal biota, such as bivalves, gastropods, and crustaceans. The presence of these invertebrates is not only an important indicator of coastal environmental health but also serves as a food source for other organisms. Utilizing coastal areas as open learning spaces allows students to gain direct experience in observing, identifying, and understanding the diversity and ecological roles of invertebrates.

Course Learning Outcomes encompass aspects of attitudes, skills, and knowledge, the success of which is highly dependent on the design of the learning process by the educator (Tarigan, 2025). Early learning planning is crucial to maximize the learning process and achieve the desired outcomes (Tarigan, 2022). Royal University students in the Lower Animal Taxonomy course conducted fieldwork activities on this beach. This approach aligns with research findings showing that field-based learning can improve students' understanding of biological concepts, identification skills, and active engagement in the learning process (Cowles & Onthank, 2021; Weldi, 2020).

Therefore, documenting invertebrate diversity at Sujono Beach is crucial as a basis for conservation efforts. Utilizing this local potential not only enriches learning materials and supports the achievement of learning objectives, but also fosters students' appreciation for biodiversity and the importance of coastal environmental conservation (Weldi, 2020). Given the high level of environmental damage caused by human behavior, integrating Sujono Beach as a natural laboratory and sustainable management of the entire Batubara coastal ecosystem are key to protecting the

environment, developing the economy, and preserving biodiversity for the future (Tarigan, 2024).

Methods

This research was conducted on Tuesday, May 27, 2025 in the Sujono Beach Area, Lalang Village, Medang Deras District, Batubara Regency. This research used direct observation and survey methods on species found in the Sujono Beach Area. The invertebrates found were collected in one container to be used as objects of observation for a species. Species grouping was carried out based on class, order, and phylum. The following are the steps: 1) Observation of Characteristics; 2) Grouping Based on Characteristics; 3) Determination of Taxonomic Level; 4) Phylum or Division; 5) Naming. The species obtained will be identified taxonomically and researchers will carry out wet preservation of the species.

Results and Discussion

Based on research conducted, it was found that invertebrate diversity on the Sujono coast consists of three phyla. Invertebrates identified on the Sujono coast include: Molluscs, Arthropods, and Echinoderms. The types of invertebrates found are shown in Table 1.

Table 1. Data on Invertebrate Animal Types in the Sujono Coastal Area

Division	Type	
	Latin Name	Local Name
Molluscs	*Anadara antiquata*	feather clam
	Anadara Granosa	blood clams
	Communist turritella	trumpet shell
	Cerithidea cingulata	brackish water snails
	Pholas orientalis	raw
	Anadara inaequivalvalis	*Pigeon shells*
	Nassarius stolatus	stone snail
	Polymesoda erosa	shell
	Natica sp	moon snail
	Achatina fulica	snail
	Mytilus sp	axe shell
	Tivela stultorum	pismo shells
	Fusinus spp	sea slugs
	Placenta placenta	oyster window glass
Arthropods	*Macrobrachium rosenbergii*	Giant Freshwater Shrimp
	Scylla species	Mangrove crab
	Uca spp	Ball crab
Echinodermata	*Tripneustes free*	Sea urchins

Phylum Mollusca

The majority of species of the phylum mollusca live in the sea. However, some also inhabit fresh water and live on land. Mollusca (from the Latin *molluscus* = soft) is a phylum of invertebrate animals (without backbones) whose bodies are soft, often protected by a hard shell made of calcium carbonate. Mollusca is the second largest phylum in the world after Arthropoda, with more than 85,000 known species (and possibly many more that have not been identified). These organisms can be found in various habitats: marine, freshwater, even moist land. The phylum Mollusca found on Sujono Beach has two classes, namely: Class Bivalvia and Class Gastropoda.

1. Feather clam (*Anadara antiquata*)

The morphological characteristics of the hairy clam include its shell measuring an average of 5 cm and covered with fine hairs. The hairy clam belongs to the phylum *Mollusca* and is classified in the class *Bivalvia* , in the order *Arcoida.* In addition to the hairy clam on the beach of Jono Beach, Lalang Village, Batu Bara Regency, North Sumatra, there are also many blood clams (*Anadara granosa) found* (Pulungan, 2025). The following is a picture of the hairy clam (*Anadara antiquata):*

Source: personal documentation

2. Trumpet shell (*Turritella communis)*

Turritella communis has a single, elongated, trumpet-shaped shell with a tapered tip. Its shell is whitish-brown and 7 cm long. *It* belongs to the phylum *Mollusca* , class *Gastropoda* , and order *Caenogastropoda* . Here's a picture of *Turritella communis:*

Source: personal documentation

3. Brackish snail (*Cheritidea cingulata*)

Cheritidea cingulata has a strong, rough, oval, and tapered shell. Its shell is blackish brown and measures 3 cm. *Cheritidea cingulata* belongs to the phylum *Mollusca, class Gastropoda* , and order *Ceruthioidea* . Here's a picture of *Cheritidea cingulate:*

Source: personal documentation

4. Mentarang (*Pholas orientalis*)

Pholas orientalis has morphological characteristics: an elongated white oval shell with a tapered tip and a wavy shell texture. Mentarang clams, also known as mentarang snails in Malay, have two thin, elongated shells connected by a flexible ligament in the sagittal plane. This clam is also known by local names such as bintarang, kepah keris, Aceh clam, and tembarang. Internationally, this clam is called angelwing clam or duckmouth clam. Mentarang clams are drilling (razor clams) and live in dense muddy sand sediments covered with a thin layer of mud (Rambe, 2025). *Pholas orientalis* belongs to the phylum *Mollusca* , class *Bivalvia* , and order *Myida* . Here is a picture of *Pholas orientalis:*

Source: personal documentation

5. Pigeon clam (*Anadara inaequivalvalis*)

Anadara inaequivalvalis has morphological characteristics: an oval-shaped shell with a rough surface, measuring 4.5 cm, serrated edges, and a whitish-brown color. *Anadara inaequivalvalis* belongs to the phylum *Mollusca* , class *Bivalvia* , and order *Arcoida.* Here is a picture of *Anadara inaequivalvalis:*

Source: personal documentation

6. Stone snail *(Nassarius stolatus)*

Nassarius stolatus has morphological characteris-tics, namely a tapered shell, a rough surface *, and* an unequal spiral curve, white with brown stripes, and measuring 2.3 cm. *Nassarius stolatus* is included in the phylum *Mollusca* , which is classified in *the gastropod class* with the order *Neogastropoda* . The following is a picture of *Nassarius stolatus:*

Source: personal documentation

7. Shellfish (*Polymesoda erosa*)

Polymesoda erosa has *morphological characteristics* , namely a cup-shaped shell with two symmetrical valves, flat on the edges, and slightly convex in the center with a milky white-brown pattern. *Polymesoda erosa* is included in the phylum *Mollusca* , which is classified in the class *Bivalvia* with the order *Veroida.* Here is a picture of *Polymesoda erosa:*

Source: personal documentation

8. Moon snail (Natica Sp)

Naticidae have morphological characteristics *, namely a spiral-shaped shell that is rounded like a moon, a hard shell with* a brown spot pattern on its surface. Included

in the phylum *Mollusca* , Naticidae are classified in the class *Gastropoda* and the order *Littorinimorpha* . Here is an image of *Naticidae:*

Source: personal documentation

9. Snail (*Achatina fulica*)

Achatina fulica has morphological characteristics: a *spiral-shaped shell* measuring 5-6 cm, brown with dark spots, and a soft and brittle shell. *Achatina fulica* belongs to the phylum *Mollusca* , *class Gastropoda* , and order *Pulmonata.* Here is a picture of *Achatina fulica:*

Source: personal documentation

10. Axe shell (*Mytilus sp*)

Mytilus sp. has a morphological characteristic of an oval, fan-shaped shell that is black with white spots. *Mytilus sp.* belongs to the phylum *Mollusca* , class *Bivalvia* , and order *Pectinoida.* The following is a picture of *Mytilus sp.*

Source: personal documentation

11. Pismo clam (*Tivela stultorum*)

Tivela *stultorum* has morphological characteristics, namely a curved triangular shell, purplish cream color, and slightly whitish cream with radial lines that radiate. *Tivela stultorum* is included in the phylum *Mollusca* , class *Bivalvia* , and order *Veneroida* . Here is a picture of *Tivela stultorum:*

Source: personal documentation

12. Sea snails (*Fusinus spp*)

Fusinus spp. has morphological characteristics in the form of an oval spiral shell, arranged like a torpedo, creamy white in color with a slightly *rough* and hard textured surface. *Fusinus spp.* is included in the phylum *Mollusca* , which is classified in the class

Gastropoda, with the order *Neogastropoda* . The following is a picture of *Fusinus spp.*

Source: personal documentation

13. Window shell oyster/Capiz (*Placuna placenta*)

Placuna placenta has a round, transparent shell morphologically resembling window glass. Its surface is smooth with wavy edges, grayish-white in color, and quite fragile in texture. *Placuna placenta* belongs to the phylum *Mollusca* , class *Bivalvia* , and order *Pterioida.* Here's an image of *Placuna placenta:*

Source: personal documentation

Phylum Arthropoda

Arthropods live in various habitats, on land, in water, freshwater, and sea. Body cavity. The body shape of crabs is protected by *a very hard shell* , composed of chitin, and armed with a pair of claws. Crab reproduction occurs outside the body (external), because in the body of this animal, eggs and sperm from the male parent are stored after copulation. Arthropods live in various habitats, on land, in water, freshwater, and sea. The body of Arthropods is divided into three main parts, namely the head, chest, and abdomen, although this division can vary depending on the class. As explained by Ruppert, Fox, and Barnes (2004), they have an exoskeleton of chitin that functions to protect the body and as a place of muscle attachment, but this exoskeleton must be removed periodically in a process called molting or ecdysis so that the animal can grow. The Arthropod phylum found on Sujono Beach has 2 classes, namely Malacostraca, Crustacea, and Gastropoda.

1. Giant freshwater shrimp (*Macrobrachium rosenbergii*)

Macrobrachium rosenbergii has morphological characteristics, namely an elongated and curved body forming a semicircle, a segmented body shape equipped with swimming legs, and a cone-shaped head with a rostrum that widens at the end. *Macrobrachium rosenbergii* is included in the phylum *Arthropoda* which is classified in the class *Malacostraca* with the order *Decapoda*. The following is a picture of *Macrobrachium rosenbergii:*

Source: personal documentation

2. Mud crab (*Scylla spp)*

Scylla spp has a flat, slightly convex shell *morphology* , with 9 sharp spines on each side of the shell, brownish black in color which helps camouflage in the mangrove environment, measuring about 2 cm. *Scylla spp* is included in the phylum *Arthropoda* which is classified in the class *Crustacea* with the order *Decapoda* . Here is a picture of *Scylla spp:*

Source: personal documentation

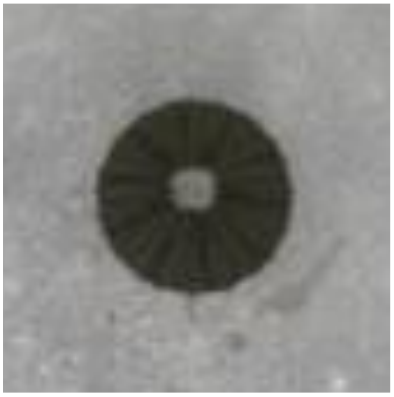
3. Fiddler crab (*Uca spp*)

Uca spp has morphological characteristics, namely its shell is square with a slightly convex surface, there are *dark blue spots on its surface* , the right and left shells are unequal in size, and its legs are finely hairy and slender. *Uca spp* is included in the phylum *Arthropoda* which is classified in the class *Malacostraca* with the order *Decapoda* . The following is a picture of *Uca spp:*

Source: personal documentation

Phylum Echinodermata

Echinoderms can be found in almost all marine ecosystems, but are most common in intertidal zones. Their body cavity consists of three embryonic layers (ectoderm, mesoderm, and endoderm) and has a perfect coelomic body cavity, also known as triploblastic coelomates. Sea urchins (Tripneustes gratilla) are black, with some also white. Their entire body is covered with sharp, pointed, and very fragile spines. They live in groups, with each group consisting of 20-40 individuals or more. Their entire body is covered with spines measuring approximately 10 cm. They feed on algae and organic particles or detritus. They usually live in groups to protect each other from enemies and possibly also to facilitate fertilization. There are also some small fish that like to live for shelter among the sea urchin spines. The phylum Echinodermata found at Sujono Beach consists of one class, echinoidea.



Source: personal documentation

Sea urchins are invertebrates belonging to the phylum Echinodermata and class Echinoidea, commonly found living on the seafloor at various depths (Hickman et al., 2008). The scientific name of sea urchins varies depending on the species, but some commonly known ones include Diadema setosum (long-spined sea urchin) and Tripneustes gratilla (tropical short-spined sea urchin) (Pechenik, 2015). Their bodies are rounded or slightly flattened, covered with

dense, sharp spines on a hard outer shell (Brusca & Brusca, 2003). These spines serve as protection from predators and also aid in locomotion (Ruppert et al., 2004). Sea urchins lack a head or complex respiratory system, but they do possess an ambulacral system of tube feet used for locomotion and capturing food particles (Pechenik, 2015). Their primary diet consists of algae and detritus, thus playing an important role as herbivores and decomposers on the seafloor (Hickman et al., 2008).

Conclusion

Based on the research results, it can be concluded that the Sujono Beach area has a high diversity of invertebrate species, dominated by the phyla Mollusca (14 species), Arthropoda (3 species), and Echinodermata (1 species). The presence of these various species plays an important role in maintaining the balance of the coastal ecosystem, both as a food source for other organisms and as an indicator of environmental health. The high diversity found indicates that the environmental condition of Sujono Beach is still relatively good. However, the potential for disturbances due to human activities still needs to be monitored. Therefore, the use of this area as a natural laboratory for biology learning, especially invertebrate identification, has great potential. Sustainable habitat management and conservation efforts are absolutely necessary to maintain ecosystem balance and ensure the sustainability of invertebrate species in this area (Tarigan, 2024).

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