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Diversity, Economic Value, and Conservation Status of Macroinvertebrates in the Coastal Areas of East Coast of Aceh Province, Indonesia

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Abstract: This research aims to analyze the diversity, economic value, and conservation status of macroinvertebrates in the coastal areas of the east coast of Aceh Province. The research method involves surveying the coastal regions of the east coast of Aceh Province, with macroinvertebrate sampling conducted through purposive sampling based on varying environmental characteristics. A total of 6.056 macroinvertebrate individuals from 55 species belonging to three classes, namely Gastropoda, Bivalvia, and Crustacea, were collected from the coastal areas of Aceh. Gastropods dominated the sample, while crustaceans were the least represented. The highest utilization of macroinvertebrates comes from the Bivalvia class, reaching 100%, while the lowest comes from the Gastropoda class at only 34.62%. Overall, no macroinvertebrates living in the coastal areas of Aceh were found to be threatened with extinction, with only 10.91% having a status of least concern. In contrast, the rest have yet to be evaluated.

Keywords: Aceh Province; Coastal areas; Conservation; Macroinvertebrates; Mangroves

Introduction

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results. The coast is a transitional area between land and sea with brackish and salty water conditions (Laignel et al., 2023). The coastal areas are characterized by extensive mangrove vegetation along the coastline. These mangrove root characteristics serve as protection against erosion and as buffers for sediment entry from the land during the rainy season (Wanjiru et al., 2023; Azmi et al., 2022; Safuridar et al., 2022). Ecologically, this area also serves as an ideal habitat for various aquatic organisms, functioning as breeding grounds, nurseries, shelters, and feeding grounds (Mawardi et al., 2024). The mangrove ecosystem is an area inundated with water during high tide and becomes a damp expanse during low tide (Morgan et al., 2024). This area serves as a potential habitat for various aquatic macroinvertebrates due to its abundant nutrient supply, which serves as food sources for various animal species including gastropods, bivalves, crustaceans, and various malacostracans also aid mangroves in maintaining the fertility and productivity of mangrove plants (Tabakaeva et al., 2018; Jesús-Carrillo et al., 2022). The rich nutrient composition available in this area originates from the decomposition of mangrove leaves, branches, and twigs, as well as from various aquatic animal organs, which decompose into potential food sources for the aquatic animal community (Ilmi et al., 2023; Bonifazi et al., 2023).

Macroinvertebrates are a group of invertebrate animals that are large enough to be seen with the naked eye without the need for a microscope. These animals

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play a central role in maintaining the balance of ecosystems in a particular area, including coastal areas, and they also play a significant role in assisting the growth and development of mangrove vegetation (Palit et al., 2022). In general, macroinvertebrates exhibit sedentary behavior, residing on the bottom of water bodies, and rocks, or attaching themselves to mangrove plants based on the characteristics of each species. Some groups of macroinvertebrates also live by digging burrows as nests in mangrove areas and burying their bodies into the substrate to avoid predation by predators (Halimatun et al., 2024). Macroinvertebrates are generally known as organisms with very slow mobility and relatively sedentary habits in specific areas. Due to their lifestyle, aquatic macroinvertebrates are highly suitable for use as bioindicators of environmental pollution (Mawardi et al., 2021; Desai et al., 2020). Macroinvertebrates are one of the most vulnerable aquatic biota to pollution in a given area because of their habitat on sediment beds and their tendency to accumulate pollutants from the surrounding area (Bahtiar et al., 2022; Mawardi & Sarjani, 2021).

Several studies conducted in the coastal areas of the east coast of Aceh Province have documented a total of 33 species of Gastropoda, 15 species of Bivalvia, and 17 species of crustaceans (Malacostraca) (Mawardi et al., 2023, 2024). There is limited information available regarding macroinvertebrate data in the eastern coastal areas of Aceh, and the status of these aquatic animals in their habitats, whether their populations are still abundant or if some species are beginning to be threatened with extinction based on IUCN data (Muhammadar et al., 2021; Octavina et al., 2025). The lack of data on the utilization of macroinvertebrates living in the eastern coastal areas of Aceh Province also provides a rationale for researchers to conduct this study to obtain comprehensive data on these aquatic organisms. It is important to research the diversity, utilization, and conservation status of macroinvertebrates on the eastern coast of Aceh Province, considering that these aquatic biota serve as a rich source of nutrition for the community (Ginantra et al., 2023; Fitriadi et al., 2023).

The coastal areas of Aceh are renowned for having the largest mangrove ecosystem in Southeast Asia. According to Safuridar et al. (2022), the mangrove area in Langsa City alone spans 8,000 hectares, excluding Aceh Tamiang and Aceh Timur. With such vast areas, these mangrove habitats serve as crucial environments for various aquatic animals, playing a significant role in the conservation of the region and serving as a vital link in the food chain to support abundant fisheries. This research aims to gather information on the diversity, utilization, and conservation status of macroinvertebrates in the coastal areas of the east coast of Aceh Province. This data can serve as a guideline and reference for governmental and non-governmental organizations in managing coastal areas sustainably.

Method

Study Location and Time

The research was conducted in the coastal areas of the east coast of Aceh Province using direct survey methods at three research locations; including the coastal area of Aceh Tamiang; the coastal area of Langsa City; and the coastal area of Aceh Timur (Figure 1). The research was carried out from April to June 2024. Macroinvertebrate sampling was conducted using purposive sampling based on varying habitat characteristics, including water salinity and mangrove vegetation in the coastal areas (Table 1). Macroinvertebrate samples were collected using transects from the sea towards the land. The collected macroinvertebrate samples from the three research locations were placed in sample bottles for identification at the Biology Laboratory of Samudra University.

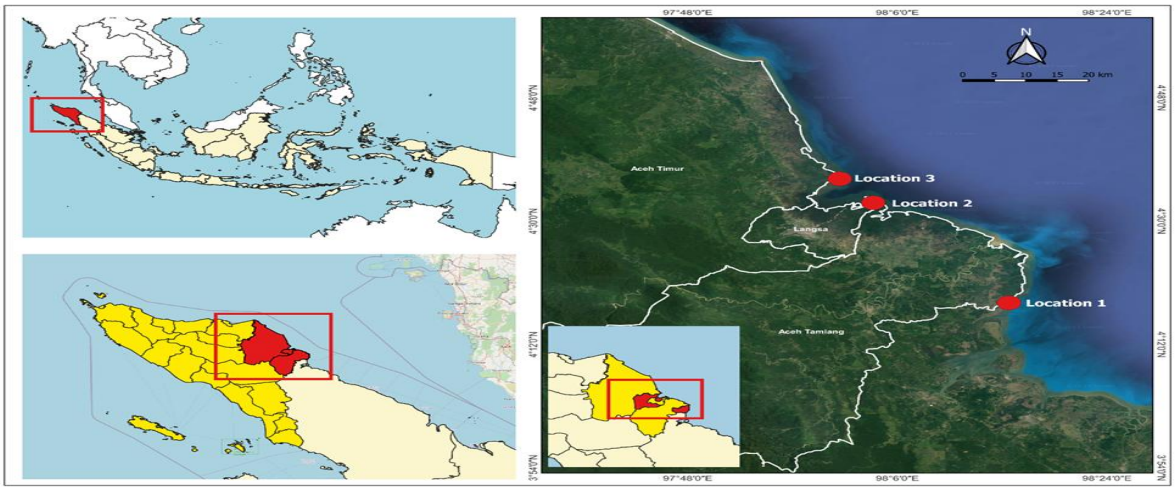

Figure 1. Sampling locations for macroinvertebrates

Table 1. The environmental condition characteristics in the research area on the coast of Aceh

Location	Coordinate	Characteristics
(I) Aceh Tamiang	4°30′12.77"N 98°25′98.19"E	The location of Aceh Tamiang is a coastal area far from settlements, with water salinity ranging from 27 to 28‰. This area is predominantly not submerged in water as it is far from the coast. The dominant mangrove species in this area include *Soneratia caseolaris*, *Bruguiera gymnorrhiza*, and *Rhizophora mangle.*
(II) Langsa City	4°32'43.9"N 98°03'53.9"E	The coastal area of Langsa City is directly connected to the Malacca Strait, with water salinity ranging from 29 to 31‰. This area is predominantly submerged in water as it is close to the coast. The dominant mangrove species in this area include *Bruguiera gymnorrhiza*, and *Rhizophora mangle*
(III) Aceh Timur	4°60′30.26"N 98°01′74.95"E	The location of East Aceh is a coastal area far from settlements, with water salinity ranging from 29 to 30‰. This area is predominantly submerged in water as it is close to the coast. The dominant mangrove species in this area include *Soneratia caseolaris*, and *Avicennia alba*

Data Collection

Sampling of macroinvertebrates at three locations in the coastal areas, including Aceh Tamiang (Location 1), Langsa City (Location 2), and East Aceh (Location 3), was conducted using transects with a length of 100 meters. Transects were established from the shoreline towards the inland, with five transects established at each location. Each transect comprised four plots measuring 5 meters by 5 meters. Sampling was carried out by digging the sediment using a scoop to a depth of 10 to 20 cm, while samples attached to roots and substrates were collected directly by hand. Macroinvertebrate samples collected at the three research locations were placed in sample bottles and fixed with 4% formalin. All collected samples were identified in the laboratory based on morphological similarities among macroinvertebrate species, including body shape, size, color, and claw shape (Ginantra et al., 2023; WoRMS Editorial Board, 2024). Environmental physicochemical data were collected in situ simultaneously with macroinvertebrate sampling. In-situ environmental physicochemical data measured during sample collection included: water salinity measured using a hand refractometer (RHS-10ATC); water pH measured using a pH meter (Extech PH100); and water temperature measured using a mercury thermometer (-10 to 110°C).

Data Analysis

The diversity index of macroinvertebrates collected at the research locations was then analyzed using the Shannon-Wiener formula, as described by Odum (1971), formulated as follows:

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

If H' < 1, then the macroinvertebrate diversity index falls into the low category. However, if 1 < H' < 3, then the macroinvertebrate diversity index falls into the moderate category. Meanwhile, if H' > 3, then the macroinvertebrate diversity index falls into the high category. The economic value of macroinvertebrates is analyzed descriptively using percentages based on information obtained from fishermen. Similarly, the conservation status of macroinvertebrates collected at the research locations, which has been verified based on data from the International Union for Conservation of Nature (IUCN), is further analyzed descriptively in tabular and graphical forms based on the conservation status of aquatic animals by species.

Result and Discussion

The research conducted in the coastal areas of the east coast of Aceh Province successfully collected 6,056 individuals from 55 species of macroinvertebrates, showing significant variation in both species and individual numbers across the research areas. The collected macroinvertebrates were classified into three classes: Gastropoda, Bivalvia, and Crustacea. The macroinvertebrates collected in the coastal areas of Aceh belong to two phyla: Mollusca and Arthropoda. Most of the Mollusca phylum inhabit coastal areas and are associated with mangrove plants on roots, stems, or sediment. The highest number of macroinvertebrates collected at all three research locations belonged to the Gastropoda class, comprising 26 species from 11 families, while the lowest number belonged to the Crustacea class, with 10 species from 6 families (see Table 2). Coastal areas with stable and smooth water circulation are suitable habitats for various aquatic biota species because, during high and low tides, plankton and various other organisms are dissolved, providing a food source for Gastropoda and Bivalvia (Antu et al., 2023).

Gastropods are generally highly dominant in coastal water areas, living by attaching themselves to the roots, stems, and branches of mangrove plants. Some gastropod species are also found attached to substrates and sediments in coastal areas (Mawardi et al., 2023). The suitable environmental conditions as habitats and the abundance of food are major factors contributing to the high abundance of Gastropods in the coastal areas of

Aceh Province. The extensive mangrove ecosystem covering an area of 8,000 hectares along the coastal areas of Aceh provides a potential habitat for various gastropod species and other aquatic species (Mawardi et al., 2021; Safuridar et al., 2022). The high abundance of food sources in mangrove areas, such as plankton and various other microorganisms, is one of the main factors contributing to the higher number of macroinvertebrate species from the Gastropoda class compared to the other two classes, Bivalvia and Crustacea (Mahilac et al., 2023; Nederstigt et al., 2025).

Table 2. Distribution of macroinvertebrates in coastal areas of Aceh

Family	Species Names	Location			Economic Value	Conservation Status
		I	II	III		
Gastropoda						
Potamididae	*Pirenella cingulata* (Gmelin, 1791)	3	7	107	UN	NE
	Cerithidea anticipata (Iradale, 1929)	76	102	340	UN	NE
	Telescopium telescopium (Linnaeus, 1758)	120	107	27	COM	LC
	Cerithidea quoyii (Homron & Jacquinot,1848)	25	17	76	UN	NE
	Cerithidea obtusa (Lamarck,1822)	31	-	12	COM	NE
	Terebralia sulcata (Born, 1778)	7	-	24	UN	NE
Tonnidae	*Tonna dolium* (Linnaeus, 1758)	-	-	4	UN	NE
Turritellidae	*Turritella terebra* (Linnaeus, 1758)	7	-	12	UN	NE
Neritidae	*Nerita balteata* (Reeve,1855)	6	98	12	COM	NE
	Neripteron violaceum (Gmelin, 1791)	11	-	-	COM	NE
	Nerita filose (Reeve,1855)	-	90	75	COM	NE
	Nerita undata (Linnaeus,1758)	-	23	42	COM	NE
Lymnaeidae	*Lymnaea stagnalis* (Linnaeus,1758)	-	14	8	UN	LC
Littorinidae	*Littororaria angulifera* (Lamarck, 1822)	17	30	96	UN	NE
	Littoraria scarba (Linnaeus, 1758)	35	127	13	UN	NE
	Littoraria undulata (J.E Gray, 1839)	8	-	-	UN	LC
Ellobiidae	*Ellobium aurismidae* (Linnaeus,1758)	6	7	9	UN	LC
	Ellobium aurisjudae (Linnaeus,1758)	3	-	-	UN	LC
Melongenidae	*Volegalea cochlidium* (Linnaeus,1758)	-	-	7	COM	NE
	Melongena corona (Gmelin, 1791)	10	-	-	COM	NE
Muricidae	*Murex trapa* (Röding, 1798)	15	5	11	UN	NE
	Hexaplex trunculus (Linnaeus, 1758)	-	-	12	UN	NE
Naticidae	*Natica marochiensis* (Gmelin, 1791)	-	-	3	UN	NE
	Polinices mammilla (Linnaeus,1758)	4	-	-	COM	NE
	Euspira catena (Da costa 1778)	43	-	-	UN	NE
Conidae	*Conus martensi* (E.A.Smith, 1884)	7	-	-	UN	NE
Bivalvia						
Corbiculidae	*Geloina expansa* (Mousson, 1849)	6	36	13	COM	NE
	Geloina bengalensis (Lamarck, 1818)	-	-	4	COM	LC
Ostreidae	*Saccostrea cucullata* (Born, 1778)	280	350	780	COM	NE
	Magallana gigas (Thunberg, 1793)	-	4	12	COM	NE
Placunidae	*Placuna placenta* (Linnaeus, 1758)	7	2	6	COM	NE
Mytilidae	*Perna viridis* (Linnaeus,1758)	25	-	-	COM	NE
	Modiolus auriculatus (Krauss,1848)	9	-	-	COM	NE
Arcidae	*Tegillarca granosa* (Linnaeus, 1758)	270	102	180	COM	NE
	Anadara antiquata (Linnaeus, 1758)	14	12	34	COM	NE
Pinnidae	*Atrina pectinata* (Linnaeus, 176)	5	-	-	COM	NE
Crustacea						
Ocypodidae	*Tubuca coarctata* (H.Milne Edwards, 1852)	119	135	278	UN	NE
	Minuca pugnax (Smith,1870)	10	120	75	UN	NE
	Gelasimus tetragonon (Herbst, 1790)	-	27	120	UN	NE
	Austruca triangularis (A.Milne-Edwards, 1873)	-	99	45	UN	NE
	Gelasimus vocans (Linnaeus, 1758)	-	215	16	UN	NE
	Tubuca bellator (White, 1847)	-	98	30	UN	NE
	Austruca lactea (De haan 1835)	-	-	11	UN	NE
	Tubuca forcipata (Adams & White, 1849)	-	-	34	UN	NE
	Paraleptuca splendida (Stimpson, 1858)	-	67	68	UN	NE

Family	Species Names	Location			Economic Value	Conservation Status
		I	II	III		
Portunidae	*Scylla paramomasain* (Estampador 1950)	17	33	55	COM	NE
	Callinectes sapindus (Rathbun, 1896)	-	5	12	COM	NE
Matutidae	*Ashtoret lunaris* (Forsskal, 1775)	-	-	7	UN	NE
Verunidae	*Hemigrapsus nudus* (Dana, 1851)	12	4	8	UN	NE
Paguridae	*Pagurus longicarpus* (Say,1817)	40	56	50	UN	NE
Odontodactylidae	*Odontodactylus scyllarus* (Linnaeus,1758)	-	2	15	COM	NE
Penaeidae	*Penaeus marguensis* (De man, 1888)	-	7	17	COM	NE
	Penaeus monodon (Fabricius, 1798)	-	6	17	COM	NE
	Penaeus setiferus (Linnaeus, 1767)	-	5	9	COM	NE
Sergestidae	*Acetes indicus* (H. Milne- Edwards, 1830)	-	5	5	COM	NE
Total		1,248	2,017	2,791		

Note: COM: Commercial, UN: Untapped, NE: Not Evaluated, LC: Least Concern

The research results indicate that macroinvertebrates collected in the coastal areas of Aceh are most dominant in the class Gastropoda, with a total of 26 species from 11 families, while the lowest was collected from the class Bivalvia, with a total of 10 species from 6 families. The Ocypodidae family from the class Crustacea is the family with the highest number of species among the macroinvertebrates collected at the research site, reaching 9 species, followed by the Potamidae family from the class Gastropoda with 6 species (Figure 2).

The Ocypodidae family comprises the highest number of species among the macroinvertebrates collected in the coastal areas of Aceh. This family is known locally as the fiddler crab, and according to information from residents, it has not yet been utilized by the local community. The lack of exploitation by the local community of the fiddler crab is one of the reasons why this species grows and thrives optimally in its habitat, resulting in a high population of fiddler crabs in the coastal areas of Aceh. These animals emerge from their burrows to forage for food during low tide and will hide in small holes as shelters if they feel threatened by predators (Tan et al., 2022; Kumar et al., 2022).

The dominance in the number of species and families from the class Gastropoda compared to Bivalvia and Crustacea is because species from the class Gastropoda are rarely exploited by the local community compared to the other two classes of aquatic biota. The higher utilization by the community of species from Bivalvia and Crustacea, which results in routine and extensive exploitation, leads to habitat disturbance and a decrease in the population of these animals in the environment (Mahilac et al., 2023). Continuous exploitation activities without selective mechanisms for certain animal species disrupt habitats and lead to a decline in their populations. It is advisable that aquatic biota species that are rarely exploited in their habitats will thrive optimally, and their populations tend to be more stable (Pausi et al., 2023).

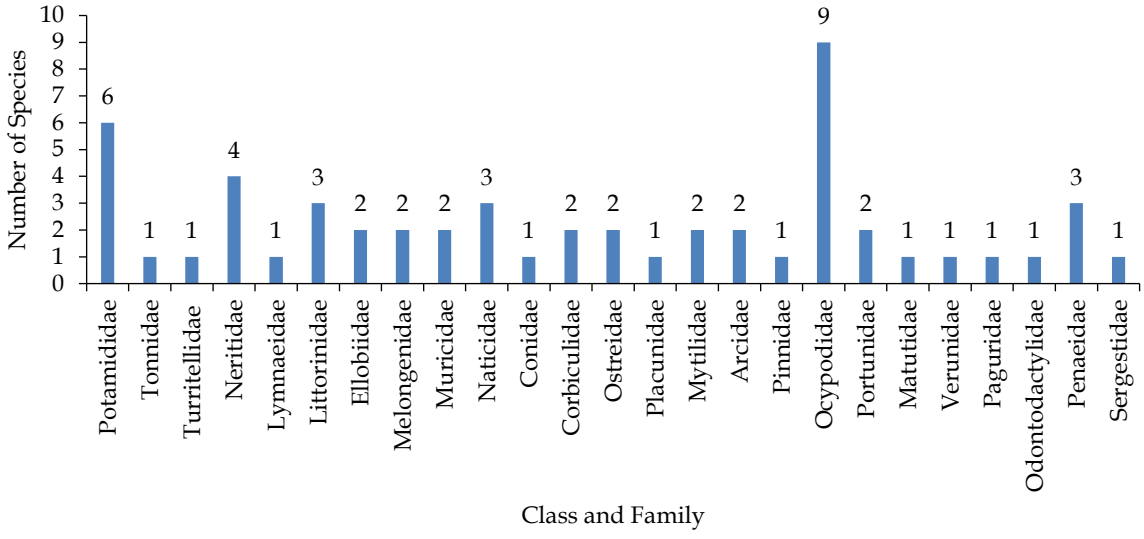

Figure 2. Distribution of macroinvertebrates based on class and family

Macroinvertebrates living in the coastal areas of Aceh are widely utilized by the local community as a source of livelihood for daily sustenance, both for consumption and commercial purposes, aiming to improve family economies. Species such as clams, crabs, shrimp, and snails are the most dominant favorites utilized by the coastal community. Research results indicate that 47.27% of macroinvertebrates in coastal areas of Aceh are utilized by the community for commercialization and consumption, while the remaining 52.73% are yet to be utilized (Figure 3). These macroinvertebrates are mostly utilized for consumption as dishes and various homemade, café, and hotel food preparations rich in nutritional content. Bivalve protein content reaches 42.81%, carbohydrates reach 20.85%, and fat reaches 17.70% (Valenzuela et al., 2022). The high market demand for these macroinvertebrates as a source of seafood dishes is due to not only their delicious taste but also their high animal protein content (Shalders et al., 2022).

The high demand for Bivalvia from both local and regional markets for consumption and commercialization is due to the delicious taste of these aquatic species and their high nutritional content, including animal protein and carbohydrates (Erniati et al., 2023; Song et al., 2025). These shellfish varieties are utilized in homemade dishes as well as being favorites on seafood menus in cafes, eateries, and restaurants. They also contain high levels of omega-3 fatty acids and low levels of fat, making them highly beneficial for meeting nutritional needs, and supporting growth, cell regeneration, and brain development in children (Biandolino et al., 2019). Similarly, the class Crustacea experiences high demand in both national and international markets. Crabs and shrimp are collected daily by fishermen to be exported from Aceh via Medan. During Chinese New Year celebrations such as Nyepi and Vesak Day, fishermen experience a special boon as demand for crab and shrimp increases significantly, leading to prices doubling compared to regular days.

The results of the conservation status analysis of macroinvertebrates living in the mangrove areas of Aceh Province show highly varied results, with the majority falling into the "Not Evaluated" category. Macroinvertebrate species categorized as "Not Evaluated" make up 89.09% of the total. This indicates that macroinvertebrates living in coastal areas of Aceh are still in a safe condition, while only 10.91% fall into the "Least Concern" category (Figure 4). The dominant "Not Evaluated" status demonstrates that the populations and habitats of macroinvertebrate species in the coastal areas of Aceh are still in normal conditions, with no concerning reports about various species of macroinvertebrates. Ideal environmental conditions and the abundance of food available in coastal areas are important factors in maintaining the populations of various macroinvertebrate species (Mawardi et al., 2023).

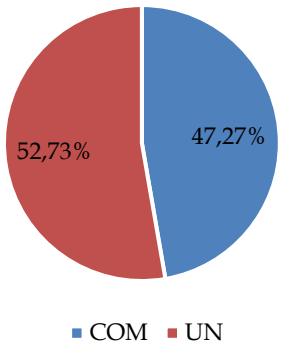

Figure 3. Economic value of macroinvertebrates

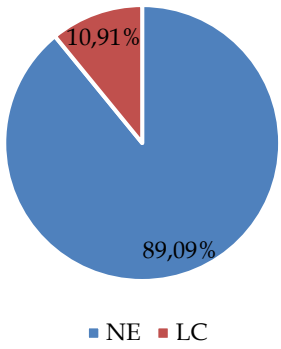

Figure 4. Conservation status of macroinvertebrates

The highest utilization of macroinvertebrates based on their class for commercialization in both local and regional markets is 100% for the class Bivalvia, while the lowest utilization by the community for commercialization is 34.62% for the class Gastropoda (Figure 5). Bivalvia, as a group of shellfish, has become a favorite food item served in local and regional cuisine, as well as in various restaurants. With its delicious taste and high nutritional content, these shellfish are highly sought after for consumption (Nugroho et al., 2023). Economic value has a strong relationship with the diversity of Gastropoda; the higher the economic value, the greater the impact on the high exploitation of these animals. Conversely, lower utilization and economic value of macroinvertebrates can lead to a higher diversity of aquatic biota due to reduced exploitation by the community (Mahilac et al., 2023).

Crustacea is a class of macroinvertebrates with stable populations, and their population distribution remains abundant in nature. According to IUCN data, 100% of Crustacea living in the coastal areas of Aceh are still categorized as "Not Evaluated", while the highest

percentage categorized as "Least Concern" comes from the class Gastropoda at 19.23%, followed by Bivalvia at 10% (Figure 6). Gastropoda and Bivalvia tend to inhabit specific areas and have very slow mobility, making it difficult for them to relocate to more stable environments in the face of extreme environmental changes or the influx of pollutants into the water. In contrast, Crustacea have higher mobility; when threatened, they can hide in their burrows, and some species are even capable of actively moving to more stable environments due to their active means of locomotion (Tan et al., 2022).

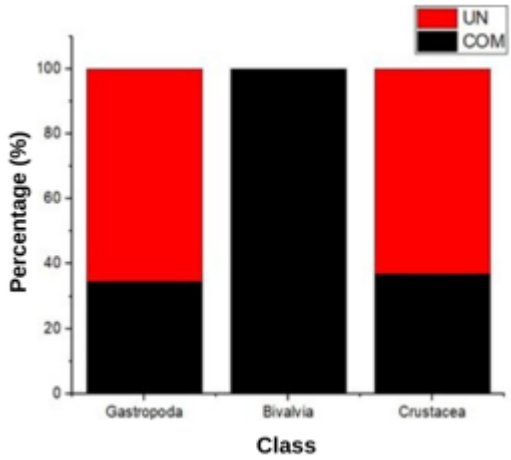

Figure 5. Economic value of macroinvertebrates by class

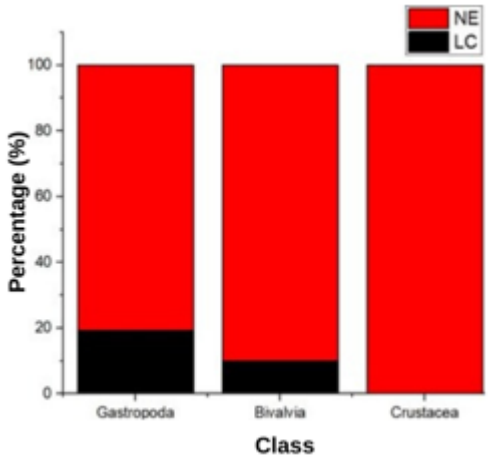

Figure 6. Conservation status of macroinvertebrates by class

The diversity index of macroinvertebrates in the coastal areas of Aceh Province varies significantly from one location to another, mainly due to the different environmental characteristics of each location. The highest diversity of macroinvertebrates is found in the coastal area of Langsa City (Location 2), with an H' value of 2.906 categorized as moderate, while the lowest diversity is observed in the coastal area of Aceh Tamiang (Location 1), with an H' value of 2.576, still classified as moderate (Table 2). The high diversity of macroinvertebrates in the Pusong coastal area compared to the other two locations is closely related to the environmental conditions as the habitat for macroinvertebrates and the abundance of available food (Azwar et al., 2023; Pola et al., 2020).

The routine exploitation conducted by the local community on macroinvertebrates in the coastal areas of Aceh Tamiang (Location 1) and Aceh Timur (Location 3) has led to a decline in the diversity of aquatic biota in these two areas. In the coastal area of Aceh Timur, every day during low tide, around 20 to 25 people search for clams, snails, and crabs to sell to collection agents, similarly in the coastal area of Aceh Tamiang (Figure 7). The good condition of mangrove vegetation and habitat makes it a potential habitat for macroinvertebrate life. Conversely, if the habitat is disturbed due to routine exploitation activities, it will lead to habitat degradation and disturbance of the aquatic biota populations (Setyadi et al., 2021). The high level of community activity, such as daily routine water transportation to search for fish, crabs, and clams, will lead to environmental degradation as the habitat for various aquatic biota (Mawardi et al., 2024).

The environmental conditions, including physical and chemical environmental data, also play a significant role in determining the characteristics of macroinvertebrate habitats. Water salinity is one environmental factor that has a significant impact on macroinvertebrate diversity. Higher water salinity is associated with higher macroinvertebrate diversity compared to relatively low salinity levels (Table 3). High water salinity in mangrove areas indicates smooth and stable water circulation. The flowing water during high and low tides carries various sources of nutrients dissolved in it, serving as food sources for various organisms, including Gastropoda, Bivalvia, and Crustacea (Keerthana et al., 2023).

This research indicates the importance of preserving the environment as a habitat for various animals that play crucial roles in maintaining ecological balance. The better the environmental conditions, indicated by the absence of pollutants in the area, the higher the diversity of various animals, including macroinvertebrates (Meng et al., 2021). Routine exploitation activities on aquatic biota, without selective mechanisms, lead to the decline of various animal species populations in the area. It is important to implement sustainable environmental management to preserve the environment and various animal species as a source of nutritious food for the health of the community and the sustainability of the environment.

The diversity of macroinvertebrates in the coastal areas of Aceh varies greatly from one area to another, ranging from (H') = 2.576 - 2.906, but it is still within the moderate category. The Bivalvia class has the highest economic value, reaching 100% with a commercial status, while the Gastropoda class has the lowest economic value at 34.62%, also categorized as commercial. The macroinvertebrates in the coastal areas of Aceh are still in a safe population condition; based on IUCN data, only 10.91% are categorized as Least Concern, while the remaining 89.09% fall under the Not Evaluated criteria. Illegal logging of mangrove vegetation, which serves as the habitat for macroinvertebrates, and exploitation without selective mechanisms pose the greatest threats to the sustainability of various macroinvertebrate species populations in the coastal areas.

Figure 7. Local community activities in search of clams, snails, and crabs on the coast of Aceh

Table 3. Macroinvertebrate diversity index and environmental physico-chemical factors

Location	H'	Category	Salinity (‰)	Water Temperature (°C)	Water pH
Aceh Tamiang (I)	2.576	Moderate	27-28	29	6.7
Langsa City (II)	2.906	Moderate	29-31	29	6.9
East Aceh (III)	2.805	Moderate	29-30	29	6.8

Conclusions

The results of the study showed that the macroinvertebrate diversity index ranged from 2,576 – 2.906 with a moderate diversity category, the most dominant species collected from the Gastropoda class while the lowest from the Crustacea class. As many as 47.27% of macroinvertebrates at the research location are species that are routinely utilized by the community for consumption or commercialized as a source of routine income for coastal communities, while 52.73% have not been utilized. As many as 89.09% of macroinvertebrate species are still in the Not Evaluated category, and only 10.91% are in the less concerning category. The high level of exploitation activities carried out routinely, especially from the Crustacea class, has caused the population of this animal to decrease, it is necessary to carry out sustainable management efforts to maintain this animal so that it remains stable in its natural habitat. The importance of preserving coastal areas as habitats for various macroinvertebrate species, whose populations have begun to decline, lies in the fact that these species serve as vital sources of livelihood for coastal communities.

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Conceptualization, T.M.S. and A.L.M.; methodology and conductor of experiment, H.I.S and A.L.M.; data analyzer and data visualization, T.M.S and A.R.S.S.; writing-review and editing, A.L.M. and A.R.S.S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
Both authors have no conflicts of interest.

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