RUMPHIUS PATTIMURA BIOLOGICAL JOURNAL
Volume 8, Issue 2 (2026), 104-115
E-ISSN: 2684-804X
DOI: https://doi.org/10.30598/rumphiusv8i2p104-115

Diversity of Crabs in the Mangrove Ecosystem at Jono Beach, Lalang Village, Batu Bara Regency

Miduk Leonardo Tambun [1*], Mawardi [1,2], Fahmy Armanda [1,2]

[1] Department of Biology Education, Faculty of Teacher Training and Education, Universitas Samudra, Langsa, Indonesia, Jln, Meurandeh, Kec. Langsa Lama, Kota Langsa, Aceh 24354
[2] Department of Science Education, Faculty of Teacher Training and Education, Universitas Samudra, Langsa, Indonesia, Jln, Meurandeh, Kec. Langsa Lama, Kota Langsa, Aceh 24354

*Corresponding Author e-Mail: midukleonardotambun@gmail.com

Check for updates

Article History:
Submitted:
March 20th, 2026
Accepted:
August 21th, 2026
Available online:
August 27th, 2026
Published:
September 20th, 2026

Keywords:
diversity., crab., jono beac.

ABSTRACT

Batu Bara Regency is a coastal area in North Sumatra Province that supports diverse mangrove-associated fauna, including crabs that play important ecological roles in coastal ecosystems. This study aimed to determine crab diversity and examine its relationship with physicochemical environmental parameters in mangrove habitats at Jono Beach, Batu Bara Regency. An observational method with purposive sampling was conducted from January to March 2026 at three stations representing different substrate characteristics: sandy substrate at Station I, muddy substrate at Station II, and a mixture of sand, mud, and clay at Station III. Sampling was conducted using a 33-m line transect with five 5 × 5 m² plots arranged in a zig-zag pattern. Data were analyzed using abundance, relative abundance, Shannon–Wiener diversity, dominance, evenness, species richness, similarity, and Principal Component Analysis (PCA). A total of 19 crab species belonging to five families were recorded, with *Perisesarma lanchesteri* being the most abundant species (36.75%). Crab diversity varied among stations, with the highest diversity occurring at Station III (H' = 2.67), which was characterized by heterogeneous sand, mud, and clay substrates. PCA further indicated that temperature, air humidity, and light intensity were associated with the community structure at Station III. These findings demonstrate that differences in mangrove substrate characteristics are associated with spatial variation in crab community structure, with heterogeneous substrates supporting higher crab diversity. The novelty of this study lies in demonstrating the spatial variation of crab communities across contrasting mangrove substrates and identifying the environmental factors associated with this variation at Jono Beach, Batu Bara Regency.

How to cite this article:
Tambun, Miduk Leonardo., Mawardi., & Armanda, Fahmy, (2026). Diversity of Crabs in the Mangrove Ecosystem at Jono Beach, Lalang Village, Batu Bara Regency. *Rumphius Pattimura Biological Journal,* 8(2), 104-115. https://doi.org/10.30598/rumphiusv8i2p104-115

Journal Homepage: https://ojs3.unpatti.ac.id/index.php/rumphius
Journal E-mail: rumphiusbiojournal@gmail.com ; rumphius.journal@mail.unpatti.ac.id
Research Article: Open Access

INTRODUCTION

Batu Bara Regency is one of the coastal regions in North Sumatra Province, Indonesia, characterized by substantial marine and coastal resource potential. Situated along the eastern coast of Sumatra and bordering the Malacca Strait, the regency extends between 2°03′00″–3°26′00″ N latitude and 99°01′00″–100°00′00″ E longitude (Batu Bara Regency Government, 2023). Among its important coastal ecosystems are mangrove forests, including those located at Jono Beach in Lalang Village. Mangrove ecosystems provide numerous ecological services, such as protecting shorelines from coastal erosion, sequestering carbon, maintaining coastal productivity, and serving as essential habitats for a wide variety of aquatic and terrestrial organisms (Karimah, 2017). Mangrove vegetation produces abundant litter, leaves, roots, and other organic materials that function as nutrient sources while providing shelter, feeding grounds, and breeding habitats for diverse fauna. Their high primary productivity makes mangrove forests among the most biologically productive and species-rich coastal ecosystems (Ministry of Marine Affairs and Fisheries, 2017).

Crabs are one of the dominant faunal groups inhabiting mangrove ecosystems. They belong to the phylum Arthropoda, subphylum Crustacea, and order Decapoda, and exhibit remarkable adaptability to fluctuating environmental conditions, including tidal cycles, salinity, temperature, and substrate characteristics. Ecologically, crabs play essential roles as detritivores, litter decomposers, sediment bioturbators, and key components of mangrove food webs (Rahayu et al., 2017; Sarjani et al, 2025). By consuming mangrove litter, crabs accelerate organic matter decomposition and nutrient recycling, while their burrowing activities enhance sediment aeration and reduce the accumulation of toxic compounds such as hydrogen sulfide (H_2S), thereby contributing to the stability and functioning of mangrove ecosystems (Harshith et al., 2016).

The composition and diversity of crab communities are strongly influenced by habitat characteristics. Environmental variables such as temperature, salinity, pH, substrate type, and mangrove vegetation structure affect the distribution, abundance, and diversity of crab species. Consequently, crab diversity is widely recognized as a valuable biological indicator for assessing the ecological condition and health of mangrove ecosystems. Generally, mangrove habitats with better environmental quality support higher crab species diversity, making community structure analyses useful for ecosystem monitoring and conservation planning.

Jono Beach in Lalang Village is a coastal area of Batu Bara Regency that still retains relatively undisturbed natural mangrove vegetation with limited anthropogenic disturbance. This ecosystem supports a variety of coastal organisms, including crabs, while also contributing to local fisheries. In addition to its ecological importance, the area has considerable potential for mangrove-based ecotourism development (Sihombing et al., 2023). Despite its ecological significance, information regarding crab diversity within the mangrove ecosystem of Jono Beach remains limited. Previous studies conducted in Batu Bara Regency have primarily focused on mangrove vegetation, environmental quality, or coastal tourism potential, whereas comprehensive data on crab species composition, diversity, and their relationships with habitat characteristics are still lacking. This lack of ecological information limits the scientific basis for effective conservation and sustainable management of the mangrove ecosystem in the area.

Based on these issues, research on crab diversity in the mangrove ecosystem of Jono Beach, Lalang Village, Batu Bara Regency is important for determining the level of diversity and species composition of crabs and for analysing their relationship with environmental parameters in the study area. This study is expected to provide information on crab species composition and diversity, as well as environmental factors associated with their distribution and occurrence. The findings are expected to serve as baseline information to support the management, conservation, and sustainable utilization of the mangrove ecosystem in the area.

MATERIALS AND METHOD

The study on crab diversity in the mangrove ecosystem of Jono Beach was conducted from January to March 2026 at Jono Beach, Lalang Village, Batu Bara Regency, North Sumatra, Indonesia. The equipment used in this study included measuring tape, a soil meter, a refractometer, crab traps, a digital camera, raffia rope, a Global Positioning System (GPS) device, sample bottles, transparent sample containers, a lux meter, and wooden stakes for plot establishment. The materials used consisted of 70% ethanol for specimen preservation, chicken viscera or dead fish as bait for crab traps, and stationery for field data recording.

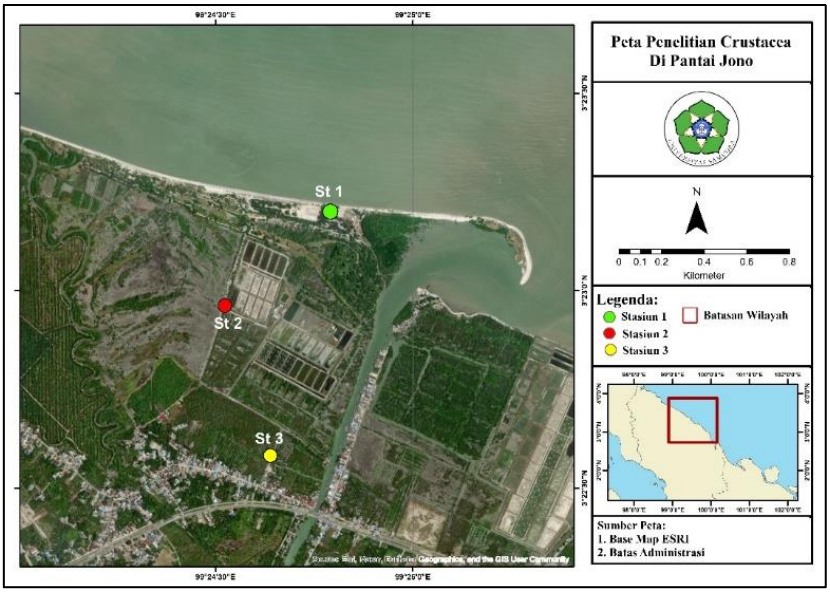

Figure 1. Sampling site

The equipment used in this study included a measuring tape, soil meter, refractometer, crab traps, camera, raffia rope, GPS, sample bottles, transparent sample containers, lux meter, stakes, name labels, and writing materials. The materials used consisted of 70% alcohol and chicken viscera as bait. Crab identification was supported by several references, including *Marine Decapod Crustacea of Southern Australia* (Poore, 2004), *FAO Species Identification Guide for Fishery Purposes* (Carpenter and Niem, 1998), *Guideline to Identification of Deep-Sea Crabs* (Wisespongpand, 2011), and relevant scientific journals. Identification was also supported by official online databases and platforms, including the *World Register of Marine Species* (WoRMS), *Fiddler Crabs*, *Crab Database*, and *iNaturalist* (Murniati *et al*., 2022).

This study employed an observational method, with sampling locations determined using purposive sampling to obtain data on crab diversity. Data collection was conducted through direct observation and species identification at each research station, accompanied by measurements of environmental parameters, including temperature, salinity, pH, light intensity, air humidity, and other environmental characteristics that may influence the occurrence and distribution of crabs.

Crab sampling was conducted using observation plots combined with three 33 m long line transects at each sampling station. Five observation plots measuring 5 × 5 m were established at each station and arranged in a zig-zag pattern at 2-m intervals along the transect lines (Razak, 1998). When crab individuals were found inside burrows during sampling, they were collected using the digging method, in which the burrows were excavated to a depth of 20 cm using a small shovel. Species belonging to the genus *Scylla* were specifically collected using crab traps (Ruwaida, 2021). The data were analyzed using abundance, relative abundance, diversity, dominance, evenness, similarity, species richness, and Principal Component Analysis (PCA).

RESULTS AND DISCUSSION

Based on the results of the study, a total of 19 crab species belonging to five families were identified. The composition of crab species varied among the sampling stations, both in terms of the number of species and families recorded. At Station I, 16 species belonging to three families were recorded; at Station II, 16 species belonging to five families were identified; while Station III had the highest species composition, with 19 species belonging to five families.

Table 1. Crab Species Composition at the Study Site

No	Family	Species	Station I	Station II	Station III
1	Portunidae	*Scylla olivacea*	-	√	√
2		*Scylla serrata*	-	√	√
3	Menippidae	*Myomenippe hardwickii*	-	√	√
4	Ocypodidae	*Austruca variegata*	√	√	√
5		*Austruca lactea*	√	√	√
6		*Austruca annulipes*	√	√	√
7		*Austruca vocans*	√	√	√
8		*Austruca bengali*	√	√	√
9		*Austruca perplexa*	√	√	√
10		*Tubuca signata*	√	√	√
11		*Tubuca paradussumieri*	√	-	√
12		*Tubuca rosea*	√	√	√
13		*Gelasimus jocelynae*	√	√	√
14	Grapsidae	*Metopograpsus quadridentatus*	√	√	√
15	Sesarmidae	*Geosesarma* sp.	√	-	√
16		*Parasesarma noduliferum*	√	-	√
17		*Perisesarma lanchesteri*	√	√	√
18		*Episesarma versicolor*	√	√	√
19		*Parasesarma pictum*	√	√	√

The results of crab observations across all sampling stations showed differences in species abundance, with the highest number of individuals recorded at Station III. This pattern was associated with the substrate characteristics at the station, which consisted predominantly of sandy mud with a small proportion of clay. The family Ocypodidae was dominant across all sampling stations. According to Peer et al. (2015) and Masiyah *et al.* (2021), the distribution of the family Ocypodidae is strongly influenced by substrate type because of its association with the burrows used by these crabs as shelters. The results showed that all crab species could be found in muddy-sandy substrates, as the structure of burrows in this type of substrate is sufficiently stable to remain intact during high tides. This finding is supported by Actuti *et al.* (2019), who reported that muddy-sandy substrates provide suitable conditions for the survival of fiddler crabs because of their relatively stable structure. Crab distribution is also influenced by food availability in muddy-sandy substrates, as crabs are generally deposit feeders (Murniati, 2010; Setiawan *et al.*, 2025).

Observations conducted across all sampling stations at Jono Beach, Lalang Village, Batu Bara Regency, recorded a total of 11,684 crab individuals representing various species. The most abundant species was *Perisesarma lanchesteri*, with 1,433 individuals, whereas the lowest abundance was recorded for *Scylla olivacea*, with 17 individuals.

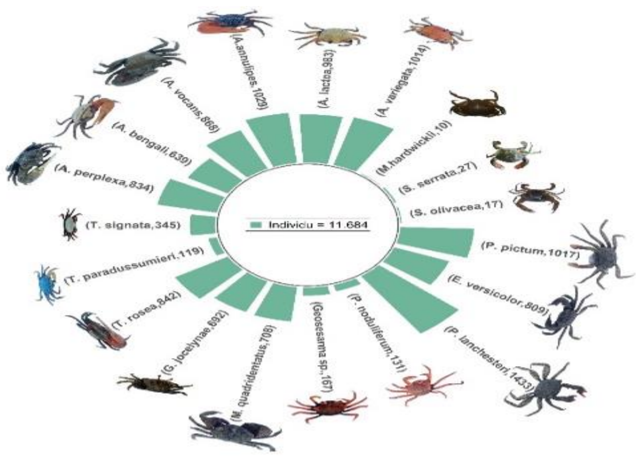

Figure 2. Total Number of Individuals Across All Sampling Stations

These findings indicate that the study area provides suitable habitat conditions for the Brachyura community, particularly within mangrove ecosystems characterized by muddy substrates. Crab distribution is influenced more strongly by sediment characteristics than by water quality. Botto and Iribarne (2000) stated that the activity of burrowing crustaceans, including crabs, is closely associated with sediment properties. Devi *et al.* (2021) further reported that crab distribution is influenced by vegetation, substrate type, food availability, salinity, and the presence of other organisms. Pandya and Vachhrajani (2021) also noted that crab density and distribution are affected by sediment composition and overall habitat characteristics. The most abundant species was *Perisesarma lanchesteri*, with 1,433 individuals. This species is a sesarmid crab that functions as a detritivore by utilizing mangrove leaf litter as a food source (Gao *et al.*, 2024). Its high abundance may be associated with its strong adaptability to mangrove habitats, particularly muddy-sandy substrates rich in organic matter (Hui *et al.*, 2024; Tongununui *et al.*, 2021; Gao *et al.*, 2024). In contrast, *Myomenippe hardwickii* had the lowest abundance, with only 10 individuals. This species tends to inhabit hard substrates, such as rocky areas and dense mangrove roots; therefore, the sandy and muddy substrates at the study site may be less suitable for its habitat requirements (Praved *et al.*, 2026).

Based on the results of the study, the abundance index across all sampling stations was 31.157. The abundance index at Station I was 7.40, at Station II was 7.62, and at Station III was 16.14.

Table 2. Abundance Index and Relative Abundance of Crabs

No	Species	Including abundance	Relative abundance (%)
1	*Scylla olivacea*	0.045	0.50
2	*Scylla serrata*	0.072	0.78
3	*Myomenippe hardwickii*	0.027	0.31
4	*Austruca variegata*	2.704	28.70
5	*Austruca lacteal*	2.621	26.48
6	*Austruca annulipes*	2.744	26.96
7	*Austruca vocans*	2.315	21.13
8	*Austruca Bengali*	1.704	16.62
9	*Austruca perplexa*	2.224	21.07
10	*Tubuca signata*	0.920	7.99
11	*Tubuca paradussumieri*	0.317	2.44
12	*Tubuca rosea*	2.245	20.71
13	*Gelasimus jocelynae*	1.845	17.71
14	*Metopograpsus quadridentatus*	1.888	19.69
15	*Geosesarma* sp	0.445	3.31
16	*Geosesarma noduliferum*	0.349	2.63
17	*Perisesarma lanchesteri*	3.821	36.75
18	*Episesarma versicolor*	2.157	20.54
19	*Parasesarma pictum*	2.712	25.68
	Total	**31.157**	**100**

The high abundance at Station III was presumably associated with sediment conditions and the availability of organic matter as a food source for organisms (Siahaan *et al.*, 2018). Organic matter originates from the weathering and decomposition of plants, remains of dead organisms, waste, and uneaten food, which are decomposed by bacteria into nutrients. Organic compounds that are not utilized in the water column eventually settle on the bottom, enriching the sediment with nutrients derived from sediment decomposition as well as from the remains of dead flora and fauna (Edward and Tarigan, 2003; Pramita *et al.*, 2021).

The highest relative abundance was recorded for *Perisesarma lanchesteri*, with a relative abundance of 36.75%, whereas the lowest was recorded for *Myomenippe hardwickii*, at 0.31%. The high abundance of *Perisesarma lanchesteri* is associated with its ability to adapt to muddy-sandy habitats with high organic matter content, which supports food availability (Botto and Iribarne, 2000; Chen and Ye, 2010). Burrowing activity also enhances sediment aeration and improves redox conditions, thereby supporting biogeochemical processes and nutrient availability (Warren and Underwood, 1986; Wolfrath, 1992; Hua *et al.*, 2024). Bioturbation by crabs further influences sediment structure, oxidation processes, and nutrient distribution, thereby supporting nitrification processes (Ferreira *et al.*, 2007; Kristensen and Alongi, 2006; Hua *et al.*, 2024; Cheng *et al.*, 2020; Zhao *et al.*, 2016).

Based on the results of the study, the overall Shannon–Wiener diversity index (H′) was 2.64, which falls within the moderate diversity category. The diversity index at Station I was 2.46, while Station II and Station III had values of 2.53 and 2.67, respectively.

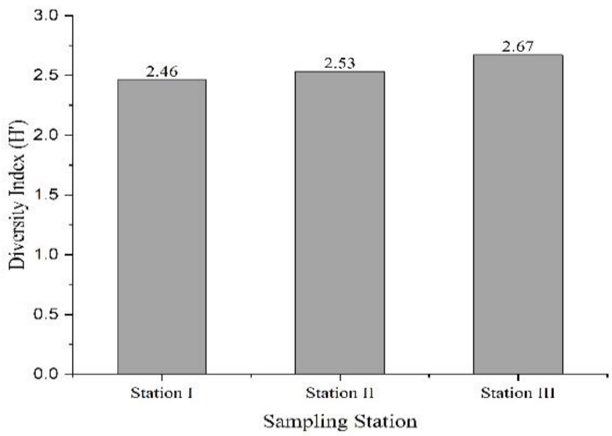

Figure 3. Diversity Index of Crabs at Jono Beach, Lalang Village, Batu Bara Regency

Moderate diversity indicates a relatively adequate level of productivity, a relatively balanced ecosystem condition, and an intermediate level of ecological pressure. The moderate diversity and variation in diversity index values among crab species may be attributed to several factors, including ecosystem disturbances caused by environmental pressures (Kamal *et al.*, 2024). The moderate diversity index may also result from an uneven distribution of species, indicating that no single species was overwhelmingly dominant at the study site (Talo and Ina, 2023). Moderate diversity suggests that only certain species are capable of adapting to and surviving under the prevailing environmental conditions, while some species may become relatively dominant within the ecosystem (Krisnawati *et al.*, 2018; Candri *et al.*, 2019; Li *et al.*, 2019). Furthermore, moderate diversity indicates a relatively adequate level of productivity, relatively balanced ecosystem conditions, and intermediate ecological pressure, suggesting that the environment remains capable of supporting the persistence of various species (Kamal *et al.*, 2024).

The results showed that the dominance index at all three sampling stations was classified as low. Station I, located in the mangrove area, had the highest dominance index, with a value of D′ = 0.10, which was categorized as low. In contrast, the lowest dominance index was recorded at Station III, with a value of D′ = 0.07, also classified as low.

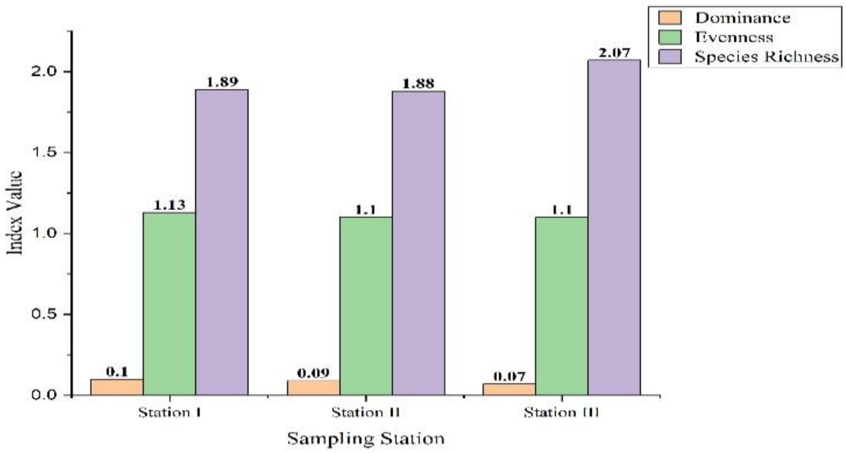

Figure 4. Values of Dominance Index, Evenness Index, and Species Richness Index

Magurran (2004) explained that a dominance index value approaching zero indicates the absence of a dominant genus or species within the community, suggesting that the community structure tends to be stable. A low dominance value also indicates that species have relatively equal opportunities to utilize the resources available in the environment (Alwi *et al.*, 2020; Shalehati *et al.*, 2023). The evenness index values at the three sampling stations were classified as high. Station I had the highest evenness index, with a value of E = 1.13, categorized as high, whereas Stations II and III had the lowest evenness value of E = 1.10, also categorized as high. Based on these values, all three sampling stations were classified as having very high evenness, indicating that individuals were relatively evenly distributed among species. High evenness values indicate the absence of a dominant species and relatively stable community conditions (Kamal *et al.*, 2024). This condition may be influenced by adequate food availability and interspecific interactions in utilizing available resources (Rahayu *et al.*, 2018). In addition, the level of evenness is also associated with environmental conditions at each sampling station (Sari *et al.*, 2018).

The species richness index values at the three sampling stations were classified as low. Station III had the highest species richness index, with a value of R = 2.07, categorized as low, whereas Station II had the lowest value, with R = 1.88, also categorized as low. Based on the obtained values, all three sampling stations were classified as having very low species richness. This condition was presumably associated with habitat characteristics and environmental pressures, both natural and anthropogenic, which may limit the presence of various crab species. Colpo *et al.* (2021) stated that crab species richness is influenced by mangrove ecosystem conditions, including vegetation area and complexity, as well as environmental pressures. Larger and more structurally complex mangrove areas can provide resources such as leaf detritus as a food source for crabs, while also reducing environmental fluctuations caused by waves, tides, and erosion (Suárez-Mozo *et al.*, 2025). More stable habitat conditions can support the presence of a greater number of crab species and consequently increase species richness (Sharifian *et al.*, 2020).

Based on the calculation of the Sørensen similarity index, the crab communities showed a high degree of similarity among the sampling stations. The similarity index between Stations I and II was 0.81 (81%), whereas the similarity indices between Stations I and III and between Stations II and III were both 0.91 (91%).

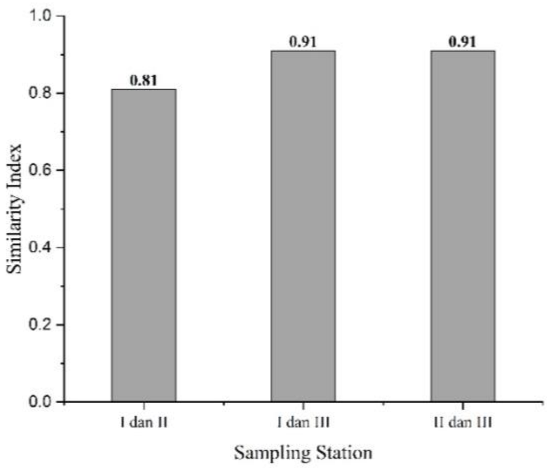

Figure 5. Similarity Index Values

Values approaching 1 indicate a high similarity in species composition, suggesting that most species recorded at one station are also present at the other stations (Sorenson, 1948). The high similarity among sampling stations indicates relatively similar habitat conditions, despite differences in substrate characteristics. Similarity in mangrove vegetation and the ranges of physicochemical factors, such as salinity and tidal conditions, may contribute to the relatively uniform distribution patterns of crabs among the sampling stations (Aryanti *et al.*, 2021).

Based on the results presented in Table 3, the measurements of environmental parameters showed variations in conditions among the sampling stations. The highest temperature was recorded at Station III, with an average of 32.7 °C. Air humidity also reached its highest value at the same station, at 73%. Meanwhile, the highest pH and salinity values were recorded at Station I, at 7.8 and 28.1‰, respectively. The highest light intensity was recorded at Station III, with an average value of 14,033 lux. The substrate composition also differed considerably among the sampling stations. Station I was dominated by sandy substrate, accounting for 83.5%, with a mud content of 16.6%. Station II was dominated by muddy substrate at 83.5%, followed by sand at 16.5%. In contrast, Station III had a more diverse substrate composition, consisting of 25.3% sand, 58.1% mud, and 16.6% clay.

Tabel 3. Physical and Chemical Environmental Parameters

Station	Temperature (ºC)	Air humidity (%)	pH	Salinity (‰)	Light intensity (Lux)	Substrat (%)		
						Sand	Muddy	Clay
I	32,5	67,2	7,8	28.1	13.833	83,5	16,5	0
II	30,3	70,0	7,4	27,1	7.960	16,5	83,5	0
III	32,7	73,0	7,5	25,1	14.033	25,3	58,1	16,6

Jono Beach is characterized by sandy-mud sediment that supports crab communities within the mangrove ecosystem. Organic matter-rich sediments provide nutrients for benthic organisms, while accumulated mangrove litter serves as a food source for deposit-feeding crustaceans. The relatively soft sediment texture also facilitates burrow excavation by crabs for shelter and reproduction (Ansyar *et al.*, 2025). The occurrence and abundance of crabs are influenced by habitat characteristics and environmental factors, including temperature, air humidity, pH, salinity, and light intensity. Overall, the environmental conditions at the study site remain suitable for crab survival. The temperature ranged from 30.3–32.7 °C and remained within the eurythermal tolerance range, indicating that temperature was unlikely to be a limiting factor for crabs (Talo and Ina, 2023). This range is also consistent with the optimal temperature range for crabs, which is approximately 25–35 °C (Hastuti *et al.*, 2019). Air humidity ranged from 67–73%, reflecting typical conditions of tropical mangrove ecosystems and being associated with canopy cover density and daily fluctuations in humidity in coastal areas (Dalengkade, 2020).

The pH values ranged from 7.4–7.8, which falls within the range generally suitable for marine organisms (6–8). These conditions allow physiological processes to proceed normally, whereas excessively low or high pH levels may interfere with organismal metabolism and reproduction (Patty *et al.*, 2015 *in* Talo and Ina, 2023). Salinity ranged from 25–28.1‰, which is also suitable for crabs because it remains within the reported tolerance range of 22–35‰ (Salsabiela, 2020). Light intensity ranged from 7,960–14,033 lux and may influence the distribution of organisms according to their respective preferences for light conditions (Odum, 1996 *in* Hanafi *et al.*, 2020).

The results of the Principal Component Analysis (PCA) showed that at Station III, environmental parameters including temperature, air humidity, and light intensity had a strong association with crab diversity. In contrast, pH and salinity were more closely associated with Station I, while Station II did not show a strong association with any of the measured environmental parameters.

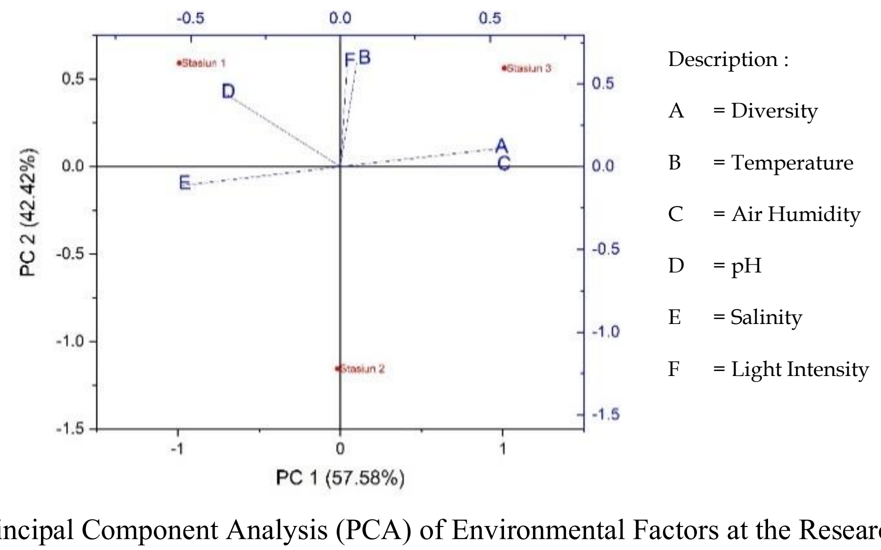

Figure 6. Principal Component Analysis (PCA) of Environmental Factors at the Research Stations

This finding is consistent with Sharifian *et al.* (2020), who stated that temperature is a key environmental driver controlling the distribution and species richness of mangrove crabs. Relatively high air humidity may also contribute to greater diversity by helping maintain water balance, reducing the risk of dehydration, and allowing crabs to perform their activities optimally (Lucu & Turner, 2024). Light intensity may also influence crab activity and habitat utilization (Chan *et al.*, 2024). The substrate characteristics at Station III, which were dominated by mud (58.1%), followed by sand (25.3%) and clay (16.6%), provided a more heterogeneous habitat that could support various crustacean species with different habitat preferences. This condition is consistent with Cannicci *et al.* (2021), who reported that substrate characteristics are among the important factors determining the distribution, composition, and community structure of mangrove crabs.

CONCLUSION

Based on the results of the study conducted at Jono Beach, Lalang Village, Batu Bara Regency, it can be concluded that crab diversity in the study area was classified as moderate, with a Shannon–Wiener diversity index (H′) of 2.64. The analysis of the relationship between crab diversity and physicochemical environmental factors indicated a strong association. Station III showed a strong association with environmental parameters, including temperature, air humidity, and light intensity, indicating that these three parameters may contribute to supporting crab diversity at the station.

AUTHORS CONTRIBUTION

M. L. Tambun conducted the research, analyzed and interpreted the data, and prepared the draft manuscript. Mawardi and F. Armanda reviewed the draft manuscript and supervised the entire research process.

ACKNOWLEDGMENTS

The author sincerely expresses gratitude for the invaluable support and assistance provided by parents, family members, friends, and especially the lecturers who have guided and supported the author throughout the research process.

CONFLICT OF INTEREST

The authors declare no conflicts of interest, and will take full responsibility for the content of the article, including implications of AI-generated art.

REFERENCES

Alwi, D., Muhammad, S. H., & Herat, H. (2020). Diversity and abundance of macrozoobenthos in the mangrove ecosystem of Daruba Pantai Village, Morotai Island Regency. Jurnal Enggano, 5(1), 64-77. DOI: https://doi.org/10.31186/jenggano.5.1.64-77

Ansyar, L., Arief, M. C. W., & Sahidin, A. (2025). Diversity of snails (Mollusca: Gastropoda) in the Mangrove Area of Karangsong, Indramayu Regency, West Java Province, Indonesia. DOI: https://doi.org/10.22146/jtbb.16927

Aryanti, N. A., Wibowo, F. A. C., Mahidi, M., Wardhani, F. K., & Kusuma, I. K. T. W. (2021). The relationship between biotic and abiotic factors and macrozoobenthos diversity in the mangrove forest of West Lombok Regency. *Jurnal Kelautan Tropis, 24*(2), 185-194. DOI: https://doi.org/10.14710/jkt.v24i2.10044

Bandekar, P. D. (2021). Tree-climbing mangrove crabs of Karwar west coast of India. *International Journal of Fisheries and Aquatic Studies*, *9*(3), 186-189. DOI: https://doi.org/10.22271/fish.2021.v9.i3c.2476

Botto, F., & Iribarne, O. (2000). Contrasting effects of two burrowing crabs (Chasmagnathus granulata and Uca uruguayensis) on sediment composition and transport in estuarine environments. *Estuarine, coastal and shelf Science*, *51*(2), 141-151. DOI: https://doi.org/10.1006/ecss.2000.0642

Cannicci, S., Lee, S. Y., Bravo, H., Cantera-Kintz, J. R., Dahdouh-Guebas, F., Fratini, S., ... & Diele, K. (2021). A functional analysis reveals extremely low redundancy in global mangrove invertebrate fauna.

Proceedings of the National Academy of Sciences, *118*(32), e2016913118. DOI: https://doi.org/10.1073/pnas.2016913118
Carpenter, K. E., & Niem, V. H. (1998). FAO Species identification guide for fishery purpose the living marine resources of the western central pacific. *Cephalopods, Crustaceans, Holothurians, and Sharks. Food and Agriculture Organization of the United Nations. Rome*. ISBN 92-5-104589-5
Chakravarty, M. S., Ganesh, P. R. C., Amarnath, D., Sudha, B. S., & Vivek, V. (2016). Diversity of crabs in Tekkali creek, Srikakulam district, Andhra Pradesh. *International journal of fisheries and aquatic studies*, *4*(1), 414-418. https://www.fisheriesjournal.com/archives/2016/vol4issue1/PartF/4-1-37.pdf
Chan, B. K., Guo, J. C., Chen, C. L., & Chan, T. Y. (2024). Activity of the shallow-water hydrothermal vent crab Xenograpsus testudinatus is affected by tides, water temperature, and light intensity. *Marine Ecology Progress Series*, *744*, 69-82. DOI: https://doi.org/10.3354/meps
Chen, G. C., & Ye, Y. (2010). Changes in properties of mangrove sediment due to foraging on Kandelia obovata leaves by crabs Parasesarmea plicatum (Grapsidae: Sesarminae). *Marine Ecology Progress Series*, *419*, 137-145. DOI: https://doi.org/10.3354/meps
Colpo, K. D., Chacur, M. M., Guimaraes, F. J., & Negreiros-Fransozo, M. L. (2021). Subtropical Brazilian mangroves as a refuge of crab (Decapoda: Brachyura) diversity. *Biodiversity and Conservation*, *20*(13), 3239-3250. DOI: https://doi.org/10.1007/s10531-011-0125-x
Dalengkade, M. N. (2020). Temporal fluctuations in air humidity inside and outside mangrove ecosystems. *BAREKENG: Jurnal Ilmu Matematika dan Terapan,* *14*(2), 159-166. DOI: 10.30598/barekengvol14iss2pp159-166
Devi, P. L., Joseph, A., & Korath, A. (2021). Habitat ecology and substratum preference of brachyuran crabs of a tropical estuary, South-West coast of India. *Regional Studies in Marine Science*, *44*, 101709. DOI: 10.1016/j.rsma.2021.101709
Gao, X., Gaitan-Espitia, J. D., & Lee, S. Y. (2024). Regulatory role of sesarmid crabs in nutrient dynamics and implications for the productivity of mangroves. *Estuarine, Coastal and Shelf Science*, *298*, 108655. DOI: https://doi.org/10.1016/j.ecss.2024.108655
Gherardi, F., & Russo, S. (2001). Burrowing activity in the sand-bubbler crab, Dotilla fenestrata (Crustacea, Ocypodidae), inhabiting a mangrove swamp in Kenya. *Journal of Zoology*, *253*(2), 211-223. DOI: https://doi.org/10.1017/S0952836901000188
Hanafi, H., Anwari, M. S., & Yani, A. (2020). Diversity of fiddler crabs in the mangrove forest of Karimunting Village, Sungai Raya Islands District, Bengkayang Regency. *Jurnal Hutan Lestari, 8*(2). DOI: https://doi.org/10.26418/jhl.v8i2.40332
Harshith, U. P., Apoorva, M. D., D'silva, P., & D'Lima, A. D. (2016). Crabs diversity in mangrove and coastal ecosystem. In *The 10th Biennial Lake Conference, Karnataka, India* (pp. 360-366). https://wgbis.ces.iisc.ac.in/biodiversity/sahyadri_enews/newsletter/Issue63/article/ewrg/sec8.html#3
Hastuti, Y. P., Affandi, R., Millaty, R., Nurussalam, W., & Tridesianti, S. (2019). Optimal temperature for improving the growth and survival of mud crab *Scylla serrata* juveniles in a recirculating system. *Jurnal Ilmu dan Teknologi Kelautan Tropis, 11*(2), 311-322. DOI: 10.29244/jitkt.v11i2.22727
Hui, T. K. L., Lo, I. C. N., Wong, K. K. W., Tsang, C. T. T., & Tsang, L. M. (2024). Metagenomic analysis of gut microbiome illuminates the mechanisms and evolution of lignocellulose degradation in mangrove herbivorous crabs. *BMC microbiology*, *24*(1), 57. DOI: https://doi.org/10.1186/s12866-024-03209-4
Kamal, E., Wulandari, D. P., & Lubis, A. S. (2024). Biodiversity of mangrove brachyuran crabs of family Ocypodidae and Sesarmidae in Koto XI Tarusan District, West Sumatera, Indonesia. DOI: https://doi.org/10.4308/hjb.31.3.507-516
Karimah, K. (2017). The role of mangrove forest ecosystems as habitats for marine organisms. *Jurnal Biologi Tropis*, 51–57. DOI: 10.29303/jbt.v17i2.497
Ministry of Marine Affairs and Fisheries of the Republic of Indonesia. (2017). *Mangrove ecosystem management to support the sustainability of coastal and marine resources*. Jakarta: Ministry of Marine Affairs and Fisheries of the Republic of Indonesia.
Lucu, Č., & Turner, L. M. (2024). Ionic regulatory strategies of crabs: the transition from water to land. *Frontiers in Physiology*, *15*, 1399194. DOI: https://doi.org/10.3389/fphys.2024.1399194
Magurran, A. E. 2004. Measuring Biological Diversity. USA: Blackwell Publishing. ISBN: 978-0-632-05633-0

Masiyah, S., Nisaa, K., Melmambessy, E. H., & Lutfi, M. A. (2021). Diversity of fiddler crabs (*Uca* spp.) and soil texture response at Payunb Beach, Merauke. *Jurnal Ilmiah Agribisnis dan Perikanan (Agrikan UMMU-Ternate), 14*(2). DOI: https://doi.org/10.26418/jhl.v6i4.29939

Murniati, D. C., Nugroho, D. A., & Kartika, W. D. (2022). *Fauna of Java: Crustaceans (Decapoda) in mangrove and estuarine ecosystems on Java Island*. Jakarta: BRIN. DOI: https://doi.org/10.55981/brin.312

Odum, E. P. (1993). *Fundamentals of ecology* (3rd ed.). In T. Samingan (Trans.), *Fundamentals of ecology* (3rd ed.). Yogyakarta, Indonesia: Gadjah Mada University Press. (Original work published 1971). ISBN: 9789794202845

Pandya, P. J., & Vachhrajani, K. D. (2021). Spatial distribution and substratum preference of the brachyuran crab, Macrophthalmus depressus (Decapoda, Ocypodidae) along the lower estuarine mudflat of Mahi River, Gujarat, India. *Crustaceana*, 1055-1067. DOI: 10.1163/001121610X521235

Peer, N., Miranda, N. A., & Perissinotto, R. (2015). A review of fiddler crabs (genus Uca Leach, 1814) in South Africa. *African Zoology*, *50*(3), 187-204. DOI: 10.1080/15627020.2015.1055700

Government of Batu Bara Regency. (2023). *Batu Bara Regency Regional Regulation Number 6 of 2023 concerning the Regency Industrial Development Plan (RPIK) 2023–2043*. Batu Bara: Government of Batu Bara Regency.

Pramita, W., Efriyeldi, E., & Galib, M. (2021). Relation macrozoobenthos with sediment organic material in the intertidal zone in Selat Baru Beach, Bengkalis Regency, Riau Province. *Journal of Coastal and Ocean Sciences*, *2*(2), 98-103. DOI: 10.31258/jocos.2.2.98-103

Praved, P. H., Neethu, K. V., Aravind, E. H., Nandan, S. B., & Catherine, P. S. (2026). Morphological and molecular characterization of the thunder crab Myomenippe hardwickii Gray, 1831 (Brachyura: Menippidae) from the Malabar coast, India. *Oceanological and Hydrobiological Studies*, *55*(1), 103-117. DOI: 10.26881/oahs-2026.1.07

Rahayu, S. M., Wiryanto, W., & Sunarto, S. (2017). Crustacean species diversity in the mangrove area of Purworejo Regency, Central Java. *Jurnal Sains Dasar, 6*(1), 57-65. DOI: 10.21831/jsd.v6i1.12643

Rahayu, S. M., Wiryanto, W., & Sunarto, S. (2018). Diversity of fiddler crabs in the mangrove area of Purworejo Regency, Central Java. *EnviroScienteae, 13*(1), 69-78. DOI: 10.20527/es.v13i1.3517

Razak, T. B. (1998). *Community structure of corals based on the line transect and quadrat transect methods on Menyawakan Island, Karimunjawa National Park, Central Java*. http://repository.ipb.ac.id/handle/123456789/132395

Ruwaida, R. (2021). Diversity of fiddler crabs (*Uca*) in the mangrove forest of Kuala Langsa, Aceh Province. *Jurnal Jeumpa, 8*(1), 493–500. DOI: 10.33059/jj.v8i1.3658

Saidah, S., Baktiar, B., & Rubianti, I. (2021). Diversity of fiddler crab species (*Uca* spp.) in the mangrove area of Monta District, Bima Regency. *ORYZA: Jurnal Pendidikan Biologi, 10*(2), 43-53. DOI: 10.33627/oz.v10i2.629

Salsabiela, M. (2020). The effect of different salinity levels on the growth of ablated vannamei shrimp (*Litopenaeus vannamei*). *Jurnal Indonesia Sosial Teknologi*, p-ISSN 2723-6609. DOI: 10.36418/jist.v1i5.49

Sari, I. P., & Prayogo, H. (2018). Diversity of fiddler crab species (*Uca* spp.) in the Mempawah Mangrove Park, Pasir Village, Mempawah Hilir District, Mempawah Regency. *Jurnal Hutan Lestari, 6*(4). DOI: https://doi.org/10.26418/jhl.v6i4.29939

Sarjani, T. M., Mawardi, A. L., Suryani, H. I., & Siregar, A. R. S. (2025). Diversity, Economic Value, and Conservation Status of Macroinvertebrates in the Coastal Areas of East Coast of Aceh Province, Indonesia. *Jurnal Penelitian Pendidikan IPA*, *11*(10), 622-632. DOI: 10.29303/jppipa.v11i10.11913

Shalehati, F., Kartika, W. D., Siburian, J., Wulandari, T., & Oktaviani, N. (2023). Diversity of Crustacea of the order Decapoda in the mangrove area of Pangkal Babu, Tungkal 1 Village, Tanjung Jabung Barat. *Jurnal Biologi UNAND, 11*(1), 46-53. DOI: https://doi.org/10.25077/jbioua.11.1.46-53.2023

Sharifian, S., Kamrani, E., & Saeedi, H. (2020). Global biodiversity and biogeography of mangrove crabs: Temperature, the key driver of latitudinal gradients of species richness. *Journal of Thermal Biology*, *92*, 102692. DOI: 10.1016/j.jtherbio.2020.102692

Siahaan, D., Muskananfola, M. R., & Suryanto, A. (2018). Relationship between crab abundance, organic matter, and sediment texture in the mangroves of Maron, Tirang, and Mangunharjo Beaches, Semarang. *Management of Aquatic Resources Journal (MAQUARES), 7*(1), 69-77. DOI: 10.14710/marj.v7i1.22526

Sihombing, H., & Daulay, H. (2023). Development of coastal tourism objects to improve the livelihoods of communities in Batu Bara Regency. *PERSPEKTIF, 12*(1), 238–250. DOI: 10.31289/perspektif.v12i1.7843

Sorenson, T. (1948). A method of establishing groups of equal amplitude in plant sociology based on similarity of species content and its application to analyses of the vegetation on Danish commons. *Biol Skar*, *5*, 1. ISSN: 0366-3612

Suárez-Mozo, N. Y., Moulatlet, G. M., Pérez-Ceballos, R., & Capparelli, M. V. (2025). Variation in mangrove species diversity across gradients of climate-change-induced environmental conditions and hydrological restoration. Journal of Environmental Management, 373, 123476. DOI: 10.1016/j.jenvman.2024.123476

Tongununui, P., Kuriya, Y., Murata, M., Sawada, H., Araki, M., Nomura, M., ... & Adachi, K. (2021). Mangrove crab intestine and habitat sediment microbiomes cooperatively work on carbon and nitrogen cycling. *PloS one*, *16*(12), e0261654. DOI: https://doi.org/10.1371/journal.pone.0261654