Jurnal Pijar MIPA
https://jurnalfkip.unram.ac.id/index.php/JPM

ISSN 1907-1744 (Print)
ISSN 2460-1500 (Online)

Diversity of Mollusks (Bivalvia and Gastropoda) in the Intertidal Zone of Medana Beach, North Lombok

Yuan Sasmitha[1], Dining Aidil Candri[1*], Hilman Ahyadi[2]

[1]Department of Biology, Faculty of Mathematics and Natural Sciences, University of Mataram, Mataram, Indonesia
[2]Department of Environmental Science, Faculty of Mathematics and Natural Sciences, University of Mataram, Mataram, Indonesia
[*]e-mail: aidilch@unram.ac.id

Received: July 9, 2025. Accepted: August 24, 2025. Published: September 24, 2025

Abstract: Mollusks are an important group of marine organisms that contribute significantly to marine ecosystem structure and function, exhibiting high species diversity and widespread distribution across various marine habitats. Medana Beach, located in North Lombok, is a coastal area with ecological potential as a habitat for mollusks, particularly bivalves and gastropods. However, excessive exploitation beyond sustainable limits has led to a decline in mollusk populations, due to rates of harvest surpassing their natural regeneration. This study aims to assess the species diversity and community structure of mollusks (Bivalvia and Gastropoda) in the intertidal zone of Medana Beach. A purposive sampling method was used to select stations based on differing environmental characteristics, while transects were laid using systematic random sampling. Mollusk sampling, environmental parameter measurements (temperature, salinity, and pH), and substrate identification were carried out at all three study stations. A total of 55 mollusk species comprising 1,052 individuals were recorded, including 14 bivalve species and 41 gastropod species. The bivalves belonged to 9 families, and the gastropods to 17 families. The highest infaunal abundance was observed at Station 3 (616.67 ind/m³), while the highest epifaunal abundance occurred at Station 1 (15.38 ind/m²). *Modiolus philippinarum* had the highest infaunal density (255.56 ind/m³), found attached to seagrass roots in muddy-sand substrates. *Cellana radiata* had the highest epifaunal density (6.13 ind/m²), found attached to rocks. The mollusk community structure at Medana Beach was relatively stable, as indicated by moderate diversity and evenness indices, with no dominant species observed. These findings suggest that the habitat conditions at Medana Beach are capable of supporting mollusk communities and are not currently experiencing significant ecological stress.

Keywords: Bivalvia; Community Structure; Diversity; Gastropoda; Medana Beach; Mollusks.

Introduction

Mollusks belong to a phylum of invertebrate animals characterized by soft bodies, the absence of a vertebral column, and in most cases, the presence of a shell. Among the various classes of mollusks, Bivalvia and Gastropoda are the most prominent [1]. Mollusks are one of the key components of marine ecosystems, known for their high species diversity and wide distribution across various marine habitats [2]. The diversity of mollusks, particularly bivalves and gastropods, can be influenced by environmental factors. Changes in water quality and differences in substrate type can significantly affect the composition and abundance of mollusk communities [3].

According to data from BPS (Statistics Indonesia) North Lombok covers an area of approximately 809.53 km² [4]. Coastal communities rely on marine resources and the potential of coastal and aquatic ecosystems for their livelihoods [5]. *Madak* is a traditional practice of harvesting intertidal biota, including bivalves and gastropods, by local communities in Lombok. The estimated mollusk exploitation by *madak* practitioners at Serinting Beach reaches approximately 3,348 gastropod individuals and 345 bivalve individuals per month [6]. The high exploitation rate of mollusks, which exceeds optimal limits and is not balanced with their growth rate, has led to a decline in mollusk populations [7].

Medana Beach is a popular tourist destination in North Lombok, known for its beautiful scenery, white sandy beaches, and clear seawater. The site has tourism potential managed by the local Tourism Awareness Group (Pokdarwis) [8]. In addition to its role as a tourism area, the beach is also utilized by local communities as a site for harvesting intertidal biota. The dual pressures of tourism infrastructure development (such as hotels and piers) and traditional exploitation activities make Medana Beach a unique socio-ecological system. The variety of habitats and substrates in this area is presumed to support a high diversity of mollusk species; however, quantitative information on its community structure remains unavailable.

Several previous studies have successfully identified various mollusk species in the Lombok region. For example, research by Candri documented 10 species of Strombidae and 3 species of Muricidae in the Gili and Tanjung Luar areas [9]. While another study by Berliana recorded 55 mollusk species at Gerupuk Beach, Central Lombok [10]. However, no studies have been conducted on mollusks in the intertidal zone of Medana Beach. Previous

How to Cite:
Y. Sasmitha, D. A. Candri, and H. Ahyadi, “Diversity of Mollusks (Bivalvia and Gastropoda) in Medana Beach, North Lombok”, *J. Pijar.MIPA*, vol. 20, no. 6, pp. 1028–1035, Sep. 2025. https://doi.org/10.29303/jpm.v20i6.9621

research in this area has only focused on the Echinodermata group [11].

The lack of research and outreach on marine biodiversity has led local communities to remain unaware of certain important species that continue to be exploited. Addressing this knowledge gap is crucial given the urgency of conservation and the sustainable use of coastal resources. This study aims to provide quantitative data on the diversity and community structure of mollusks (Bivalvia and Gastropoda) in the intertidal zone of Medana Beach, which is expected to serve as a scientific basis for management, conservation, and local policy formulation. Furthermore, this research emphasizes the uniqueness of Medana Beach as a socio-ecological ecosystem that integrates community-based tourism, habitat diversity, and the traditional practice of *madak*, thereby offering novelty by enriching the mollusk biodiversity database while providing practical contributions to coastal management in North Lombok.

Research Method

This study was conducted from May to July 2023 at Medana Beach, Medana Village, Tanjung Subdistrict, North Lombok Regency, during low tide (Figure 1). Identification of mollusk species (Bivalvia and Gastropoda) was carried out at the Marine Laboratory, Faculty of Mathematics and Natural Sciences, University of Mataram.

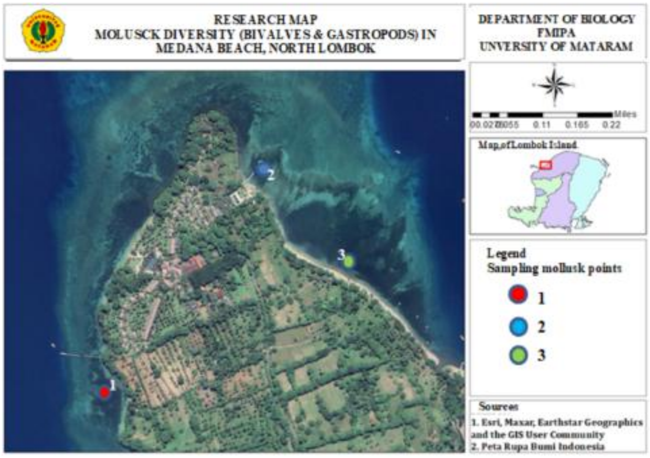

Figure 1. Research Location Map

The tools and materials used in this study included stationery, rulers, 1×1 m² plots, a refractometer, a pH meter, small shovels, thermometers, ziplock bags, sieves, a camera, measuring tapes, brushes, trays, plastic bags, distilled water, 70% alcohol, tissues, and labelling paper.

The present study employed an exploratory descriptive approach. Research was conducted at three stations, selected based on differing environmental characteristics. Station 1 featured rocky substrate, mud, sandy mud, coral fractures, and dense seagrass vegetation. Station 2 was dominated by sandy coral fracture substrate, with some rocky substrate, sandy mud, and sparse seagrass vegetation. Station 3 was characterized by sandy mud substrate and dense seagrass vegetation. At each station, three transects were established as replicates, with 20 m intervals between sampling points. Each transect measured 100 m in length and was divided into five observation plots, resulting in 15 square plots per station. Transect placement followed a systematic random sampling design, where transects were randomly located and 1×1 m² plots were systematically arranged. Epifauna samples were collected directly within the 1×1 m² plots, while infauna samples were obtained from five points within each plot using a shovel with a volume of 0.0024 m³, then sieved to separate organisms from the substrate. Environmental parameters (temperature, pH, and salinity) and substrate type identification were performed concurrently with the collection of bivalve and gastropod samples.

The data obtained were processed using Microsoft Excel 2010. Data processing in this study included:
Infaunal abundance [12].

$$\mathrm{K} = \frac{\mathrm{ni}}{\mathrm{A}}$$

Epifaunal abundance [13].

$$\mathrm{K} = \frac{\mathrm{ni}}{\mathrm{V}}$$

The Shannon–Wiener diversity index [14].

$$\mathrm{H'} = -\sum_{i=s}^{s} pi \ln pi$$

Criteria:
H′≤1 = Low
1.1<H′≤3= Medium
H′>3.1 = High
The evenness index was calculated using the Evenness formula [15].

$$\mathrm{E} = \frac{\mathrm{H'}}{\ln \mathrm{S}}$$

Criteria: ranges from 0 to 1. A value closer to 1 indicates that individuals are more evenly distributed among species, while a value closer to 0 suggests that the community is dominated by only a few species.
The dominance index [14].

$$\mathrm{C}=\sum\left(\frac{\mathrm{ni}}{\mathrm{N}}\right)$$

Criteria:
C ≤ 0.5 : No dominant species
0.51 < C ≤1 : Presence of dominant species

Results and Discussion

A total of 55 species comprising 1,052 individuals were recorded from the three observation stations at Medana Beach, including 14 bivalve species and 41 gastropod species (Figure 2). Bivalves were represented by nine families: Arcidae, Cardiidae, Mytilidae, Spondylidae, Isognomonidae, Pteriidae, Pinnidae, Mactridae, and Veneridae, while gastropods comprised 17 families: Cerithiidae, Potamididae, Bullidae, Neritidae, Cypraeidae, Naticidae, Strombidae, Columbellidae, Conidae, Costellariidae, Muricidae, Nassaridae, Olividae, Volutidae, Lottiidae, Angaridae, and Trochidae. Gastropods outnumbered bivalves, likely due to their broader adaptability, habitat range, and distribution. Their higher abundance may also be attributed to greater mobility, resulting in the largest number of families, genera, and species within the phylum Mollusca [16].

The lower relative abundance of bivalve species is attributed to greater harvesting pressure by local communities compared to gastropod species. Such unsustainable exploitation, combined with their inherently slow growth and reproduction rates, and the absence of adequate aquaculture practices, has led to a continuous population decline, potentially resulting in local depletion [17].

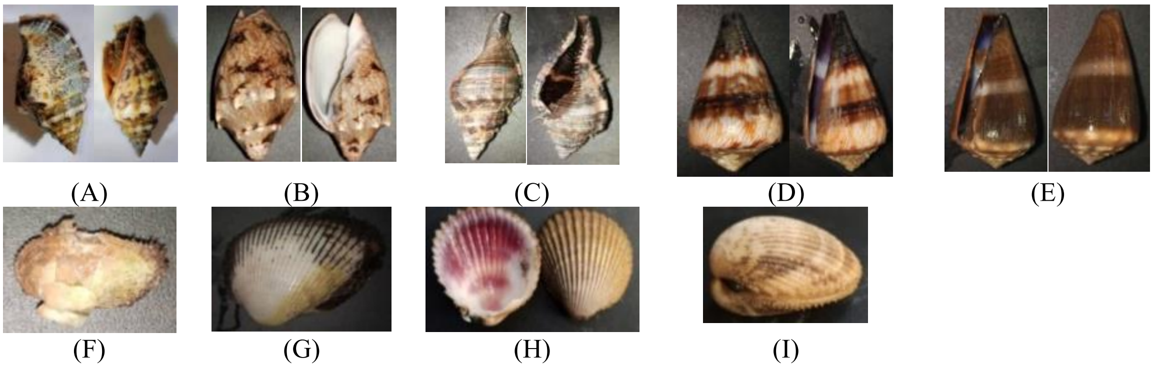

Figure 2. (A) *canarium mutabile*, (B) *Cymbiola innexa*, (C) *Urosalpinx cinere*, (D) *Conus imperialis*, (E) *Conus distans,* (F) *Anadara crebricostata*, (G) *Anadara antiquata*, (H)*Trachycardium procerum,* (I) *Trachycardium egmontianum*

In the Medana Beach area, local communities refer to the harvesting of intertidal organisms, including bivalves and gastropods, during low tide as *ngangsat* or *madak*. As shown in Figure 2, several mollusk species were found in low numbers at the research stations. The low species counts at each station are likely due to high exploitation pressure by local communities, particularly targeting bivalves and gastropods with high economic value [18]. The genus *Anadara* (kerang darah) is heavily utilized for local consumption, sale in local markets, and shell use in construction materials. In Oebelo Village, continuous harvesting has been reported to significantly reduce blood clam abundance[19].

Table 1 Abundance and Substrate of Mollusks (Bivalves and Gastropods) in the Intertidal Zone of Medana Beach, North Lombok

Class	Species	Station 1		Station 2		Station 3		Substrate
		Infauna	Epifauna	Infauna	Epifauna	Infauna	Epifauna	
		ind/m³	ind/m²	ind/m³	ind/m²	ind/m³	ind/m²	
Bivalvia	*Anadara antiquata*		0.07	16.67				B
	Anadara crebricostata	16.67			0.07	16.67		PL
	Trachycardium procerum	25		16.67	0.07	50		PL, L, PK
	Trachycardium egmontianum	33.33		16.67	0.07	22.22		PL, PL
	Modiolus philippinarum	41.67		38.89		255.56		PL
	Septifer bicolularis				0.07			PK
	Spondylus eastae				0.13		0.13	PK
	Isognomon isognomum				0.07			PK
	Pinctada margaritifera				0.07			PK
	Atrina strangei	16.67		41.67		66.67		PL, PK
	Mactra maculata	16.67		16.67		33.33		L, PL, PK
	Pitar citrinus	50				16.67		L, PL
	Gafrarium pectinatum			16.67				PL, PK
	Tapes literatus					16.67		PL, PK
Gastropoda	*Cerithium dialeucum*		1.64		0.53		0.33	PL, L
	Cerithium rostatum		0.33		0.07		0.07	PL, L
	Terebralia paluris			108.33	0.43			B
	Bulla ampulla		0.2				0.07	PL, L
	Nerita albicilla		0.2	16.67	0.07			B
	Nerita hellicinoides			16.67				B

	Monetaria annulus		0.16		0.36		0.31	PL, L,PK
	Monetaria moneta				0.11			PL, PK
	Natica dillwynii				0.07			PL
	Natica vitellus		0.13					PL
	Naticarius stercusmuscarum				0.13			PK, PL
	Polineces mammilla	16.67	0.07					L
	Canarium daveyi		0.2		0.69		0.36	PL, PK, L
	Canarium urceus		0.09		0.1		0.33	PL, PK
	Canarium youngorum		0.2		0.07		0.07	PL, L
	Canarium mutabile		0.13		0.23		0.33	PL, PK
	Gibberulus gibbosus				0.13			PL, PK
	Euplica scripta				0.13		0.07	PL, PK
	Euplica bidentata		0.2		1.29		2.73	PL, PK
	Conus distans		0.07					L, PL
	Conus imperialis		0.07					PL
	Conus radiates		0.07					PL
	Conus ebraeus				0.07			B
	Conus bruuni				0.07			PK
	Vexillum plicarium	25		16.67		50		PL, L, PK
	Vexillum concentricum	33.33	0.07					PL
	Vexillum virgo			16.67		38.89		PL
	Urosalpinx cinerea		0.07					L
	Ergalatax margariticola		1		0.36		0.07	B, PL, PK
	Ergalatax crassulnata						0.13	PL
	Ergalatax martensi			33.33			0.13	B, PL
	Nassarius graphiterus	125	2.8	16.67	0.2	16.67	0.27	L, PL, PK
	Nassarius albescens					33.33		PL
	Oliva reticulata	16.67						L
	Oliva sericea			16.67				PL
	Cymbiola innexa				0.07		0.07	PL
	Cellana radiate		6.13					B
	Patelloida striata		0.8					B
	Angaria javanica		0.36		0.07		0.29	PL, L, B, PK
	Tectus fenestratus		0.33		0.51		0.98	PL, PK, L
	Tectus niloticus						0.13	PL
	Total	416.67	15.38	405.56	6.28	616.67	6.87	

Note: B Rocky, L Muddy, PL Muddy sand, PK Coral rubble

The abundance of infauna and epifauna is described as the distribution of the number of individuals found within an ecosystem. Table 1 shows that infaunal abundance is higher than epifaunal abundance. Infaunal abundance ranges from 512 to 864 ind/m³, while epifaunal abundance ranges from 4 to 29 ind/m². This difference is likely because infauna inhabit sediment layers up to 20 cm deep, which provide a larger living space compared to the surface, natural protection from predators, and abundant nutrient reserves [20].

Table 1 indicates that the highest infaunal abundance was recorded at Station 3, which was dominated by muddy sand substrate and seagrass vegetation. The type of aquatic substrate influences the nutrient content and organic matter within it; finer sediment particles tend to have higher nutrient content derived from organic matter [21]. Sand sediment generally contains less organic matter than muddy or fine sediments, as its larger particle size and pore spaces facilitate the transport of organic material by currents, making it less likely to settle [22].

The species with the highest abundance at Station 3 was *Modiolus philippinarum*, with 255.56 ind/m³, found attached to seagrass roots in a muddy sand substrate. The seagrass bed ecosystem serves as a habitat for *M. philippinarum*, providing shelter, breeding grounds, and feeding areas [23]. The genus *Modiolus* is generally found in tropical and subtropical waters and is classified as semi-infaunal. *Modiolus* inhabits muddy and sandy substrates in the littoral to sublittoral zones, with part of its body buried in sediment, and uses byssal threads to support and attach itself to the substrate [24]. *M. philippinarum* is known for its tolerance to environmental stress. *M. philippinarum* can survive at temperatures of 38 °C for a short duration, with 100% mortality occurring at 42 °C after 30 minutes, indicating its high thermal tolerance [25].

Euplica bidentata was the epifaunal species with the highest abundance at Stations 2 and 3, as it was found attached to seagrass leaves. *E. bidentata* is a herbivorous species that feeds on algae or plant detritus attached to substrates. The high availability of food enables *Euplica* to adapt well under conditions of low or no competition [26]. The family Columbellidae comprises small marine snails distributed worldwide, with the highest abundance in tropical regions [27]. At Station 1, *Nassarius graphiterus* was the infaunal species with the highest abundance, found in muddy substrates. This is consistent with the findings of Pandey, who reported that *N. graphiterus* is abundant in muddy substrates because such sediments provide organic matter and allow the species to burrow easily to forage for detritus [28]. *Cellana radiata* exhibited the highest epifaunal abundance at Station 1, found attached to rocky substrates. *C. radiata* shows high abundance in intertidal zones with rocky substrates [29].

Table 1 shows that the bivalve and gastropod species found exclusively on sandy rock substrates were *Anadara antiquata*, *Cellana radiata*, *Conus ebraeus*, *Nerita albicilla*, *Nerita helicinoides*, *Patelloida striata*, and *Terebralia palustris*. *C. radiata* and *P. striata* of the family Lottiidae were found only at Station 1, attached to rocks submerged in seawater. Members of the family Lottiidae are generally sedentary and are typically found on hard substrate surfaces. They form depressions, or “home scars”, on rocks to reduce evaporation and protect themselves from predators. Lottiidae move during the night at high tide, and during low tide, they remain within their home scars [30].

This research found that members of the family Neritidae were located on rocky substrates, particularly on the surface and underside of rocks, and even hidden within rock crevices. Bivalve species such as *Septifer bilocularis*, *Spondylus eastae*, *Isognomon isognomon*, and *Pinctada margaritifera* were observed attached to coral rubble. *Spondylus* possesses spines on its shell that serve as camouflage and aid in attachment to the substrate. As an epifaunal species, *Spondylus* can adapt well to substrate conditions unsuitable for other infaunal bivalve species [31]. Different substrate types host specific bivalve and gastropod species, meaning that some species are found exclusively on certain substrates; however, in muddy sand substrates, several species can still be found on other substrates, although in smaller numbers [32].

Table 2. Mollusk Community Structure in the Intertidal Zone of Medana Beach, North Lombok

Community structure	Station 1	Station 2	Station 3	Pantai Medana
H'	2.46	2.86	2.44	2.99
Category	Medium	Medium	Medium	Medium
E	0.70	0.78	0.72	0.75
Category	uniform	uniform	uniform	uniform
C	0.14	0.09	0.16	0.08
Category	No species was dominant	No species was dominant	No species was dominant	No species was dominant

Note:H' diversity index, E Evenness Index, C Dominance Index

Table 2 shows that the Shannon–Wiener diversity index (H) values at Stations 1, 2, and 3 were classified as “medium” according to the Shannon–Wiener diversity index criteria [14]. A medium diversity index occurred because the habitat supported the presence of gastropods, such as sufficient food availability, favorable pH, and muddy substrates preferred by gastropods [33]. This is consistent with the substrates found in Medana Beach, namely mud, muddy sand, sandy rock, and coral rubble. The diversity index values for mollusks (bivalves and gastropods) at the three stations did not differ significantly. The highest diversity index was recorded at Station 2, with a value of 2.86. Station 2 was dominated by coral rubble substrate, along with sandy rock and muddy sand. Coral rubble provides shelter, living space, and attachment surfaces for bivalve and gastropod species. Complex substrates generate diverse microhabitats, allowing species with different ecological requirements to coexist; species diversity is significantly higher in heterogeneous substrates [34].

Species diversity at Station 1 was 2.46, while at Station 3 it was 2.44. Differences in diversity are influenced by species distribution and abundance [35]. A community is considered to have high species diversity if it consists of many species with equal or nearly equal abundances; conversely, if a community consists of few species and only a small number of dominant species, then species diversity is considered low [36].

he relatively even distribution of bivalve and gastropod individuals at the study sites was attributed to the similar environmental conditions across all three stations. Table 3 shows that no species dominated in any of the stations. The low dominance index of bivalves and gastropods at Medana Beach is related to the values of the diversity index (H′) and the evenness index (E). Diversity and evenness indices are inversely proportional to dominance values. When diversity and evenness are high, dominance will be low, and vice versa. The presence of dominance indicates that the environmental conditions are highly favorable for the growth of certain species. In aquatic habitats, if a dominant species is present, it suggests that the ecosystem is under considerable ecological stress [14]. Such stress may cause mortality in organisms unable to adapt, while those capable of adapting will experience substantial population growth and become dominant [37].

Table 3 shows that the mollusk community structure in the intertidal zone of Medana Beach is relatively stable, as indicated by the medium category of diversity and evenness indices and the absence of dominant species. This condition suggests that the habitat at Medana Beach is capable of supporting the survival of mollusks (bivalves and gastropods) and is not under significant ecological stress.

Table 3. Environmental Parameters in the Intertidal Zone of Medana Beach, North Lombok

Station	Temperature (C^o)	Salinity($^o/_{oo}$)	pH
1	31.6	30.2	8.2
2	28.7	33.4	7.95
3	30.2	34.5	7.64

Table 3 indicates variations in environmental parameters (temperature, salinity, and pH), which are likely due to differences in measurement times. Based on previous research conducted in the seagrass ecosystem of Labakkang Waters, Pangkep, South Sulawesi, environmental conditions in seagrass habitats are considered optimal for the survival of mollusks, with temperature ranging from 28.85 °C to 31.49 °C, salinity from 26.89 ‰ to 34.21 ‰, and pH from 7.19 to 8.30 [38]. This is consistent with the results of the present study, which show that all three stations exhibit environmental parameters (temperature, salinity, and pH) that are ideal for the growth of bivalves and gastropods.

Conclusion

Based on the results of this study, a total of 1,052 mollusk individuals were recorded, comprising 55 species, of which 14 species belong to the class *Bivalvia* and 41 species belong to the class *Gastropoda*. The highest abundance was recorded at Station 3, while the lowest was at Station 2. The most abundant species, *Modiolus philippinarum*, was found attached to seagrass roots in muddy sand substrates. The mollusk community structure in the intertidal zone of Medana Beach was relatively stable, as indicated by medium diversity and evenness indices, as well as the absence of dominant species.

Author Contributions

Yuan Sasmitha and Dining Aidil Candri: research conceptualization, data collection and analysis, and preparation of the initial draft of the manuscript.
Hilman Ahyadi: Research supervision, validation of analysis results, writing improvement, and final revision of the manuscript for publication.

Acknowledgements

The authors would like to express their gratitude to their academic supervisors, colleagues, and families for their invaluable support in completing this research.

Reference

[1] R. M. Marwoto, Heryanto, N. R. Isnaningsih, N. Mujiono, Alfiah, and R. Prihandini, *Moluska Jawa (Gastropoda & Bivalvia)*. Bogor: IPB Press, 2020.

[2] B. A. Nugroho, *Mollusca Pulau Tarakan Deskripsi-Identifikasi-Habitat dan Klasifikasi*. Yogyakarta: Deepublish, 2023.

[3] R. Agustina, O. Supratman, and A. M. Farhaby, “Kelimpahan dan Keanekaragaman Moluska (Gastrpoda dan Bivalvia) di Kawasan Pesisir Desa Rebo Kabupaten Bangka,” *J. Trop. Mar. Sci.*, vol. Vol.7(1), no. 1, pp. 6–14, 2024, doi: https://doi.org/10.33019/jour.trop.mar.sci.v7i1.4112 .

[4] “Luas Wilayah dan Persentase Menurut Kabupaten/Kota di Provinsi Nusa Tenggara Barat,” Badan Pusat Statistik Provinsi Nusa Tenggara Barat. [Online]. Available: https://ntb.bps.go.id/id/statistics-table/1/MTY1IzE=/luas-wilayah-dan-persentase-menurut-kabupaten-kota-di-provinsi-nusa-tenggara-barat-2016.html

[5] J. Purba, *Pengelolaan Lingkungan Sosial*. Jakarta: Yayasan Obor Indonesia, 2005. [Online]. Available: https://books.google.co.id/books?id=b_nqP4VI3FwC&pg=PP1&source=kp_read_button&hl=id&newbks=1&newbks_redir=0&redir_esc=y#v=onepage&q&f=false

[6] L. Febrianti, I. Bachtiar, and Karnan, “Diversity of Gastropods and Bivalvia Caught By Pemadak in The Intertidal Zone of Serinting Beach, Special Economic Zone Mandalika,” *J. Biol. Trop.*, vol. 23, no. 1, pp. 81–89, 2023, doi: 10.29303/jbt.v23i4b.5921.

[7] E. Efriyeldi and R. Kurniawan, “Growth, Mortality, Exploitation Rate, and Recruitment of Blood Clam (Anadara granosa) in the Rangsang Barat Waters, Riau Province,” *J. Natur Indones.*, vol. 21, no. 1, p. 7, 2023, doi: 10.31258/jnat.21.1.7-14.

[8] Firman Andika, I. W. Suteja, and Indrapati, “Partisipasi Masyarakat dalam Pelestarian Potensi Daya Tarik Wisata Pantai Impos Desa Medana Kabupaten Lombok Utara,” *J. Responsible Tour.*, vol. 4, no. 2, pp. 535–540, 20224, doi: https://doi.org/10.47492/jrt.v4i2.3672.

[9] D. Aidil, I. Nurafifah, H. Ahyadi, and I. W. Suana, “Composition and Communities Distribution of Strombidae and Muricidae in Gili , Tanjung Luar

Region," *Int. J. Sci. Basic Appl. Res.*, vol. 63, no. 2, pp. 71–81, 2022.
[10] C. G. Berliana, D. A. Candri, and H. Ahyadi, "Mollusca Biodiversity as A Quality Bioindicator Waters in Central Lombok Gerupuk Bay Coastal Area," *J. Pijar Mipa*, vol. 19, no. 2, pp. 265–272, 2024, doi: 10.29303/jpm.v19i2.5520.
[11] D. S. A. P. Purwati P, Widianwary P, "Timun Laut Teluk Medana, Lombok Barat,. Pola Sebaran dan Kelimpahan," 2008. doi: https://doi.org/10.14710/ik.ijms.13.4.219-226.
[12] J. E. Brower, J. E. Zar, and C. N. von Ende, *Field and laboratory methods for general ecology*. Boston, 1998.
[13] M. F. Fachrul, *Metode Sampling Bioekologi*. 2007.
[14] E. P. Odum, *Dasar-dasar ekologi: Fundamentals of ecology*, Third edit. Yogyakarta: Gadjah Mada University Press, 1992.
[15] E. C. Pielou, "The measurement of diversity in different types of biological collections," *J. Theor. Biol.*, vol. 13, no. C, pp. 131–144, 1966, doi: 10.1016/0022-5193(66)90013-0.
[16] Hartoni and A. Agussalim, "Komposisi dan Kelimpahan Moluska (Gastropoda dan Bivalvia) di Ekosistem Mangrove Muara Sungai Musi Kabupaten Banyuasin Provinsi Sumatera Selatan," *Maspari J.*, vol. 5, no. 1, pp. 6–15, 2013.
[17] D. A. Candri, L. J. Hidayati, H. Ahyadi, and Y. Zamroni, "Community Structure of Molluscs at Batu Kijuk Village," *J. Penelit. Pendidik. IPA*, vol. 9, no. 2, pp. 856–863, 2023, doi: 10.29303/jppipa.v9i2.2990.
[18] I. Akhrianti1, D. G. Bengen, and I. Setyobudiandi2, "Distribusi Spasial dan Preferensi Habitat Bivalvia di Pesisir Peraiaran Kecamatan Simpang Pesak Kabupaten Belitung Timur," *J. Ilmu dan Teknol. Kelaut. Trop.*, vol. 6, no. 1, pp. 171–186, 2014, doi: 10.29244/jitkt.v6i1.8639.
[19] M. F. Tje and L. N. L. Toruan, "Analisa Kelimpahan Kerang Darah (Anadara Granosa) dan Pemanfaatannya Oleh Masyarakat di Desa Oebelo, Kabupaten Kupang," vol. 2, no. 2, pp. 30–36, 2019, doi: https://doi.org/10.35508/aquatik.v2i2.2566.
[20] Berlianasari, V. Mayta, Guntur, and C. S. U. Dewi, "Struktur Komunitas Makrozoobenthos Pada Ekosistem Padang Lamun (Seagrass) di Teluk Penerusan, Kabupaten Buleleng, Bali," Universitas Brawijaya, 2022.
[21] S. I. Febryana, I. Riniatsih, and Munasik, "Kelimpahan Megabenthos yang Berkaitan dengan Karakteristik Substrat Dasar di Ekosistem Padang Lamun Perairan Jepara," vol. 14, no. 1, pp. 79–88, 2025, doi: DOI : 10.14710/jmr.v14i1.42802.
[22] G. A. Yudha, C. A. Suryono, and A. Santoso, "Hubungan antara Jenis Sedimen Pasir dan Kandungan Bahan Organik di Pantai Kartini, Jepara, Jawa Tengah," *J. Mar. Res.*, vol. 9, no. 4, pp. 423–430, 2020, doi: 10.14710/jmr.v9i4.29020.
[23] R. Hidayat and A. H. Nugraha, "Kelimpahan Bivalvia pada Ekosistem Padang Lamun di Bintan Utara," vol. 8, no. 1, pp. 91–101, 2024, doi: https://doi.org/10.31629/akuatiklestari.v8i1.6737.
[24] O. H, "Reproductive cycle and spawning of Modiolus philippinarum (Bivalvia: Mytilidae) in a seagrass bed in Kin Bay, Okinawa Island, Southern Japan," *Venus*, vol. 60, no. 3, pp. 173–181, 2001.
[25] S. Rajagopal, G. Van Der Velde, K. V. K. Nair, and H. A. Jenner, "Response of the tropical mussel Modiolus philippinarum (Hanley) to heat treatment: An experimental study for antifouling application," *Mar. Freshw. Behav. Physiol.*, vol. 32, no. 4, pp. 239–253, 1999, doi: 10.1080/10236249909379052.
[26] J. R. Parorrongan1, F. Zahida, and I. P. Yuda, "Keanekaragaman dan Kelimpahan Gastropoda di Pantai Seger, Lombok Tengah," *Biota J. Ilm. Ilmu-Ilmu Hayati*, vol. 3, no. 2, pp. 79–86, 2018, doi: 10.24002/biota.v3i2.1896.
[27] E. E. S. Marta deMaintenon, "Molecular phylogeny of Columbellidae (Gastropoda: Neogastropoda)," *Pubmed*. doi: 10.7717/peerj.13996.
[28] V. Pandey, G. Thiruchitrambalam, and K. Satyam, "Habitat heterogeneity determines structural properties of intertidal gastropod assemblages in a pristine tropical island ecosystem," *Indian J. Geo-Marine Sci.*, vol. 47, no. 4, pp. 846–853, 2018.
[29] J. Madin, S. M. Ho, and B. A. V. Maran, "Gastropods in the intertidal shore of Kota Kinabalu, Sabah (Malaysian Borneo)," *Borneo J. Resour. Sci. Technol.*, vol. 11, no. 1, pp. 9–23, 2021, doi: 10.33736/bjrst.3371.2021.
[30] E. Y. T. Zapanta, M. A. Fortaleza, M. E. Elumba, R. C. L. Uy, and C. L. Nañola, "Diel movement patterns of pacific sugar limpet, patelloida saccharina (Gastropoda: Patellogastropoda: Lottiidae) in response to semi-diurnal tides of Samal Island, Philippines," *Raffles Bull. Zool.*, vol. 68, no. December, pp. 870–879, 2020, doi: 10.26107/RBZ-2020-0095.
[31] M. mansur Islami, "Sekilas tentang Spondylus (Bivalvia: Spondylidae) - A glance about Spondylus (Bivalvia: Spondylidae)," *Oseana*, vol. 36, no. 3, pp. 39–46, 2011.
[32] D. A. Candri, M. S. Rahmani, H. Ahyadi, and Y. Zamroni, "Diversity and Distribution of Gastropoda and Bivalvia in Mangrove Ecosystem of Pelangan, Sekotong, West Lombok," *J. Biol. Trop.*, vol. 22, no. 3, pp. 1092–1100, 2022, doi: 10.29303/jbt.v22i3.1413.
[33] L. Erlinda, R. Yolanda, and A. A. Purnama, "Struktur Komunitas Gastropoda Di Danau Sipogas Kabupaten Rokan Hulu Provinsi Riau," *J. Mhs. Prodi Biol. UPP*, vol. 1, no. 1, p. 110490, 2015, [Online]. Available: https://www.neliti.com/publications/110490/
[34] K. Romoth, A. Darr, S. Papenmeier, M. L. Zettler, and M. Gogina, "Substrate Heterogeneity as a Trigger for Species Diversity in Marine Benthic Assemblages," *Biology (Basel).*, vol. 12, no. 6, 2023, doi: 10.3390/biology12060825.
[35] J. W. Nybakken, *Biologi laut: Suatu Pendekatan Ekologis*. Jakarta: HarperCollins College Publisher, 1992.
[36] A. Sugianto, *Ekologi Kuantitatif:Metode Analisa Populasi dan Komunitas*. Surabaya: Usaha nasional, 1994.
[37] B. Abdillah, Karnan, and D. Santoso, "Struktur

Komunitas Moluska (Gstropoda dan Bivalvia) pada Daerah Intertidal di Perairan Pesisir Poton Bako Lombok Timur Sebagai Sumber Belajar Biologi," *J. Pijar MIPA*, vol. 14, no. 3, pp. 208–216, 2019, doi: 10.29303/jpm.v14.i3.1619.

[38] Hamsiah, E. Y. Herawati, M. Mahmudi, and A. Sartimbul, "Seasonal variation of bivalve diversity in seagrass ecosystem of Labakkang coastal water, Pangkep, South Sulawesi, Indonesia," *AACL Bioflux*, vol. 9, no. 4, pp. 775–784, 2016.