

Diversity Of Gastropod Types in The Intertidal Zone of Kolbano Beach South Central Timor Regency, East Nusa Tenggara

Sardina Ndukang¹, Hildegardis Missa², Aloysius Djalo³

^{1,2,3} Biology Education Study Program, Widya Mandira Catholic University, Indonesia

Article Info

Article history:

Received February 6, 2024

Revised June 17, 2024

Accepted June 21, 2024

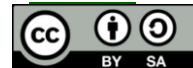
Keywords: (AZ)

Diversity,
Gastropods,
Intertidal Zone
Kolbano Beach

ABSTRACT

Research on gastropods on Kolbano beach, South Central Timor Regency has never been published. The aim of this research was to determine the types of gastropods in the Intertidal Zone of Kolbano Beach, South Central Timor Regency. The samples used in the research were all gastropods located in plots located in the intertidal zone of Kolbano Beach. This research uses a qualitative approach, collecting research data using identification and documentation tables. Data analysis is completed using the Shanon Wiener Diversity Index formula. The results of the research showed that the gastropods successfully identified on Kolbano beach consisted of the species *C.maldivus*, B). *C.flvidus*, C). *C.clerii*, D). *V. turbinillus*, E). *O.floralia*, F). *F.palidus*, G). *A.punctulata*, H). *Murex Blainvilli*, I). *Crassispira harpularia*, J). *T. reticulata*, K). *Plesiotrochus monachus*, L). *Persicula variabilis*, M). *C.scabridum*, N). *Vaceuelus favosus*, O). *Polinices tumidus*, P). *C.olidium*, Q). *M.moneta*, R). *Trochus maculates*. S). *Carolliophila solutistoma*, T). *M.myosotis*. The results of the calculation of the diversity index, uniformity index and dominance index reached 2.195, so it can be concluded that the gastropods on Kolbano Beach consist of 16 families, 18 genera and 20 species and are at a medium level of diversity.

This is an open access article under the [CC BY-SA](#) license.



Corresponding Author:

Hildegardis Missa ,

Biology Education Study Program , Faculty of Teacher Training and Education , Widya Mandira Catholic University ,
Jl. San Juan No. 1. East Penfui, Kupang Regency, East Nusa Tenggara Province, Indonesia

Email: hildegardismissa@unwira.ac.id

1. INTRODUCTION

Indonesia is known as an archipelagic country which has 75% sea and water area. Indonesia has enormous wealth in mollusks (Islami, 2017). Ulmaula et al., (2016) said that there are 100,000 mollusk species spread almost throughout the world. According to (ase, (2021) around 20% of the types of mollusks in the world live in Indonesia. Ahmad, (2018) also added that there are 1,500 types of gastropods in Indonesia. Gastropods are animals that use their stomachs to walk. Gastropod movements are caused by muscle contractions such as wave, which starts from the back and goes to the front. When gastropods move, the front legs have glands to produce mucus which makes walking easier and leaves marks when walking (Albert et al., 2022).

Gastropods play a role in the food chain cycle and have important economic value, such as various types of shellfish and various types of snails. Gastropods have high adaptability to various habitats, such as accumulating heavy metals without dying and acting as environmental indicators (Islami, 2017). Gastropods in the ecosystem can influence the life of another biota. In a food chain, apart from being prey for other biota, gastropods can act as herbivores (grazers), carnivores, scavengers, detritivores, deposit feeders, suspension feeders and parasites (Tri et al., 2019).

Much research has been carried out on gastropods, including reports of 14 species in the Meranti Islands, Riau (Wahyuni et al., 2016), 31 species in East Biak, Papua (Faidiban et al., 2017). 20 species in North Buton source, 37 species in Central Maluku (Persulesy & Arini, 2018). 22 species in Garut Regency, West Java (Bancin et al., 2020), and 40 species in Lembata Regency, East Nusa Tenggara (Toby et al., 2017a).

Gastropods that live in waters are generally found as detritivores. In the food chain, detritivores play a role in converting detritus which has a low energy level into trophic with a higher energy level (Wahyuni et al., 2016). Gastropods are often found on land, freshwaters and coastal areas (Slamet et al., 2021a).

The coastal area is a transition area between land and sea, where the sea is influenced by land activities, for example sedimentation and fresh water flows. In the landward direction there are parts that are flooded with

water which is influenced by the nature of the sea, for example tides, sea breezes as well as salt water infiltration. Therefore, coastal areas are border areas between land and sea which are influenced by certain characteristics (Faidiban et al., 2017). This coastal area is the border between water and land areas. Coastal areas have different substrate characteristics such as sandy mud, sandy rock, muddy rock, muddy sand, this kind of substrate makes it possible to find various types of gastropods. This area is often called the Intertidal Zone (Purnomo, et al., 2019).

South Central Timor Regency is a district in East Nusa Tenggara Province known for its beaches with distinct substrate characteristics, particularly Kolbano Beach. This beach features several unique elements, especially due to its varied substrates and surfaces. One distinguishing aspect of Kolbano Beach is the colorful pebbles that cover the shore. These pebbles come in a range of colors, including white, pink, black, and brown, setting them apart from the typical sand found on most beaches. In addition to the colorful pebbles, Kolbano Beach also has fine sand in certain areas. The textural contrast between the pebbles and sand creates a unique variation in substrates. In some parts of the beach, large rocks further enhance the substrate diversity. These rocks are found both along the coastline and in the water, offering a dramatic and varied landscape. Furthermore, coral formations can be found in several areas of Kolbano Beach. These formations not only enrich the substrate but also provide a variety of habitats for marine life. The diverse geological conditions of Kolbano Beach contribute to these substrate variations. Erosion, sedimentation, and tectonic activity in the region influence the types and distribution of substrates along the coast, which serve as habitats for gastropods. This beach is a beach that is often visited by tourists to enjoy its natural beauty, and no researcher has ever observed gastropod species, therefore this research is the first research on Kolbano Beach.

2. RESEARCH METHOD

The research was conducted in the intertidal zone of Kolbano Beach South Central Timor Regency (TTS). Determination of sampling locations is based on differences in environmental conditions, with the distance between stations being around 500 m. The research location map is presented in Figure 1.

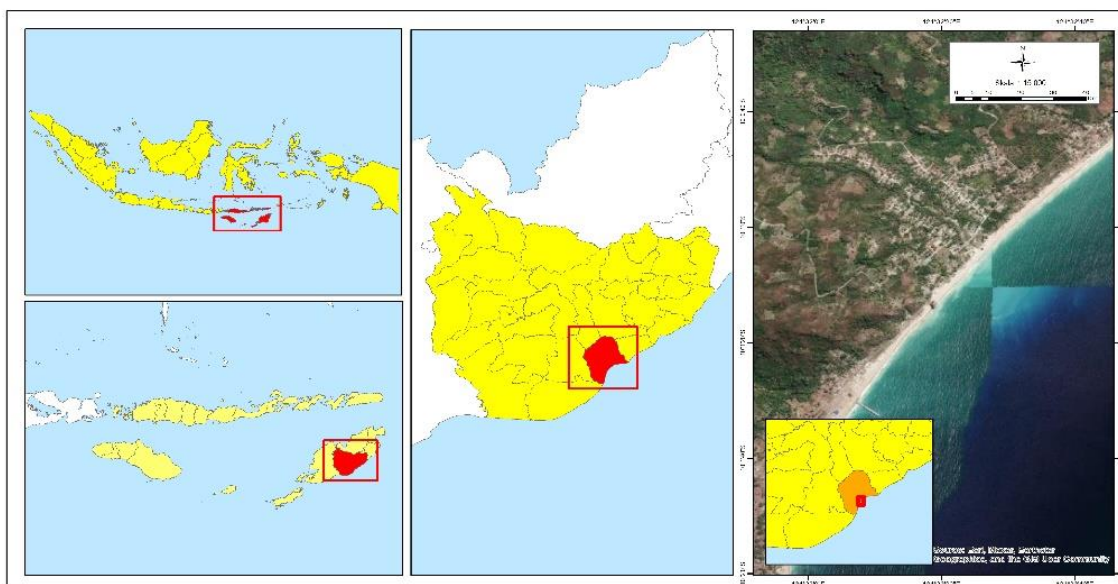


Figure 1. Gastropod Identification Research Location on Kolbano Beach , South Central Timor Regency, East Nusa Tenggara

Sampling was carried out during low tide at four stations. By using the square transect method in a place that allows sampling to be accessed. The location determination in this research was carried out deliberately according to a location that was considered suitable for the natural habitat of gastropods (source). Gastropod species found in each quadrat were recorded in an observation table, then samples were used to identify the type of species and the number of each type of species found. Each Gastropod species found is taken as a sample which will later be preserved using 4% formalin and placed in a jar as an additional collection of Gastropod wet preservation preparations.

Identification of gastropods on Kolbano beach was carried out by observing morphological characteristics such as shell shape, apex, Chrl, Whorl Body, siphonal canal, spire, suture, aperture, and columella and compared with gastropoda that had been found previously using the official website, namely <http://Conchology.be>. Data analysis was carried out by determining the Latin name of each species found. The sample data obtained was then calculated using the Shannon Wiener Diversity Index with the formula ($H' = -\sum P_i \ln P_i$).

3. RESULTS AND DISCUSSION

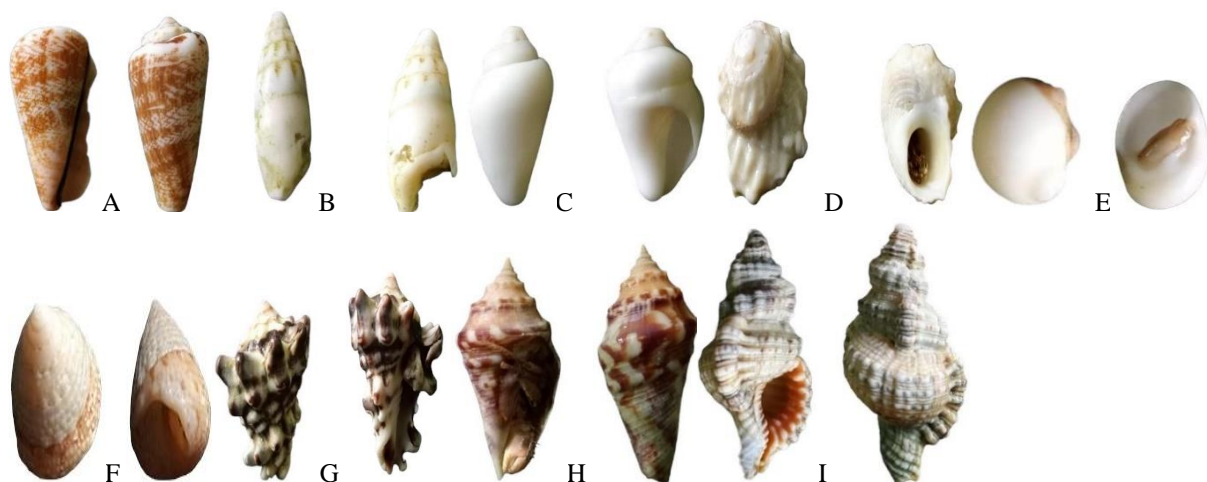
Gastropods Found on Kolbano Beach

Gastropod identification research carried out at Kolbano Beach succeeded in finding 16 gastropod families, namely Conidae, Olividae, Chilodontaidae, Naticoidae, Trochidae, Turbinellidae, Muricidae, Pseudomelatomidae, Neritidae, Nassariidae, Cypraeidae, Ellobiidae, Plesiotrochidae, Cytiscidae, Cerithiidae, Strombidae, 18 genera consists of *Conus*, *Vasum*, *Olivella*, *Fuegotropon*, *Acanthinucella* *Muricopsis*, *Crassispira*, *Tritia*, *Plesiotroyhus*, *Persicula*, *Cerithium*, *Vaceuchelus*, *Polinices*, *Canarium*, *Moneter*, *Trochida*, *Nerita*, *Myosotella*, and 20 species consisting of *C.Maldivus*, *C.Flavidus*, *C.Clerii*, *V. turbinellus*, *O. floralia*, *F. palidus*, *A.punctulata*, *Murex Blainvilli*, *Crassispira harpularia*, *T. reticulata*, *Plesiotrochus monachus*, *Persicula variabilis*, *C.scabridum*, *Vaceuelus favosus*, *Polinices tumidus*, *C.olidium*, *M. moneta*, *Trochus maculates*, *N. plicata*, *M. myosotis*, research data are clearly presented in table 1 and Figure 2.

Table 1. Types of gastropods on Kolbano beach, South Central Timor Regency

No	Family	Genus	Species	Substrate
1	Conidae	<i>conus</i>	<i>C. maldivus</i>	Sandy and rocky
			<i>C. flavidus</i>	Sandy and muddy
			<i>C. c lerii</i>	Sandy and muddy
2	Turbinelidae	<i>Vasum</i>	<i>V. turbinellus</i>	Muddy
3	Olividae	<i>Olivella</i>	<i>O. floralia</i>	Sandy and rocky
			<i>Fuegotropone</i>	<i>F. pallidus</i>
4	Muricidae	<i>Acanthinucella</i>	<i>A. punctulata</i>	Muddy
			<i>Muricopsis</i>	<i>Carolliophila solutistoma</i>
5	Pseudomelatomidae	<i>Crassispira</i>	<i>Crassispira harpularia</i>	Muddy
6	Nassaridae	<i>Tritia</i>	<i>T. reticulata</i>	Muddy
7	Plesiotrochidae	<i>Plesiotroyhus</i>	<i>Plesiotrochus monachus</i>	Sandy and rocky
8	Cytiscidae	<i>Persicula</i>	<i>Persicula variabilis</i>	Sandy and muddy
9	Cerithiidae	<i>Cerithium</i>	<i>C. scabridum</i>	Muddy
10	Chilodontaidae	<i>Vaceuchelus</i>	<i>Vaceuelus favosus</i>	Sandy and muddy
11	Naticoidae	<i>Polinices</i>	<i>Polinices tumidus</i>	Muddy
12	Strombidae	<i>Canarium</i>	<i>C. olidium</i>	Muddy and sandy
13	Cypraeidea	<i>Monetary</i>	<i>M. moneta</i>	Muddy
14	Trochidae	<i>Trochida</i>	<i>Trochus maculates</i>	Sandy and coral _
15	Neritidae	<i>Nerita</i>	<i>N. plicata</i>	Sandy and muddy
16	Ellobiidae	<i>Myosotella</i>	<i>M. myosotis</i>	Sandy and muddy

The table above shows that the most common gastropod habitats are found in muddy sandy substrates with a total of 8 species, followed by muddy substrates with a total of 7 species and sandy, rocky substrates with 5 species.



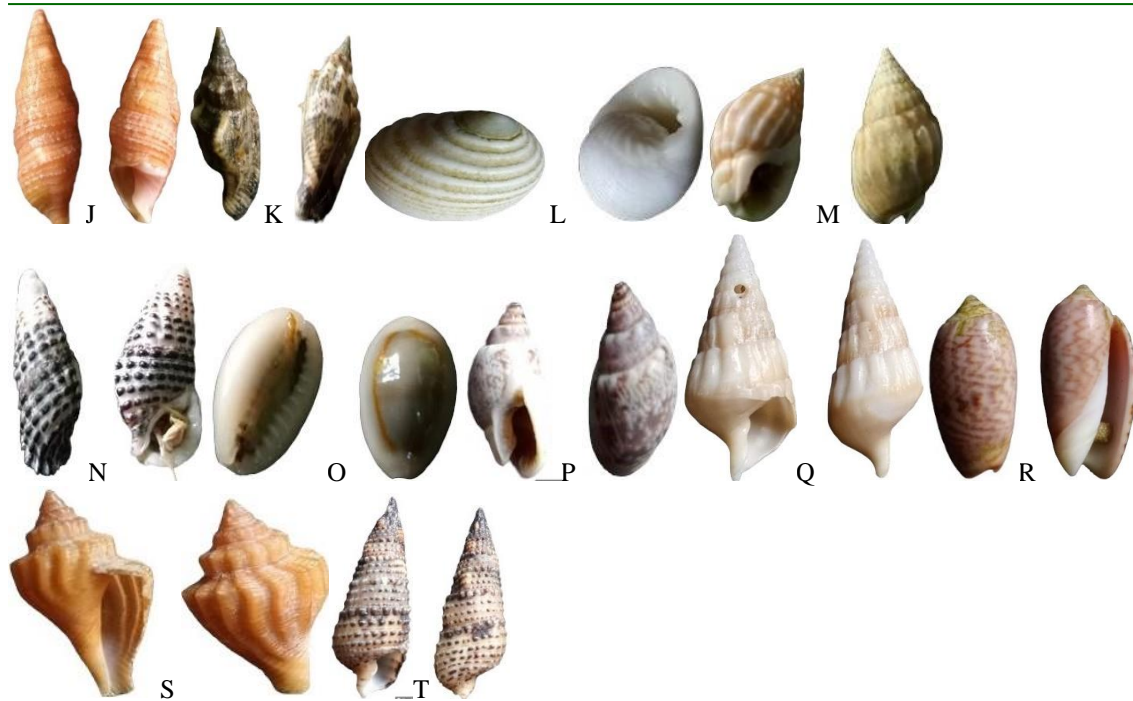


Figure 2. Gastropods on Kolbano beach, South Central Timor Regency , East Nusa Tenggara A). *C. Maldives* , B). *C. Flavidus* , C). *C. Clerii* , D). *V. turbinillus* , E). *O. floralia* , F). *F. pallidus* , G). *A. punctulata* , H). *Murex Blainvilli* , I). *Crassispira harpularia* , J). *T. reticulata* , K). *Plesiostrochus Monachus* , L). *Persicula Variabilis* , M). *C. scabridum* , N). *Vaceuelus favosus* , O). *Polinices tumidus* , P). *C. olidium* , Q). *M. moneta* , R). *Trochus maculates* . S). *Carolliophila solutistoma* , T). *M. myosotis* .

Based on Figure 2 above, the gastropods found in this study have different morphologies and living habitats (Slamet et al., 2021b). *Conus maldivus* (Figure 2A) is the common name of the Maldivian cone, namely marine gastropods from the Conidae family or snails that have cone shells. *C. Maldives* is predatory and venomous so it can sting humans. The shell size varies between 18 mm and 83 mm. The shell is surrounded by a line of small spots that swirl around the brown and white shell and form a band. Sometimes the bands are irregular (Yanti et al., 2022). *Olivella floralia* (Figure 2B) is a species of marine gastropod in the family Olividae. This species is nicknamed dwarf olive. The shell length of this species varies between 6 mm to 15 mm. The shell is slender and mostly white, with a white to blue or purple upper rim (Khoobdel et al., 2017). *Conus flavidus* (Figure 2C) is the name often used for species of marine gastropods in the family conidae. This snail is predatory and venomous or can sting humans. The shell of this gastropod is patterned with spiral ropes and fine beads, yellowish to orange in color with bright lines, the top of the shell is purple with a white middle. The body rotates straight, is purple on the inside and the maximum shell length is 4 to 7.5 cm. This species feeds on small coral fish (Yanti et al., 2022).

Vaceuchelus flavosus (Figure 2D) is a sea snail from the Chilodontidae family. The shell height reaches 2.6 mm and the shell has no opening teeth. The size of the shell is very small, pure white, the shell contains four circles, the outer part is rough and the inner part is smooth (Slamet et al., 2021b). *Polinices tumidus* (Figure 2E) is a predatory marine gastropod from the Naticidae family. The shell is pure white, slightly elongated in shape, reaches 4 cm in height, the operculum is brown and has horns (Budawan et al., 2020). *Trochus maculatus* (Figure 2F) is a marine gastropod with the family Trochidae, generally with a maculate upper shell. The shell size varies between 25 mm and 65 mm. These gastropods have varied shapes, and their shells are dense, heavy, cone-shaped and have the shape of a false umbilicus. The spire is conical, or swollen and slightly convex at the bottom, or sometimes narrowing around the top of the body. The color of the upper surface consists of longitudinal lines or flames of purplish brown or red (Pietersz et al., 2022). *Conus clerii* (Figure 2G) is a cone-shaped marine gastropod from the family Conidae. Generally, gastropods of the genus *conus* are predatory and venomous, and can sting humans. The maximum recorded shell length is 65 mm (Wardani, 2023). *Vasum turbinellus* (Figure 2H) is a gastropod belonging to the Turbinellidae family, shell length varies between 36.7 mm and 86 mm, yellowish white and chestnut black, stained and indistinctly striped, yellowish white opening, outer edge with black spots (Handayani et al., 2021).

Fuegotrophon pallidus (Figure 2I) is a marine gastropod from the Muricidae family or often called rock gastropods, its shell reaches 21.9 mm in length (Ira et al., 2015). *Crassispira harpularia* (Figure 2J) is a marine gastropod from the Pseudomelatomidae family with a chestnut or brown colored shell, a more elongated spire, a longer and denser siphonal canal (Wulansari & Kuntjoro, 2018). *Canarium olidium* (Figure 2K) is a marine

gastropod from the family Strombidae. This species is a true snail (Ngo, 2020). *Nerita plicata* (Figure 2L) is a tropical marine gastropod from the family Neritidae. This species is found throughout the Indo-western Pacific (Isoni et al., 2023). *Tritia reticulata* (Figure 2M) tall shell measuring 30 mm and almost the same width. The exterior of this species is dull white or pink and sometimes black (Mailissa et al., 2021). *Acanthinucella punctulata* (Figure 2N) is a marine gastropod previously known as *Acanthina punctulata* which comes from the family Muricidae or rock snails. This snail is small, about 2.5 cm. The shell has dark spiral markings that resemble dots or broad lines (Parorrongan, Zahida, & Yuda, 2018). *Monetaria moneta* (Figure 2O) is a small sea snail because its shell has historically been widely used in various Pacific and Indian Ocean countries as money in the form of coins. The smallest shell size is 3 cm, irregular and flat, pale shell color from white to cream and some are greenish gray with yellowish edges, with darker transverse lines and fine yellow rings. Several of these genera have been described as full species (Toby et al., 2017b).

Myosotella myosotis (Figure 2P) is a gastropod that has a yellowish to brownish shell with fine striations with a shell size of 3 cm -7 cm (Tri, Rukmana, & Purnomo, 2019). *Plesiotrochus monachus* (Figure 2Q) is a type of marine gastropod that comes from the Plesiotrochidae family (Khoobdel et al., 2017). It has an elongated cone-shaped shell, small in size between 5 mm to 10 mm but some reach 24 mm. Imperforate vortices are flat to concave in shape (Persulesy & Arini, 2018). *Gibberula brinkae* (Figure 2R) is a marine gastropod that has a shell size varying between 10 mm and 35 mm, color and morphology vary greatly (Budiawan et al., 2020). *Carolliophila solutistoma* (Figure 2S) is a species of marine gastropod from the Muricidae family or often called rock gastropods (Pietersz et al., 2022). This species was first discovered in the exclusive economic zone of New Zealand (Budiawan et al., 2020). *Centhium scabridum* (Figure 2T) is a species of marine gastropod from the Cerithiidae family which has a shell size varying between 10 mm and 25 mm (Wulansari & Kuntjoro, 2018).

Diversity of Gastropod Types

The diversity of Gastropod species identified on Kolbano beach has a species diversity index value of 2.195. In accordance with the established Shamon-Wiener diversity index criteria, the level of Gastropod diversity on Kolbano beach is classified as moderate with $H'1 \leq H' \leq 3$ species diversity index data presented in table 2.

Table 2. Gastropod species diversity index on Kolbano beach

No	Species name	Amount	Pi (Ni/N)	Ln. Pi	(- $\sum pi \ln pi$)
1	<i>C. m aldivus</i>	6	0.048	-3,045	-0.145
2	<i>C. fl a vidus</i>	17	0.135	-2,003	-0.270
3	<i>C. c lerii</i>	1	0.008	-4,836	-0.038
4	<i>V. turbinellus</i>	1	0.008	-4,836	-0.038
5	<i>O. floralia</i>	1	0.008	-4,836	-0.038
6	<i>F. pallidus</i>	3	0.024	-3,738	-0.089
7	<i>A. punctulata</i>	10	0.079	-2,534	-0.201
8	<i>Murex Blainvilli</i>	1	0.008	-4,836	-0.038
9	<i>Botta pleurotoma</i>	1	0.008	-4,836	-0.038
10	<i>T. reticulata</i>	26	0.206	-1,578	-0.326
11	<i>Plesiotrochus Monachus</i>	1	0.008	-4,836	-0.038
12	<i>Persicula Variabilis</i>	1	0.008	-4,836	-0.038
13	<i>C. scabridum</i>	2	0.016	-4.143	-0.066
14	<i>Vaceuelus favosus</i>	1	0.008	-4,836	-0.038
15	<i>Polinices tumidus</i>	5	0.040	-3,227	-0.128
16	<i>C. olidium</i>	37	0.294	-1,225	-0.360
17	<i>M. moneta</i>	9	0.071	-2,639	-0.189
18	<i>Trochus maculates</i>	1	0.008	-4,836	-0.038
19	<i>N. plicata</i>	1	0.008	-4,836	-0.038
20	<i>M. myosotis</i>	1	0.008	-4,836	-0.038
Total		126			2,195

Table 2 above shows that the species most commonly found on Kolbano beach is *C. olidium* with a total of 37 based on its habitat. This species lives on muddy, sandy substrates. This result is supported by research (Isoni et al., 2023) which states that *C. Olidium* is Gastropods are often found on beaches on muddy, sandy substrates. Apart from that, the fewest species of gastropod found was *A. punctulata*, the small number of individuals found was caused by the type of habitat occupied which was not the original habitat of this organism. The natural habitat of these species is the sandy and coral rocky seabed (Ngo, 2020).

The Conidae and Muricidae families are the gastropods with the most numerous species, namely 3 species, including *C. Maldivus*, *C. Flavidus*, *C. Clerii*, *F. pallidus*, *A. punctulata*, and *Murex Blainville*. These two families were found with three species each because this family is very abundant in coastal areas, muddy expanses of tropical and subtropical climates (Isoni et al., 2023). The fewest families found were: Olividae, Chilodontidae, Naticoidae, Trochidae, Turbinellidae, Pseudomelatomidae, Neritidae, Nassariidae, Cypraeidae, Ellobiidae, Plesiotrochidae, Cytiscidae, Cerithiidae, and Strombidae with 1 species each. This is influenced by differences in the composition of gastropod species which are caused by biological and ecological characteristics, such as the condition of substrate texture and organic material content, therefore these families can only live and develop in certain environmental conditions (Wulansari & Kuntjoro, 2018). The small number of gastropod species found is also due to the fact that these species are food for the Crustaceae class, especially the type *Pagurus* sp. Ganthropods cannot adapt to the existing environment (source). Apart from that, the fewest species found could also be due to their inability to adapt to environmental factors and human interference, namely excessive harvesting of several species to be used as fish bait and consumed (Yunita et al., 2023) (Rukmana & Purnomo, 2019).

The results of calculating the species diversity index are a measure that shows the community diversity of an occupied area (Toby et al., 2017a). The species diversity index shows high, medium and low diversity values (Siswansyah et al., 2023). In the research at Kolbano beach, temperature and soil pH were measured in each plot. The aim was to determine the life range of gastropods on Kolbano beach. The measurement results obtained figures of 27 °C – 30.3 °C. This shows that this temperature range is stable and good for gastropod life. According to Siswansyah et al., (2023) sea surface temperatures in Indonesia, the range is between 28 °C – 31 °C, thus the inconspicuous temperature changes in the study area are very suitable for gastropod life. Measuring the degree of acidity (pH) resulted in between 7 - 8. According to (sources) the pH range of sea water is 7-8, so that Kolbano Beach, South Central Timor Regency, East Nusa Tenggara has a good level of acidity. The degree of acidity is an ecological factor to control the activity and distribution of plants and animals in waters (Yunita et al., 2023) (Parorrongan, Zahida, Yuda, et al., 2018).

4. ACKNOWLEDGEMENT

The conclusion of research on gastropod identification at Kolbano Beach, South Central Timor Regency, East Nusa Tenggara Province, was that 20 types of gastropods were found, consisting of *C. maldivus*, B). *C. flavidus*, C). *C. c lerii*, D). *V. turbinillus*, E). *O. floralia*, F). *F. pallidus*, G). *A. punctulata*, H). *Murex Blainvilli*, I). *Crassispira harpularia*, J). *T. reticulata*, K). *Plesiotrochus monachus*, L). *Persicula v ariabilis*, M). *C. scabridum*, N). *Vaceuelus favosus*, O). *Polinices tumidus*, P). *C. olidium*, Q). *M. moneta*, R). *Trochus maculates*. S). *Carolliophila solutistoma*, T). *M. myosotis*. The calculation results index diversity, index uniformity, and index dominance, diversity gastropods found on the coast Kolbano reached 2,195 incl in category currently Because mark diversity is in the criteria $H' 2.0 \leq H' \leq 3.0$. Kolbano Beach has four types of substrate, namely muddy, muddy sandy, sandy and muddy, sandy and coral with a temperature of 30 °C with a pH of 7.

5. REFERENCES

- Ahmad, A. (2018). Identification of the Phylum Mollusca (Gastropod) in Water Palipi Evening Subdistrict Proud Regency Majene [Online Thesis]. Alauddin Makassar State Islamic University.
- Albert, DDA, Bujeng, V., & Chia, S. (2022). Identification of Mollusc Remains (Bivalve and Gastropod) from Archaeological Sites in Semporna, Sabah. *Tropical Life Sciences Research*, 33 (2), 196–237. <https://doi.org/10.21315/tlsr2022.33.2.10>
- Bancin, IR, Suharsono, S., & Hernawati, D. (2020). Gastropod Diversity in Water Sancang Beach Littoral Garut Regency. *JOURNAL OF BIOSCIENCE*, 6 (3), 72–81. <https://doi.org/10.24114/jbio.v6i3.17739>
- Boettiger, A., Ermentrout, B., & Oster, G. (2005). The neural origins of shell structure and pattern in aquatic mollusks. *PNAS Journal*, 106 (16), 6837–6842. www.pnas.org/cgi/content/full/
- Budiawan, H., Ardiansyah, F., & Nurmasari, F. (2020). Diversity Species Class Gastropods in the Bama Beach Mangrove Forest, Baluran National Park. *BIOSSENSE*, 03 (2), 1–13.

-
- Faidiban , D., Pramana Yuda, I., Zahida, F., Biology Studies , P., Technobiology , F., Atma Jaya Yogyakarta, U., & Babarsari No, J. (2017). Diversity Gastropods and Bivalves at Segara Indah Beach, East Biak, Papua. *Atma Jaya University Yogyakarta, Faculty Technobiology, Study Program Biology*, 1–14.
- Handayani, M., Rangan, JK, Lumingas, L JL, Manginsela, FB, Kepel, RC, & Ompi, M. (2021). Structure Community Gastropods in the Bahowo Mangrove Ecotourism Area. *Handayani Journal Scientific Platax*, 9 (2), 281–288. <http://ejournal.unsrat.ac.id/index.php/platax>
- Ira, Rahmadani, & Irawati, N. (2015). Diversity And Density Gastropods in the Waters of Morindino Village Subdistrict Cambodia North Buton Regency. *AQUASAINS: Journal Knowledge Fisheries and Resources Waters*, 5 (1), 1–9.
- Islami, MM (2017). Notes The Richness of Gastropod Species on the Coast Leti Island, South Banda Region. *Biology News: Journal Life Sciences*, 16 (1), 95–99.
- Isroni , W., Sari, PDW, Sari, LA, Daniel, K., South, J., Islamy , RA, Wirabuana , PYAP, & Hasan, V. (2023). Checklist of mangrove snails (Gastropod: Mollusca) on the coast of Lamongan District, East Java, Indonesia. *Biodiversity*, 24 (3), 1676–1685. <https://doi.org/10.13057/biodiv/d240341>
- Khoobdel , M., Dehghani, H., Tavana, A.M., Ghasemi, M., Dakhteh , S.M., Hesni , M.A., & Rezaie- Atagholipour , M. (2017). Faunal data and envenomation emergency first aid of cone snails (*Conus* spp.) in Qeshm Island, the Persian Gulf. *Asian Pacific Journal of Tropical Medicine*, 10 (12), 1167–1171. <https://doi.org/10.1016/j.apjtm.2017.10.024>
- Lase, Y. (2021). Diversity Class Gastropods and Bivalves in The Saragian Estuary Aceh Singkil Regency As Reference Addition to the Kingdom Animalia Sub-Material at SMAN 1 Singkil Utara [Online Thesis]. Ar-Raniry State Islamic University.
- Mailissa, M.G., Puguh, S., & Keiluhu, H.J. (2021). Diversity Gastropods and Public Knowledge About Gastropods on Liki Island, Sarmi Regency, Papua. *Journal Education and Development*, 9 (4), 140–148.
- Ngo, A. R. (2020, January 1). Inventory New Species of Indonesian Molluscs. *Solaria News*, 1–17. <https://www.researchgate.net/publication/351098299>
- Parorrongan , JR, Zahida, F., & Yuda, I. (2018). Diversity and Abundance Gastropods at Seger Beach, Central Lombok Diversity and Abundance of Gastropods at Seger Beach, Central Lombok. *BIOTA*, 3 (2), 79–86. <http://Conchology.be>.
- Parorrongan , JR, Zahida, F., Yuda, IP, Kunci , K., Gastropods ., Lombok, L., & Tengah, M. (2018). Diversity and Abundance Gastropods at Seger Beach, Central Lombok Diversity and Abundance of Gastropods at Seger Beach, Central Lombok. *BIOTA: Scientific Journal of the Life Sciences*, 3 (2), 79–86.
- Persulesy, M., & Arini, I. (2018). Species Diversity and Density Gastropods In Various Substrate Rock In Tihunitu Beach waters Subdistrict Haruku Island, Central Maluku Regency. *BIOPENDIX: Journal Biology, Educational and Applied*, 5 (1), 12–22.
- Pietersz , J. H., Pentury , R., & Unepetty , P. A. (2022). Diversity Gastropods Based on the type of mangrove on the coast of Waiheru Village. *TRITON: Journal Management Resource Waters*, 18 (2), 103–109. <https://doi.org/10.30598/tritonvol18issue2page103-109>
- Rukmana, YT ari, & Purnomo, T. (2019). Diversity and Abundance Gastropods at Barung Beach Toraja Sumenep, Madura. *LENTERABIO: Defeated Scientific Biology*, 8 (3), 213–218. <http://ejournal.unesa.ac.id/index.php/lenterabio>
- Siswansyah , PP, Kuntjoro , R., & Mathematics and Science Natural Sciences Surabaya State University, F. (2023). Relationship of Gastropod Types with Physical and Chemical Parameters of Water. *LENTERABIO: Periodically Scientific Biology*, 12 (3), 371–380. <https://journal.unesa.ac.id/index.php/lenterabio/index>
-

-
- Slamet, R., Purnama, D., & Negara, BFS (2021a). Identify Types and Abundance Gastropods on Sepang Bay Beach, Bengkulu City. *Journal Fishery Unram*, 11 (1), 26–34. <https://doi.org/10.29303/jp.v11i1.216>
- Slamet, R., Purnama, D., & Negara, BFS (2021b). Identify Types and Abundance Gastropods on Sepang Bay Beach, Bengkulu City. *Journal Fishery Unram*, 11 (1), 26–34. <https://doi.org/10.29303/jp.v11i1.216>
- Toby, EN, Zahida, F., Wibowo, A., & Jati, N. (2017a). Identification Diversity of Gastropod Types on Baobolak Beach, Regency Lembata, East Nusa Tenggara. Faculty Technobiology Atma Jaya University Yogyakarta, 1–14.
- Toby, EN, Zahida, F., Wibowo, A., & Jati, N. (2017b, January 8). Identification Diversity of Gastropod Types on Baobolak Beach, Regency Lembata, Nusa Tenggara. Atma Jaya University Yogyakarta, Faculty Technobiology, Biology Study Program, 1–14.
- Tri, Y., Rukmana, A., & Purnomo, T. (2019). Diversity and Abundance Gastropods at Barung Beach Toraja Sumenep, Madura. *LENERABIO: Defeated Scientific Biology*, 8 (3), 213–218. <http://ejournal.unesa.ac.id/index.php/lenterabio>
- Tri, Y., Rukmana, A., Purnomo, T., Biology, J., Mathematics, F., Knowledge, I., University, A., & Surabaya, N. (2019). Diversity and Abundance Gastropods at Barung Beach Toraja Sumenep, Madura. *LENERABIO: Defeated Scientific Biology*, 8 (3), 213–218. <http://ejournal.unesa.ac.id/index.php/lenterabio>
- Ulmaula, Z., Purnama, S., & Sarong, MA (2016). Diversity Based Gastropods and Bivalves Character Sediment of the Intertidal Area of the Ujong Beach Area Subdistrict Peukan Bada, Aceh Besar Regency. *Journal Scientific Student Maritime Affairs and Fisheries Unsyiah*, 1 (1), 124–134.
- Wahyuni, S., Purnama, AA, & Afifah, N. (2016). Types of Molluscs (Gastropods and Bivalves) in the Mangrove Ecosystem in Dedap Village, District Tasikputripuyu Regency Meranti Islands, Riau. Faculty Pasir University Teaching and Education Sciences Forecasting, 1–17.
- Wardani, SAR (2023). Diversity Gastropods at Tambakrejo Beach, Regency Blitar. *Journal of Science and Mathematics*, 8 (1), 9–12.
- Wulansari, DF, & Kuntjoro, S. (2018). Diversity Gastropods and their Role as Bioindicators Heavy Metal Lead (Pb) at Kenjeran Beach, Bulak District, Surabaya City. *LENERABIO: Defeated Scientific Biology*, 7 (3), 142–147.
- Yanti, I., Laheng, S., & Putri, DU (2022). Diversity Gastropods on the Mangrove Forest Floor in Binontoan Village Regency Tolitoli, Central Sulawesi. *JAGO TOLIS: Journal Tolis Agrocomplex*, 2 (2), 41–44.
- Yunita, N., Hutasuhut, MA, & Idami, Z. (2023). Abundance and Dominance Gastropods in Pantai Bunga Beach Batu Bara Regency North Sumatra. *Metamorphosis: Journal of Biological Sciences*, 10 (2), 324. <https://doi.org/10.24843/metamorfosa.2023.v10.i02.p16>