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Diversity of Mollusca Types (Bivalves and Gastropods) on Oesosole Beach As A Source for Learning Biology in Booklet Form

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Abstract: Mollusca has two largest class members, namely Bivalvia and Gastropoda. Gastropods are characterized by a single-threaded shell. Meanwhile, Bivalves have two shells that are connected dorsally. This research aims to determine the types of mollusks (Bivalvia and Gastropods), the diversity index, and the use of research results in booklet form. This research was conducted at Oesosole Beach, East Rote District, Rote Ndao Regency, East Nusa Tenggara Province in April 2023. The research method used was quadratic transects with R and D. The results of the research showed that the types of Bivalves and Gastropods found were the Bivalvia class, consists of 8 families with 10 species. Meanwhile, gastropods consist of 7 families with 9 species. The diversity index value for Bivalves and gastropods is classified as moderate. Bivalves with a value of H'= 1.57 and gastropods with a value of H'= 1.08. Utilization of research results as a learning resource in the form of booklets obtained results from validator tests and user trials with a score of 90.75%. This shows that the bivalve and gastropod booklets are of very good qualifications. The bivalves found on Oesosole Beach consisted of 10 species and 9 species of gastropods. The diversity index for Bivalves and gastropods is in the medium category. Utilization of research results in booklet form is suitable for use in the learning process.

Keywords: Bivalves; Booklets; Diversity; Gastropods

Introduction

Mollusca is a group of animals that are triploblastic coelomates and invertebrates that are soft-bodied and multicellular. Mollusca has two largest class members, namely Bivalvia and Gastropoda. Both have varying body shapes and shell sizes. Bivalves are a type of shellfish that have a pair of shells. Bivalve shells can open and close using one or two elastic adductor muscles (Insafitri, 2010). Gastropods have the characteristic of a single-threaded shell, usually also called snails or snails which can walk using their stomachs (Bancin et al., 2020). Some also have no shells or are called naked snails (Setyobudiandi, 2010). Gastropod habitats are found on various sand-mud slopes, this is because Gastropods are infauna animals, which give a striking reaction to the size of the seabed texture. Bivalves live by digging, immersing themselves, and attaching themselves using adhesives to the substrate (Ulmaula et al., 2016). The people of the Oesosole coast in general often use Bivalves and Gastropods as expensive food and decoration ingredients. Therefore, it is important to carry out this research so that local people not only know how to consume bivalves and gastropods and use them as expensive decorations but also know the types and names of bivalves and gastropods that they usually encounter or consume, and know that when they are used will continuously affect the status of biodiversity levels which will result in extinction.

One of the tourism potentials found in East Nusa Tenggara, specifically on Rote Island, is Oesosole Beach. Oesosole Beach is one of the beaches which is a tourist destination located in Faifua Village, East Rote District, Rote Ndao Regency. Oesosole Beach has an area of ± 80,000 m^2 with a beach length of ± 1000 m^2. Oesosole

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waters have quite a large economic potential, especially in seaweed cultivation (Triwiyanto et al., 2015). According to observations, Oesosole Beach is a fishing area for various types of marine animals including bivalves and gastropods, namely shellfish, snails, and snails as daily food ingredients found by local people and fishermen (Fitriah et al., 2018).

Learning resources include messages, people, materials, tools, techniques, and settings (Mularsih et al., 2017). The learning resource in question is in the form of a booklet that contains pictures and theories containing material. Based on data from the analysis of student needs in the fourth semester of the biology education study program (PSPB), with the highest score they chose to develop learning resources in the form of booklets. The percentage of students' needs for developing learning resources in booklet form is 100% approved. This is because fourth-semester students need to develop learning resources in the form of booklets on the material of the phylum Mollusca (Bivalvia and Gastropoda) where the learning resources for this material as a whole have a separate book but specifically about bivalves and gastropods do not yet exist. Therefore, developing learning resources in the form of booklets for PSPB students is very necessary and is an effort to complement learning activities in class and can help students to better understand the material on the phylum Mollusca (Bivalvia and Gastropoda).

Until now there has been no research regarding the diversity of Mollusca types, especially Bivalves, and Gastropods on Oesosole Beach, so the author is interested in conducting research with the title "Diversity of Mollusca Types (Bivalvia and Gastropods) on Oesosole Beach, Rote Ndao Regency as a Resource for Learning Biology in Booklet Form".

Method

Time and Place of Research

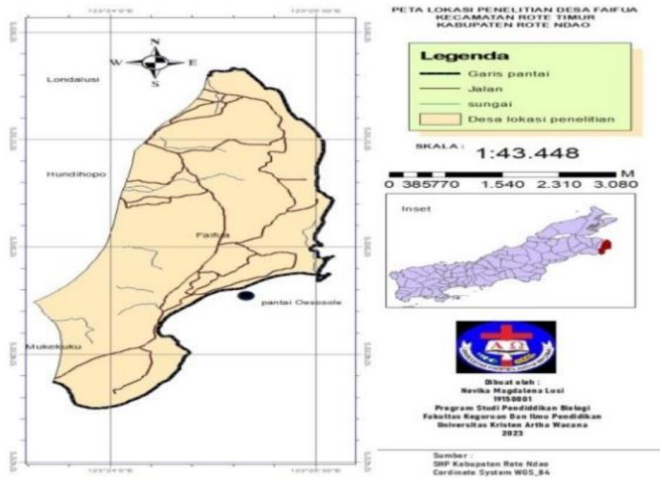

Figure 1. Map of the research location for Oesosole Beach, NTT

This research was carried out in April 2023. The research location is Oesosole Beach, Faifua Village, East Rote District, Rote Ndao Regency.

Research Approaches and Types

The approach used in this research is quantitative. Meanwhile, this type of research is development research. This research identified the diversity of Mollusca types (Bivalvia and Gastropods) on Oesosole Beach, the results of which were developed as a biology learning resource in the form of a booklet.

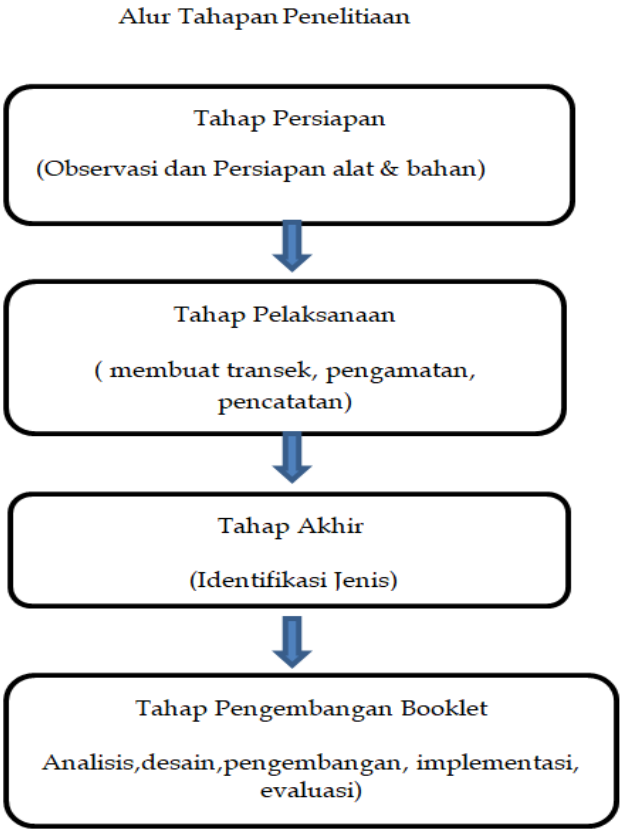

Figure 2. Flow of research stages

Data Collection Technique

The choice of location in Oesosole coastal waters consists of 1 location near tourist attractions. Consists of 3 transect lines. Each transect line has 4 quadrants placed zigzag along the transect line. Data collection on types of bivalves and gastropods used the sample quadratic method (Figure 3).

Observations were made from points 0 to 35 m, with a width of 50 m to the left and 50 m to the right. Observations were made by looking at the number of types and individuals of bivalves and gastropods on Oesosole Beach. Environmental parameters measured during the research included water pH, water temperature, and salinity.

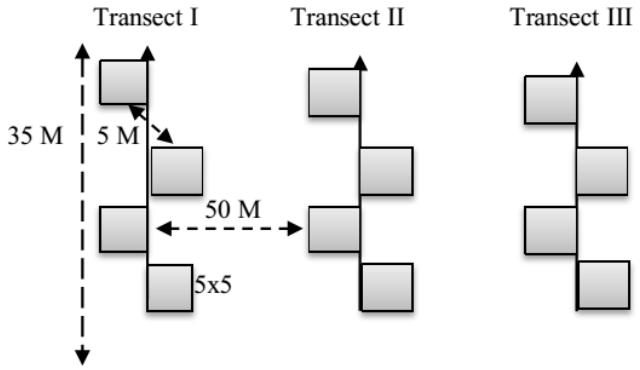

Figure 3. Sketch of the line transect method

Development Style

The development model used in this research is the ADDIE development model with five stages according to Mulyatiningsih (2012), namely analysis, design, development, implementation, and evaluation. Reasons for developing booklet teaching materials on types of bivalves and gastropods are expected to be able to support the teaching and learning process in the classroom. After the booklet on the types of bivalves and gastropods was developed, the next stage was to test the validity or suitability of the booklet on the types of bivalves and gastropods to be used as teaching material suitable for fourth-semester PSPB students. There are three important parts to look at in this validation test stage, namely validation tests in terms of material, validation tests in terms of design, and validation tests in terms of media.

Data Analysis

To determine the diversity of Mollusca species (Bivalvia and Gastropods) on Oesosole Beach, use the species diversity index formula from Shannon Wiener. The species diversity index can be calculated according to Shannon and Wiener (1963) with the formula:

$$H` = -\sum(Pi)(\ln Pi) \quad (1)$$

Note:
H' = Shannon Wienner diversity index
Pi = Probability of importance for each i-th species= ni/N
Ni = Number of individuals of each type I
N = Total number of individuals

Below are the criteria for the diversity index as follows, if: H > 3 = High, 1< H'< 3 = Medium, and if H < 1 = Low (Rosalyn, 2007).

Textbook Development Data Analysis

Analysis of data obtained from observations in the field will be analyzed in a quantitative descriptive manner. This species diversity index is used to determine the diversity of Pelecypoda/Bivalvia and Gastropod species in Oesosole coastal waters. To analyze textbook development data, two data analysis techniques are used, namely:

Qualitative Descriptive Analysis

Qualitative descriptive data analysis techniques are techniques based on the results of comments and suggestions in the questionnaire instruments obtained through material experts, media, design, small group, and large group tests. This analysis is carried out by grouping information from qualitative data in the form of comments and suggestions for improving the product and the results for revising product development.

Descriptive Statistical Analysis

Data obtained from assessment questionnaires from experts and user trials (students) were processed using descriptive statistical analysis techniques in the form of descriptive percentages. Data analysis was obtained through a questionnaire in percentage form (Sugiyono, 2019) using the following formula to calculate the percentage for each subject:

$$Precentage = \frac{Number\ of\ Answer\ Scores}{N\ x\ Highest\ Weight} x\ 100\% \quad (2)$$

Next, to calculate the percentage of the entire object, use the percentage formula. This percentage technique is used to present data which is the frequency of responses from booklet product trial subjects. The formula used is:

$$\text{Percentage} = \sum \frac{P}{N} \quad (3)$$

Note:
P = The total percentage of subjects
N = Total number of trials

Next, interpretation and decision-making regarding the quality of the development product are given using qualification levels of achievement qualifications: very good, good, quite good, not good, and very poor (Riduwan, 2012).

Result and Discussion

Types of Mollusca (Bivalvia and Gastropods) Found

Bivalves found in Oesosole coastal waters consist of 8 families, namely Arcidae, Cardiidae, Psammobiidae, Mytilidae, Pinnidae, Veneridae, Mactridae, and Tellindae with a total of 10 species. Meanwhile, Gastropods consist of 7 families, namely Trochidae, Conidae, Turbinellidae, Cerithiidae, Turbibelloidae, Neritidae, and Strombidae with a total of 9 species spread over the three observation transects. Based on research that has been carried out, the number of Bivalves and Gastropods found in transect I was 19

individuals, transect II there were 17 individuals, transect III there were 12 individuals. So the total number of Bivalves found was 48 individuals with a total of 10 species, namely Anadara indica, Vasticardium lomboke, Asaphis violescens, Modiolula phaseolina, Pinna muricata, Gafrium pectinatum, Mactra maculata, Linconcha castrensis, Periglypta puerpera, Scutarcopagia scobinata. Meanwhile, there were 427 gastropods found in transect I, 262 individuals in transect II, and 341 individuals in transect III. So the total number of individuals found was 1,030 individuals with 9 species found, namely Trochus conus, Conus ebraeus, Conus coronatus, Vasum turbinellus, Vexillum umbrosum, Clypeomorus subreviculus, Nerita undata, Strombus luhuanus, Nerita hisrio.

Results of Bivalvia and Gastropod Diversity Index Analysis

Based on Table 1, it is known that the diversity of Bivalves on Oesosole Beach is classified as medium, with a value of H' = 1.57. The Shannon-Wienner diversity index criteria proposed by Sirait et al. (2018) state that H'<1 means low species diversity, H<H'<3 means medium species diversity, and H'>3 means high species diversity. The results of the calculation of the bivalve species diversity index also illustrate that the diversity of bivalve species in the waters of Oesosole Beach is quite good. The diversity index value is medium. This is because the environmental conditions in Oesosole coastal waters support the continuity of bivalve life, such as temperature, pH, and salinity. According to Kisma et al. (2016), the diversity index value is in the medium category, indicating that the conditions of the aquatic environment can still be tolerated by bivalves and can still support the survival and reproduction of bivalves. This is also because the area experiences sufficient productivity, the ecosystem condition is quite balanced and the ecological pressure is moderate. The diversity index value of a community will not have a high value if within that community there are one or more species that are more prominent than the other species (Gita, 2016). According to Wulansari et al. (2018) stated that the diversity of organisms is very dependent on the state of factors in their environment, both biotic and abiotic, such as pH, temperature, and bottom water substrate. Clark (1974) and Odum (1996) stated that if the diversity of an ecosystem has a relatively high value then the condition of the ecosystem is stable. On the other hand, if an ecosystem declines, the ecosystem is said to be in a state of stress or degradation. Katili (2011) (2011) and Jambo et al. (2021) said that diversity in a body of water can also decrease due to ecological pressure. The high and low diversity is also due to ecological pressure originating from settlement, transportation, and fishing activities around the location.

Table 1. Bivalvia Class

Species	Transect I	Transect II	Transect III
Vasticardium lomboke	0.23	0	0.05
Asaphis violescens	0.14	0	0.20
Anadara indica	0.14	0	0.20
Modiolula phaseolina	0.14	0.16	0.20
Gafrium pectinatum	0.34	0.31	0.29
Mactra maculata	0.23	0	0
Pinna moricata	0.32	0.25	0
Lionconcha castrensis	0.28	0	0
Periglypta puerpera	0.14	0.25	0.34
Scutarcopagia scobinata	0	0.25	0.20
H'	2.01	1.23	1.46

Table 2. Class Gastropods

Species	Transect I	Transect II	Transect III
Clypeomorus petrosa	0.31	0.29	0.30
Nerita undata	0.29	0.29	0.35
Nerita histrio	0.02	0.03	0.01
Conus ebraeus	0.32	0.30	0.17
Conus coronatus	0.02	0.05	0
Vasum turbinellus	0.12	0.10	0.10
Trochus conus	0.01	0	0
Vexillum umbrosum	0.01	0.02	0
Strombus luhuanus	0.01	0	0.04
H'	1.15	1.10	0.99

Based on the results of the calculation of the gastropod species diversity index on Oesosole Beach, it is classified as moderate, with a value of H'= 1.08. Moderate diversity indicates that environmental conditions are good enough to support the survival of gastropods. The opinion of Wulandari (2016) and Saripantung et al. (2013) explains that the high and low value of the species diversity index can be caused by various factors, including the number of species or individuals found as well as the existence of several types that are found in more abundant quantities than other species. other. For the low diversity category found in transect III, this can be expected because there are more gastropod species found than other species. The species that is often found in III is Nerita undata. Dewiyanti (2004) in Erlinda et al. (2015), states that the presence of more prominent species will cause low diversity.

Table 3. Results of Environmental Parameter Measurements

Parameter	Measurement results
Temperature	26 °C
pH	5
Salinity	40 %

Seawater Temperature

Based on the table above, it shows that the temperature of the Oesosole Rote beach waters is in the range of 26°C. The temperature is obtained when sampling, namely one measurement is carried out for all transects. Based on the measurement results, it was found that the water temperature was still within the quality standard range for marine biota. The quality standard temperature range for Mollusca life is between 26-30^{0}C. This shows that sea surface temperatures are generally within the tolerance range and are good for Bivalves and Gastropods. According to Sukarno (1981) in Lopo (2013) a good temperature for the growth of Gastropods ranges from 25–30^{0}C. These results indicate that sea surface temperatures are generally within the tolerance range and are good for Bivalves and Gastropods.

pH of Seawater

Based on the measurement results obtained on all transects, the pH was 5, which is a good pH for the life of bivalves and gastropods. Even though the pH results are below the quality standards of Minister of Environment Decree No. 2 of 1988, if the pH value is in the range of 5.7 – 8.436, it is still suitable for Mollusca life. If the pH is lower or higher than this value, it can be detrimental and not beneficial for Mollusca life.

Salinity

The results obtained from salinity measurements on all transects showed a value of 40%. According to Fauziani (2017) states that good salinity for bivalve life is in the range of 30–40%. Meanwhile, gastropods generally live at salinities ranging from 25-40 ppt (Persulessy et al., 2019). This shows that the salinity range at the research location can still be tolerated by animals from the bivalve and gastropod groups.

Changes in salinity also affect the life of bivalves and gastropods. When the intertidal area exceeds its tolerance limit, namely drying out due to tides and then being flooded or the salinity of rainwater flowing down, then these species can experience death. Astuti (2009), believes that salinity will have a direct effect on the mollusca population because each mollusca has a different tolerance limit for salinity levels which depends on the ability of the organism to control its body's osmotic pressure.

Table 4. Results of Analysis of Booklet Media Development

Validator	Number of question items	∑	%	Qualifications and Interpretation
Materials Expert	22	81	92.04	Very good and no revision needed
Design Expert	14	53	94.64	Very good and no revision needed
Media Expert	10	36	90	Very good and no revision needed
Small Group Test	17	408	85.71	Very good and no revision needed
Large Group Test	17	1864	91.37	Very good and no revision needed

(a) (b) (c) (d)

Figure 4. Bivalvia and Mollusca Booklet. (a) Front cover; (b) Back cover; (c), (d) contents of the booklet

Material Expert Test

The feasibility test of the booklet material developed in the Bivalvia and Gastropoda class was assessed by a material expert, namely Mrs. Apriliana Ballo, S.Si M.Si. He is a biology lecturer at Artha Kupang Christian University. on June 5, 2023, the developer submitted the bivalve and gastropod booklet and questionnaire to the material expert. Assessment is carried out by giving a score for each question in the questionnaire. Based on the results of the assessment of the bivalve and gastropod booklets by material experts, the results were then interpreted as follows: In terms of

material, very good results were obtained with a score of 93.18%, with no need for revision. Because the material is developed in a directed and systematic manner according to the core and basic competencies that have been described. In terms of suitability, the booklet and material were found to be 87% in very good condition and no repairs were needed. It focuses on anatomy, morphology, reproduction, as well as roles and classification. In terms of presentation, a result of 92% was obtained with very good qualifications and no need for revision. Because the presentation is very good and clear, equipped with pictures that match the bivalve and gastropod booklet. So overall, the results obtained from the three aspects assessed were 92.04%. This shows that the bivalve and gastropod booklets have very good qualifications and do not need improvement.

Test Design Expert

Who played a role in expert design testing of the bivalve and gastropod booklets that were developed, and assessed by Mr. Agus Maramba Meha, S.Pd, M.Pd. The developer submitted the media booklet and assessment questionnaire to the design expert on June 5, 2023. Based on the results of the Design expert's assessment of the phylum mollusca material on the bivalve and gastropod booklets which were then interpreted, results were obtained based on the assessed aspects as follows: in the physical appearance aspect, the results obtained were equal to 94.44% with very good qualifications and no need for revision. Because in terms of overall physical appearance, the booklet media is attractive to look at. However, there are several errors in the contents of the booklet, such as the correct use of symbols. In the design aspect, results were obtained of 93.75% with very good qualifications and no need for revision. Because it is very interesting from a design perspective. However, there are shortcomings in the author's biography section which is not included. In the illustration aspect, results were obtained of 100% with very good qualifications and no need for revision. Because the illustrations support each other, for example, the picture illustrations contained in the material are by the bivalves and gastropods booklet that was developed. So overall the results obtained from the three aspects assessed were 94.64%. This shows that the booklet media is in very good qualifications and does not need revision.

Media Expert Test

Apart from testing material experts and design experts, researchers also tested the suitability of bivalve and gastropod booklets from a media perspective. media expert test was given to the mother Theodora S.N. Manu S.Pd, M.Pd on June 15, 2023. Based on the assessment of media experts, the bivalve and gastropod booklet obtained results of 90% with very good qualifications and does not need to be revised. The interpreted booklet media obtained results according to the following aspects: The physical appearance aspect obtained results of 87.5% with very good qualifications and no revision. Because in terms of physical appearance, it looks simple and easy to explain the material because the mechanism of the phylum Mollusca material is systematic and easy for students to understand. Aspects of the function and benefits of the booklet obtained 100% results with very good qualifications and no need for revision. Because learning uses language that is understood, the clarity of the images of bivalves and gastropods, and the colors and layout of the book's contents are in sync, it is possible to increase students' reading creativity and thinking about the phylum Mollusca material. Aspects of component completeness obtained results of 87.5% with very good qualifications and no need for revision. However, there are errors in several components such as basic competencies, indicators, and learning objectives which are considered less synchronized with the curriculum for animal taxonomy courses so they need to be adjusted to make it easier for students to understand the content of the material during the learning process. So overall, from the three aspects assessed, a result of 90% was obtained. This shows that the booklet on bivalves and gastropods is of very good qualifications and does not need revision.

After completing validation tests on the development of bivalve and gastropod booklets, the final step in developing booklet media was the ADDIE model, namely the implementation of booklets for students of the Biology Education Study Program at Artha Wacana Christian University, semester IV, consisting of two groups, namely a small group and a large group.

Test Small Groups

Conducted on June 21, 2023. Small group testing was carried out randomly with 7 students. The researcher explained the bivalvia and gastropod booklet media to students, then the researcher distributed questionnaires to measure students' responses to the booklet that had been explained. Based on Table 4, the results of the small group test assessment of the bivalve and gastropod booklet obtained a result of 85.71% with very good qualifications and no need for revision. According to the results of the small group test expert's assessment, there are several aspects as follows: The physical appearance aspect was obtained at 88.09% with very good qualifications and no need for revision. Aspects of the function and benefits of the booklet

obtained 83.33% with very good qualifications and no need for revision. The suitability aspect of the bivalve and gastropod booklet was obtained at 88.09% with very good qualifications and no need for revision. The content of the booklet was 84.82% with very good qualifications and no need for revision.

Test Large Groups

The large group test is aimed at all fourth-semester PSPB students at Artha Christian University in Kupang. Based on the table of results of the large group test assessment of the bivalve and gastropod booklet, the results were 91.37% with very good qualifications and no need for revision. According to the results of the large group test expert's assessment, there are several aspects as follows: The physical appearance aspect was obtained at 87.72% with very good qualifications and no need for revision. Aspects of the function and benefits of the booklet were obtained 90% with very good qualifications and no need for revision. The suitability aspect of the booklet was found to be 91.11% with very good qualifications and no need for revision. The content aspect of the booklet obtained 91.37% with very good qualifications and no need for revision.

Next, the researcher counted the total number of objects which were the frequency or responses to the bivalve and gastropod booklets from material experts, design experts, media experts, small groups, and large groups with the total as follows:

Product qualification percentage =

$$\frac{\text{material expert} + \text{design expert} + \text{media expert} + \text{small group} + \text{large group}}{total\ number\ of\ trials}$$

$$= \frac{92.04 + 94.64 + 90 + 85.71 + 91.37\%}{5}$$

$$= 90.75\%$$

Based on the total of 90.75%, the bivalve and gastropod booklet indicates that the qualifications are very good and do not need revision. Decision-making regarding the suitability of this bivalve and gastropod booklet refers to the level of achievement qualifications according to Riduwan (2012).

Conclusion

Based on the results obtained in research on Oesosole Beach, the author concludes that the types of molluscs of the Bivalvia and Gastrpod class found were: Anadara indica, Vasticardium lomboke, Asaphis violescens, Modiolula phaseolina, Pinna muricata, Gafrium pectinatum, Mactra maculata, Linconcha castrensis, Periglypta puerpera, Scutarcopagia scobinata. Meanwhile, the gastropod species are Trochus conus, Conus ebraeus, Conus coronatus, Vasum turbinellus, Vexillum umbrosum, Clypeomorus subreviculus, Nerita undata, Strombus luhuanus, Nerita histrio. The diversity index for the Bivalvia and Gastropod classes in the waters of Oesosole Beach is in the medium category. Booklets can be used as learning resources.

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Author Contributions

Conceptualization, S.T.M.N. and N.M.L.; Methodology, N.M.L. and N.I.B.; Validation, N.M.L. and S.T.M.N; Data analysis, N.I.B.; Results, S.T.M.N, N.M.L.; Writing of original draft preparation, N.M.L and N.I.B; Review and editing, S.T.M.N. All authors have read and approved the published version of the manuscript.

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Conflicts of Interest

The author of this article declares no conflict of interest.

References

Astuti, I. (2009). Substrat Dasar dan Parameter Oseanografi Sebagai penentu Keberadaan Gastropoda Dan Bivalvia Di Pantai Siukae Kabupaten Rembang. *Jurnal Ilmu Kelautan*, *14*(1), 50–59. https://doi.org/10.14710/ik.ijms.14.1.50-59

Bancin, I. R., Suharsono, S., & Hernawati, D. (2020). Diversitas Gastropoda di Perairan Litoral Pantai Sancang Kabupaten Garut. *Jurnal Biosains*, *6*(3), 72. https://doi.org/10.24114/jbio.v6i3.17739

Clark. (1974). *Coastal Ecosystem Ecological Considerations for Management Of The Coastel Zone Washington D.C*. Publications Department The Conservation Fondations.

Dewiyanti, I. (2004). *Struktur Komunitas Moluska (Gastropoda dan Bivalvia) Serta Asosianya pada Ekosistem Mangrove Di Kawasan Pantai Ulee-Lheue Banda Aceh, NAD*. Retrieved from https://repository.ipb.ac.id/handle/123456789/16847

Erlinda, L. (Lia), Yolanda, R. (Rofiza), & Purnama, A. A. (Arief). (2015). Struktur Komunitas Gastropoda Di Danau Sipogas Kabupaten Rokan Hulu Provinsi Riau. *Jurnal Mahasiswa Prodi Biologi UPP*, *1*(1), 110490. Retrieved from

https://www.neliti.com/publications/110490/

Fauziani, D. A. (2017). *Analisis Sumberdaya Dan Pemanfaatan Bivalvia Bernilai Ekonomis Di Perairan Kampung Bugis Kelurahan Tanjung Uban Utara Kabupaten Bitan*. Fakultas Ilmu Kelautan Dan Perikanan Universitas Maritim Raja Ali Haji.

Fitriah, E., Yuyun Maryuningsih, & Roviati, E. (2018). Pemanfaatan Daging dan Cangkang Kerang Hijau (Perna Viridis) Sebagai Bahan Olahan Pangan Tinggi Kalsium. *The 7th University Research Colloqium*, 412–423. Retrieved from https://repository.urecol.org/index.php/proceeding/article/download/216/212

Gita, R. S. D. (2016). Keanekaragaman Jenis Kepiting Bakau (Scylla spp.) Di Taman Nasional Alas Purwo Mangrove Crab Diversity (Scylla spp.) In alas Purwo National Park. *Jurnal Biologi Dan Pembelajaran Biologi*, *1*(2), 148–161. https://doi.org/10.32528/bioma.v1i2.443

Insafitri. (2010). Keanekaragaman, keseragaman, dan dominansi bivalvia di area buangan lumpur lapindo Muara Sungai Porong. *Jurnal Kelautan*, *3*(1), 54–59. https://doi.org/10.5281/zenodo.33103

Jambo, N. A., Kaligis, E. Y., Kumampung, D. R., Darwisito, S., Schaduw, J. N., & Pratasik, S. B. (2021). Keanekaragaman dan Kelimpahan Filum Echinodermata pada Zona Intertidal Molas Kecamatan Bunaken Kota Manado. *Jurnal Pesisir dan Laut Tropis*, *9*(2), 104. https://doi.org/10.35800/jplt.9.2.2021.35771

Katili, A. S. (2011). Struktur Komunitas Echinodermata pada Zona Interdal di Gorotalo. *Jurnal Penelitian dan Pendidikan*, *8*(1), 51–61. Retrieved from https://repository.ung.ac.id/get/simlit_res/1/268/struktur-komunitas-echinodermata-pada-zona-intertidal-di-gorontalo.pdf

Kisma, M. D., Ramadhan, A., & Djirimu, M. (2016). Jenis Jenis dan Keanekaragaman Bivalvia di Perairan Laut Pulau Maputi Kecamatan Sojol KabupatenDonggala dan Pemanfaatannya Sebagai Media Pembelajaran Biologi. *E-Jipbiol*, *4*(1), 1–14. Retrieved from http://jurnal.untad.ac.id/jurnal/index.php/EBiol/ar ticle/view/7394/5918.

Lopo, Y. (2013). *Diversitas Jenis Gastropoda Sebagai Bioindikator Kualitas Perairan Pantai Kecamatan Kota Lama*. Universitas PGRI, NTT.

Mularsih, H. K., & W. (2017). *Belajar dan Pembelajaran serta Pemanfaatan Sumber Belajar*. Rajawali Pers.

Mulyatiningsih, E. (2012). *Metode Penelitian Terapan Bidang Pendidikan*. Alfabeta.

Odum, E. P. (1996). *Dasar-Dasar Ekologi Edisi ketiga*. Gajah Mada Universitas Press.

Persulessy, M., & Arini, I. (2019). Keanekaragaman Jenis dan Kepadatan Gastropoda di Berbagai Substrat Berkarang di Perairan Pantai Tihunitu Kecamatan Pulau Haruku Kabupaten Maluku Tengah. *Biopendix: Jurnal Biologi, Pendidikan Dan Terapan*, *5*(1), 45–52. https://doi.org/10.30598/biopendixvol5issue1page45-52

Rosalyn, I. (2007). Indeks Keanekaragaman Jenis Serangga Pada Pertanaman Kelapa Sawit Di Kebun Tanah Raja Perbaungan PT. In *Perkebunan Nusantara III. Universitas Sumatera Utara, Medan*. Universitas Sumatera Utara.

Saripantung, G. L., Tamanampo, J. F., & Manu, G. (2013). Struktur Komunitas Gastropoda Di Hamparan Lamun Daerah INtertidal Kelurahan Tongkeina Kota Manado. *Jurnal Ilmiah Platax*, *1*(3), 102. Retrieved from https://media.neliti.com/media/publications/160430-ID-none.pdf

Setyobudiandi, I. (2010). *Seri Biota Laut Gastropoda Dan Bivalvia*. Sjahrir Banda Naira.

Sirait, M., Rahmatia, F., & Pattulloh, P. (2018). Komparasi Indeks Keanekaragaman dan Indeks Dominansi Fitoplankton di Sungai Ciliwung Jakarta (Comparison of Diversity Index and Dominant Index of Phytoplankton At Ciliwung River Jakarta). *Jurnal Kelautan: Indonesian Journal of Marine Science and Technology*, *11*(1), 75. https://doi.org/10.21107/jk.v11i1.3338

Sugiyono. (2019). *Metode Penelitian Kuantitatif*. Alfabeta.

Sukarno. (1981). *Terumbu Karang di Indonesia Permasalahan dan Pengelolaannya. Lembaga Oseanologi Nasional*. Jakarta: Lembaga Ilmu Pengetahuan Indonesia.

Triwiyanto, K., Suartini, N. M., & Subagio, J. N. (2015). Keanekaragaman Moluska Di Pantai Serangan, Desa Serangan, Kecamatan Denpasar Selatan, Bali. *Jurnal Biologi*, *19*(2), 63–68. https://doi.org/10.24843/JBIOUNUD.2015.vol19.i02

Ulmaula, Z., Purnawan, S., & Sarong, M. A. (2016). Keanekaragaman Gastropoda dan Bivalvia Bedasarkan Karateristik Sedimen daerah intertidal Kawasan Pantai Ujong Pancu Kecamatan Peukan Bada Kabupaten Aceh Besar. *Jurnal Ilmiah Mahasiswa Kelautan Dan Perikanan Unsyiah*, *1*(1), 124–134. Retrieved from https://jim.usk.ac.id/fkp/article/view/14

Wulandari, A. (2016). Struktur Komunitas Moluska Di Padang Lamun Perairan Pulau Belitung Provinsi Bangka Belitung Community. *Jurnal Oseanologi Dan Limnologi Di Indonesia*, *37*(1), 1–23. Retrieved from https://www.researchgate.net/publication/3355

99087_Struktur_komunitas_mollusca_padang_lamun_perairan_Pulau_Talise_Island_Sulawesi_Utara

Wulansari, D. F., & Kuntjoro, S. (2018). Keanekaragaman Gastropoda dan Peranannya Sebagai Bioindikator Logam Berat Timbal (Pb) di Pantai Kenjeran, Kecamatan Bulak, Kota Surabaya. *LenteraBio*, *7*(3), 241–247. Retrieved from https://ejournal.unesa.ac.id/index.php/lenterabio/article/view/28410/25990