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The Abundance of Gastropoda in Bonebula Beach Central Banawa Sub-District and The Utilization as Learning Media

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ABSTRACT

The objective of this study is to describe the abundance of gastropods in the marine waters of Bonebula Beach, Banawa Tengah Subdistrict, and to utilise the findings as a learning resource in the form of electronic pocket books. The research methodology employed is descriptive quantitative research, with the location determined through purposive sampling, resulting in the designation of three observation stations. Station 1 is situated within the seagrass ecosystem, Station 2 within the mangrove ecosystem, and Station 3 within the coral ecosystem. The sampling was conducted using a free collection method. The findings revealed the presence of 19 species of gastropods belonging to 13 families and six orders. The abundance of gastropods on Bonebula Beach is classified as moderate, representing 18.33% of the total population. The percentage of content experts, design experts and media experts is 85%, 85.33% and 84.29%, respectively, with an average feasibility rating of 84.87%. This indicates that the electronic pocket book medium is highly feasible for use.

INTRODUCTION

Marine waters are characterized by a higher salinity and a greater diversity of organisms than fresh and brackish waters. The sea encompasses a vast expanse, which, in turn, allows for a high abundance and diversity of marine organisms. This is evidenced by the fact that species in the deep sea remain largely unidentified and are still unknown to humans (Mewengkang et al., 2022).

Gastropods are animals that belong to the mollusc group and are also classified as shelled animals. The term "gastropod" is derived from two Greek words: "gastro," meaning stomach, and

"podos," meaning foot. Therefore, gastropods are animals that walk using their stomachs as their feet. This animal exhibits low or slow mobility and occupies the bottom of the water column. Its diverse and abundant existence, along with a number of other characteristics, make it an effective indicator of water quality (Wulansari & Kuntjoro, 2018).

Learning media is a tool utilized by educators, specifically teachers or lecturers, for the distribution of information or knowledge in the context of teaching and learning activities. Its purpose is to facilitate effective and efficient learning. Learning media encompasses the material to be taught, yet its application necessitates a specific model or method to ensure optimal material implementation. The validity test is a crucial initial step in determining the suitability of learning media for teaching and learning activities (Pratama et al., 2024).

Bonebula Beach is situated in Central Sulawesi Province, Donggala Regency, Central Banawa Regency, and is endowed with rich natural resources. It is a popular tourist destination. The coast of Bonebula Beach is home to a diverse array of ecosystems, including mangrove forests, seagrass beds, coral reefs, and sandy beaches. The aforementioned ecosystems encompass a multitude of organisms belonging to the Gastropoda class of the *Mollusca phylum*. This gastropod is the most prevalent class in coastal ecosystems within the mollusc phylum, and is utilized as an indicator or determinant of whether an ecosystem is polluted or not. As stated by Selvianita et al. (2024). The presence of macrozoobenthos, including gastropods, is at risk due to the anthropogenic impact of tourism in the area. Human activities can lead to a decline in ecological conditions, ultimately affecting the survival and abundance of gastropods. The abundance of a species is determined by the abiotic and biotic environment, as well as its tolerance to environmental factors. Given the condition of Bonebula Beach, it is crucial to disseminate information about the importance of the existing gastropod species, so that the community is aware of this. To this end, research was conducted (Prabandini et al., 2021).

METHOD

This research is a type of quantitative descriptive research, the objective of which is to provide an objective explanation of existing phenomena through the use of numerical data (Arikunto, 2006). The objective of quantitative descriptive research is to establish a standardised set of characteristics for individuals or groups of gastropods at Bonebula Beach, employing the species abundance index formula. The instruments utilized in this investigation included a water pH meter, a refractometer, a thermometer, and a reference guide for gastropod identification.

The data collection technique is comprised of several stages, which are outlined below: 1. The survey stage entailed conducting field surveys and preliminary observations regarding the presence of gastropods in the marine waters of Bonebula Beach, Central Banawa District. The preparation stage involved the preparation of research permits and the borrowing of tools and materials used for research at Bonebula Beach. 3. The implementation phase commences with the determination of research stations through the use of purposive sampling based on environmental hue. Station 1 is situated within a seagrass ecosystem, station 3 within a mangrove ecosystem, and station 4 within a coral ecosystem (Kalay & Lewerissa, 2022). The line transect technique was employed at each station, which consisted of three transects and measured 50 meters. The transect was installed by pulling the rope from the shoreline vertically towards the sea. Sampling was conducted three times a day in the morning, afternoon, and evening. Gastropods were sampled freely. The samples were collected and identified. The data was then analysed by calculating the abundance index (Caron & Marcusen, 2016).

Data Analysis

Once the gastropod species have been identified, their abundance is calculated. The abundance of species can be measured by relative abundance, which can be formulated as follows:

In accordance with the Relative Abundance formula as outlined by Krebs (1998), the formula is as follows:

$$\text{Abundance} = \frac{\sum \text{individuals of a species} - i}{\sum \text{All individuals of all species}} \times 100\%$$

The criteria for the Abundance Index are as follows:

$$<15\% \quad = \text{Low}$$

15%-20% = Medium
>20% = High

RESULTS AND DISCUSSIONS

Towale Village is situated within the Banawa Tengah subdistrict. The village is situated in a lowland area, with an average ambient temperature of 30-32°C. Towale Village boasts a plethora of beaches, one of which is Bonebula Beach, situated approximately 42 km from Palu City. Bonebula Beach is a coastal area that is subject to tidal influences, and is therefore classified as an intertidal zone. Bonebula Beach is also a tourist destination in Towale Village, Central Banawa District, Donggala Regency, situated in close proximity to Limboro Village and its Kaluku Beach. Bonebula Beach boasts a lengthy coastline extending from the Pusentasi border to Kaluku Beach, encompassing approximately 1 km. The furthest low tide point is situated at a distance of approximately 200 m (source: Towale Village office).

Physical environment

Table 1. Environmental Parameters

No.	Parameters	Station 1	Station 2	Station 3
1.	Temperature	30	29	30
2.	pH	6.63	6.50	6.79
3.	Salinity	32/oo	30/oo	33/oo

The study was conducted using three distinct stations, with the physical environmental conditions observed at each station quantified according to three parameters, as detailed in Table 1.

Table 2. Individual count and abundance of gastropods

No	Name	Station 1	Station 2	Station 3	Σ
1.	<i>Cerithium vulgatum</i>	50	0	7	57
2.	<i>Euchelus atratus</i>	0	6	12	18
3.	<i>Nerita polita</i> L.	0	28	0	28
4.	<i>Bunglon Nerita</i> L.	7	1	3	11
5.	<i>Conomurex luhuanus</i>	9	0	1	10
6.	<i>labiatum kenari</i>	21	0	1	22
7.	<i>Pertukaran Lamarckii</i>	1	0	7	8
8.	<i>Trokus radiatus</i>	16	0	15	31
9.	<i>Angaria delphinus</i>	2	0	16	18
10.	<i>Turbo crassus</i>	0	15	5	20
11.	<i>Lunala Jungi</i>	0	5	1	6
12.	<i>Turbo Bruneus</i>	0	17	1	18
13.	<i>Vasum turbinus</i>	1	0	7	8
14.	<i>Konus ebraeus</i>	1	11	1	13
15.	<i>tukang sihir konus</i>	0	7	0	7
16.	<i>Conus flavidus</i>	1	0	8	9
17.	<i>Nassarius olivaceus</i>	1	17	0	18
18.	<i>Drupa grossularia</i>	0	0	6	6
19.	<i>Chicoreus capucinus</i>	0	3	0	3
Σ Individuals		110	110	91	311
Σ Spesies					19

The findings of the research conducted at three observation stations revealed the presence of 19 species of gastropods, 15 genera, 12 families, and 6 orders.

Result of media validation

The results of the content expert validation indicate that the contents of the pocket book are deemed to be highly suitable, with a percentage of 85%. The results of the validation of the feasibility of learning media by media experts indicate that the pocket book media is in the very feasible category, with a percentage of 85.33%. Based on the results of the validation of the learning media by design experts, it is in the very feasible category, with a percentage of 84.2%. Based on the results of the validation of electronic pocketbooks from the three expert teams, it can be concluded that the pocketbook is feasible to be tested by a group of 25 students, with a percentage of 85.5%.

The findings of the research conducted in the Central Sea Waters of Towale Village, Banawa District, Donggala Regency, which employed purposive sampling or an environmental hue-based approach, yielded a total of 19 species. The species identified included *Cerithium vulgatum*, *Euchelus atratus*, *Nerita polita* L, *Nerita chamaeleon* L, *Conomurex luhuanus*, *Canarium labiatum*, *Bursa lamarckii*, *Trochus radiatus*, *Angaria delphinus*. The species included in the study were *Turbo crassus*, *Turbo bruneus*, *Lunella jungi*, *Vasum turbinillus*, *Conus ebraeus*, *Conus magus*, *Conus flavidus*, *Nassarius olivaceus*, *Drupa grossularia*, *Chicoreus capucinus*, representing 15 genera. The identified species include *Cerithium*, *Euchelus*, *Nerita*, *Conomurex*, *Canarium*, *Bursa*, *Trochus*, *Angaria*, *Turbo*, *Lunella*, *Vasum*, *Conus*, *Nassarius*, *Drupa*, and *Chicoreus*, representing 12 distinct families. The families *Cerithiidae*, *Chilodontidae*, *Neritidae*, *Strombidae*, *Bursidae*, *Trochidae*, *Angariidae*, *Turbinidae*, *Turbinellidae*, *Conidae*, *Nassaridae*, and *Muricidae*, along with the family *Ranellidae*, comprise six orders of gastropods. The classification of gastropods includes the following orders: *Neotaenioglossa*, *Seguenziida*, *Cycloneritida*, *Littorinimorpha*, *Trochida*, and *Neogastropoda*. The life cycle of the Gastropoda class is contingent upon the physical and chemical conditions of the environment in its habitat, which in turn affects the abundance of species. The abundance of gastropods is significantly influenced by environmental factors, including substrate conditions and the availability of nutrients or food (Haumahu & Supusepa, 2023).

The gastropod fauna of Bonebula Beach Marine Waters, situated within the Central Banawa District of Donggala Regency, is dominated by the *Cerithium vulgatum* species, which exhibits a relatively moderate abundance of 18.33%. This is due to the fact that the species is well-suited to seagrass ecosystems on sandy substrates (Rahmi et al., 2024). The relationship between gastropods and seagrasses is well-established, with gastropods utilizing the epiphytic biomass attached to seagrass leaves as a source of food and protein. Furthermore, seagrass provides a protective habitat for *Cerithium vulgatum* from wave action and predatory animals. Furthermore, the *Cerithium vulgatum* species exhibits a relatively expansive distribution across marine ecosystems, displaying a moderate abundance, high endurance, and a proclivity for seagrass ecosystems on sandy substrates (Slamet et al., 2021).

The lowest abundance of gastropods observed in the marine waters of Bonebula Beach, Central Banawa Subdistrict, Donggala Regency is that of the *Chicoreus capucinus* species, which exhibited a relative abundance of 0.96%. This species is typically found in muddy substrates within mangrove ecosystems (W. Wulandari, 2023). The low abundance of this species is also attributable to the prevalence of anthropogenic activities and the presence of pollutants in the water, which have led to a decline in nutrient levels and food sources for gastropods (Akbar et al., 2024).

Station 1 is situated in the seagrass area, where a total of 11 species of gastropods were identified. These include *Cerithium vulgatum*, *Chamaeleon Nerita*, *Conomurex luhuanus*, *Canarium labiatum*, *Bursa lamarckii*, *Trochus radiatus*, *Angaria delphinus*, *Vasum turbinillus*, *Conus ebraeus*, *Conus flavidus*, and *Nassarius olivaceus*. At this station, the most prevalent species is *Cerithium vulgatum*, with a total of 57 individuals observed. This is due to the fact that the water conditions at this station are conducive to the survival of the *Cerithium vulgatum* gastropod species (Putri et al., 2021). Station 1 is characterized by the presence of free and open water, along with seagrass substrates that serve as a habitat for diverse marine biota and provide a substrate for the activities of snails and clams (Yanti et al., 2022). It is well documented that gastropods are adept at colonizing seagrass substrates. The relationship between gastropods and seagrasses is well documented. Gastropods utilize the epiphytic biomass attached to seagrass leaves as a source of food and protein (Nadaa et al., 2021).

Station 2 of the mangrove ecosystem area yielded 10 species of gastropods, including *Euchelus atratus*, *Nerita polita* L., *Nerita chamaeleon* L., *Turbo crassus*, *Lunella jungi*, *Turbo bruneus*, *Conus ebraeus*, *Conus magus*, *Nassarius olivaceus*, and *Chicoreus capucinus*. Of these, the most prevalent

species was *Nerita polita* L., with a total of 28 individuals. This is due to the fact that the substrate conditions at this station are conducive to the survival of the gastropod species *Nerita polita* L (Hati et al., 2022). Although *Nerita polita* L is a type of visitor gastropod, its adaptability allows it to adapt to certain substrates. Mangrove substrates, in particular, provide an abundant source of nutrients that support the food supply for gastropods in the ecosystem (Nurrudin et al., 2015).

Station III in the coral area yielded 15 species of gastropods, including *Cerithium vulgatum*, *Euchelus atratus*, and *Nerita chamaeleon*. The gastropods found at this station included *Conomurex luhuanus*, *Canarium labiatum*, *Bursa lamarckii*, *Trochus radiatus*, *Angaria delphinus*, *Turbo crassus*, *Lunella jungi*, *Turbo bruneus*, *Vasum turbinellus*, *Conus ebraeus*, *Conus flavidus*, *Drupa grossularia*, and others. Of the 15 species of gastropods identified at this station, the most prevalent is *Angaria delphinus*, with a total of 16 individuals. This is likely due to the fact that *Angaria delphinus* is more commonly observed on coral rock substrates. This species is found in rocky substrates and lives attached (Desy et al., 2022). This species is a sessile organism within the coral ecosystem. It adheres to both dead and living coral in order to procure sustenance and maintain its existence. They do not form colonies, as is the case with other *Nerita* and gastropod species (Batubara et al., 2024).

The research findings indicate that the types of gastropod substrates present in the area are diverse, including those found on seagrass, mangrove, and coral rock substrates (Paspania et al., 2023). The presence of 19 species of gastropods in Bonebula Beach is closely associated with the environmental factors prevailing at that location. The disparity in gastropod species abundance can be attributed to variations in habitat type and the accessibility of nutrients or food sources essential for gastropod survival (Farid et al., 2023).

Learning media constitutes one of the essential elements of any teaching and learning process. Learning media serves as an instrument that enables educators to convey learning materials in a manner that captures the attention and interest of their pupils. It is crucial for teachers to select instructional media that aligns with the content being conveyed and to adapt their approach to accommodate student behavior when choosing learning media. Some educators remain unaware of the significance of employing learning media that align with the learning objectives, thereby ensuring a dynamic and engaging learning environment for students (Wulandari et al., 2023).

The analysis of learning media indicates that a percentage value between 81% and 100% is highly feasible. The results of the assessment of learning resources in the form of electronic pocketbooks were obtained from content experts with a percentage of 85%, design experts 85.33%, media experts 84.2%, and tested on 25 Biology Education students with an average score of 4.28 and a percentage of 85.5%. The mean value suggests that the pocket book is highly feasible for use as a learning medium (Arikunto & Cepi Safrudin, 2010).

CONCLUSION AND SUGGESTION

In light of the findings yielded by the research, it can be posited that: The abundance of gastropods on Bonebula Beach is classified as moderate, representing 18.33% of the total sample. The most prevalent species is *Cerithium vulgatum*, which was identified by content experts in 85% of cases, design experts in 85.33% of cases, and media experts in 84.29% of cases. The average feasibility rating for this media type was 84.87%, indicating that electronic pocket book media is a highly feasible option for use in this context.

In light of the findings of the study, the author's recommendations include the necessity for more precise measurements of water quality, encompassing both physical and chemical aspects. For future research endeavors, it is essential to assess the levels of brightness, turbidity, chemical oxygen demand (COD), biological oxygen demand (BOD), and dissolved oxygen (DO), or the solubility of oxygen, in order to gain a more comprehensive understanding of the subject matter. The author proposes that this type of research be conducted in stages. In order to disseminate information to the general public, it would be beneficial to create a more visually appealing poster or banner that can be utilized in offline settings in addition to online media.

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