Study of the Mullusca Community in The Reclamation Beach of Manado Beach

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ABSTRACT

This study aims to inventory the types of molluscs and community structure and to know their activities on the reclamation beach of Manado Bay. The types of molluscs encountered in the first phase of the study totaled 15 species from 7 families while in the second phase there were 21 species from 10 families. Based on the results of data analysis in phase I research in the intertidal zone showed that the mollusk density value was 58.30 Ind/m2. The damage index obtained from the analysis results is low, namely H' = 1.684. The dominance value obtained from the results of data analysis is low, namely C = 0.27-0.44. The highest species frequency value was found in the Cellana radiata species with a value of 0.60 and the lowest in the species Menathais tuberosa, Drupa rubusidae, Drupa ricinus, Nerita polita, with a value of 0.03. The relatively high importance value index was found in the species Saccostrea cucullata with a value of 106.28% while the lowest value was in the species Menathais tuberosa and Drupa ricinus with a value of 1.24%. In phase II research in the subtidal zone showed that the mollusk density value was 1.86 Ind/m2. The damage index obtained from the analysis results is classified as moderate, namely H' = 2.950. The domination value obtained from the results of data analysis is C = 0.06, which means that the value is classified as low. The activity of molluscs in terms of their ability to respond and adapt to the molluscs in the intertidal zone varies according to the species observed based on the size of the species and their preferred adaptability. The reclamation coastal waters area has a temperature of 29.5 °C, Salantas 30 0/00,

Keywords:Community Structure, Mollusc, Reclamation.

INTRODUCTION

Molluscs are one of the many potential biological resources found in an ecosystem, and have an important role for the balance of the ecosystem (Nugraha et al, 2019). In the aquatic environment, these organisms play an important role in the food chain while providing nutrition, especially for fish and other marine biota (Roring et al., 2013). In addition, molluscs can be used as bio-indicators of water quality because of their relatively sedentary nature of life for a long period of time so that their presence makes it possible to determine environmental quality. Therefore, changes or disturbances in the aquatic environment will certainly affect the structure of the mollusk community(Normalasari et al, 2019).

Manado Bay is one part of the North Sulawesi sea area which has a coastal area which is famous for its rich potential of biological resources, one of which is molluscs.(Lumuindong, 2009).InManado Bay, molluscs are scattered along the coastal area to the flat coral reefs and are exposed at low tide by wave activity and changes in salinity (Ompi and Lumingas, 1997). Along with development and civilization, the people around Manado Bay need new lands to fulfill socio-economic activities, while the land on the mainland is increasingly limited, with conditions like this the community begins to utilize coastal areas for various purposes. Therefore, part of the coastal areas of Manado Bay have carried out the development of beach reclamation (Tumurang et al, 2018).

The megamas area reclamation beach is administratively located in Wenang Selatan District, Manado City. Activities around the reclamation beach are quite dense, such as places for fishing boats to dock, places for recreation, and places to sell. This beach has wide types of rocky (intertidal zone) and sandy (subtidal zone) substrates so it is very suitable for habitat for marine biota to live and breed, one of which is molluscs. The structure of the mollusc community can be disrupted if adequate environmental management is not accompanied, such as the disposal of solid and liquid industrial, culinary and automotive waste. Research on the structure of the mollusk community is important to be carried out to determine the condition of water quality, so that it can provide appropriate management for the waters around the reclamation beach.

RESEARCH METHODS

Location and Time of Research

The research was conducted from July to August on the reclamation beach of Manado Bay, North Sulawesi (Figure 1). With the research location centered on the station precisely at coordinates 1o28'41.90"N - 124o49'59.20"E.

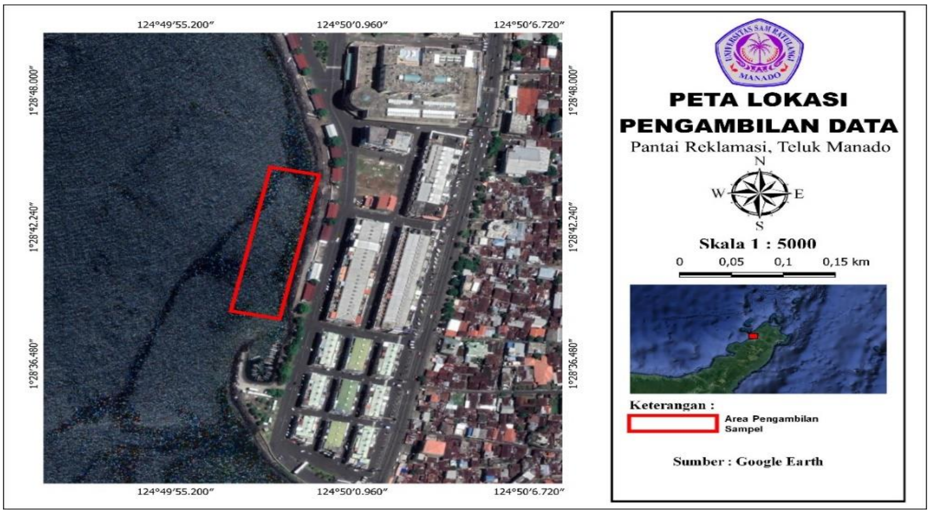


Figure 1. Research sites

Preliminary Research

In the early stages a survey was carried out by looking at and observing the beach structure, as well as knowing the distribution of the mollusca population at the location where the selection or determination of research stations would be carried out.

Observation of Mollusca Activity at Reclamation Beach

Prior to sampling, the activity of mollusc species living in the intertidal zone was observed. The molluscs observed are certain species that have the ability to move up and down the waters and avoid harmful factors. Observations were made using the observation method or direct observation of mollusc species that were affected by environmental factors such as the influence of excessive heat from the sun, the influence of heavy rain, exposure to heavy sea waves and predators.

Mollusca Sampling

Mollusca sampling stage I was carried out in the intertidal zone using the quadrant transect method. A 100 meter long transect is placed parallel to the shoreline in the supralitoral, midlitoral and sublitoral sections. Then each transect is placed in a quadrant measuring (1x1m), repeated at every 10 m distance between quadrants to 10 quadrants on each line, so 3 transect lines x 10 quadrants = 30 observation quadrants.

Furthermore, the second phase of mollusc sampling was carried out in the subtidal zone using the cruising survey method on an area of 10 x 25m or 250m2. Sampling is assisted by diving equipment and then dives from the lowest ebb (intertidal zone) to the bottom of the waters then explores the area of the area that has been determined while collecting and documenting samples of molluscs found in that area.

Mollusca Type Identification

The mollusc species found were identified based on the guidebook namely;Indonesian Snails and Clams (Dharma, 1992), WORMS Digital Platform "World Register of Marine Species" and NHMR "Natural History Museum Rotterdam". Identification of species is based on grouping based on morphology and shell structure. Once grouped, then identified up to the species level. Identification books and digital platforms are used to look at families of snail species and after obtaining a suitable family, then determine the type or species based on morphology, color, pattern and size.

Measurement of Aquatic Physics-Chemical Parameters

Parameters measured were temperature, salinity, and pH. Water temperature was measured using a digital thermometer, salinity was measured using a salinometer, while litmus paper was used to measure the pH of the waters.

Data analysis
Species Density and Relative Density

Species density and relative density can be calculated using the following formula (Odum 1998):

$$Kepadatan\ Spesies = \frac{Jumlah\ individu\ suatu\ jenis}{Luas\ Wilayah\ (m^2)}$$

$$Kepadatan\ Relatif = \frac{Kepadatan\ setiap\ jenis}{Jumlah\ kepadatan\ semua\ jenis}\ x\ 100$$

Diversity Index

Diversity shows the diversity of species and is a characteristic of community structure. The species diversity index can be calculated using the Shannon-Wiener formula (Krebs 1989):

$$H' = -\sum_{i=1}^{s} Pi\ ln\ Pi$$

Information:
H'= Diversity index.

$P_i = \frac{ni}{N}$ (relative abundance of the i-type biota).

ni = Number of individuals of the i-th species
N = Total number of individuals of all species.
S = Number of species.

Index of Dominance and Relative Dominance

To describe the most common type of molluscs found, it can be determined by calculating the dominance value. The dominance value can be expressed in the Simpson domination index in Odum (1993), namely:

$$C = \sum \left(\frac{ni}{N}\right)^2$$

Information :
C = Dominance Index
ni = Number of individuals of each species
N = Total number of individuals of all species
To determine the relative dominance value of each type, the following formula is used:

$$Dominasi\ Relatif\ (\%) = \frac{Dominasi\ spesies\ A}{Dominasi\ total\ spesies} X\ 100$$

Type Frequency and Relative Frequency

Species frequency (Fi) is the probability of a species being found in the observed sample points, formulated as follows Bengen (2000):

$$Fi = Pi / \sum P$$

Information :
Fi = Type Frequency
Pi = Number of plots found i-type
∑P = Sum of all plots

Relative frequency (Rfi) is the ratio between the frequency of species-i and the total frequency for all species, formulated as follows Bengen (2000):

$$R\,fi = Fi / \sum F\ x\ 100$$

Information :
Rfi = Relative Frequency
Fi = Frequency of type i
∑F = Frequency of all types

Significant Value Index

Important Value Index (INP), is used to calculate and predict the overall role of mollusc species in a community. The higher the IVI value of a species against other species, the higher the role of the species in the community Bengen (2000). The formula used to calculate IVI is:

$$INP = RDi + RFi + RCi$$

Information :
INP = Significant Value Index
RDi = Relative density of type i
RFi = Relative frequency of type i
RCi = Relative dominance of type i

RESULTS AND DISCUSSION

Overview of research locations

Megamas Reclamation Beach is one of the coastal areas located in Wenang Selatan District, Manado City. The coastal waters themselves are also included in the Manado Bay area. Reclamation Beach is the name of the local community for this location, because this location is a coastal water area that has been processed into a reclamation area for economic and business interests.

The oceanographic conditions of these coastal waters are characterized by deep sea conditions, tide ranges ranging from 1 to 2 meters with a semi-diurnal type and the tidal characteristics of this area are heavily influenced by tidal oscillations.from the Pacific Ocean. The reclamation waterfront area has a rocky substrate type while the water bottom area has a sandy and muddy substrate type. Water quality measurements have been carried out for the parameters of temperature, salinity and pH. The water temperature at this location is 29.5o C, the salinity is 30o/oo, and the pH value is 8 for the water measurement results

Phase I Research in the Intertidal Zone
Type Composition

The types of molluscs found in the intertidal zone of the Manado Bay reclamation coast totaled 15 species from 7 families. This number is more than previous studies in the same location, namely 14 species from 8 families (Lumuindong, 2009). All types of molluscs found in the intertidal zone live and attach to rocky substrates. The types of molluscs found can be seen in (Table 1).

Table 1. Types of molluscs found at the study site.

No	Family	Species
1.	Nacellidae	*Cellana testudinaria*(Linnaeus, 1758) *Radiata trousers*(Born, 1778)
2.	Lottiidae	*Patelloida saccharinoides*Habe & Kosuge, 1966 *Patelloid saccharina*(Linnaeus, 1758)
3.	Siphonariidae	*Siphonaria javanica*(Lamarck, 1819) *Siphonaria Sirius*Pilsby, 1894
4.	Muricidae	*Menathais tuberosa*(Roding, 1798) *Morula uva*(Roding, 1798) *Drupa rubusidaeus*Roding, 1798 *Drupa ricinus*(Linnaeus, 1758)
5.	Neritidae	*Nerita Costa*Gmelin, 1791 *Nerita plicata*Linnaeus, 1758 *Nerita Polita*Linnaeus, 1758
6.	Calyptraeidae	*Desmaulus extinctorium*(Lamarck, 1822)
7.	Ostreidae	*Saccostrea cucculata*(Born, 1778)

Species Density and Relative Density

Based on the analysis of the density of molluscs in the intertidal zone of the Manado Bay reclamation beach, the density value was 58.30 ind/m2. This density value is somewhat higher than previous research at the same location with a value of 28.9 ind/m2 (Lumuindong, 2009). The high density of molluscs in the present study is due to the large number of species of Saccostrea cuccullata of 765 individuals. A diagram of the mollusk density values in the intertidal zone can be seen in (Figure 2).

The highest density value was found in the species Saccostrea cuccullata with a value of 25.50 ind/m2 and a relative density value of 43.74% while the lowest density value was found in the species Menathais tuberosa and Drupa ricinus with the same density value of 0.10 ind/m2 and a density relatively 0.17%. According to Bahari et al (2020), the density of mollusks can be affected by several factors, namely environmental conditions, availability of food sources, competition, and environmental changes that can affect the number of species and structure of the mollusks.

Diversity Index

The diversity index value in the intertidal zone of the Manado Bay reclamation beach is H' = 1.684 and in previous research at the same location, H' = 0.909 (Lumuindong, 2009). The two diversity values belong to the low diversity category because the value (H' < 2.0). According to Rau et al (2013), low diversity values are probably caused by environmental factors and predators. The value of the mollusk diversity index can be seen in (Table 2).

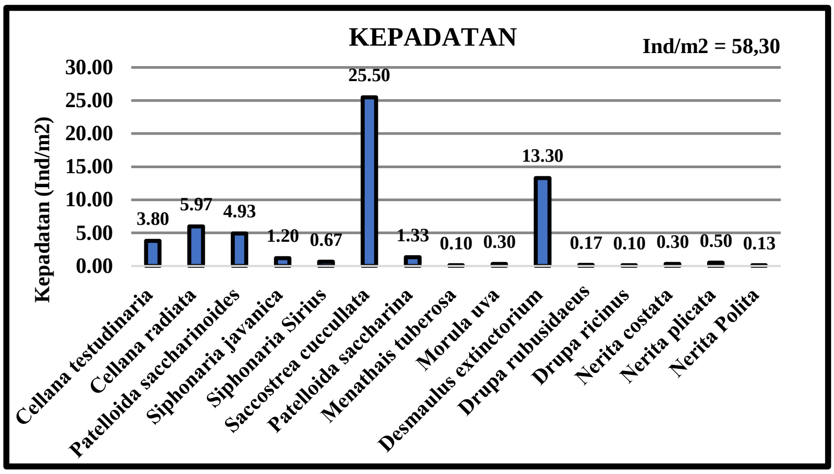


Figure 2. Mollusca Density Diagram in the Intertidal Zone

Table 2. Diversity Index (H').

No	Species Name	Amount	Pi	lnPi	Pi*LnPi
1.	*Cellana testudinaria*	114	0.065	-2,731	-0.178
2.	*Cellana radiata*	179	0.102	-2,279	-0.233
3.	*Patelloida saccharinoides*	148	0.085	-2,470	-0.209
4.	*Siphonaria javanica*	36	0.021	-3,883	-0.080
5.	*Siphonaria Sirius*	20	0.011	-4,471	-0.051
6.	*Saccostrea cucculata*	765	0.437	-0.827	-0.362
7.	*Patelloid saccharina*	40	0.023	-3,778	-0.086
8.	*Menathais tuberosa*	3	0.002	-6,368	-0.011
9.	*Morula uva*	9	0.005	-5,270	-0.027
10.	*Desmaulus extinctorium*	399	0.228	-1.478	-0.337

11.	*Drupa rubusidaeus*	5	0.003	-5,857	-0.017
12.	*Drupa ricinus*	3	0.002	-6,368	-0.011
13.	*Nerita Costa*	9	0.005	-5,270	-0.027
14.	*Nerita plicata*	15	0.009	-4,759	-0.041
15.	*Nerita Polita*	4	0.002	-6,081	-0.014
Total		1749	1,000	-61,889	-1,684
H' Diversity					1,684

Domination Index and Relative Dominance

The domination index values obtained from data analysis on the three observation transects in the intertidal zone of the Manado Bay reclamation coast ranged from C = 0.27 to 0.44. The highest value is found on transect 3 while the lowest value is found on transect 2. The dominance index value ranges from 0 to 1, where the smaller the dominance index value indicates that no species dominates in the community, conversely the greater the dominance index value, it indicates that there is certain species dominate (Odum, 1993). The results of the average dominance value of the three observation transects in the intertidal zone were C = 0.37 which means below (<0.50) so that it can be concluded that there is no particular species that is dominant.

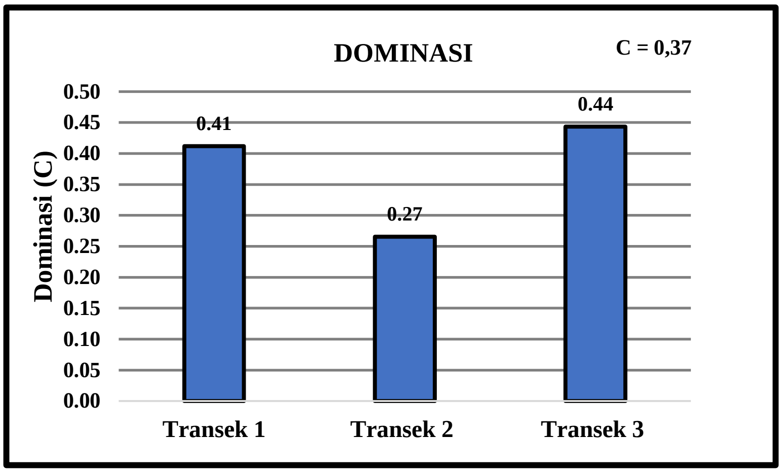


Figure 3. Dominance Index Chart (C).

Type Frequency and Relative Frequency

The value of the frequency of occurrence of a species from the three observation transects in the intertidal zone of the Manado Bay reclamation beach can be seen in (Figure 4). The value of the frequency of occurrence varies between 0.03 – 0.60. The species that has the highest frequency value is Cellana radiata with a value of 0.60 and a relative frequency value of 19.15%, while the lowest frequency value is found in the species Menathais tuberosa, Drupa rubusidaeus, Drupa ricinus, and Nerita polita which both have a frequency value of 0 .03 and the relative frequency value is 1.06%. Based on the results above, it can be concluded that Cellana radiata species can be found in almost all plots or quadrants in the three observation transects, while Menathais tuberosa, Drupa rubusidae, Drupa ricinus,

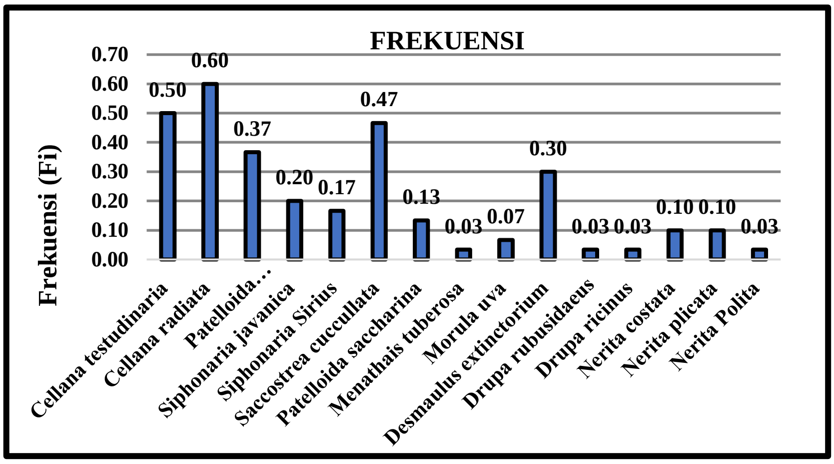


Figure 4. Frequency (Fi) Chart.

Significant Value Index

The importance value index of a species was obtained based on the results of analysis of the three observation transects in the reclamation coastal intertidal zone of Manado Bay as shown in (Figure 5). At this research location there are species that have a relatively high index of importance, namely the species Saccostrea cuccullata with a value of 106.28% and the lowest index of importance is found in the species Menathais tuberosa and Drupa ricinus with the same value of 1.24%. Based on these results, it shows that the species Saccostrea cuccullata has a good adaptation to aquatic environmental conditions and plays a large role in the structure of the mollusk community at the study site (Bua, 2017).

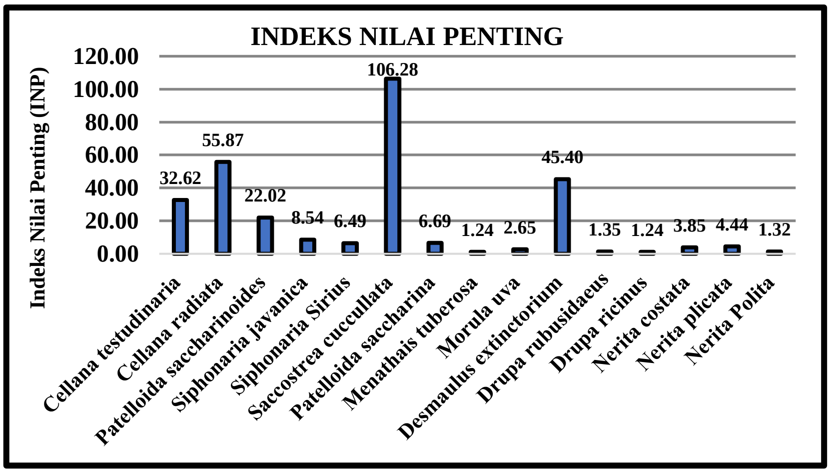


Figure 5. Significant Value Index (%) diagram.

Phase II Research in the Subtidal Zone

Type Composition

The types of molluscs found in the phase II study of the subtidal zone on the reclamation beach of Manado Bay totaled 21 species from 10 families. Based on the results of sampling, the types of molluscs found in the subtidal zone were obtained from sandy, dead coral, rocky and muddy substrate surfaces.

Table 3. The types of molluscs found in the subtidal zone.

No	Family	Species
1.	Conidae	*Conus musicus*Hwass, 1979 *Conus terebra*Born, 1778 *Conus rattus*Hwass, 1792 *Conus blanfordianus*Crosse, 1867 *Conus miles*Linnaeus, 1758 *Conus ebraeus*Linnaeus, 1758 *Conasprella ximenes*(Gray, 1839)
2.	Naticidae	*Polinices celephanti*(Links, 1807)
3.	Cypraeidae	*Talparia talpa lutani*Bridges, 2015
4.	Cysticcidae	*Gibberula asellina*Jousseaume, 1875 *Gibberula miliaria*(Linnaeus, 1758)
5.	Acteonidae	*Affinis pupae*(A. Adams, 1855)
6.	Muricidae	*Chicoreus capucinus*(Lamarck, 1822) *Murexsul cevikeri*(Houart, 2000) *Murexsul armatus*(A. Adams, 1854)
7.	Mitridae	*Strigatella imperialis*(Roding, 1798) *Imbricaria verrucosa*(Reeve, 1845)
8.	Nassariidae	*Tritia reticulata*(Linnaeus, 1758)
9.	Terebridae	*Duplicaria gemmulata*(Kiener, 1837) *Terebra consobrina*Deshayes, 1857
10.	Dolicholatiridae	*Dolicholatirus cayohuesonicus*(GB Sowerby III, 1879)

Species Density and Relative Density

Based on the analysis of the density of molluscs in the subtidal zone of the Manado Bay reclamation beach, a density value of 1.86 ind/m2 was obtained. A diagram of the density values of molluscs in the subtidal zone can be seen in (Figure 6). The species that has the highest density value is Gibberula miliaria with a value of 0.19 ind/m2 and a relative density of 10.34%, while the species that has the lowest density value is Talparia talpa lutani with a value of 0.02 ind/m2 and a relative density of 1.29 %. According to Odum (1998), a species that has the highest density value indicates that this organism has the ability to occupy a wider space so that there are more opportunities to develop.

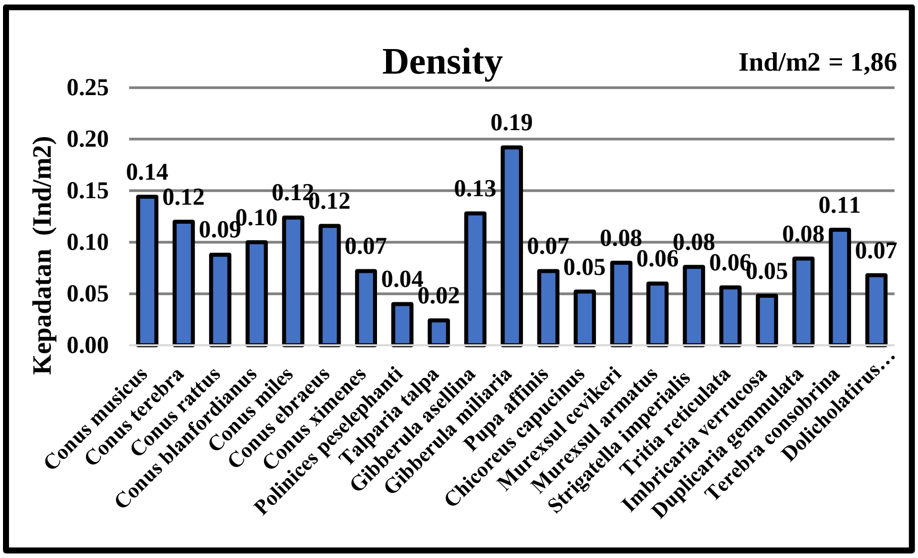


Figure 6. Mollusca Density Diagram in the Subtidal Zone

Diversity Index

The results of the analysis to obtain the index value of species diversity in the subtidal zone on the reclamation beach of Manado Bay are shown in (Table 4). The mollusc diversity index value in the subtidal zone is H = 2.950. This index value belongs to the category of moderate diversity because the value of H' 2.0 < H' < 3.0 according to the Shanon Wiener Index criteria. The highest diversity index value was found in the Gibberula miliaria species with a value of 0.235 and the lowest diversity value was found in the Talparia talpa lutani species with a value of 0.056. Handayani (2006), said that a community is said to have high species diversity if the community is composed of many species with the same or almost the same abundance of species.

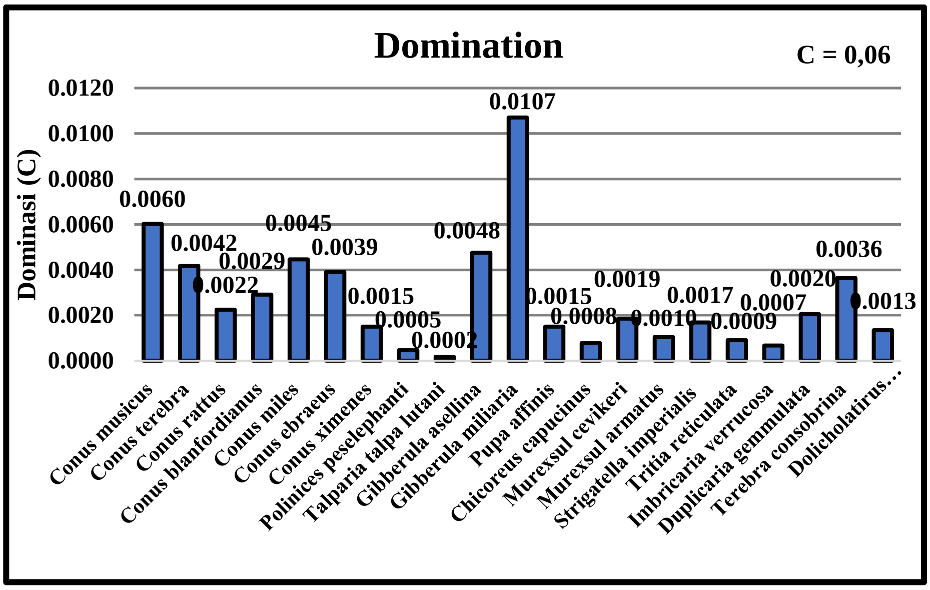
Table 4. Mollusk diversity index in the subtidal zone

No	Species Name	Amount	Pi	lnPi	Pi*LnPi
1.	*Conus musicus*	36	0.078	-2,556	-0.198
2.	*Conus terebra*	30	0.065	-2,739	-0.177
3.	*Conus rattus*	22	0.047	-3,049	-0.145
4.	*Conus blanfordianus*	25	0.054	-2,921	-0.157
5.	*Conus miles*	31	0.067	-2,706	-0.181
6.	*Conus ebraeus*	29	0.063	-2,773	-0.173
7.	*Conasprella ximenes*	18	0.039	-3,250	-0.126
8.	*Polinices celephanti*	10	0.022	-3,837	-0.083
9.	*Talparia talpa lutani*	6	0.013	-4,348	-0.056
10.	*Gibberula asellina*	32	0.069	-2,674	-0.184
11.	*Gibberula miliaria*	48	0.103	-2,269	-0.235
12.	*Affinis pupae*	18	0.039	-3,250	-0.126
13.	*Chicoreus capucinus*	13	0.028	-3,575	-0.100

14.	*Murexsul cevikeri*	20	0.043	-3,144	-0.136
15.	*Murexsul armatus*	15	0.032	-3,432	-0.111
16.	*Strigatella imperialis*	19	0.041	-3.195	-0.131
17.	*Tritia reticulata*	14	0.030	-3,501	-0.106
18.	*Imbricaria verrucosa*	12	0.026	-3,655	-0.095
19.	*Duplicaria gemmulata*	21	0.045	-3,095	-0.140
20.	*Terebra consobrina*	28	0.060	-2,808	-0.169
21.	*Dolicholatirus cayohuesonicus*	17	0.037	-3,307	-0.121
Total		464	1,000	-66,083	-2,950
H' Diversity					2,950

Domination Index and Relative Dominance

Based on the results of the analysis, the mollusca dominance index value in the subtidal zone on the reclamation beach of Manado Bay is C = 0.06. The dominance index value is below 0.5 which means low or no dominant species (Krebs, 1989). Dominance index values in the subtidal zone varied between 0.0002 - 0.0107. The Gibberula miliaria species had the highest dominance index value in the subtidal zone, namely 0.0107 and a relative dominance value of 18.84%, while the species that had the lowest dominance index value was Talparia talpa with a value of 0.0002 and a relative dominance value of 0.29%. A diagram of the dominance index in the subtidal zone can be seen in (Figure 7).



GFigure 7. Mollusca dominance index diagram in the subtidal zone

Table 5. Research Results at Manado Bay Reclamation Beach

No	**Research sites**	**Density**	**Diversity**	**Domination**	**Frequency**	**Significant Value Index**

1.	Intertidal Zone	58,3	1,684	0.27 - 0.44	0.03 – 0.60	300
2.	Subtidal Zone	1.86	2,950	0.06	-	-

Mollusca Activity on Reclamation Beach

Observations of mollusc activity at the study site were carried out in the intertidal zone on the species Patteloidae saccharinoides, Pattella saccharina, Siphonaria javanica, siphonaria Sirius, Nerita costata, Nerita plicata, and Nerita polita for 3 days. Observations were made on July 13-15 2022 starting at 07.00 WITA, at that time the water was at the highest tide or supralitoral, only a few types of molluscs were seen, namely Nerita costata, Nerita plicata, Nerita polita and also limpets which were moving along the surface of the substrate, p. this is done to get food because most of the food is carried away when the tide inundates the substrate and is retained during low tide.

At 09.00 WITA the sea water began to fall in the midlittoral section. The species Nerita costata, Nerita plicata and Nerita polita were not seen in this area but several other species had appeared, such as Patteloidae saccharinoides, Pattella saccharina, Siphonaria javanica, siphonaria Sirius, who were doing almost the same activity as types of molluscs that are in the supralittoral section. When the water starts to recede again, it can be seen that several types of molluscs have stopped their activities, such as the types in the supralittoral section. However, there are some individuals that are in crevices or behind rocks, which can carry out foraging activities because they are found on a moist substrate and are not exposed to light. sun.

The results of observations at 12.00 WITA seawater had receded completely or were in the sublittoral section and at that time the sun had illuminated the entire intertidal section. It can be seen that there are no species carrying out activities, but several species that have occupied rock crevices can carry out activities. This indicates that the species that have occupied rock crevices already have a good response to environmental changes so that they can anticipate before the occurrence of heat in their habitat. Species that are behind the rocks when they have finished looking for food, will rest by staying silent on the substrate they want. By the time the sea water started to rise around 13 o'clock. 00 WITA and until the highest tide again, species in the midlitoral and sublittoral sections cannot carry out feeding activities other than avoiding and protecting from predators. Meanwhile, Saccostrea and Calyptraea species will get food when immersed in water by filtering plankton (filter feeding) (Lumuindong, 2009).

As the description above can be explained, molluscs that have high mobile and adaptive characteristics will dominate the zone. The species Patteloidae saccharinoides, Pattella saccharina, Siphonaria javanica, Siphonaria Sirius, Nerita costata, Nerita plicata, and Nerita polita only dominate certain zones. Molluscs that occupy the supralitoral part, such as Nerita costata, Nerita plicata, and Nerita polita, have the ability to move slowly and choose supralitoral habitats as places of activity, while Patteloidae saccharinoides, Pattella saccharina, Siphonaria javanica, Siphonaria Sirius can carry out activities in the midlitoral to sublittoral areas because of these species.

has a fairly good mobile ability compared to species that are in the supralittoral section.

Aquatic Environmental Conditions

Temperature

One of the environmental parameters measured is temperature. The results of temperature measurements obtained at the study site were 29.5°C. According to Wahyuni et al (2017), a good temperature for mollusc growth ranges from 25 - 31 °C. Based on this range, the temperature at Manado Bay Reclamation Beach is good for Mollusca life.

Salinity

Based on salinity measurements using a salinometer, the value obtained is 30 0/00. Benthos animals can generally tolerate salinities ranging from 25–40 0/00 (Bulahari et al, 2019). Based on this range, the salinity in Manado Bay Reclamation Beach is good for the growth of molluscs.

Degree of Acidity (pH)

The degree of acidity or pH is one of the most important parameters for organisms in a body of water. According to Syafikri (2008), death is more often caused by a low pH than a high pH and the pH value that supports mollusc life ranges from 5.7 to 8.4. The pH measurement results obtained at the study site were 8. Based on this value, the pH value at the Manado Bay reclamation beach was classified as good for supporting mollusc life.

substrate

Manado Bay Reclamation Beach has rocky, sandy and muddy substrate types. According to Rangan (2010), the substrate is very influential on the breeding of a community, where the substrate is used as a place to live, find food, and a place to hide from the threat of predators. Therefore, waters that have various types of substrates will of course be inhabited by various aquatic communities, one of which is the mollusc community.

CONCLUSION

The types of molluscs found in the research phase I in the intertidal zone totaled 15 species from 7 families while the types of molluscs found in the research phase II in the subtidal zone totaled 21 species from 10 families. Manado Bay Reclamation Beach is still in good condition, this is because the diversity of mollusk species on the reclamation beach is quite high so that the condition of the waters around the reclamation beach is still maintained. Mollusk activity on the reclamation beach of Manado Bay varies according to the species observed based on the size of the species and their preferred adaptability.

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