

Structure of gastropod communities at mangrove ecosystem in Lubuk Kertang village, West Berandan District, Langkat Regency, North Sumatera Province

T Manullang, D Bakti and R Leidonald

Department of Aquatic Resources Management, Faculty of Agriculture, Universitas Sumatera Utara, Medan 20155.

Email: dbakti06@yahoo.com

Abstract. Gastropod was one of the class from mollusca in mangrove ecosystem. Lubuk Kertang Village's mangrove forest was been converted into tourist areas, agricultural land and settlements. The purpose of this study was to analyze the structure of gastropods at *Avicennia lanata*, *Rhizophora apiculata* and *Sonneratia alba*. This research was conducted at Lubuk Kertang Village in February-March 2017. Gastropod were collected in 1 m × 1 m transect in mangrove. Examples of biota were taken by using shovel, then the biota was inserted into a plastic bag sample, wrote date of sampling and identified. The results showed there were 15 species Gastropods, namely *Achatina fulica*, *Cerithidea alata*, *Cerithidea cingulata*, *Cerithidea obtusa*, *Chicoreus capucinus*, *Cymatium pileare*, *Ellobium aurimisdæ*, *Ellobium aurisjudæ*, *Littoraria melanostoma*, *Littoraria scabra*, *Murex tribulus*, *Nerita balteata*, *Nerita planospira*, *Pugilina cochlidium*, *Stramonita gradata*, *Telescopium telescopium* and *Terebralia sulcata*. Diversity index ranged 1.702 to 2.165 was in medium category, Similarity index ranged 0.676 to 0.799 was in low category and Dominance index ranged 0.142 to 0.282 that categorized was low. The highest gastropod density was 31 individuals/m² in the *Sonneratia alba*. The conclusion of the research is the existing mangrove ecosystem in Lubuk Kertang Village in a stable state.

1. Introduction

Mangrove ecosystem is an ecosystem that is affected by water conditions that change at any time. It because effected by aquatic biota that associated with mangrove ecosystem. Potential mangroves as a source of nutrients for biota living in it as a place to live, feeding ground, nursery and spawning ground [1]. One of the fauna that capable to adapt and survive in such extreme environments is Gastropoda [2]. Abundancy and distribution of gastropods were influenced by local environmental factors, food availability, predation and competition. Environmental changes can affect the number of species and differences in the structure of the gastropod community. Gastropod meat is used as a source of animal protein and its shells are used as raw materials in industry and jewelry.

Utilization of mangrove forest to a plantation land resulted in decreased productivity of mangrove forest in Lubuk Kertang Village, the function destroys mangrove vegetation and disrupts the life of biota in it, one of them is Gastropoda. Gastropoda can be used as one of the biological indicators of a water. Gastropoda density is highly dependent on its tolerance to environmental change. Therefore, the linkage between mangrove species and Gastropoda located in Mangrove Ecosystem in Lubuk Kertang Village, Berandan Barat District Langkat, North Sumatera Province needs to be studied.



2. Materials and Method

Study site

The research was conducted in Lubuk Kertang Village, Langkat Regency, North Sumatra Province, Indonesia. Data were collected from February to March 2017. The materials used were Global Position System (GPS), meter, tool box, 1m x 1m board, digital camera, and Paper millimeter blok.

Method of Gastropods

Each observation station was set at 3 plots with an area along transects perpendicular line from the water to the mainland dominated mangrove species *Rhizophora apiculata*, *Avicennia lanata* and *Sonneratia alba* with transects squares of 10 m x 10 m, whereas in the plot are sub plot size of 1 m x 1 m placed to observe and identify the gastropod biota. The steps are as follows [3]:

- A. Sampling of Gastropoda was done in transect observation of 10 m x 10 m mangrove vegetation.
- B. In each plot of transect 10 m x 10 m, it is made sub plot with three randomly placed spots, where each point uses 1 m x 1 m transect.
- C. Sampling of gastropods is done on each sub plot, ie at low tide, making it easier to calculate and identify the gastropods' species.
- D. Biota retrieval is carried out on substrates, roots, stems and leaves to the highest tide limit.
- E. Samples of biota were taken by using shovel (hand and picking) for the epifauna, then the biota is inserted into a plastic bag sample that has been given 70% alcohol solution and also wrote station location information, transect, plot and date of sampling and further identified [4].

Problem formulation

Biota Density of Gastropods with formula [5]:

$$K = \frac{n_i}{A} \quad (1)$$

Information:

K = Density
 n_i = Number of individuals of a type
 A = Area

Diversity Index is calculated by the formula :

$$K = - \sum_{i=1}^s P_i \ln P_i \quad (2)$$

Information:

H' = Shannon-Wiener diversity index
 P_i = Number The proportion of the number of individual species i to the number of individuals
 Total $P_i = n_i / N$ with n_i : number of species i N: total sum species

Similarity Index is calculated by the formula:

$$K = \frac{H'}{H_{\max}} \quad (3)$$

Information :

K = Similarity index (*Evenness*)
 H' = Shannon-Wiener diversity index
 $H_{\max} = \log 2^S$; S = Number of species or taxa

Dominance Index is calculated by the formula:

$$K = \sum_{i=1}^s \left(\frac{n_i}{N} \right)^2 \quad (4)$$

Information :

- K = Simpson's Dominance Index
 ni = Number of individuals of a type of i
 N = Total Number of individuals
 S = Number of genera

3. Results and Discussions*The diversity and composition of gastropods*

Gastropods found in *Avicennia lanata* was very diverse. Gastropods found mostly in the substrate and a bit attached to the mangrove stems. Gastropods composition highest species were *Cerithidea cingulata*, *Cymatium pileare*, *Nerita balteata* and *Cerithidea alata* 21%, 19% and 16%, while the value was lowest for the species *Ellobium aurismisdae* and *Nerita planospira* with a value of 1%. In mangroves *Avicennia lanata* found gastropod family potamididae with species *Cerithidea alata* and *Cerithidea cingulata* which has a high enough composition value among other types. This was due to *Cerithidea* has a high adaptability and wide spread and substrate conditions in the form of sand and clay sand suitable to support the life of this genus. One of the gastropods that dominates the mangrove ecosystem is from the family Potamididae (*Cerithidae cingulata*). Potamididae conch is the original inhabitant of mangrove forests and lives in tidal areas and likes muddy areas [7]. The composition of gastropods on *Avicennia lanata* can be showed on Table 1.

In *Rhizophora apiculata* vegetation found 13 species of gastropods. Of the 13 species of gastropods were the most dominant found attached to the roots of mangrove is the *Nerita balteata* by 49%, while the lowest value was found on substrate were *Achantina fulica*, *Chicoreus capucinus* and *Ellobium aurimisdæ* with a value of 1%. *Nerita balteata* composition of 49% is dominant gastropods in *Rhizophora apiculata*, living on the mangrove root as their habitat and able to win the competition to get food and living place compared to other species. The highest density was found in the *Rhizophora apiculata* and the dominant gastropod was *Nerita balteata* species, the species likes mangrove forests as their habitat and were able to win the competition for food and livelihoods compared to other species [8]. The composition of gastropods on *Rhizophora apiculata* can be showed on Table 2.

Table 1. Composition species gastropods in *Avicennia lanata*

Number.	Species Name	Family	Total	Percentage (%)
1.	<i>Achantina fulica</i>	Achatinidae	9	5
2.	<i>Ellobium aurisjudæ</i>	Ellobidae	1	0
3.	<i>Ellobium aurimisdæ</i>		2	1
4.	<i>Littoraria melanostoma</i>	Littorinidae	8	5
5.	<i>Littoraria scabra</i>		1	0
6.	<i>Pugilina cochlidium</i>	Melongenidae	14	8
7.	<i>Stramonita gradate</i>	Muricidae	7	4
8.	<i>Murex tribulus</i>		3	2
9.	<i>Nerita balteata</i>	Neritidae	28	16
10.	<i>Nerita planospira</i>		2	1
11.	<i>Cerithidea alata</i>	Potamididae	28	16
12.	<i>Cerithidea cingulata</i>		37	21
13.	<i>Terebralia sulcata</i>		1	0
14.	<i>Telescopium telescopium</i>		3	2
15.	<i>Cymatium pileare</i>	Ranelidae	35	19

Table 2. Composition species gastropods in *Rhizophora apiculata*

Number.	Species Name	Family	Total	Percentage (%)
1.	<i>Achantina fulica</i>	Achatinidae	3	1
2.	<i>Ellobium aurimisdæ</i>	Ellobidae	2	1
3.	<i>Littoraria melanostoma</i>	Littorinidae	5	2
4.	<i>Littoraria scabra</i>		21	9
5.	<i>Pugilina cochlidium</i>	Melongenidae	1	0
6.	<i>Chicoreus capucinus</i>	Muricidae	2	1
7.	<i>Nerita balteata</i>	Neritidae	121	49
8.	<i>Nerita planospira</i>		23	9
9.	<i>Cerithidea alata</i>	Potamididae	15	6
10.	<i>Cerithidea cingulata</i>		35	14
11.	<i>Cerithidea obtuse</i>		4	2
12.	<i>Telescopium telescopium</i>		5	2
13.	<i>Cymatium pileare</i>	Rannelidae	10	4

In the *Sonneratia alba* gastropods that most widely encountered was *Littoraria scabra* attached on mangrove's leaves and trunks by 44%, while the value was lowest for the *Terebralia sulcata* and *Telescopium telescopium* that found in the substrate with a value of 1%. The composition of gastropods on *Sonneratia alba* can be showed on Table 3.

Table 3. Composition species gastropods in *Sonneratia alba*

Number.	Species Name	Family	Total	Percentage (%)
1.	<i>Littoraria melanostoma</i>	Littorinidae	12	4
2.	<i>Littoraria scabra</i>		123	44
3.	<i>Pugilina cochlidium</i>	Melongenidae	1	0
4.	<i>Nerita balteata</i>	Neritidae	21	7
5.	<i>Nerita planospira</i>		5	2
6.	<i>Cerithidea alata</i>	Potamididae	38	14
7.	<i>Cerithidea cingulata</i>		52	19
8.	<i>Cerithidea obtuse</i>		7	3
9.	<i>Terebralia sulcata</i>		2	1
10.	<i>Telescopium telescopium</i>		4	1
11.	<i>Cymatium pileare</i>	Rannelidae	13	5

In the mangrove vegetation, *Sonneratia alba* is found in seedlings category and gastropods of *Littoraria scabra* 44%, which lives attached to trunk and leaves by climbing trees. The dominant type of gastropod and found attached to the leaves of mangrove plants is *Littoraria scabra* and *Littoraria melanostoma*. Generally gastropods found in leaves took calcium carbonate contained in these plants by eating leaves [9]. Gastropods living in mangrove trees attached to roots or mangrove stems and some are climbing, for example in *Littoraria* and *Cassidula* [10].

Value of Diversity, Similarity and Dominance Index of Gastropod on Mangrove

Based on the data analysis, total population, Diversity Index (H'), Similarity Index (E) and Dominance (D) Gastropod at first, second and third sampling in each research station are presented in Table 4. Based on the result of research, the value of environmental chemical physics parameter and substrate type presented in Table 5.

Table 4. Value of Diversity, Similarity and Dominance Index of Gastropoda on Mangrove

Stasion	Type of Mangrove	Σ Total	Σ Type Population	Index Value H'	Index Value E	Index value D
1.	<i>Avicennia lanata</i>	179	15	2.165	0.799	0.142
2.	<i>Rhizophora apiculata</i>	247	13	1.735	0.676	0.282
3.	<i>Sonneratia alba</i>	278	11	1.702	0.709	0.260

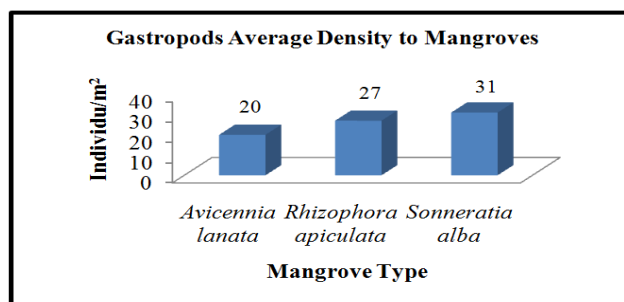
Table 5. Physical Chemical Parameter and Substrate Type

Station	Type of Mangrove	Water temperature (°C)	Substrate pH	Salinity (‰)	C-Organic (%)	Sediment type
I	<i>Avicennia lanata</i>	29.3	6.2	24.3	1.89	Sandy Clay Loam
II	<i>Rhizophora apiculata</i>	29.7	5.4	24	4.12	Sandy Clay Loam
III	<i>Sonneratia alba</i>	29.7	5.8	25	7.22	Sandy Clay Loam

The value of Similarity index (E) ranges (0.676-0.799), Diversity index was 1.702 to 2.165 in the medium category, Dominance index from 0.142 to 0.282 belongs to the low category. A community was said to have high species diversity if the community was composed by many types Abundance of the same or almost the same kind. Conversely, if the community is made up of very few species and if only a few dominant species were of low biodiversity [11]. If the index of dominance is "low" then in the community being observed there is no extreme species dominating other species. This shows the condition of the community in a stable condition and environmental conditions were quite excellent [12].

The result of water temperature measurement at the three stations ranged from 29.3-29.7°C, the value of acidity degree (pH) of substrate ranged from 5.4-6.2, salinitas research location ranged from 24-25 ‰. The range of gastropod pH tolerance ranging from 5 to 9 is generally found in areas with more pH Greater than 7, High or low salinity will not affect the presence of gastropod species, because Gastropoda has adaptability or tolerance to salinity [13].

Average density of the gastropods on mangrove, the highest was found on *Sonneratia alba* 31 individuals / m² while the lowest found on *Avicennia lanata* 20 individuals / m². The difference in density is due to the selection of preferred feed sources depending on species of molluscs present, so that the availability of feed at the site is an important factor related to the density. In addition, the range of water depth is commonly associated with the way of life and foraging from some families of gastropods [14]. The density of Gasropoda on Mangrove can showed on figure 1.

**Figure 1.** Gastropod Density of Mangrove Types

4. Conclusions

Gastropods that live on the mangrove ecosystem in Village Lubuk Kertang there were 8 Families and 15 species Gastropods found in three types different mangrove vegetation, results calculation diversity index in medium category, similarity index in low category and dominancy index was low. The highest gastropod density was 31 individuals/m² in the mangrove *Sonneratia alba*.

5. References

- [1] Sari S Pratomo A and Yandri F 2014 Relation of mangrove density to pelecypoda abundance at costal area of tanjung pinang riau *Journal of University Maritime of Raja Ali Haji Riau Kepulauan Tanjung Pinang*
- [2] Rusnaningsih 2012 Gastropoda community structure and population study cerithidea obtuse (lamarck 1822) in mangrove forest pangkal babu, tanjung jabung barat district, jambi. University of Indonesia Depok
- [3] Lina F Lestari and Zulfikar A 2014 Gastropoda community in mangrove ecosystem nyirih river tanjungpinang district tanjung pinang municipality *Journal of University Maritime of Raja Ali Haji, Riau Kepulauan Tanjung Pinang*
- [4] Carpenter K E and Niem V H 1998 The living marine resource of the western central pacific vol. 1 seaweeds, corals, bivalves and gastropods Italy
- [5] Saptarini D I Trisnawati and Hadiputra M A 2011 Community structure gastropoda (moluska) mangrove forest sendang blue, South Malang *Journal of Surabaya Institute Technology Surabaya*
- [6] Odum E P 1983 *Basic Ecology* (Canada: CBS College Publishing) p 613
- [7] Afkar Djufri and Ali M S 2014 Makrozoobenthos association with mangrove ecosystem in reuleng leupung river, aceh besar distric *Journal of EduBio Tropika* **2**: 187-250
- [8] Nasution N A Yunasfi and Rangkuti A M 2016 Relation of mangrove density to mollusc density in dusun ii of pulau sembilan village, pangkalan susu sub-district, langkat regency, north sumatera province *Journal of Aquacoastmarine* **14**: 11-18
- [9] Muhsin Jamili and Hendra 2016 distribution of vertical gastropoda on mangrove rhizophora apiculata in kendari bay *Journal of Biological Research* p 2355-6404
- [10] Pribadi R R Hartati and Suryono C A 2009 Composition of type and distribution of gastropoda in mangroveforest area segara anakan Cilacap *Journal of Marine Science* **14**: 102-111
- [11] Ernanto R F Agustriana and Aryawati R 2010 Community structure of gastropoda on mangrove ecosystem in estuary of batang ogan komering ilir river South Sumatra *Journal of Maspari* p 73-78
- [12] Ramses Notowinarto and Dewi I S 2016 Community structure mollusca penempel on mangrove vegetation in pulau kasu subdistrict padang city of Batam *University of Kepulauan Riau Batam*
- [13] Romdhani A M Sukarsono and Susetyarini R E 2016 Diversity of gastropoda mangrove forest village baban subdistrict gapura sumenep regency as a source of biology learning *Journal of Biology Education Indonesia* pp 2442-3750
- [14] Islami M M 2015 Spatial gastropoda and its relation to environmental characteristics on the coast of nusaulaut island, central maluku *Journal of Tropical Marine Science and Technology* **7**: 365-378