

Morphometric analysis, density and diversity of macroalga in Dara Mara marine waters, Anarae Village, Nuse Rote Ndao

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ABSTRACT

This research was about morphometric analysis of macroalgae, density and diversity, located in marine waters of Dara Mara, Anarae Village, Ndao Nuse Sub District, Rote Ndao Regency. This study aims to identify and measure the morphometric, density and diversity of macroalgae. Transect line method using quadrants were used in this study. The results showed that there were 21 macroalgae species consisting of 11 species of Chlorophyta, 3 species of Phaeophyta and 7 species of Rhodophyta. The highest species and relative density of macroalgae were found in *Caulerpa* species which were 6.8 individuals/m² and 51.127%, while the lowest were *Codiumedule*, *Halimeda opuntia*, *Monostroma nitidum*, *Dictyota cervicornis*, and *Padina japonica*, which were 0.033 individuals/m² and 0.250%. The diversity index were low with the value of H' 0.76, while the morphometric analysis of each species showed significant differences in each type of algae, presumably due to differences of environmental factors.

Key words : Macroalgae, Morphometrics, Diversity.

Introduction

East Nusa Tenggara is one of the island provinces which is the largest seaweed supplier province in Indonesia. Most of the people of East Nusa Tenggara who live in coastal areas are fishermen and seaweed farmers which is on the islands of Sumba, Sabu, Rote, Semaun and Timor Island. In addition *Kappaphycus* and *Eucheuma* species is the types of seaweed that are cultivated. The waters of East Nusa Tenggara also have seaweed diversity spread throughout the coastal and water areas of East Nusa Tenggara. Seaweed known as macroalgae is divided into three classes, namely Chlorophyceae (green algae), Phaeophyceae (brown

algae), and Rhodophyceae (red algae).

Macroalgae is a plant that has organs such as leaves, stems, roots that are not clear or not clearly differentiated. This is because only at a glance there are many types of algae that show external forms such as having roots, stems, leaves and even fruit, even though it is all just a false form (Nontji, 2007). One area in East Nusa Tenggara Province that has macroalgae potential is Rote Ndao District. This regency is an archipelago district where one of the islands is Rote Island. Rote Ndao Island was a separated island and the outermost island of the islands that are in the area of Rote Ndao Regency and the position of the island is adjacent to the Australian sea waters. Ndao people, especially in Anarae Vil-

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lage, generally only know a few types of macroalgae, especially those that are commonly eaten or cultivated while others are not well known.

Macroalgae found in the coastal areas of Dara Mara Beach, Anarae Village are varied, this may be due to the level of aquatic fertility, and physical conditions such as currents, depth, substrate and temperature. Therefore this study was designed to identify the type, diversity and density of macroalgae, to analyze macroalgae morphometrics to determine the length, width, height and other intra-specific factors.

Methods

This research was carried out in the intertidal zone of Dara Mara Beach in Ndao Nuse District, Rote Ndao District.

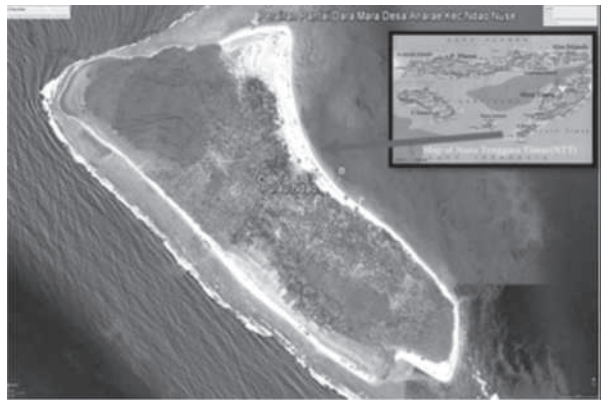


Fig. 1. Ana Dara Marine Waters Rote Ndao (10°49'S – 122°40'E) (Google Earth)

Data collection was done by using a line transect with quadrant sampling technique is modified Krebs (1999). Sampling was carried out by placing a transect line at the study location and was divided into three transect lines with each 100 m long transect placed perpendicular to the coastline. Retrieval at low tide, so that the macroalgae sample can be seen clearly and easily collected. Each transect line is placed 10 quadrants with a distance of 10 m, the size of the quadrant is 1 x 1 m². Each individual macroalgae found identified using identification books of (Jha, 2009; Calumpong, 2002; Trono, 1997) as a reference to identify the types of macroalgae.

Data analysis

Analysis of macroalgae community structure is used in the formula adopted from Krebs (1989) and

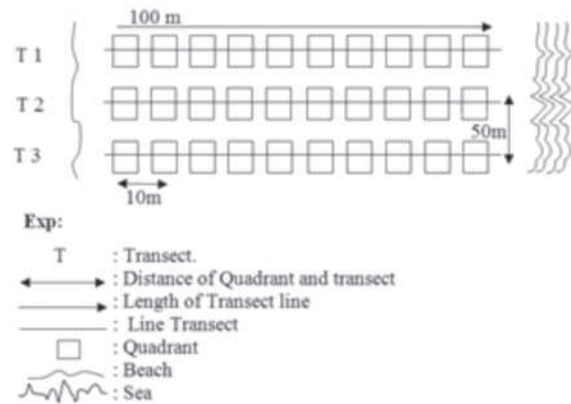


Fig. 2. Design of Transect Line

Odum (1993) namely:

$$\text{Density} = \frac{\text{Number of species}}{\text{Total are sampling (m)}^2}$$

$$\text{Relative Density} = \frac{\text{Number of Species}}{\text{Total Species (m)}^2} \times 100$$

Diversity

Diversity index uses the Shannon-Wiener index for general diversity (H') (Odum, 1993) with the following formulations:

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

Where :

H' = Shannon-Wiener diversity index
 pi = fraction of the entire population made up of species i

S = number of species encountered
 Σ = sum from species 1 to species S

Criteria :

- H' > 3 = High species diversity,
- 1 ≤ H' ≤ 3 = Abundant species diversity,
- H' < 1 = low species diversity

Results and Discussion

Anarae Village is one of the five villages in the Ndao Nuse Subdistrict, Rote Ndao District, with an area of 2.4154 m² and a coastal area of 350 m². The results showed that Anarae village contained various types of macro algae with various substrates such as sand mixed with mud, dead coral fragments

mixed with sand and muddy water. The dominant substrate in these area was a small coral fracture mixed with sand along the waters of Dara Mara Beach. Based on the location and condition of the topographic form, the Anarae Village is an open area which is directly facing the sea and this area is a lowland whose land is the same height as sea level.

Composition of Macroalgae

Based on the results, macroalgae were mixed vegetation from various species. Of the 21 species found Chlorophyta division were 11 species, Phaeophyta division were 3 species, and Rhodophyta division were 7 species.

Density of macroalgae type

The composition of the highest species was Chlorophyta division there were 11 species, the lowest composition was from the Phaeophyta division there were 3 species, while Rhodophyta division had 7 species. The analysis of macroalgae abundance in Dara Mara marine water were presented in the Table 2.

Data analysis shows that the highest species density in Dara Mara Beach found in *Caulerpa lentillifera* with value of 6.8 individuals/m² while the lowest density was found in *Codium edule*, *Monostroma nitidum*, *Dictyota cervicornis* and *Padina japonica*, with

values of 0.033 individuals/m². Based on the species density standard by Ayhuan *dkk.* 2017 it can be categorized that the density of macroalgae species at Dara Mara Beach is at a moderate level because the

Table 2. Species Density of Macroalga

No	Species Macroalgae	Species Density (ind/m ²)
1.	<i>Caulerpa lentillifera</i>	6.80
2.	<i>Chaetomorpha crassa</i>	1.93
3.	<i>Codium edule</i>	0.03
4.	<i>Enteromorpha compressa</i>	0.7
5.	<i>Enteromorpha intestinalis</i>	0.2
6.	<i>Halimeda cylindracea</i>	0.1
7.	<i>Halimeda incrassata</i>	0.06
8.	<i>Halimeda opuntia</i>	0.03
9.	<i>Monostroma nitidum</i>	0.03
10.	<i>Neomeris annulata</i>	0.06
11.	<i>Ulva lactuca</i>	0.06
12.	<i>Dictyota cervicornis</i>	0.03
13.	<i>Padina australis</i>	0.06
14.	<i>Padina japonica</i>	0.03
15.	<i>Acanthophora spicifera</i>	1.13
16.	<i>Ceratodictyon spongiosum</i>	0.13
17.	<i>Eucheuma spinosum</i>	0.36
18.	<i>Gracilaria arcuata</i>	0.63
19.	<i>Gracilaria heteroclada</i>	0.16
20.	<i>Hypnea boergesenii</i>	0.1
21.	<i>Laurencia papillosa</i>	0.6

Table 1. Composition of Macroalgae

No	Macroalgae Species	Devision	Transect I	Transect II	Transect III
1	<i>Caulerpa lentillifera</i>	Chlorophyta	-	√	√
2	<i>Chaetomorpha crassa</i>		√	√	√
3	<i>Codium edule</i>		-	√	-
4	<i>Enteromorpha compressa</i>		√	√	√
5	<i>Enteromorpha intestinalis</i>		√	-	-
6	<i>Halimeda cylindracea</i>		√	√	-
7	<i>Halimeda incrassata</i>		√	√	-
8	<i>Halimeda opuntia</i>		-	-	√
9	<i>Monostroma nitidum</i>		-	√	-
10	<i>Neomeris annulata</i>		-	-	√
11	<i>Ulva lactuca</i>		-	√	-
12	<i>Dictyota cervicornis</i>	Phaeophyta	-	-	√
13	<i>Padina japonica</i>		-	√	-
14	<i>Padina australis</i>		-	√	√
15	<i>Acanthophora spicifera</i>	Rhodophyta	-	√	√
16	<i>Ceratodictyon spongiosum</i>		√	√	-
17	<i>Eucheuma spinosum</i>		√	-	√
18	<i>Gracilaria arcuata</i>		-	√	√
19	<i>Gracilaria heteroclada</i>		-	√	-
20	<i>Hypnea boergesenii</i>		-	√	-
21	<i>Laurencia papillosa</i>		√	√	√

species density is greater than 20 species.

Relative Density

The Relative density of macroalgae in Dara Mara Marine Waters showed the highest relative density was in the Chlorophyta division from the *Caulerpa lentillifera* with a value of 51,127%, followed by *Caetomorpha crassa* with a value of 14,536%. While the lowest density was a mixture of Chlorophyta, Phaeophyta and Rhodophyta divisions namely *Codiumedule*, *Monostroma nitidum*, *Dictyota cervicornis* and *Padina japonica* with a value of 0.250%. Shows in Figure 3.

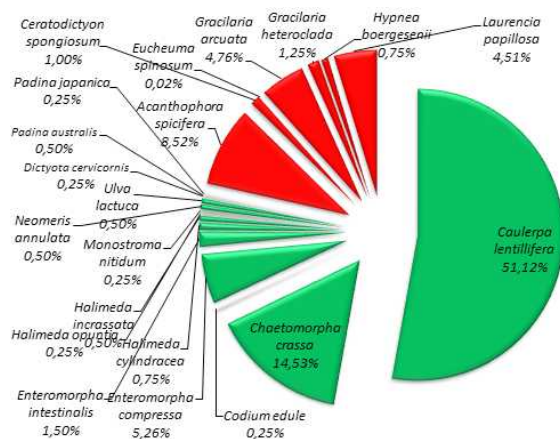


Fig. 3. Relative Density of Macroalga

Species Diversity

The diversity index Analysis (H') shows that the value of diversity (H') was 0.761 and categorized in the low diversity index. Atmadja (1996) states that low diversity was probably caused by the influence of environmental factors. Another thing that causes low macroalgae diversity was suspected due to the competition of other plant which seagrass also grows abundantly in the same area. Other factors that affect macroalgae diversity were environmental disturbances, physiological pressures that cause by the environment such as grassing or predation of herbivore animals (fish or turtles). The interaction of environmental ecology such as abundance has an important influence on species diversity in a habitat. If the community is composed by very few species and only a few species are dominant, then the community has a low diversity (Atmadja, 1996).

Morphometric analysis

Morphometric analysis showed that each measure-

ments of macroalgae species had differences in size and shape (length, height, width, stem diameter and branching) although in the same species, they had varying sizes. This is allegedly caused due to differences and the influence of environmental factors.

Conclusion

Based on the results of research conducted in the waters of Dara Mara Beach Anarae village, Ndao District Nuse, Rote Ndao District, it can be concluded as follows: 21 macroalgae species consisting of 11 species of Chlorophyta, 3 species of Phaeophyta and 7 species of Rhodophyta. The highest species and relative density of macroalgae were found in *Caulerpa lentillifera* species which were 6.8 individuals/m² and 51.127%, while the lowest were *Codium edule*, *Halimeda opuntia*, *Monostroma nitidum*, *Dictyota cervicornis*, and *Padina japonica*, which were 0.033 individuals/m² and 0.250%. The diversity index were low with the value of H' 0.76, while the morphometric analysis of each species showed significant differences in each type of algae, presumably due to differences of environmental factors.

References

- Afrianto, E. and Liviawati, E. 1993. *Seaweed Culture and Processing*. Jakarta: PT. Bhatara Niaga Media. 58 P.
- Afrianto, E. and Liviawati, E. 1993. *Budidaya Rumput Laut dan Cara Pengolahannya*. Penerbit Bhartara. Jakarta.
- Aslan, L.M. 1998. *Budidaya Rumput Laut*. Kanisius. Yogyakarta.
- Aslan, L.M. 1998. *Seaweed Culture (Revise Edition)*. Yogyakarta: Kanisius
- Atmadja, W., Kadi, S.A., Sulistijo, Satari, R. 1996. *Introduction of Indonesian Macroalgae*. Puslitbang Oceanology LIPI. Jakarta.
- Atmadja, W.S., A. Kadi; Sulistijo and Rachmaniar. 1996. *Pengenalan Jenis-jenis Rumput Laut Indonesia*. Puslitbang Oseanologi-LIPI. Jakarta.
- Ayhuan, H.V., Neviaty, P.Z. and Dedi, S. 2017. Analisis Struktur Komunitas Makroalga Ekonomis Penting di Perairan Intertidal Manokwari, Papua Barat. *Jurnal Teknologi Perikanan and Kelautan*. 8(1) : 19-38.
- Bold, H.C. and Wynne, M.J. 1985. *Introduction to the Algae : Structure and Reproduction*. 2nd. ed Prentice hall, Inc., Englewood cliffs
- Bold, H.C. and Wynne, M.J. 1987. *An Introduction of Algae*. Oxford Publishing CO. United State of America
- Calumpong, H.P. and Menez, E.G. 1997. *Field Guide to the Common Mangrove, Seagrasses, and Algae of the Philippines*. Bookmark Inc. Makati City. Philippines.

- Guiry, M.D. and Guiry, G.M. 2007. *Algae base*. World-wide electronic publication National University of Ireland, Galway. <http://www.algabase.org>.
- Hidayat, A. 1994. *Budidaya Rumpun Laut*. Surabaya: Penerbit Usaha Nasional. 96 hal.
- Hoey, A.S. and Bellwood, D.R. 2011. Suppression of herbivory by macroalgal density: a critical feedback on coral reefs?. *Ecology Letters*. 14(3) : 267-273.
- Hull, S.C. 1987. Macroalgal mats and species abundance: a field experiment. *Estuarine, Coastal and Shelf Science*. 25(5) : 519-532.
- Jha, B., Reddy, C.R.K., Thakur, M.C. and Rao, M.U. 2009. Seaweeds of India. The Diversity and Distribution of Seaweed of Gujarat Coast. New York.
- Krebs, C.J. 1989. *Ecological Methodology*. Addison Wesley Longman, Inc. New York.
- Krebs, C.J. 1999. *Ecological Methodology*. Second Edition. Addison Wesley Longman, Inc. New York.
- Marianingsih, P., Amelia, E. and Suroto, T. 2013. Inventory and Identification of Macroalgae Marine Water Untung Island Jawa. *Proceeding SEMIRATA 2013*, 1(1).
- Nontji, A. 2007. *Laut Nusantara* Penerbit Djambatan. Jakarta. 75P
- Nybakken, J.W. 1998. *Biology Laut*. Pendekatan Ekologi. Jakarta: PT. Gramedia Pustaka Utama. 367 P
- Nybakken, J.W. 1998. *Ocean Biology Laut*. Ecological Approach. Jakarta: PT. Gramedia Pustaka Utama. 367 P
- Odum, P.E. 1993. *Basic of Ecology*. Third Edition. Yogyakarta: Gadjah Mada University Press..
- Odum, P.E. 1993. *Dasar Ekologi*. Third Edition. Yogyakarta: Gadjah Mada University Press.
- Trono, G.C. 1997. *Field Guide and Atlas of the Seaweed Resources of the Philippines*. Bookmarks, Inc. Makaty City. 306 hal.
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