

The Diatom Community in Maluku Coastal Water in West Sumbawa

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Abstract – The existence of diatoms greatly affects the life in the water as it plays some important roles as a source of food for various organisms in aquatic ecosystems. In addition, the diatoms existence is commonly used as an environmental bio-indicator. The purpose of this study was to determine the diatom community structure in the Maluku Coastal waters. The water sample was taken from three coastal waters areas by using plankton net of 20 μm in size and there thirty-eight diatom species were identified. Data of diatom community were analyzed by using parameters of density, species diversity index, species evenness index, and values of importance for diatom species. The density of diatom in all sampling sites is 1600 ind./L. Five species of diatoms that have the highest density were *Asteroplanus karianus* (573.333 ind./L), *Thalassiothrix longissima* (423.333 ind./L), *Striatella unipunctata* (130 ind / L), *Gyrosigma scalprum* (50 ind / L), and *Licmophora abbreviate* (40 ind/L). The diversity index value of the diatom species was in moderate category (1.964). *Asteroplanus karianus* was a species that can be found in all three sampling sites and with the highest value of importance of 40.751%. The diatom species evenness index was 0.522, which means that the diatom species were not distributed evenly, because there were several species dominating with a large number of individuals at certain sampling sites.

Keywords - community, diatom, Maluku coastal water

I. INTRODUCTION

Coastal ecosystems are dynamic ecosystems and have a variety of diverse habitats and have enormous biological potential resource. One of the most important biological resources in the presence of marine ecosystems is phytoplankton, especially diatoms [1]. Diatoms as a component of phytoplankton are functioning as primary sources for aquatic ecosystems.

The existence of diatoms greatly affects the life in the coastal waters because the diatoms play an important role not only as the source of food for various marine organisms but also in the transfer of carbon, nitrogen and phosphate. Changes in the function of waters were caused by some factors coming not only from the nature but also from human activities. These changes often results in the changes in the structure and quantitative value of microalgae, especially diatoms because these organisms have varied responses, ranging from very vulnerable to high tolerance to any conditions that occur in the coastal waters and diatoms are one of the organisms commonly used as an environmental bio-indicator [2]. Diatoms are

very effective and economical bio-indicators for environmental changes because they have several advantages compared to other organisms, in which diatoms have wide distribution with varied populations, have the important role in the food chain and short life cycle, they are fast reproducing and are found in almost all substrates so that they are able to record the history of their habitat, many of their species are sensitive to environmental changes so that they are quick to respond, able to reflect changes in water quality in the short and long terms, and they are easy in sampling, analysis and identification [3]. This study would like to discover how the structure of the diatom species community in the coastal waters in Maluku, West Sumbawa is, which was analyzed by using density parameters, species diversity index, species evenness index, and the value of importance.

II. RESEARCH METHOD

Seawater samples were taken at 3 points on the coastal waters of Maluku, West Sumbawa in July 2018. Samples were taken by filtering 100 liters of seawater by using a 20 micron-meter plankton net. Samples were preserved with formalin at a preservation concentration of 4%. Observation and identification of diatom species were carried out at the Biology Laboratory of FMIPA the university of Mataram. Diatom species identification is done morphologically [4] based on sources written by [5], [6], [7], [8], and [9].

III. RESULTS AND DISCUSSION

Thirty-eight diatom species were identified in the Maluku Coastal waters. It showed that the sampling point III has the largest population of 33 species. Whereas, at sampling points I and II there are 10 and 18 species, respectively (Figure 1).

The number of diatom species found in Maluku Beach is 38 species, higher if compared to 26 diatom species found in Jeranjang Beach [10] and 31 diatom species found in Dumai coastal waters, Riau [2]. But this number is fewer than 70, the number of diatom species found in the waters of the North, East, and South Beaches of Lombok Island [11], and 74 species in the Mangrove Waters of the Gili Sulat East Lombok Habitat [12]. It is found that 6 out of the 38 species spreading throughout the study sites are *Asteroplanus karianus*, *Climatosphenia moniliger*, *Coscinodiscus radiatus*, *Navicula lyra*, *Striatella unipunctata*, and *Thalassiothrix longissima*.

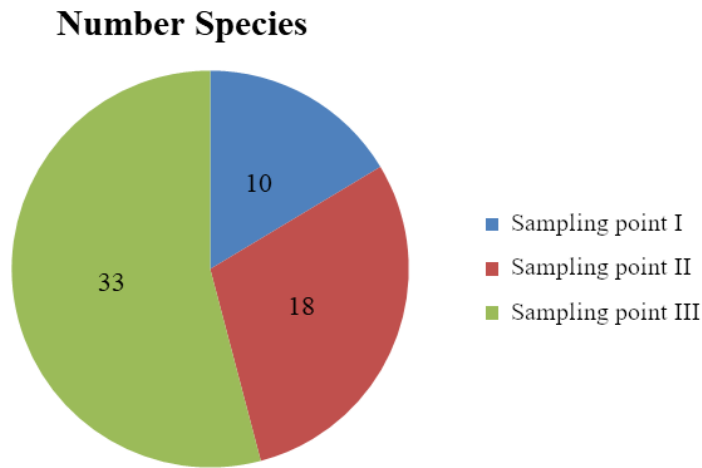


Fig. 1. Comparison of the Number of Diatom Species Taxonomy

A. The Diatom Species Density

The total diatom density in the Maluk coastal waters is 1,600 individuals / liter. Diatom density at each of the highest sampling points is at sampling point III, which is 1163.333 ind / L while at sampling points I and II are 136,667 ind / L and 350,000 ind / L, respectively. The average \pm SD diatom density at the three sampling areas (I, II, and III) of research was $1 \pm 10,541$ ind / L, $19,444 \pm 32,000$ ind / L, and $32,253 \pm 97,951$, respectively. The comparison of the average density of diatoms at each point of the study site can be seen in Figure 2.

The diatom species that have the highest density are *Asteroplanus karianus* with density of 573,333 ind / L, *Thalassiothrix longissima* has 423,333 ind / L density, *Striatella unipunctata* has 130 ind / L density, *Gyrosigma scalprum* has 50 ind / L density, and *Licmophora minimize* has 40 ind / L density. Whereas *Camphylodiscus undulates*, *Cocconeis scutellum*, *Grammatophora marina*, *Mastogloia decussate*, *Navicula membranacea*, *Nitzschia frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Rhizosolenia alata*, and *Triceratium reticulum* are diatom species which have 3.333 ind / L, the lowest density.

The species that have the highest density is assumed to be caused by the physical chemistry factors of the waters, so the organic matter content is high. The large amount of dissolved inorganic nitrogen and dissolved phosphorus also causes the high density of *Asteroplanus karianus*. According to [13], dissolved inorganic nitrogen and dissolved inorganic phosphorus are significantly lower in the areas where *Asteroplanus karianus* breeds and this causes nutritional deficiencies for *Pyropia*.

Study findings [14] indicate that in Ariake coastal waters, Japan *Asteroplanus karianus* is a dangerous diatom species because it can cause bleaching in *Pyropia*. Field study findings show that *A. karianus* causes red tides only in winter on most beaches, such as the western and eastern waters of the Dutch coastal waters, Baltic coastal waters, and Ariake coastal waters. Nonetheless, laboratory study findings show that the growth rate of *A. karianus* is higher within condition of high water temperature than that low water temperature. However, *A. karianus* does not grow well at 30° C [13], meanwhile the water temperature in the Maluk coast at the time of the study was 25° C.

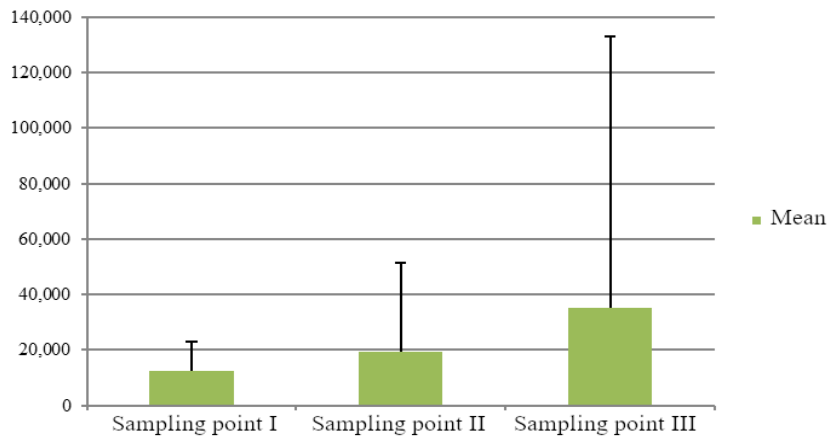


Fig. 2. The Comparison of Average Density of Diatom Species

B. The Species Diversity and Evenness Index

Diatom species diversity index in Maluku Beach is classified as moderate, that is 1.964. The sampling point II has the highest species diversity index with 2.039, and the sampling point I has the lowest species diversity index with 2.028 (Figure 3). Further, evenness index of diatom species in Maluku Beach is 0.522 (uneven distribution). The highest species evenness index is at sampling point I with 0.881, and the lowest is at sampling point III with 0.581 (Figure 3). The air temperature at the sampling point I is the tolerance limit of diatom species to the ambient temperature for the place to live, namely 28°C.

The overall species diversity index value is 1.964, which is categorized as medium. This relates to the adaptation of each species to the salinity of seawater 29‰ and the pH of seawater amounting to 7. The classification is based on [15], in which if $H' < 1.0$, species diversity is categorized as low, low productivity as an indication of the existence of heavy pressure and unstable ecosystem. If the value is $1.0 < H' < 3.322$, it is categorized as moderate diversity, sufficient productivity, ecosystem condition is quite balanced, moderate ecological pressure. If $H' > 3.322$, it is categorized as high diversity, good ecosystem stability, high productivity, resistant to ecological pressure.

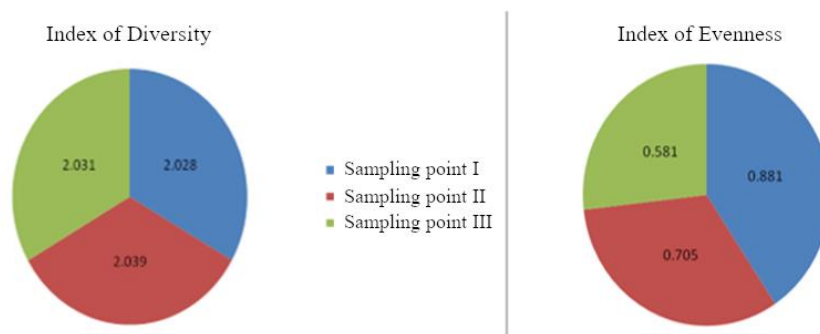


Fig. 3. Comparison of Diversity and Evenness Indexes of Diatom Species

The Evenness of diatom species in Maluku coastal waters is 0.522. According to [16], if evenness is close to zero, the evenness between species is low and, in contrast, evenness of species that is close to one can be said to be even or equal. The low index of evenness for diatom species in Maluku Beach at the sampling point which has a high density indicates that there are several species that dominate with a large number of individuals. All types of organisms such as plants, diatoms can be bio-indicators for their environment [17].

C. The Value of Importance

The species value of importance for members of the Bacillariophyceae class from the three study sampling points was significantly different. The species that has the highest value of importance with 40.751% is *Asteroplanus karianus*. This is because the species *A. karianus* was found with the highest amount of density with 573,333 ind / L, compared to other diatom species. Whereas *Camphylodiscus undulatus*, *Cocconeis scutellum*, *Grammatophora marina*, *Hantschia amphioxys*, *Mastogloia decussata*, *Navicula membranacea*, *Navicula cancellata*, *Nitzschia frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Mastogloia decussata*, *Navicula membranacea*, *Navicula cancellata*, *Nitzschia frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Mastogloia decussata*, *Navicula membranacea*, *Navicula cancellata*, *Nitzschia frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Mastogloia decussata*, *Navicula membranacea*, *Navicula cancellata*, *Nitzschia frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Rhizosolenia alata*, coral specula, and *triceratium reticulum* have the lowest value of importance with 1.848%.

IV. CONCLUSION

Based on the results of the study, it was concluded that the diatom community structure in the Maluku Coastal Waters are: (1) There were 38 species identified with a density of 1600 ind / L. (2) The diatom species diversity index was 1.946. (3) The evenness index of diatom species was 0.522. (4) The Species that have the highest value of importance were *Asteroplanus karianus* with 40.751%, while those of *Chaetoceros decipiens*, *Camphylodiscus undulatus*, *Cocconeis scutellum*, *Grammatophora marina*, *Hantschia amphioxys*, *Mastogloia decussata*, *Navicula membranacea*, *Navicula cancellata*, *Nitzschia Frequens*, *Odontella aurita*, *Rhabdonema adriaticum*, *Rhizolenia alata*, and *Triceratium reticulum* have the lowest value of importance with 1.848%.

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