International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

Vol. 31 No. 1 February 2022, pp. 372-378

Structure Of The Phytoplankton Community In The Water Area Of The Small Islands Bungus Kabung Bay, Padang City

Vivi Safitri, Jabang Nurdin* and Nofrita

Department of Biology, Faculty of Matematics and Natural Science, Andalas University, Padang, 25163, West Sumatra, Indonesia

Abstract – Phytoplankton is a group of plankton that can carry out photosynthesis and their lives floating on the water surface because they are carried by currents or waves. Phytoplankton is a primary producer that can form organic substances from inorganic substances in the photosynthesis process. This research was carried out from December 2020 to July 2021 in the water area of the small islands of Bungus, Kabung Bay, Padang City. This study aims to determine the structure of the phytoplankton community in the waters of the small islands of Bungus, Kabung Bay. This study used a survey method and the sampling was determined by purposive random sampling. Based on this study, it was found that the phytoplankton diversity index in the waters of the Bungus Kabung Bay Island was included in the medium category with an even distribution in all locations and the absence of dominating species.

Keywords – community, phytoplankton, structure.

I. INTRODUCTION

The island is now a topic that is often used by the community in good travel. The Bungus Kabung Bay water area is one of the marine ecosystems in the southern part of Padang City, West Sumatra. According to Fitriani (2004), this area is used as a tourism area because it has many small islands that have clean beaches, clear water and very beautiful coral reefs. Small islands in this area include Setan Island, Pasumpahan Island, Ular Island, Sikuai Island, Sironjong Island, Sirandah Island, Bintangor Island, Sinyaru Island and many other small islands in the Bungus waters of Kabung Bay. As a result of the high utilization in the area, it is suspected that it will cause changes to sea conditions both in terms of physical and water quality. This will directly or indirectly affect the aquatic biota community that lives in it (Afrizal, 1993).

One of the aquatic biota communities that live in marine ecosystems is Plankton. Plankton is small organisms that live floating in the water and have limited movement because they cannot fight the movement of water or currents (Nybakken, 1992) because living plankton is influenced by water currents (Sachlan, 1982 in Adinogroho, Subiyanto and Haeruddin, 2014). Phytoplankton are primary producers capable of forming organic substances from inorganic substances in the process of photosynthesis. Phytoplankton is one of the parameters that determine primary productivity in the sea, because phytoplankton can photosynthesize in the presence of the chlorophyll pigment contained therein and with the help of sunlight. This makes phytoplankton referred to as primary producer, because they can form organic substances from inorganic substances (Thurman, 1994 *in* Aryawati, 2007).

Phytoplankton with high abundance is generally found in the waters around river mouths due to the entry of nutrients from the land that flows from the river to the sea (Nontji, 1984 *in* Alianto, 2006). In general, phytoplankton will be denser in waters near the coast and will decrease in waters towards the high seas due to lack of nutrients, and besides that they are not evenly distributed but live in groups (Arinardi, Sutomo, Yusuf, Trimaningsih, Asnaryanti and Riyono, 1997). Changes in the physical and chemical conditions of the waters will also cause the presence of a dominant type of phytoplankton (Wetzel, 1983 *in* Alianto, 2006).

Corresponding Author: Jabang Nurdin

It is suspected that the increased activity in these waters will reduce water quality and other environmental parameters and the composition of phytoplankton will also be high. Therefore, it is necessary to research the structure of the phytoplankton community in the water area of the small islands of Bungus, Kabung Bay, Padang City.

II. Research Methods

This research was carried out from December 2020 - to July 2021. Phytoplankton sampling was carried out in the water area of the small islands of Bungus, Kabung Bay, Padang City.The identification and analysis of phytoplankton data were carried out at the Laboratory of Animal Ecology, Department of Biology, Faculty of Mathematics and Natural Sciences, Andalas University. The tools used are GPS, digital camera, plankton net No. 25, Lamotte water sampler, 20 ml sample bottle, 3 cc syringe, plastic bag, rubber band, masking tape, permanent marker, microscope and stationery. The materials used are 4% formalin, and 5% Lugol.

Phytoplankton samples were taken at each location (Figure 1) by using a 100 l Lammote bottle sampler and then filtered using Plankton net No. 25. At each location, three repetitions were carried out. The filtered sample was put into a sample bottle and then given 40% formalin which was arranged in such a way that the formalin solution in the sample became 4% and labeled with label paper. and data analysis.

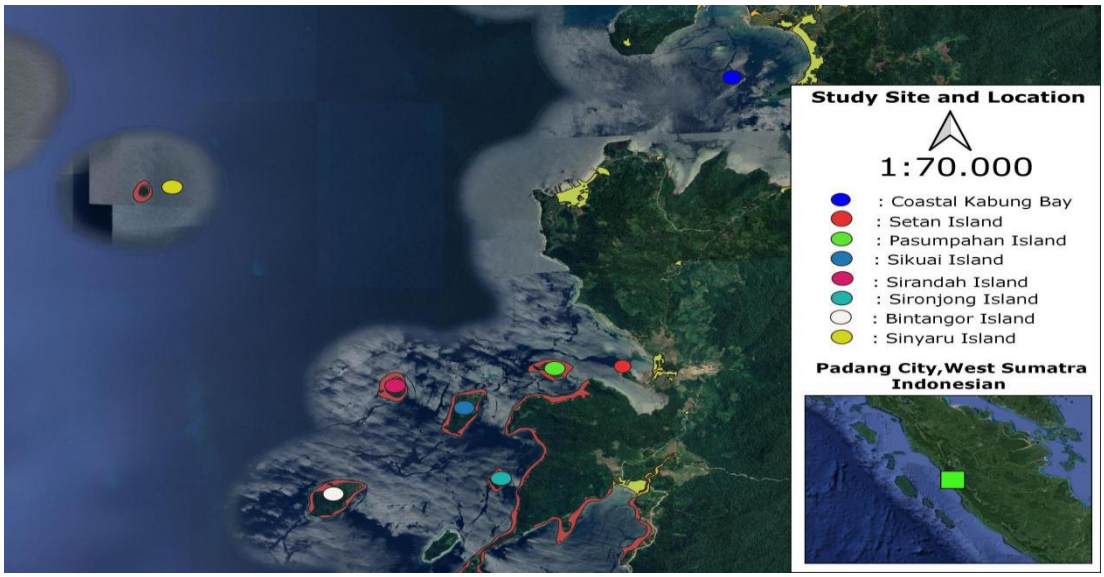

Figure 1. Research Locations (GIS)

Phytoplankton samples that have been taken in the field are removed from the cool box and then observed under a microscope as much as 1 ml. Observations were made drop by drop with magnification starting from 4x to 100x magnification. Phytoplankton samples obtained were photographed and identified using identification books such as Prescott (1978), Yamaji (1980), and Bold and Wyne (1985), as well as online identification through *algaebase.org* and *marinespecies.org*.

Data analysis

a. The density of phytoplankton is determined by using the formula:

$$K = \frac{axc}{l}$$

Note : K = Number of phytoplankton per liter (ind/l)

a = The average number of individuals of a phytoplankton species in 1 ml

c = Volume of sample concentrate (ml)

l = Volume of filtered water (l) (Michael, 1984)

b. The frequency of attendance is determined by using the formula:

$$FK = \frac{\text{the number of sample units occupied by a species}}{\text{number of units of the whole sample}} \text{ x } 100\%$$

(Michael, 1984)

c. Diversity Index (diversity)

Phytoplankton diversity was analyzed using the Shannon-Wiener Diversity Index.

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

Description: H' = Diversity Index

ln = Natural logarithm

pi = number of individuals of a species sum of individuals of all species

s = Number of all species (Michael, 1984)

The criteria for the diversity index are classified as follows:

H' < 1.0 : Low diversity index

1 ≤ H'≤ 3 : Medium diversity index

H' > 3 : High diversity index

(Stirn, 1991 *in* Pirzan and Pong-Cook, 2008)

d. Equitability Index (equality)

The evenness of the population in the community at each location is calculated using an evenness index, namely:

$$E = \frac{H'}{H \text{ maks}}$$

Note : E = Equitability Index (E ranges from 0-1)

H' = Shannon-Wiener diversity index

Hmax = ln s

s = number of species (Michael, 1984)

An evenness index is a non-unitary number whose magnitude is between 0-1. The greater the evenness index means that the individual distribution of each species is more evenly distributed and there are no dominant species, and vice versa (Odum, 1998).

e.Dominance Index

The Dominance Index is calculated using the Simpson Index of Dominance formula (Brower, Jerrold and Ende, 1990):

$$C = \frac{\sum ni \ (ni - 1)}{N \ (N - 1)}$$

Description: C = Dominance index

ni = Total number of individuals of the I species

N = Total number of individuals of all species.

The greater the value of the dominance index, the greater the tendency of the species to dominate.

III. Research Result

1. Phytoplankton Density

The waters area of the small islands of Bungus, Kabung Bay have phytoplankton densities that vary between 30.267 - 109.467 ind./l (Figure 2).

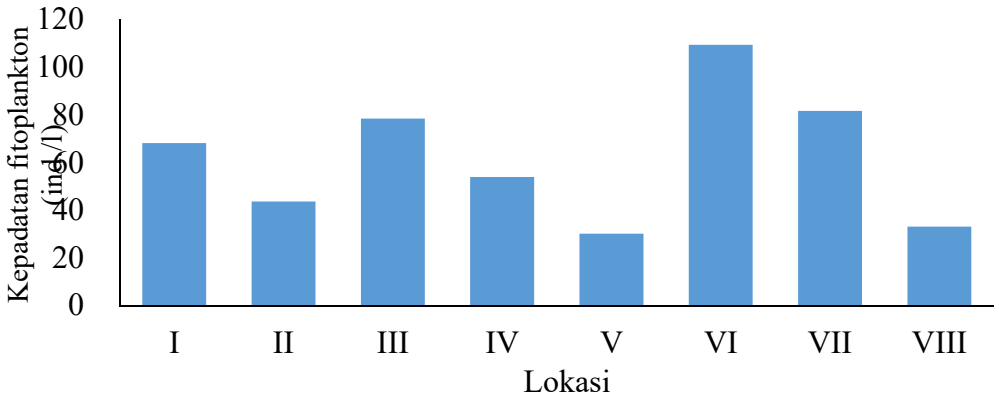

Figure 2. Phytoplankton density (ind./l) at each location in the water area of the small islands of Bungus, Kabung Bay, Padang City.

Note: I. Pesisir Pantai Teluk Kabung, II. Pulau Setan, III. Pulau Pasumpahan, IV. Pulau Sikuai, V. Pulau Sirandah, VI. Pulau Sironjong, VII. Pulau Bintangor, VIII. Pulau Sinyaru

2. Frequency of Phytoplankton Presence

The distribution of phytoplanktonin the water area of the small islands of Bungus, Kabung Bay can be seen from the Presence Frequency (FK) value of each species. According to Suin (2002), the grouping of attendance frequencies is divided into five categories, namely rarely (1-20%), sometimes there (21-40%), often there (41-60%), often (61-80%) and always present (>80%). Phytoplankton found in the water area of the small islands of Bungus, Kabung Bay are classified as rare to always present (Table 1).

Table 1. Frequency of phytoplankton presentin the water area of the small islands of Bungus, Kabung Bay, Padang City.

Criteria	FK(%)	Number of Species	FK Range(%)
Seldom	12,50	87	0-20
Sometimes there	25 - 37.5	72	21-40
Often there	50,00	22	41-60
Often	62.50 - 75.00	24	61-80
There always is	87.50 - 100	44	81-100

Note: FK range based on Suin (2002)

3. Diversity Index (H'), Equitability Index (E) and Phytoplankton Dominance Index (C)

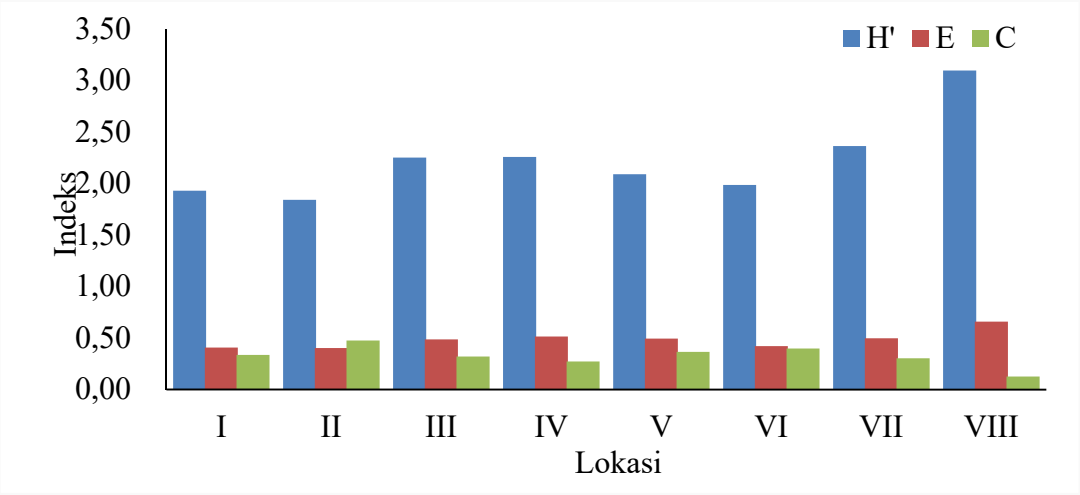

Figure 3. Diversity Index (H'), Equitability Index (E) and Phytoplankton Dominance Index (C) for each location in the water area of the small islands of Bungus, Kabung Bay, Padang City.

Note : I. Pesisir Pantai Teluk Kabung, II. Pulau Setan, III. Pulau Pasumpahan, IV. Pulau Sikuai, V. Pulau Sirandah, VI. Pulau Sironjong, VII. Pulau Bintangor, VIII. Pulau Sinyaru

The diversity index at each location ranged from 1.841 – 3.094 (Figure 3). The diversity index (H') is grouped into three categories, namely low (H' < 1), moderate (1 H' 3) and high (H' > 3) (Strin, 1991 *in* Pirzan and Pong-Masak 2008). Based on this category, the phytoplankton diversity index in the water area of the small islands of Bungus, Kabung Bay is classified as moderate which indicates that the ecosystemin the water area of the small islands of Bungus, Kabung Bay is still in good health or has not been polluted.

The equity index at each location ranges from 0.402-0.658, if the equity index obtained is close to 0 then the distribution is uneven so that there is a dominating species in it, whereas if the equity index value is close to 1 then the distribution is even and there are no dominating species (Odum, 1998). While the dominance index at each location ranged from 0.126 to 0.476, the higher the dominance index value, the greater the tendency for species to dominate (Brower, Jernold and Ende, 1990). The dominance index in the water area of the small islands of Bungus, Kabung Bay is almost close to zero, so this indicates that there are no dominant species.

IV. Discussion

The high density of phytoplankton on Sironjong Island is suspected because on this island there is marine aquarium tourism so that the remnants of fish feed that are not eaten by fish will settle so that these nutrients can be useful for phytoplankton growth. of the *Trichodesmium erythraeum* species. *T. erythraeum* is a type of phytoplankton that is often found in the sea. According to Sediadi (2004), the high density of *T. erythraeum* is usually caused by the season, nutrients and water temperature that affect its growth. *Trichodesmium* sp. can grow well at a temperature of 28 ° C but can also grow at temperatures between 20 - 34 ° C (LaRoche and Breitbart, 2005 *in* Pello, 2014). While the lowest density was found on Sirandah Island, this is presumably because on this island there is a lot of development for tourism so it is suspected that the various ongoing activities there cause changes in environmental quality, causing the low density of phytoplankton found on the island.

The frequency of the presence of phytoplankton was mostly found on the rare criteria, namely 87 species, while species with a frequency of presence of 81-100% (always present) were found in all observation stations in the water area of the small islands of Bungus, Kabung Bay as many as 44 species. all locations show that the species has a wide distribution so looking at the frequency of presence can describe the distribution of species, if the species has a high frequency of presence then the species is often found in that habitat (Nurdin and Anwar, 2002).

The highest diversity index was found at the Sinyaru Island location, which was 3,094 which was included in the high category (H' > 3) and the lowest was found at the Setan Island location, which was 1,841 into the medium category (1 H' 3). In the research of Gharib *et al.,* (2011) in the waters of Matrouh Beach, Egypt also obtained a diversity index that is classified as moderate to high, this is also followed by good and very good water quality from the results obtained in this study (based on WQI / *Water Quality Index*).

The equitability index at each location ranged from 0.402-0.658 (Figure 3), the highest equity index was at Sinyaru Island (0.658) and the lowest was at Setan Island (0.402). And the dominance index at each location ranged from 0.126-0.476 (Figure 3) and was almost close to zero, indicating that there were no dominant species in all of these locations. Although there are species that have a large number of individuals but are not classified as dominant in the station they occupy.

V. CONCLUSION

Based on research that has been done, the average phytoplankton density is 62,367 ind/l and the diversity index in the waters of the small islands of Bungus Kabung Bay is included in the medium category (H'=2.556) with an even distribution in all locations (E=0.463) and the absence of dominating species (C=0,270).

REFERENCES

[1] Adinugroho, M. Subiyanto and Haeruddin. 2014. Composition and Distribution of Plankton in Semarang Bay Waters. science. 16(2): 39-48.

[2] Afrizal, S. 1993. Diatom Algae Periphyton on Artificial Substrate in Cimahi River, West Java. Health and Science Edition. Andalas Research Journal V (12): 1-13.

[3] AlgaeBase. 2020. AlgaeBase: Listing The World's Algae. accessed from www.algaebase.org in November 2020.

[4] Alianto. 2006. Primary Productivity of Phytoplankton and Its Relationship with Nutrient and Light Elements in Banten Bay Waters. Thesis. Bogor Agricultural Institute. Bogor.

[5] Arinardi, O.H., A.B. Sutomo, S.A. Yusuf, Trimaningsih, E. Asnaryanti and S.H. Riyono. 1997. Range of Predominant Plankton Abundance and Composition in Eastern Indonesian Waters. Oceanology Research and Development Center. Indonesian Institute of Sciences. Jakarta.

[6] Aryawati, R. 2007. Abundance and Distribution of Phytoplankton in Berau Waters, East Kalimantan. Thesis. Bogor Agricultural Institute. Bogor.

[7] Bold, H.C. and M. J. Wynne. 1985. Introduction to the Algae, Second Edition. Prentice-Hall Mc. Engelwood Cliffs New York

[8] Brower J., H. Z. Jerrold and C. V. Ende. 1990. Filed and Laboratory Methods for General Ecology. Third Edition. W. M. C. Brown Publishers. USA.

[9] Fitriani, L. 2004. An Ecotourism Development Study in the Bungus Bay Area of Kabung Island, Padang City. Thesis. Bogor Agricultural Institute. Bogor.

[10] Gharib, S. M., Z. M. El-Sherif, A. M. Abdel-Halim and A. A. Radwan. 2011. Phytoplankton and environmental variables as a water quality indicator for the beaches at Mathrouh, South-Eastern Mediterranean Sea, Egypt : an assessment. Oceanology. 53(3) : 819-836.

[11] Marinespecies. 2020. World Register of Marine Species : WoRMS. accessed from www.marinespesies.org in November 2020.

[12] Michael, P. 1984. Ecological Methods for Field and Laboratory Investigation. Tata McGraw-Hill Publishing Company Limited. New Delhi.

[13] Nurdin, S and S. Anwar. 2002. Relationship between Plankton and Water Quality in "Oxbow Lake" Kenidai Bay, Kampar River Kanan. Terubuk XVII (51): 29-42.

[14] Nybakken, J. W., 1992. Marine Biology An Ecological Approach. PT. grammar. Jakarta.

[15] Odum, E. P. 1998. Fundamentals of Ecology. Gadjah Mada University Press. Yogyakarta.

[16] Pello F.S. 2014. The Relationship between Phytoplankton Productivity and Nutrient Availability with respect to Input Loads from Rivers and Seas in Deep Ambon Bay Waters. Dissertation. Graduate Faculty. Bogor Agricultural Institute. Bogor.

[17] Pirzan, A. M and P. R. Pong-Cook. 2008. Relationship between Phytoplankton Diversity and Water Quality on Bauluang Island, Takalar Regency, South Sulawesi. Journal of Biodiversity. 3(9): 217-221.

[18] Prescott, G.W. 1978. Freshwater Algae. Third Edition. W.M.C. Brown Company Publisher. London.

[19] Sediadi, A. 2004. Dominance of Cyanobacteria in Transitional Seasons in Banda Sea and Surrounding Waters. Makara Science Journal. VII(1):1-14.

[20] Suin, N. M. 2002. Ecological Methods. Andalas University Press. field.

[21] Yamaji, I. 1980. Illustrations of The Freshwater Plankton of Japan. Hoikusha Publishing Co. Ltd. Japan.