# Community Structure of Phytoplankton in Some Spermonde Islands South Sulawesi Indonesia

**Arina Mana Sikana[*], Catur Retnaningdyah[**], Nia Kurniawan[**]**

[*] Magister Biology, Brawijaya University

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***Abstract-*** Water conditions can be determined by examining the structure of the plankton community. The aim of this study was to evaluate the status of water quality and biota - primarily phytoplankton in the Spermonde Islands. Sampling was carried out at 3 locations in the Spermonde Islands, based on different types of anthropogenic activities, including: Bonebatang Island, Kodingareng Keke, and Barrang Lompo. The physical and chemical conditions of water at the test site in the Spermonde Islands were lightly polluted by organic matter, especially nitrates. The plankton community structure in the test islands shows the characteristics of diversity - low evenness; and high dominance by diatoms.

***Index Terms-*** Plankton, community structure, water quality, Spermonde.

## I. INTRODUCTION

Phytoplankton is very important for the food chain in the sea because it is the main producer that provides the largest contribution to the total primary production of an aquatic ecosystem and greatly determines the fertility and biological potential of these waters. The abundance of phytoplankton can provide information about aquatic productivity. Aquatic productivity in this case is a measure of the capacity of the waters in terms of supporting the life of organisms. The relationship between phytoplankton communities and aquatic productivity is positive [1]. If the abundance of phytoplankton in certain waters is high, it can be assumed that these waters have high water productivity. Oligotrophic waters have an abundance range of phytoplankton 0-2000 ind/ L, 2000-5000 ind/ L for mesotrophic waters, and greater than 5000 ind/ L for eutrophic waters [2].

Water conditions can be determined by examining the structure of the plankton community, particularly phytoplankton. Phytoplankton or often known as microalgae, are organisms that are quite sensitive to contamination, which is reflected in the level of population and/ or the rate of photosynthesis. Changes in phytoplankton species diversity tend to indicate pollution of aquatic ecosystems [3]. On the other hand, phytoplankton is also an important vector for the transfer of pollutants from water to the upper tropic levels.

Spermonde is an archipelago located on the west coast of South Sulawesi Province, precisely at the coordinates of 4°52'32.16″ S 119°06'51.84″ E. This area is composed of 120 islands, with a total population of ± 50000 people and most of them work in the fisheries [4]. This island is an area bustling with human activities, especially settlements, transportation and tourism.

The variety of human activities can affect and even damage coastal aquatic ecosystems as a habitat for various aquatic organisms, mainly plankton, such as changes in the structure of the its community. The decrease in the abundance and composition of these organisms is usually indicates the ecological disturbances occured in the coastal waters.

The purpose of this study was to determine the community structure (composition and abundance) of plankton, to determine the relationship between the organic matter content of the water and the structure of the biotic community and to determine the condition or level of water pollution by using the biotic community structure as bioindicator of coastal water quality. The results of this research activity are expected to provide information about the community structure of plankton as an indicator of Spermonde's water quality. Furthermore, this information can be used as a consideration in efforts to manage the coastal waters in Spermonde Islands.

## II. IDENTIFY, RESEARCH AND COLLECT IDEA

### *A. Determination of the observation location.*

This research was conducted in three islands of Spermonde: Barrang Lompo, Kodingareng Keke, and Bonebatang. Barrang Lompo Island has the highest anthropogenic activity, while Kodingareng Keke is a tourism spot with medium anthropogenic activity, and Bonebatang which is an uninhabited island. The sampling of each island was carried out at 1-3 stations which recorded using GPS (Global Positioning System).

**Table 1.** Coordinates, substrats and activities of observed areas in the Spermonde Islands.

| Location | Position | |
|---|---|---|
| | Longitude | Latitude |
| Bonebatang | 109$^0$ 19' 40,3'' | 05° 01'07,1'' |
| Kodingarengkeke | 119° 17'16,1'' | 05° 06'20,4'' |
| Barrang Lompo | 119° 19' 48,2'' | 05° 02'48,4'' |


**Figure 1.** Research sampling locations in Spermonde Islands.

*B. Identify the types of plankton.*

Plankton sampling followed the instructions of Marine Fisheries Research Agency which was carried out by filtering ± 30 L of water samples using plankton net measuring 25-250 msh at each research station. The samples then collected in the bottles dropped by 4% formalin, and stored in the coolbox. The process of identification and analysis of plankton was carried out in the Ecology laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Brawijaya University referring to the Marine Plankton identification book by Nontji [5] and other relevant sources.

*C. Environmental parameter measurement.*

Environmental parameters (physical and chemical quality of water) that are measured include pH, temperature, salinity, DO, BOD, and nitrate.

*D. Processing and analysis of data*

The data that has been obtained is tabulated properly as a whole and then analyzed with quantitative ecology to determine the structure of the plankton community (diversity, evenness and domination of species).

## III. WRITE DOWN YOUR STUDIES AND FINDINGS

In the observation in the three research locations, it was found that 13 phytoplankton species were classified into five classes (Table 4.3.1). The five classes consist of Bacillariophyceae, Dinophyceae, Cyanophyceae, Mediophyceae and Coscinodiscophyceae. Class Bacillariophyceae (diatom) represented by eight species, Dinophyceae (dinoflagellates), Cyanophyceae, Mediophyceae and Coscinodiscophyceae represented by one, one, one, and two species, respectively.

Based on the abundance of phytoplankton obtained in the test waters, it shows variations in the number of the three sampling locations. The average plankton abundance recorded in this study was 1501 ind/ l which in general classifies as oligotrophic waters [2], composed of a total of 13 phytoplankton species spread over three locations, with details: 1) Bonebatang Island, 11 species with a total abundance of 2644 individuals/ l, 2) Kodingareng Keke Island of 10 species with a total abundance of 1230 individuals/ l, and 3) Barrang Lompo Island of 5 species with a total abundance of 630 individuals/ l.

**Table 2**. Distribution & composition of phytoplankton found around Spermonde Islands.

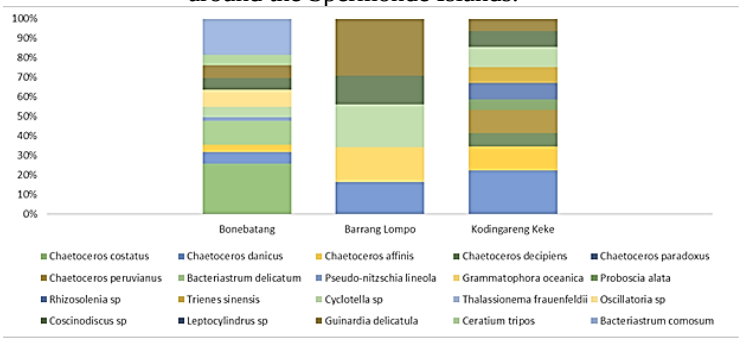
| Location* | Number of Genus/ Composition (%) | | | | |
|---|---|---|---|---|---|
| | Bacillario-phyceae | Cyano-phiceae | Coscinodisco-phyceae | Dino-phyceae | Medio-phyceae |
| **BB** | 6/ 60 | 1/ 7.5 | 2/ 5 | 1/ 0.6 | 1/ 26.9 |
| **KK** | 8/ 91 | 0/ 0 | 2/ 9 | 0/ 0 | 0/ 0 |
| **BL** | 3/ 52.4 | 0/ 0 | 2/ 47.6 | 0/ 0 | 0/ 0 |

Note: BB=Bonebatang; KK=Kodingareng Keke; and BL=Barrang Lompo

The composition of phytoplankton in general tends to change over the time caused by environmental conditions such as physical, chemical and biological factors. During the measurement, diatoms became the dominant group in the abundance of water tested. Diatom is phytoplankton with high of growth rates, tolerance and adaptation to environmental changes and are able to utilize nutrients better than other classes of phytoplankton [6]. Furthermore, diatoms (Bacillariophyceae) and dinoflagellates (Dinophyceae) stated to be the most dominate phytoplacton in the tropical waters [5].

*Cyclotella* sp. recorded as diatom species that always dominates in all of the observed coastal waters, with a mean IVI value of 40.65%. Followed by *Chaetoceros danicus* and *Coscinodiscus* sp. with the mean IVI value of 33.36% and 29.05, respectively. Meanwhile, in general, other plankton species are only scattered in certain locations with low frequency (Fig. 2). On the other hand, there are two types of algae that have the potential of HAB (Harm Algae Blooming), namely *Leptocylindrus* sp. (INP 3.7%) and *Pseudo-nitzschia. lineola* (INP 0.8%) which produces the neurotoxin compound DA (domoic acid).

**Figure 2.** Importance Value Index (INP) of plankton found around the Spermonde Islands.




Species *Cyclotella* sp. recorded as diatoms with the highest IVI that were evenly distributed in all the location tested. In general, this kind of phytoplankton are mostly found in oligotrophic (poor-nutrient) environments [7]. In line with that, many researchers mention *Coscinodiscus* sp. and *Chaetoceros* sp. as genus of diatom that dominated in marine and coastal waters [8]. On the other hand, the field study shows that plankton diversity index value in the waters around the Spermonde Islands is classified as moderate (H':1.19-2.27), with an uneven distribution (E:0.34-0.75), and low to moderate dominance (C:0.16-0.53) [9]. The results above are strongly suspected to be related to water quality pollution around the Spermonde Islands.

Water quality greatly affects the presence of aquatic biota, especially in relation to its distribution and [10]. The results of the physical-chemical quality monitoring showed that the water quality parameters observed in the five selected islands of Spermonde were generally not significantly different. Furthermore, 5/6 parameters of the physical-chemical quality of the water tested did not meet the national water quality standards for the needs of aquatic biota [11], namely levels of DO (4.63-7.70), BOD5 (25.38-29.81), salinity (29.3-30.2), temperature (30.55-33.01), and as well as nitrates (0.03-0.1) (primarily). These results are proven to indicate the occurrence of organic matter contamination in the test water observed. On the other hand, the level of water fertility measured based on the value of the nutrient

content of nitrate and dissolved oxygen (DO) was categorized as oligotrophic water so that it can have an impact on decreasing the plankton community structure in the water tested.

**Table 3.** Average results of water quality observations in the Spermonde Islands.

| Parameters | Unit | Result Observed** | | |
|---|---|---|---|---|
| | | BB | KK | BL |
| Temperatures | $^0$C | 31 | 30.55 | 32.44 |
| Salinity | $^o/_{oo}$ | 30 | 29 | 30 |
| pH | | 8.19 | 7.99 | 8.32 |
| DO | ppm | 4.63 | 4.95 | 6.10 |
| $BOD_5$ | ppm | 25.39 | 28.70 | 28.33 |
| Nitrat | mg/l | 0.06 | 0.05 | 0.16 |

Note: BB = Bonebatang, KK = Kodingareng Keke, and BL = Barrang Lompo

## IV. CONCLUSION

The Spermonde Islands has been experiencing a water quality declining, characterized by an increase in nitrate that exceeded the quality standard for aquatic biota. This kind of pollution is thought to have an effect to the plankton community structure by decreased the number of its diversity and eveness, with high domination of one or some tollerant species. In line with that, most of the parameters of water quality has not met national standards for the needs of aquatic biota.

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## AUTHORS

**First Author** – Arina Mana Sikana, Biology Conservation, Brawijaya University, ar93ina@gmail.com.
**Second Author** – Catur Retnaningdyah, Lecture, Brawijaya University, catur@ub.ac.id
**Third Author** – Nia Kurniawan, Lecture, Brawijaya University, wawan@ub.ac.id

**Correspondence Author** – Arina Mana Sikana, ar93ina@gmail.com, 089505570970.