Original Research Article

Trophic Status of Cikidang Pangandaran River Based on Chlorophyll-a Concentration

ABSTRACT

Trophic status is an indicator of water fertility. This research aims to determine the fertility status in the Cikidang Pangandaran River based on the concentration of chlorophyll-a. This research was carried out from November 2021 to January 2022. The research method used was a survey method with the technique of taking river water samples by *purposive sampling*. River water samples were taken four times at four stations. Water quality parameters measured include temperature, light transparency, pH, CO2, BOD, DO, nitrate, and phosphate. Based on the research results, the concentration of chlorophyll-a ranged from 0.0035-0.0078 mg/L, the lowest results were at station 4 and the highest at station 2. The Cikidang River had an oligotrophic status or low fertility.

Keywords: Chlorophyll-a, Trophic Status, Cikidang River

1. INTRODUCTION

Cikidang River is one of the rivers in Pangandaran Regency, which empties directly into Pangandaran Beach. The Cikidang River is used as a source of agricultural irrigation, domestic waste disposal, fishing boat transportation routes, and capture fisheries activities. Along the flow of the Cikidang River passing through residential areas, of course, many human activities produce waste and are dumped directly into the river. The upstream area of the Cikidang River already has agricultural activities, where agricultural activities use chemical fertilizers so that runoff water from rice fields can enter the river body. These activities can lead to changes in the trophic status of the waters.

Trophic status is an indicator of water fertility. According to Zulfia and Aisyah (2013) the classification of the trophic status of the waters can be divided into 3, namely: Oligotrophic, which are waters with low fertility levels, clear waters, and do not support relatively large fish populations. Mesotrophic, water with moderate or medium fertility levels with moderate nutrient conditions. Eutrophic, water with a high level of fertility and support the survival of organisms in it.

Determination of the trophic status of waters can be obtained by calculating the concentration of chlorophyll-a dissolved in these waters. Chlorophyll-a is a phytoplankton pigment that is the main factor to produce primary production in the food chain in waters (Isnaeni et al. 2015). According to Baktiar et al. (2016) several physical and chemical parameters that can control and influence the distribution of chlorophyll-a in waters, namely light intensity, nutrients, especially nitrate and phosphate.

So far, information regarding the trophic status based on the concentration of chlorophyll-a in the waters of the Cikidang River is still unknown. Therefore, it is necessary to conduct this research, so that the fertility status of the waters can be known for the development of fisheries management

2. MATERIAL AND METHODS

2.1 DESCRIPTION OF THE SAMPLING SITES

The research was conducted from November 2021 - January 2022. The method used was a survey method with a purposive sampling technique. River water samples were taken 4 times and replicated at four stations with a frequency of 14 days. Determination of sampling location based on river order and consideration of organic input load. The observation station can be seen in Figure 1.

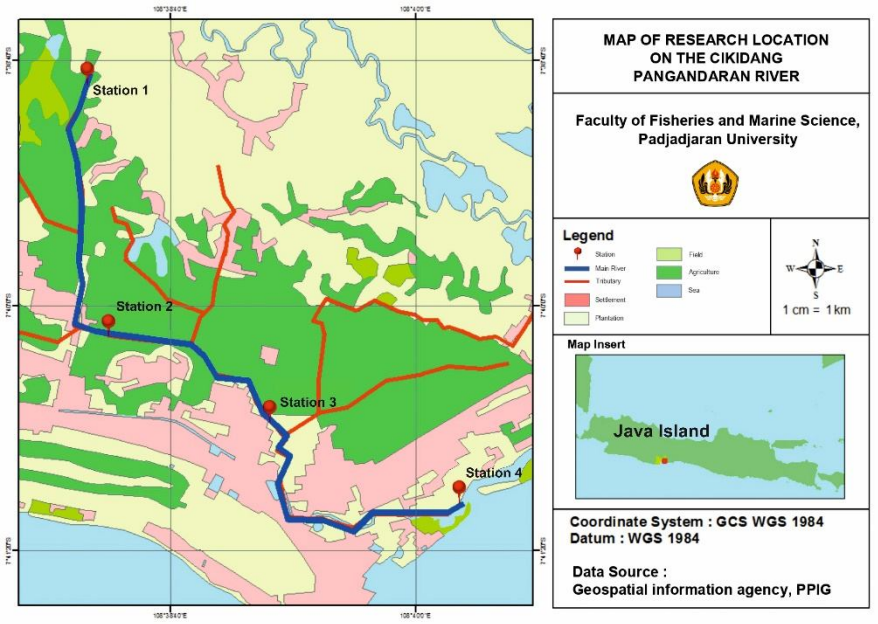

Figure 1. Location of the Research Station on the Cikidang River, Pangandaran

Station 1 : It is a source of water in the rice fields, and there are already agricultural activities. The color of the water is still clear with coordinates 7038'50.2" S, 108038'07.8" E.

Station 2 : It is a spring in the rice field area, and there are already agricultural activities. The color of the water is still clear with the coordinates of 7038'50.2" S, 108038'07.8" E.

Station 3 : In this area, you can see several drainage pipes coming from people's houses that flow directly into the river. The color of the water is turbid yellowish with coordinates 7040'36.4" S, 108039'11.7" E.

Station 4 : In this area there is fishing boat activity, it is suspected that the area contributes organic material input due to the tidal area. It is an estuary area with coordinates of 7041'04.4" S, 108040'14.8" E.

2.2 SAMPLING AND WATER QUALITY MEASUREMENT

1000 ml of water samples were taken and for chlorophyll-a samples were put in 1500 ml bottles (Febbrianna et al. 2017). Measurement of the concentration of chlorophyll-a in water samples from each station was carried out using the spectrophotometric method (Zahidah 2017) with a spectrophotometer at 665 nm, 645 nm and 630 nm which is the maximum absorption of chlorophyll-a in acetone solvent.

2.3 CHLOROPHYLL-A CONCENTRATION MEASUREMENT

Calculation of the value of chlorophyll-a concentration according to (Wetzel and Likens 1991 in Zahidah 2017) is as follows:

$$\textbf{Chlorophyll-a} = Ca\ (v/(VL))$$

Ca is obtained from the equation: 11.6 D665 – 1.31 D645 – 0.14 D630

Description:
v = Volume of acetone used (mL)
V = Volume of filtered water to be extracted (L)
L = Cuvet length (cm)
D665 = Optimal density at a wavelength of 665 nm.
D645 = Optimal density at a wavelength of 645 nm.
D30 = Optimal density at a wavelength of 630 nm.

3. RESULTS AND DISCUSSION

The measurement of the physical and chemical parameters of the Cikidang River during the research, which can be presented in Table 1.

Table 1. Physical and Chemical Parameters Of The Cikidang River

No	Parameters	unit	The Results	PP Quality Standard No. 22 Year 2021	
				Class I	Class II
1.	Temperature	^{0}C	26,75 - 29,57	Deviation 3	Deviation 3
2.	Transparency	cm	16,12 - 135,75	-	-
3.	pH	-	7,38 - 7,48	6 - 9	6 - 9
5.	Carbon dioxide	mg/L	19,8 - 47,3	-	-
3.	BOD	mg/L	10,41 - 16,36	3	6
4.	DO	mg/L	4,38 - 5,06	4	3
7.	Nitrate	mg/L	0,25 - 0,37	10	20
8.	Phosphate	mg/L	0,009 - 0,02975	0,2	1,0

The results of the measurement water temperature of the Cikidang River ranged from 26.75 to 29.570C (Figure 2). The highest temperature is at station 4 at 29.57°C, and the lowest temperature is at station 1 at 26.750C. According to Mardhia and Abdullah (2018), the optimum temperature for water growth is 25-300C. Based on Government Regulation no. 22 the Year 2021 class II and III are 30C deviations from normal temperature, then the temperature parameter of the Cikidang river is still within the water quality standard criteria according to its designation.

The transparency of the Cikidang River ranges from 16.12-135.57 cm (Figure 2). Station 2 has the lowest value because at the location there is the input of domestic and agricultural waste so the conditions of the waters are cloudy which prevents the entry of sunlight into the waters. According to Rahman et al. (2016) the high and low values of transparency are influenced by the presence of domestic waste which can inhibit the entry of sunlight into the water column. According to the Minister of Environment Regulation No. 28 of 2009 the Cikidang river is included in the status of hypertrophic waters because it has a transparency of <2.5 m.

pH value at the time of observation in the Cikidang Pangandaran River ranged from 7.38 to 7.48 (Figure 2). According to Effendi (2003) aquatic organisms are sensitive to changes in pH and prefer a pH ranging from 7-8.5. pH of the Cikidang River based on Government Regulation no. 22 of 2021 is good for supporting fishery activities because it is still within the threshold of class II and III water quality standards, which is around 6-9.

Cikidang Pangandaran River's carbon dioxide ranged from 19.8 to 47.3 mg/L (Figure 2). According to Idrus (2018), a good concentration of carbon dioxide (CO2) for the life of aquatic organisms is less than 15 mg/L, more than that will be

dangerous because it can inhibit the binding of oxygen in the waters. The concentration of carbon dioxide in the Cikidang River water is in a fairly high category and is dangerous for aquatic organisms. Because the concentration of carbon dioxide that can be tolerated by aquatic organisms is 5-10 mg/L (Idrus 2018).

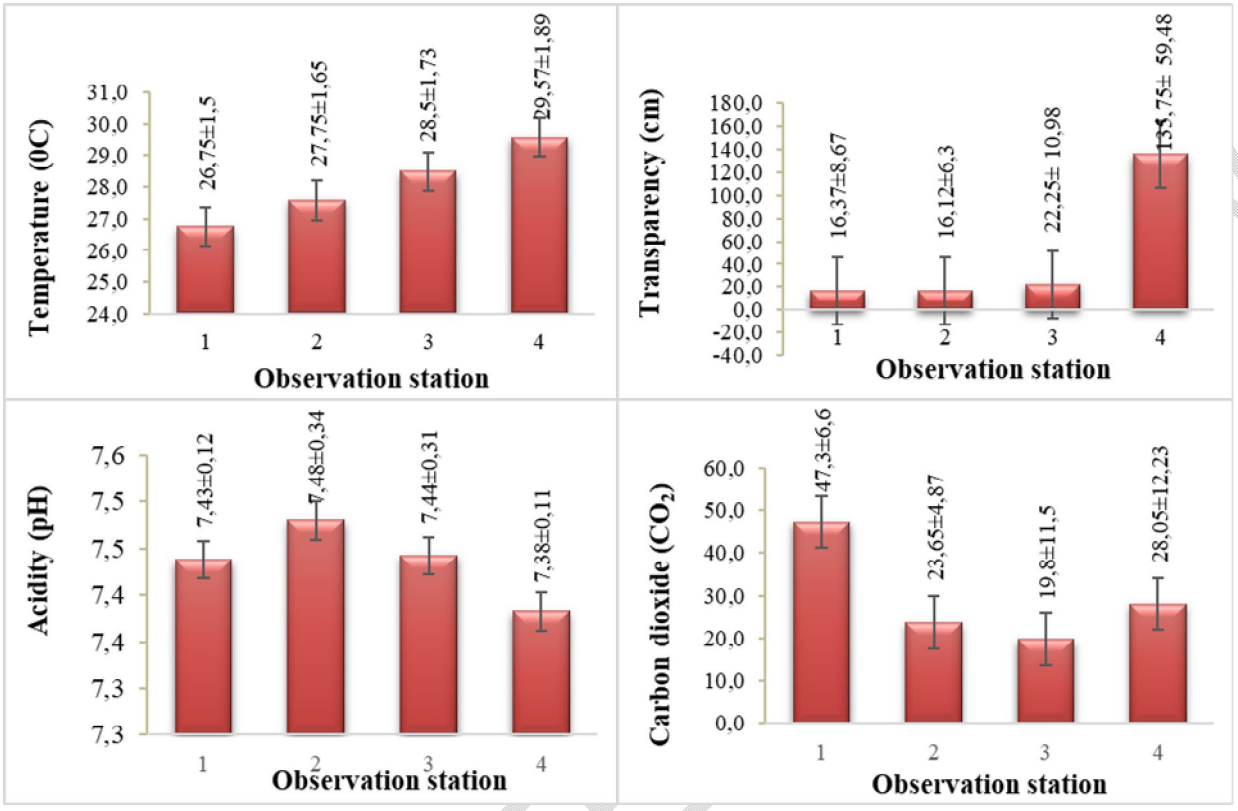

Figure 2. Graph of Temperature, Transparency, pH and CO2

BOD on average ranges from 10.41-16.36 mg/L (Figure 3). According to Effendi (2003), waters that have BOD levels of more than 10 mg/L can be said to be polluted. Based on Government Regulation No. 22 of 2021, the range of BOD results during research has exceeded the threshold for class II and III quality standards, which are more than 3 mg/L and 6 mg/L.

Dissolved oxygen in the Cikidang River was not very different, ranging from 4.38-5.06 mg/L (Figure 3). The low oxygen concentration at station 4 is due to the high temperature at station 4. According to Pardede et al. (2013) the concentration of dissolved oxygen with temperature is inversely proportional, if the water temperature is low, the oxygen solubility of the water will increase. Based on Government Regulation No. 22 of 2021, the range of dissolved oxygen in the Cikidang River is under class II and III quality standards, namely at least 3 mg/L and 4 mg/L for fishery activities.

nitrate in the Cikidang Pangandaran River ranged from 0.25-0.37 mg/L (Figure 3). The highest nitrate is found at station 1, this is due to the presence of waste in the form of fertilizer waste at station 1. According to Effendi (2003) waste from agricultural activities (fertilization), industrial activities, and explosives can affect the concentration. nitrate in water. Based on the research results, the Cikidang River is still far below the water quality standard for classes II and III according to Government Regulation No. 22 of 2021 which stipulates nitrate concentrations of 10 mg/L and 20 mg/L.

Phosphate in the waters of the Cikidang River ranged from 0.009 to 0.02975 mg/L (Figure 3). According to Rumanti et al. (2014) the optimal phosphate concentration for phytoplankton growth ranges from 0.27-5.51 mg/L, whereas if the phosphate concentration is less than 0.02 mg/L it will be a limiting factor. Based on PP No.22 of 2021, the average range of phosphate values in the Cikidang River is still far below the class II and III thresholds of 0.2 and 1.0 mg/L.

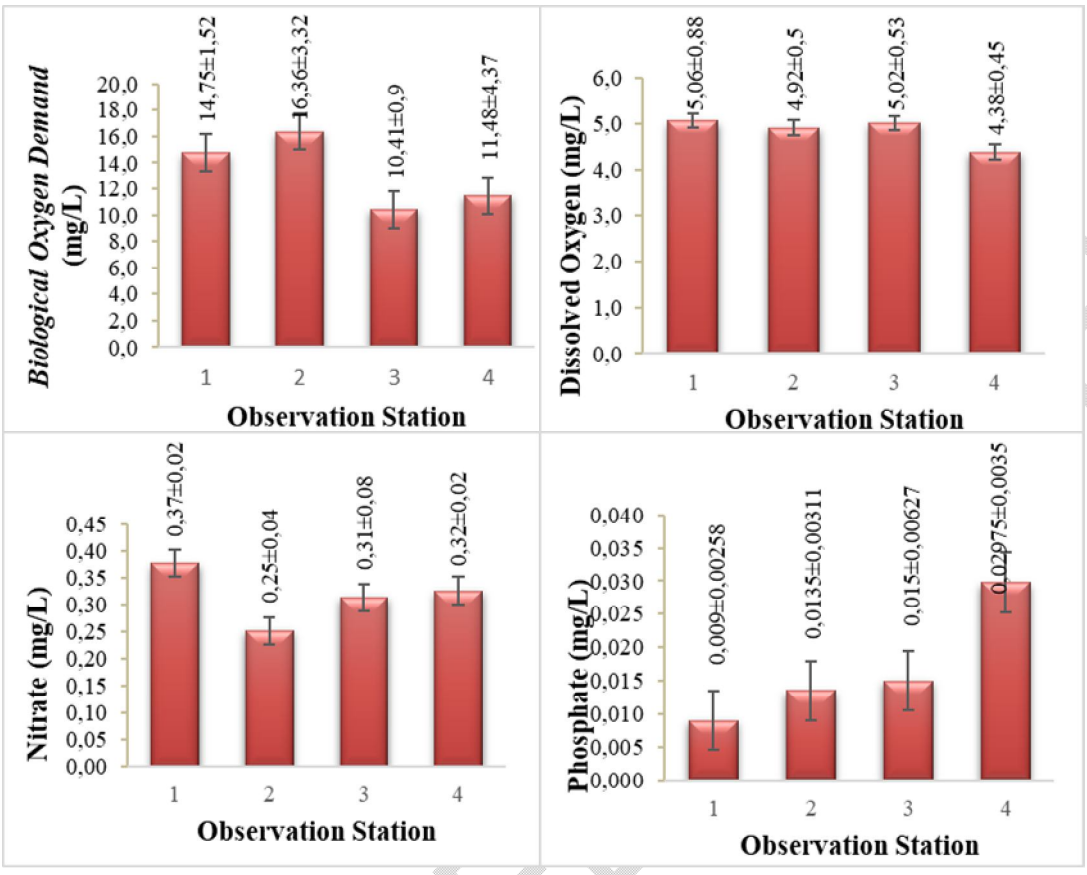

Figure 3. Graph of BOD, DO, Nitrate and Phosphate

Chlorophyll-a

Chlorophyll-α is an important pigment needed by phytoplankton in carrying out the photosynthesis process, besides that, phytoplankton are primary producers (primary productivity) because they are able to convert inorganic materials into organic materials through the process of photosynthesis (Herlianti and Soedarsono 2016). The average concentration of chlorophyll-a in the waters of the Cikidang river is 0.0035-0.0078 mg/L (Table 2).

Table 2. Chlorophyll-a

Station	Chlorophyll-a
1	0,0054±0,0049
2	0,0078±0,0071
3	0,0035±0,0022
4	0,0031±0,0026

Based on Table 2, the value of chlorophyll-a concentration varies at each station. The highest average concentration of chlorophyll-a is at station 2, the high concentration of chlorophyll-a at this station is because it gets a lot of organic waste

input from household activities and agricultural activities so it contributes a lot of nutrients. This is in line with the opinion of Hidayah et al. (2016) that waste from household activities and small industrial activities that produce organic waste is a source of nutrients. Nutrients are needed in the formation of chlorophyll-a concentrations in waters (Zahidah 2017).

The lowest average value of chlorophyll-a is found at station 4 at 0.0031 mg/L, this is because station 4 is an estuary area that receives less organic matter input from the mainland. This is to the research of Sihombing et al. (2013), the closer to the open sea, the less nutrient input from land, causing lower chlorophyll-a concentrations. The research of Mariana et al. (2016) explained that the low concentration of chlorophyll-a in river mouths was due to the lack of nutrient input from the mainland. In addition, at station 4, many fishing boats pass by which makes organic matter carried away by the current from the fishing boat's trajectory. According to Puspitasari et al. (2021) that some organic and inorganic materials found in river mouths are deposited, dissolved, and even carried away by currents to the sea.

Based on the Minister of Environment Regulation No. 28 of 2009 the concentration of chlorophyll-a in the Cikidang River can be said to have oligotrophic status or low fertility because it is < 2.0 mg/L. The low concentration of chlorophyll-a in the Cikidang River is due to the research being carried out during the rainy season so it affects the concentration of chlorophyll-a in the waters. According to Rahman et al. (2015) high rainfall can affect the low concentration of chlorophyll-a in waters.

4. CONCLUSION

The concentration of chlorophyll-a in the Cikidang River has an average of 0.0035-0.0078 mg/L, based on this value, the Cikidang River is classified as oligotrophic water or low fertility. Water quality in the Cikidang River generally meets the requirements of class II and III quality standards according to Government Regulation No. 22 of 2021 concerning the Implementation of Environmental Protection and Management, so that it still supports the sustainability of fish resources

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