AQUATIC QUALITY PARAMETER AT LAKE LIMBOTO

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ABSTRACT

Lake Limboto has so far experienced changes in ecological structure due to the burden of nutrient input through fisheries, agriculture, plantation, and household activities. The input of organic material has the potential to be a source of nutrients that has an impact on changing water conditions. This study aims to determine the physical chemical parameters of Lake Limboto waters. The method used in this research is descriptive method, the location of sampling at each sampling point of the observation was carried out by purposive sampling which was divided into 8 stations, the results of the water quality parameters showed the average value of the whole station namely brightness 10-17cm, temperature 26- 31^{O}C, pH 6.3-7.6, DO 5.30-6.30 mg/L, nitrate 10.4-16.1 mg/L, and phosphate 0.23-0.81 mg/L. This condition causes a decrease in the environmental quality of Lake Limboto which is based on the value of chemical and physical parameters of the waters.

Keywords: *Aquatic Quality, Lake Limboto, Parameters of Aquatic Quality*

INTRODUCTION

Gorontalo is one of the provinces in Indonesia which are geographically near the equator, with an area of 12,435.00 km^2. Several rivers which flow into Lake Limboto are Aloe, Marisa, Meluopo, Biyonga, Bulota, Talubongo, Bolango, Pohu, Ritenga, and Topodu. The largest tributaries are Alo Molalahu and Pohu. Of the ten rivers, only Biyonga flows all year round. Besides, Lake Limboto maintains some functions as a watershed, flood control, fishery resources, tourism object, means of transportation, research and education object, and water absorption area (Hasim, 2013).

Besides one of the tourism objects in Gorontalo, Lake Limboto has been supporting the community activities. The field survey data in 2012 indicated that the number of farmers and fish farmers and traditional fishers were 592 and 937 respectively. Those active communities live in Limboto, Telega Jaya, Tilango, Batudaa, Tabonggo, and will probably increase in number (Saleh, 2014).

Based on the data from BPS of Gorontalo in 2010-2014, potential land areas in 2010, 2011, 2012, 2013, and 2014 were 13,114 Ha, 13,019 Ha, 13,556 Ha, 13,806 Ha, and 13,959 Ha respectively. Meanwhile, the farmland areas by the type of irrigation are in Batudaa, Bongomeme, Tibawa, Pulubala, Limboto, Limboto Barat, Telaga, Telaga Biru, and Telaga Jaya with a total area of 4,948 Ha.

To this extent, the potential natural resource wealth in Lake Limboto is not in line with the current phenomenon. The water status of Lake Limboto has been considered critical. In 1932, the area of Lake Limboto was ±7,000 Ha but in 2017, the area had degraded into ±2,693 Ha. That phenomenon happens due to eutrophication through various activities conducted by the community in waters and a high load of nutrient and sediment inputs from outside the waters or from a watershed in which the high land area had been functionally transferred into residential, mining, agricultural, and plantation areas (Umar *et al*., 2018).

Human activities in waters have a significant impact on water quality and this may bring about eutrophication. Sustainable attempts to maintain lake waters should thus be made by considering the physical and chemical properties of waters (Linus *et al*., 2016).

Due to the current phenomena occurring in Lake Limboto on these days, proper attempts to preserve the waters of Lake Limboto, considering that the water area of Lake Limboto has annually degraded, are pivotal. This research aims to analyze the condition of waters at Lake Limboto by taking the chemical and physical properties of waters into account.

RESEARCH METHODOLOGY

Research Flow

1. Sampling Station

This research was conducted in September 2019 at the waters of Lake Limboto. In terms of sampling location, there are eight stations which are Station 1 (Limboto), Station 2 (Hunggaluwa Bawah), Station 3 (Lupoyo), Station 4 (Barakati), Station 5 (Mid-lake), Station 6 (Hutadaa), Station 7 (Iluta), and Station 8 (Dembe).

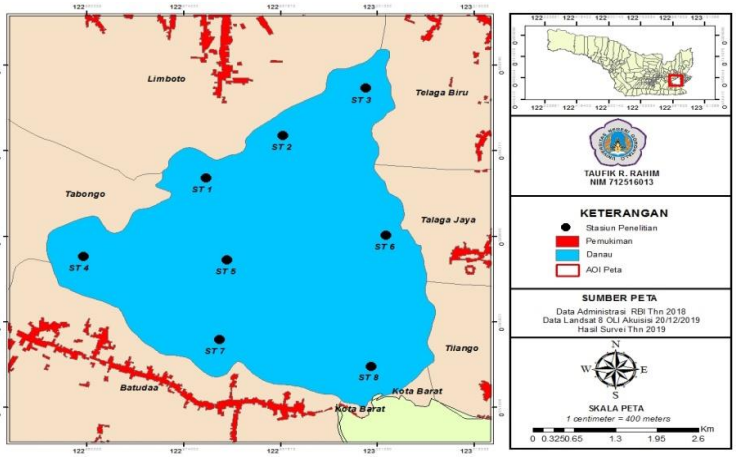

Figure 1. The Locations of Sampling Stations

2. Sampling Method

We conduct direct sampling to collect *in situ* data consisting of pH, water brightness, D.O. (dissolved oxygen), and temperature. Furthermore, the *ex-situ* data include nitrate and phosphate parameters identified at UPTD Balai Laboratorium Kesehatan Daerah in Gorontalo. To elicit the conception of water quality, we collect two types of data i.e. primary and secondary data. Primary and secondary data are collected to complement the data acquired from field surveys

(Marlian and Effendi, 2015; Rahman, 2016).

Research Design

The method applied in this research is the survey method. The descriptive data analysis is used to analyze *in situ* and *ex situ* data. The determination of sampling location is done using the purposive sampling technique based on the activities made at the water area (see Figure 1 and Table 1).

Table 1. The Description of Sampling Stations

No.	Station	Location Coordinate	Utilization of Water Area	Water Condition
1	Limboto	N00^{O}34.973' E122^{O}58.790'	Fish trap	Shallow
2	Hunggaluwa Bawah	N00^{O}35.438' E122^{O}59.324'	Fishing boat activity	Shallow
3	Lupoyo	N00^{O}35.421' E122^{O}59.904'	Fish trap	Shallow
4	Barakati	N00^{O}34.225' E122^{O}58.668'	Water hyacinth zoning	Shallow
5	Pertengahan Danau	N00^{O}34.324' E122^{O}59.523'	Fish trap	Shallow
6	Hutadaa	N00^{O}35.424' E123^{O}00.156'	Fish trap	Shallow
7	Iluta	N00^{O}33.518' E122^{O}59.264'	KJA	Shallow
8	Dembe	N00^{O}33.431' E122^{O}59.743'	KJA	Shallow

FINDINGS AND DISCUSSION

Chemical and Physical Parameters in the Waters of Lake Limboto

Referring to the mean value of chemical and physical parameters in all stations in Lake Limboto, Lake Limboto evidently has the brightness of 10-17 cm, a temperature of 26-31˚C, pH of 6.3-7.6, D.O. of 5.30-6.30 mg/L, nitrate of 10.4-16.1 mg/L, and phosphate of 0.23-0.81 mg/L.

Each station is identified as having different chemical and physical parameters. Station 6 is identified as having the highest brightness value which is 22 cm and the highest temperature which is 31˚C. Furthermore, Station 5 has the highest pH which is 7.6, and Station 7 has the highest D.O which is 6.25 mg/L. Station 2 has the highest nitrate which is 16.1 mg/L and phosphate which is 0.81 mg/L. The detailed description of water quality parameters is presented in Table 2.

Table 2. Chemical and Physical Parameters in the Waters of Lake Limboto

Station	Brightness (cm)	Temperature (^{O}C)	pH	D.O (mg/L)	Nitrate (mg/L)	Phosphate (mg/L)
1	17	29	7.1	5.50	15.7	0.34
2	17	29	6.3	5.85	16.1	0.81
3	15	29	7.3	5.80	14.1	0.34
4	20	28	6.9	6.20	10.7	0.78

5	16	29	7.6	5.90	13.6	0.54
6	22	31	7.3	5.45	11.6	0.38
7	15	27	7.0	6.25	10.4	0.46
8	10	26	7.3	5.30	15.0	0.23

Based on Table 2, the chemical and physical parameters of waters, notably in Station 8 (Dembe), have degraded. Meanwhile, Station 5 (mid-lake) has a condition dissimilar to that in Station 8 (Dembe) whose majority of areas are covered by the community KJA and suit the condition of the waters through a different level of productivity.

Nutrient distribution in waters is predominated by the near-land waters i.e. rivers, river mouths, and the edges of the lake and gradually degrades in the mid-waters and more degrades in the outer waters. The low and high chemical and physical parameters are engendered by nutrient input due to human activities and environmental changes. Furthermore, in terms of fertility status, referring to the chlorophyll-a level, the waters are categorized into a trophic level, as defined by Marlian *et al*. (2015).

Based on the mean value of the brightness of lake waters, the brightness of the lake waters has degraded into 10-17 cm, indicating that the waters have undergone eutrophication which indicate the the overview through upwelling process (Khasanah *et al*., 2013).

According to Pertiwi *et al*. (2017) and Hamuna *et al*. (2018), KEPMEN-LH No. 51/2004 decides the standards of waters quality which include a temperature of 25-31˚C, brightness of 2-13 meters, pH of 6-8, D.O. of >5 mg/L, nitrate of 0.008 mg/L, and phosphate of 0.015 mg/L. If the chemical and physical parameters of waters have exceeded the standards, the waters are unsuitable for organisms to live in.

Amalia (2010) and Prihatin *et al*. (2018) explain that ammonia and nitrogen concentrations are higher in the waters with KJA than that in the waters without KJA as excessive nutrients (nitrate and phosphate) in waters significantly contribute to the degradation of waters quality.

Tarigan and Wiadnyana (2013), Nurmasita (2016), and Linus *et al*. (2016) describe that the concentration of chemical and physical parameters of waters may change by seasons, particularly in the dry season which is April, May, June, July, and September. Moreover, nitrate of 0.01-0.05 mg/l and phosphate of 0.03 mg/l may contribute to fertility, resulting in the degradation of water quality.

CONCLUSION

Referring to the research findings, due to various activities including household waste, agricultural and plantation activities, changes in watershed utilization, and water input from upstream rivers, the water quality of Lake Limboto has degraded, impacting the lake ecosystem. If we refer to KEPMEN-LH No. 51/2004, the water status of Lake Limboto has degraded.

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