# WATER QUALITY IMPACT ON FISH CULTURED IN LAKE TUTUD, NORTH SULAWESI, INDONESIA

*by* Reiny Antonetha Tumbol 12

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# WATER QUALITY IMPACT ON FISH CULTURED IN LAKE TUTUD, NORTH SULAWESI, INDONESIA

Suzanne Lydia Undap[1*], Reiny Tumbol[1] and Sandra Tilaar[1]

[1]Faculty of Fisheries and Marine Sciences, Sam Ratulangi University, Kampus Kleak, Manado, 95115, Indonesia
*Corresponding author: suzanneundap@unsrat.ac.id

**ABSTRACT**

*Lake Tutud is a lake located in North Sulawesi, Indonesia. The estimate terrain elevation above seal level is 390 meters. Latitude: 1°2'40.56", Longitude: 124°41'49.55". We determined the current condition of the water quality of Lake Tutud in terms of physical and chemical parameters in a fish farming location, Tombatu village. The determination of sampling points at each station was placed vertically at three predetermined points from the guard house toward the front of the net, the distance between one point to the next point was ± 15 m; whereas the analysis of water quality parameters was done using a HORIBA water quality checker type U-536. Determination points were done by purposive sampling which refers to the physiographic location wherever possible in order to represent or describe the water condition. The research was carried out for 6 months and done in 3 stages - morning, afternoon and evening. Direct measurement (in situ) was performed once a week at the three points which included parameters pH, temperature, conductivity, DO, Oxidation reduction potential, turbidity, TDS, depth and GPS. In conclusion, the water quality condition at the aquaculture site still complies to water quality standard according to PP No.82 of 2001.*

**Keywords:** Aquaculture, Lake Tutud, Water Quality

## INTRODUCTION

Lake is one of the natural resources that can be utilized to increase demand and meet human nutrition, such as the development of fish farming business (Zonneveld et al, 1991). Lake Tutud, one of natural lakes in North Sulawesi, is located in Southeast Minahasa Regency and has been used as hatchery for fish by village communities Tombatu 3. In recent years, based on the results of interviews with fish farmers in the village Tombatu 3, it was revealed that their cultured fish are often stricken with the disease in certain seasons. In fact, in 2015 the cases of mass death of fish farming in Lake Tutud emerged, and caused 3,000 fish loss. The case shows that Lake Tutud has problems of water quality degradation affecting the health of fish leading to a high fish mortality rate.

To determine whether good or not the water quality, the measurement is based on various parameters of water quality either biological, physical or chemical. Physical parameters such as temperature and chemical parameters are dissolved oxygen and pH of the environment is a limiting factor, if it does not qualify the needs of farmed fish will have an impact on the health of the fish. So that the water quality standard size of the health condition of the fish.

Recognizing the importance of aquaculture activities on Lake Tutud, observation of water quality monitoring of physcisc and chemistry in the area needs to be done, to get the current data for fish cultured in Lake Tutud with reference to regulation government No. 82 of 2001 on water quality management and control water pollution. Accordingly, it can be seen the impact of water quality on the health of fish in aquaculture development area in Lake Tutud (**Figure 1**).

## METHODS

The determination of sampling points at each station was placed vertically at three predetermined points from the guard house toward the front of the net, the distance between one point to the next point was ± 15 m; whereas the analysis of water quality parameters was done using a HORIBA water quality checker type U-536. Determination points were done by purposive sampling which refers to the physiographic location wherever possible in order to represent or describe water condition. The research was carried out for 6 months and done in 3 stages - morning, afternoon and evening. The direct measurement (in situ) was performed once a week at the three points which included parameters pH, temperature, conductivity, DO (Dissolved Oxygen), ORP (Oxidation Reduction Potential), turbidity, TDS (Total Dissolved Solids), depth and GPS (Global Positioning System).

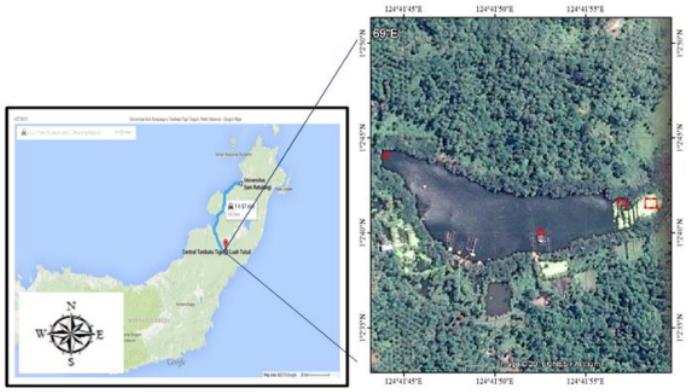

**Figure 1.** Lake Tutud

## RESULTS AND DISCUSSIONS

*Temperature*

Based on the results of temperature measurements, Lake Tutud had a variation on temperature between 26.82ºC - 32.04ºC (**Figure 2**). Temperature has a significant effect on the exchange process or metabolism of living beings. In addition to affecting the process of exchange of substances, temperature also affects the amount of oxygen dissolved in the water, it also gives impacts on growth and appetite of fish (Pujiastuti et al, 2013). In addition, temperature affects the solubility of oxygen in the water, where the higher the temperature the lower the level of dissolved oxygen (Buttner et al, 1993), which in turn have an impact on the concentration of dissolved oxygen in the water.

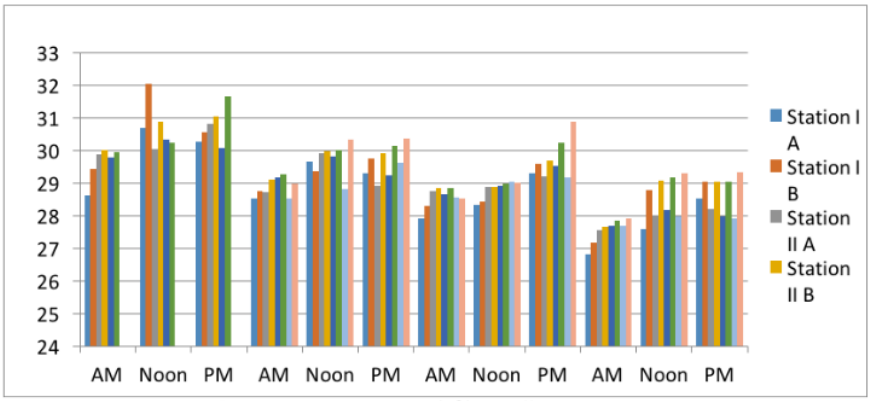


**Figure 2.** Temperature (ºC) at different stations

pH of water (**Figure 3**.) affects fertility because it affects the life aquatic microorganisms. Acidic waters will be less productive, even kills fish farming. At low pH (high acidity), dissolved oxygen content will be reduced, as a result of decreased oxygen consumption, respiratory activity rose and appetite will be reduced. The opposite occurs in alkaline conditions (Koordi and Tancung, 2007).

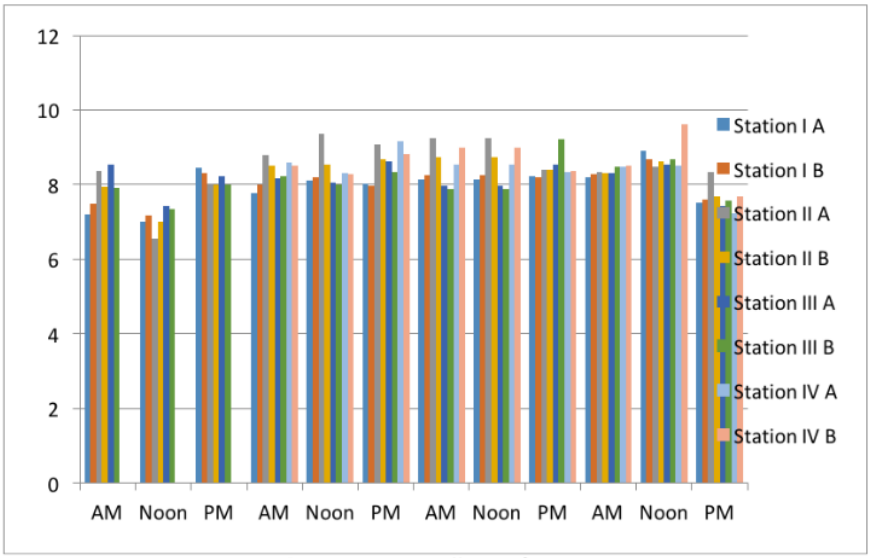


**Figure 3.** pH at Different Stations

*Dissolved oxygen (DO)*

The results of the measurement of dissolved oxygen (DO) at all sampling points in the area of cultivation nets at Lake Tutud ranged from 1 to 5.5 mg/L as measured by HORIBA (**Figure 4**). DO measurement results (5.5 mg/L) in the lake of Tutud were not that distinct to that as measured by de Breving and Rompas (2012). As well as results of research Tatangindatu et al (2013) the value DO in the village of Lake Tondano Paleloan ranged from 7.41 to 7.77 mg / L, where the position of village Paleloan are right across the village of Lake Tondano Toulimembet.

However, based on research results Kamsuri et al (2013), which was run in March-April 2013, the DO values ranged from 3.88 to 6.39 mg / L. While the distribution of DO value on the results of this study between 6.31 to 10.2 mg / L. Values DO experiencing an upward trend and were higher as compared to the results of previous studies. This shows that in the waters of Lake Tondano Village Toulimembet fitness level of the water in 2014 is better when compared to the year 2013.

The values of DO in the waters of the lake in the village of Toulimembet already exceeded the Standards of Quality of Water Quality set in Government Regulation PP No. 82 in 2001 on Water Quality Management and Pollution Control class I as a source for drinking water, which requires the value of DO is > 6 mg / L and Class III minimum DO value is 3 mg / L (Tabel 1). Kordi and Tancung (2007), the DO level appropriate for fish cultivation is between 5- 7 mg / L. This shows the general level of DO in the cultivation area is not polluted by biodegradable organic materials from the waste cultivation itself so that the impact of the DO value is still appropriate for the health of fish cultivation.

**Tabel 1**. Government Regulation (PP. No. 82 in 2001)

| Parameters | Class I | Class III |
|---|---|---|
| Temperature (°C) | Deviation 3 (from natural) | Deviation 3 (from natural) |
| pH | 6 - 9 | 6 - 9 |
| DO (mg/L) | 6 | 3 |

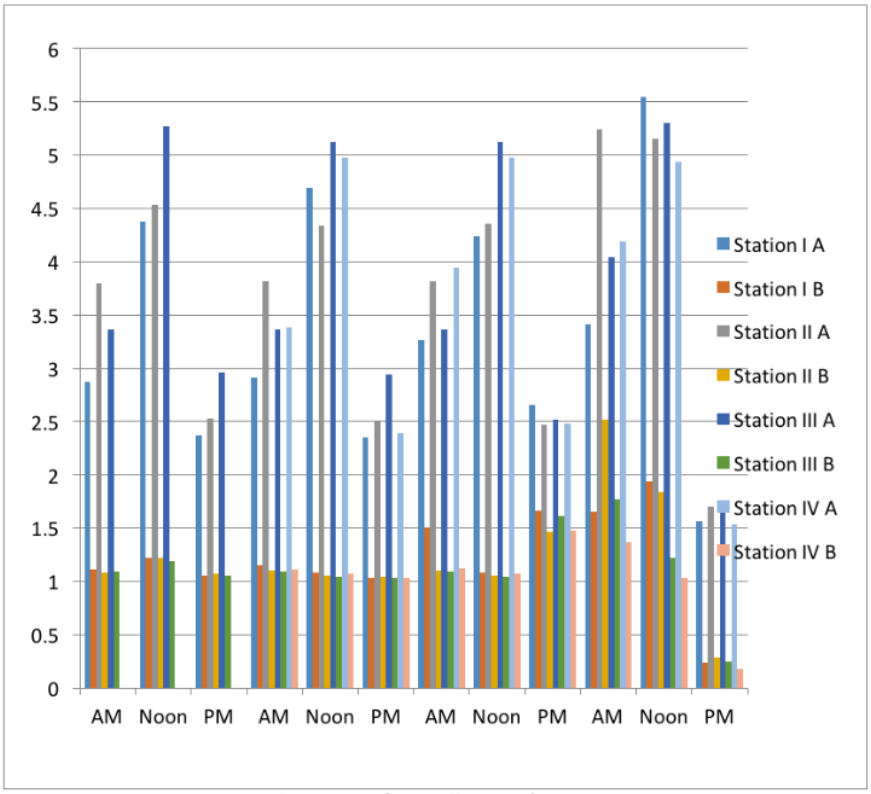


**Figure 4**. DO at Differents Stations

## CONCLUSIONS

The water quality condition at the aquaculture site still complies to water quality standards according to PP No.82 of 2001.

## ACKNOWLEDGEMENT

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the small size of the clay particles. Consequently $O_2$ exchange brought by the water comes into the sediments to be obstructed (Emiyarti, 2004).

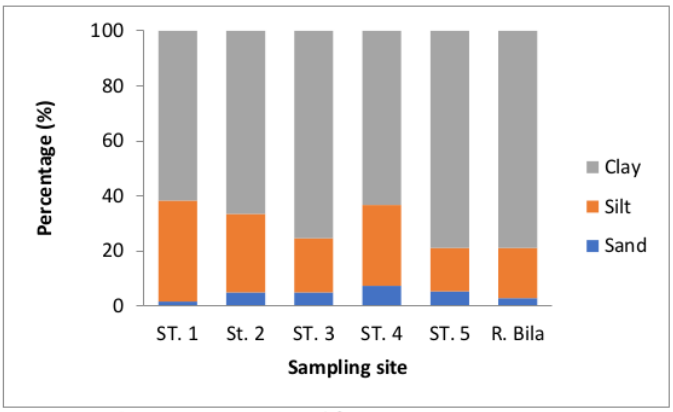


**Figure 2.** Proportion of Sediment Texture

The second highest concentration of sediment texture from Lake Tempe is silt. Silt is one of the ingredients of land which has a particle size that is smaller than 50μ to 2μ (Hardjowigeno, 2007). Washing of the silt entering the area in the form of fine particles are carried by the flow of the river to the lake. The main source of silt load is the result of weathering rinse the top layer of rock or soil in a watershed (Sudradjat et al, 1996 in Tamod, 1998).

Type of particles in Tempe Lake is relatively smooth. Sediment with the largest percentage in the form of fine particles showed that the sediment in Lake Tempe was derived from organic compounds and deposition of the dissolved particles originating from the input streams that enter Lake Tempe.

*Chemical characteristic*

*Organic Carbon & Total Organic Matter*

The results of analysis of organic carbon in the sediments of Lake Tempe shown in **Fig 3**. The image showed that the levels of C-organic sediments of Lake Tempe ranged between 3.44% - 16.86%. The high concentration of organic carbon is suspected due to agricultural activities of communities around Lake Tempe where the land management was carried out intensively ignoring the principles of conservation land, there for it is more susceptible to erosion.

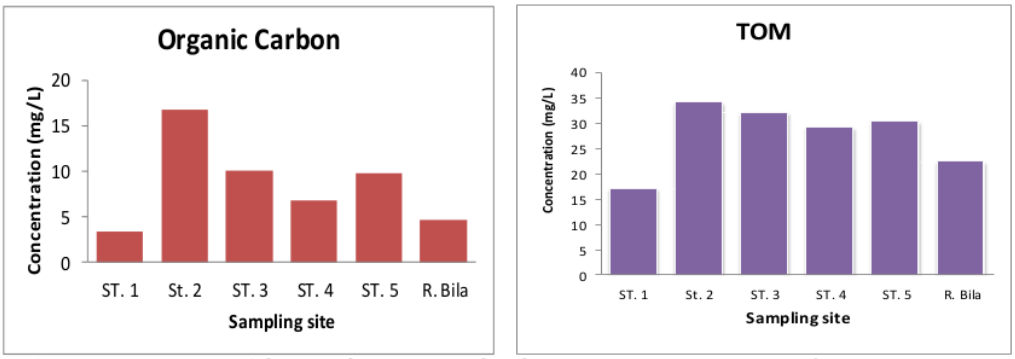


**Figure 3.** Distribution of Organic Carbon and TOM Concentration in Lake Tempe Sediment

Arsyad (2000) suggested the nutrient content of organic matter in the sediment and erosion results in higher concentration than that in the soil left remained. This is partly due to the selectivity of erosion events. Besides the top layer of soil contains nutrients higher than that from lower layers of the soil.

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