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RESEARCH ARTICLE

PARAMETER ANALYSIS $SO4_2^-$, CL^-, FE, CD, PO_4, NO_3, PB, AND ZNON THE WATER LAKE DUMA GALELA, NORTH HALMAHERA DISTRICT

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Abstract

This research conducted to measure the chemical parameters and estimate the carrying capacity of the environmentof lake Duma GalelaNorth Halmahera Utara. The air quality test uses the Air Quality Index approach that is unbeatable with PP. 82 of 2001. The results showed Lake Duma TSS levels at TS-1 26.5 mg/L, TS-2 23.8 mg/L, TS-3 21.7 mg/Land TS-4; 24.9 mg/L. The value of Chemical Oxygen Demand (COD) averaged 3-4 mg/L. The Dissolved Oxygen (DO) value was between 5.3-6.7mg/L. Sulfate TS-1; 11.63 mg/L, TS-2; 12.15 mg/L, TS-3; 11.52 mg/Land TS-4; 11.23 mg/L. Chloride ion (Cl-) TS-1; 23.46 mg/L, TS-2; 23.16 mg/L, TS-3; 23.41 mg/Land TS-4; 21.86 mg/L. Iron (Fe) TS-1; 0.0472 mg/L, TS-2; 0.0516 mg/L, TS-3; 0.0608 mg/L and TS-4; 0.0434 mg/L. Cadmium (Cd) TS-1; 0.007 mg/L,TS-2; 0.007 mg/L, TS-3; ND and TS-4; 0.009 mg/L. Nitrate between 0.0063-0.23 mg/L . Lead (Pb) TS-1; 0.03 mg/L , TS-2; 0.02 mg/L, TS-3; 0.04 mg/Land TS-4; 0.06 mg/L, Zn TS-1; 0.01 mg/L, TS-2; 0.02 mg/L, TS-3; 0.03 mg/L, and TS-4 0.01 mg/L. Thus, lake Duma is in a good condition for use in fish farming to support the community's economy.

Introduction:-

Lake Duma is the largest lake in Halmahera with an area of 250 hectares, located in Galela District, North Halmahera Regency. Currently Duma lake is designated as one of the culinary tourism spots, because it offers beautiful views and there are many freshwater fish farming, such as; mujair, gourami, mas, and catfish. The increasing number of residents around the lake has led to higher development around the lake, as a result it often use as a place to wash and dispose of waste, including B3 waste which contains heavy metals so as to produce organic and inorganic waste which triggers a decrease in the quality of the lake waters. Heavy metal pollution is a very dangerous pollutant for the environment caused by its non-biodegradable, toxic, and can experience bioaccumulation in the food chain. Heavy metals in certain concentration conditions as a byproduct included in the waste of the mining industry, metal industry, refining, electroplating, color industry, agricultural waste, to domestic waste (Pratomo, et.al, 2017)

Method:-

The research was conducted in August 2020 in Duma lake, Galela District, North Halmahera, usingWater Quality Index (IKA) approach. The tools used thermometer, global positioning system, pH meter, DO meter, TDS meter, and AAS for chemical parameters. The research stages began with the determination of the sampling point (TS) at

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four locations, namely; TS-1 at a depth of 3.5 m, TS-2; 7.6 m, TS-3; 4.12 m and TS-4 at 6.5 m. For temperature, turbidity and pH measurements carried out in situ while TSS, COD, DO, SO42-, Cl-, Fe, Cd, PO4, NO3, Pb, and Zn in the laboratory. The water quality test uses the Water Quality Index approach and is adjusted to PP. No. 82 of 2001 concerning Class II Water Quality Management.

Results and Discussion:-

Parameters for the Physical and Chemical Quality of Lake Duma Water:

Analysis of parameters pH, TSS, DO, COD, SO_4^{2-}, Cl^-, Fe, Cd,PO_4, NO_3, Pb, and Zn in the Duma Galela lake water in detail can be seen in Table 1.

Table 1:- Data of Physical Chemical Parameters for Lake Duma Galela Water.

No.	Physical Parameters	Unit	Analysis Results				Baku	Ket
			TS-1	TS-2	TS-3	TS-4	Quality	
1	Temperature	°C	28.7	28.5	28.6	28.6	(-)	Fulfill
2	Turbidity	NTU	0.23	0.19	0.18	0.17		Fulfill
3	TSS	mg/L	26.5	23.8	21.7	24.9	50	Fulfill
No.	**Chemical Parameters**	**Unit**	**Analysis Results**				**Baku**	**Ket**
			TS-1	**TS-2**	**TS-3**	**TS-4**	**Quality**	
1	pH	(-)	6.8	6.9	7.4	7.2	6.-9	Fulfill
2	COD	mg/L	3	3	4	4	25	Fulfill
3	DO	mg/L	5.6	6.4	6.7	5.3	4	Fulfill
4	Sulfate	mg/L	11.63	12.15	11.52	11.23	400	Fulfill
5	Chloride	mg/L	23.46	23.16	23.41	21.86	600	Fulfill
6	Iron (Fe)	mg/L	0.0472	0.0516	0.0608	0.0434	1.0	Fulfill
7	Cadmium (Cd)	mg/L	0.007	0.007	ND	0.009	0.01	Fulfill
8	Phosphate (PO4)	mg/L	0.171	ND	ND	ND	0.2	Fulfill
9	Nitrate (NO3)	mg/L	9	7	8	9	10	Fulfill
10	Nitrite (NO2)	mg/L	0.052	ND	ND	ND	0.06	Fulfill
11	Lead (Pb)	mg/L	0.03	0.02	0.04	0.06	0.03	Fulfill
12	Zinc (Zn)	mg/L	0.01	0.02	0.03	0.01	0.05	Fulfill

Turbidity:

The test results for measuring the turbidity of TS-1 0.23 NTU, TS-2 0.19 NTU, TS-3 0.18 NTU and TS-4 0.17 are NTU. It indicated that the turbidity valuemet the water quality requirements based on the maximum level specified namely 5 NTU. The highest turbidity value is found at TS-1, namely 0.23, in which TS-1 is the location of fish ponds from local fishermen. Although there are many ponds at this location, the turbidity level of the lake water is still low because it is rare to find leftovers for the fishermen's livestock.

Figure 1:- Portrait of Lake Duma Galela Condition.

Total Suspended Solid (TSS):

The results of determining the levels of TTS is TS-1 26.5 mg/L, TS-2 23.8 mg/L, TS-3 21.7 mg/L and and at TS-4 with a value of 24.9 mg/L, the TSS value obtained met the standard quality of lake waters as required in PP. No. 82

of 2001. The TSS value shows that the condition of the Duma lake is still in good condition, although there is an increasing in organic matter originating from domestic waste and sedimentation pressure from the lake which has not had a major effect on water quality (Figure 2). According to Putera (2014), Tobing, et al (2014), Rizky et al (2015), stated that the high TSS value is influenced by higher organic matter due to the entry of domestic waste from community activities, fish feed residue that accumulates in the water, which the fish feed provided by fish farmers can only be consumed as much as 70% and the rest becomes waste. Lailial, Nurhayati, Kiki, (2017).

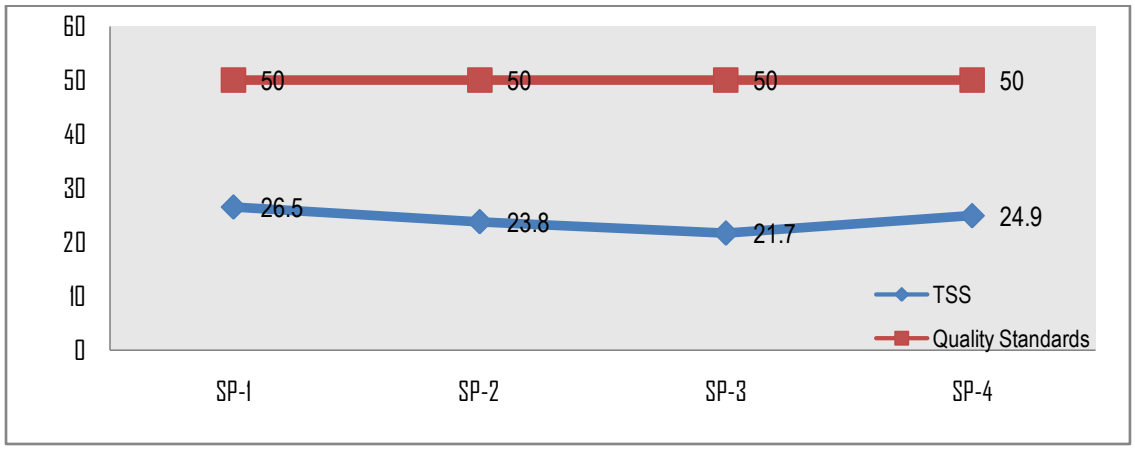

Figure 2:- TSS Test Results for Lake Duma Water.

The pH value of Lake Duma Water:

The lowest pH value was at TS-1 6.8 and the pH value increased at TS-2, namely 6.9 and the highest at TS-3 7.4 then decreased at TS-4, namely 7.2. The decrease in pH value on TS-4 is influenced by domestic activities such as washing and fish farming directly on site. According to Rizki at all (2015) and Yuningsih at al (2014), the inclusion of organic and organic compounds in waters originating from domestic activities and fish cultivation can affect the pH value. Meanwhile, according to Harlin (1980), a good water pH ranges from 6.5-85 with a pH tolerance range for aquatic organisms ranging from 6.5-9.0.

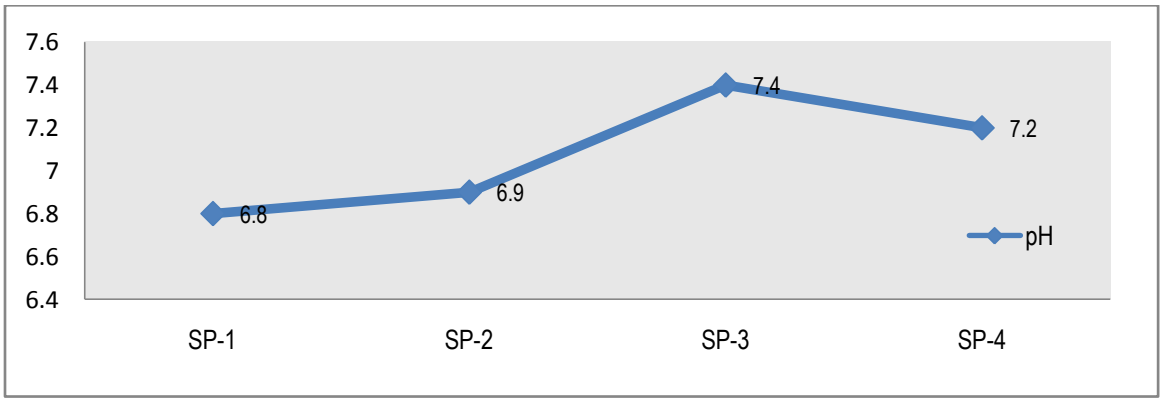

Figure 3:- The pH value of Lake Duma Water.

Chemical Oxygen Demand (COD):

COD values obtained at TS-1 3 mg/L , TS-2 3 mg/L, TS-3 4 mg/L and TS 4 mg/L (Figure 4) indicate that the COD parameters for Lake Duma still meet the requirements for COD in waters. The low COD value is due to the lack of activity in the surrounding community which results in quite high domestic limb and the remaining metabolime in fish is still low (Effendi, 2016). The value of COD in lake waters will increase if the domestic waste that enters is high because the incoming organic material will be difficult to degrade biologically (Zahrudin, et.al, 2016), meanwhilePujiastuti (2013) explain that if domestic activity and metabolic waste in fish are not excessive then the increase in COD value will be suppressed.

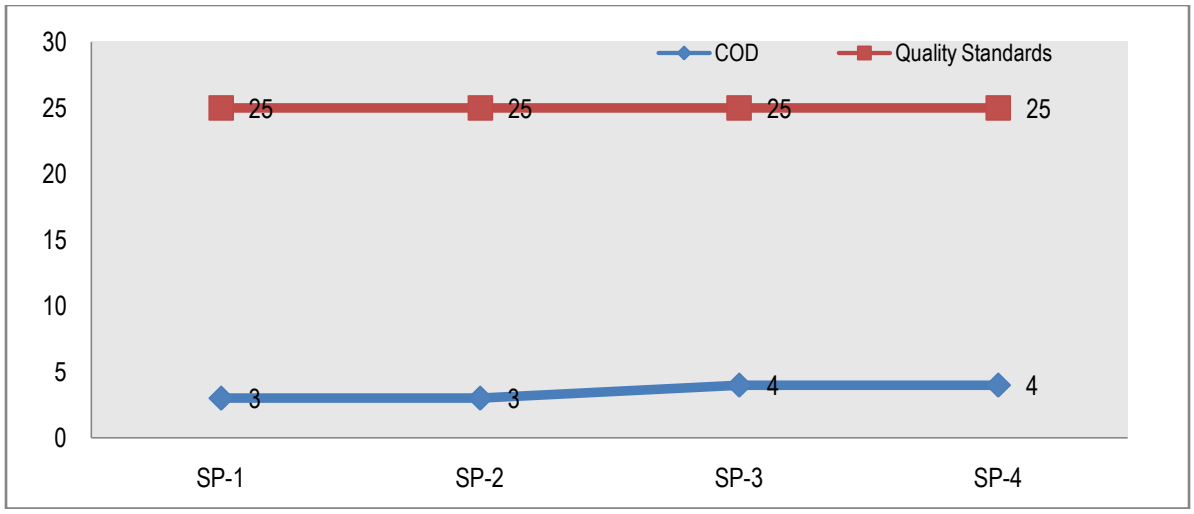

Figure 4:- COD Test Results for Lake Duma Water.

Dissolved Oxygen (DO):

The DO value from the test results shows TS-1 5.6 mg/L , TS-2 6.4 mg/L , TS-3 6.7 mg/L and TS-4 decreased to 5.3 mg/L (Figure 5). The low DO values in TS-1 and TS-4 are due to the activity of freshwater fish farming in Duma Lake which triggers an increase in organic matter so that microbes use it for decomposition. The decomposition process requires a lot of oxygen. If there is more organic matter in the waters, the oxygen needed by microbes to oxidize organic matter will increase so that the oxygen in the waters will decrease. According to Reid and Wood (1976), the quality of oxygen in the liquid medium decreases along with the quality of the feed used in fish farming..

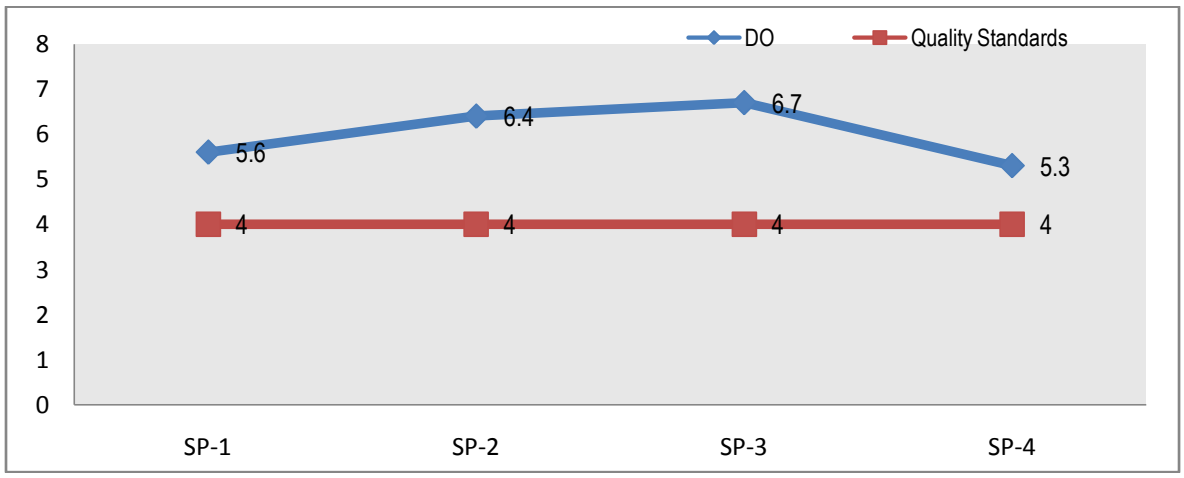

Figure 5:- Duma Lake Water DO Test Results.

Sulfate (SO42-):

The results of the sulfate test (SO42-) on TS-1 obtained a value of 11.63 mg/L , TS-2 12.15 mg/L , TS-3 11.52 mg/L and at TS-4;.23 mg/L (Figure 6). Parameter valueSulfate (SO42-) found infour locations are still far from the quality standard value, which means that they still meet the quality standards in PP. 18 of 2001. The production of sulfate ion values have been absorbed by plants has been reduced and the decomposition of organic matter which can increase metal corrosivity in lake waters for a long time will threaten this parameter to be high.

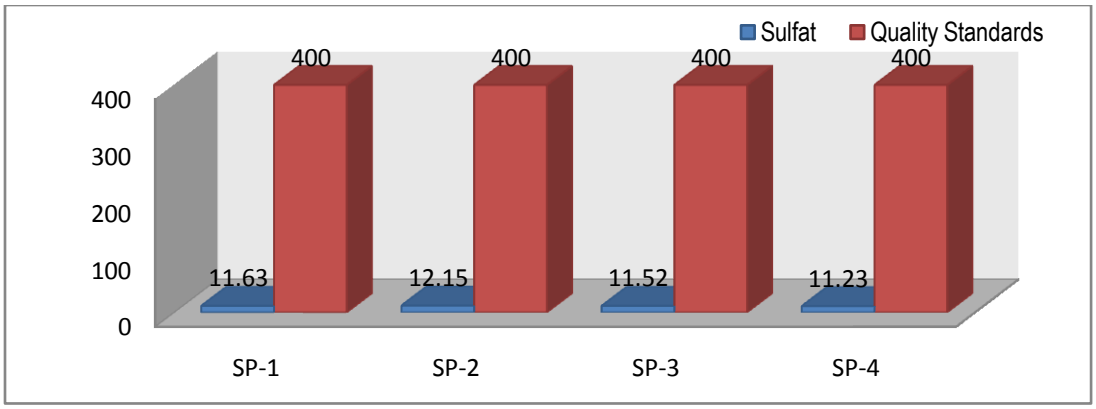

Figure 6:- Duma Lake Water Sulfate Test Results

Chloride (Cl-):

Data results of chloride ion (Cl-) is TS-1 23.46 mg/L , TS-2 23.16 mg/L , TS-3 23.41 mg/L and TS-4 with a value of 21.86 mg /L. This shows that the chloride ion concentration (Cl-) is still appropriate.

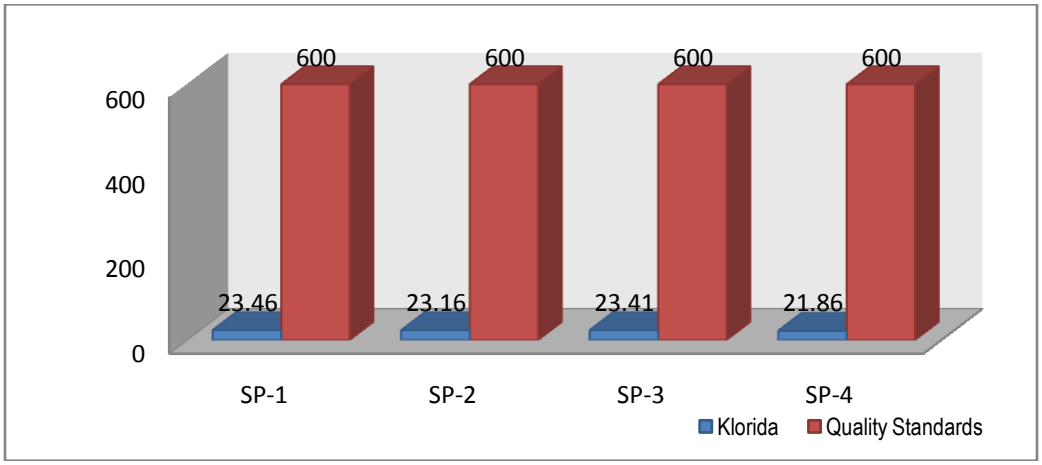

Figure 7:- The results of the Duma Lake Water Chloride Test.

Iron (Fe):

The iron (Fe) parameter test showed that almost all samples had met the quality standard. The concentration of Fe at TS-1 is 0.0472 mg/L , TS-2 0.0516 mg/L , TS-3 0.0608 mg/L and at TS-4 is 0.0434 mg/L , the Fe content comes naturally from the soil of Duma Lake and from other sources. other naturally. Overall, Fe concentration has not had an impact on disturbing the aquatic ecosystem.

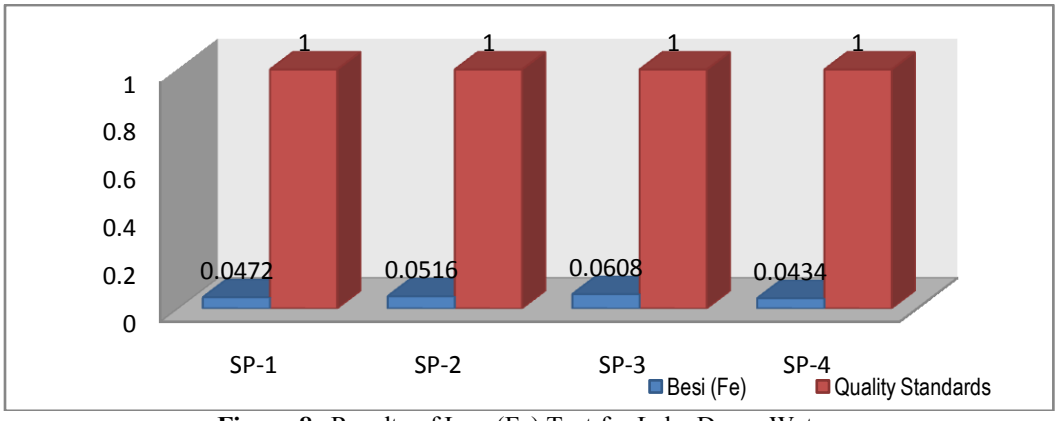

Figure 8:-Results of Iron (Fe) Test for Lake Duma Water.

Cadmium (Cd):
The Cadmium metal analysis (Cd) from the four sampled points, namely TS-1 0.007 mg/L TS-2 0.007 mg/L, TS-3 ND and TS-4 0.009 mg/L, it was obtained an average that met the criteria. quality standards, the concentration of Cd metal should not exceed 0.01 mg/L . However on presearch on Cd metal on Lake Duma water hyacinth plants found a high value of Cd metal, namely 1.48 ppm (Walanda., R &ZamZam., Z, 2020). Bon the Cd metal content in a waters should not exceed 0.03 mg/L in accordance with PP No.82 / 2001 (R. Happy Arief, et.al, 2012). Cd metal is naturally a component found in the layers of the earth and can enter the waters through a series of geochemical processes and human activities such as processing metal ores (Gbaruko, BC and Friday, 2007). Cadmium is a silver white metal, soft, shiny, insoluble in bases, easily reacts and when heated to form cadmium oxide. Cadmium is present in combination with chlorine (CdCl) or sulfursulfite (Festri&Pandebesie, 2014)

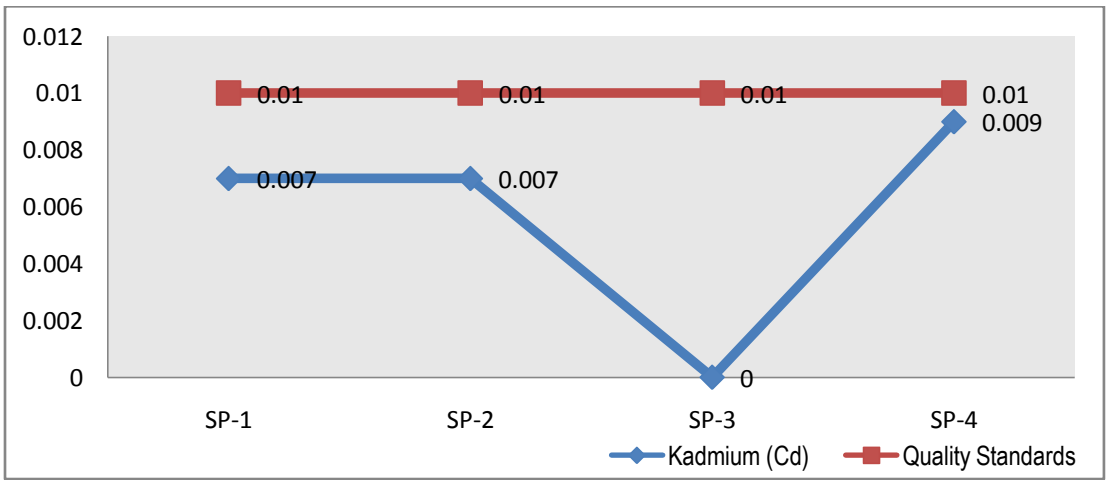

Figure 9:- Duma Lake Water Chloride Test Results.

Phosphate (PO4)**:**
Phosphorus is a chemical that is needed by living things. There are two forms, namely organic phosphate compounds and inorganic phosphate compounds, where phosphates in natural water and waste are as orthophosphate compounds, polyphosphates and organic phosphates (Arfah, 2014). In agricultural areas, orthophosphate comes from the ingredients in fertilizers that enter rivers or lakes through drainage of rainwater flows. Based on the test results, it was only found on TS-1 with a value of 0.171 while TS-2, TS-3 and TS-4 were not detected (ND). The phosphate value shows that it is still below the quality standard, namely 0.2mg/L. The low phosphate value or even at a certain point was not detected due to the plantation activities, and there was no finding of excessive use of fertilizers by the residents around the lake. Meanwhile, there was no river flow associated with the lake, so there was no river flow to the lake with a load of phosphate material. Phosphate and hydrogen phosphate are ions formed from phosphorus, where phosphorus itself becomes an important part of DNA molecules and as energy-storing molecules such as ATP and ADP and fat in cell membranes.

Nitrate (NO3):
The nitrate parameters at TS) -1 of 0.0063 mg/L , TS-2 and TS-3 were not detected (ND), while TS-4 increased to 0.23mg/L . However, the nitrate concentration is still above class II water quality, which is 10 mg/L according to PP. 82/2001. Tobing, et al (2014 explained that the trigger for increasing nitrate concentration in the waters is fish feed. The waste of fish feed in the water contains the main nutrient nitrogen which results in enrichment of organic matter (Putra, et.al 2014). Contribution of fish feed into the water. water provides 86% nitrate enrichment (Ginting in Tobing, et.al (2014). This lake is very beneficial for the surrounding community to cultivate freshwater fish such as tilapia, tilapia, goldfish, catfish and so on, so that it can allow high values nitrate, which is sourced from the cultured fish. This is also confirmed by Indrayani et al. (2015) that for every kilogram of domesticated fish it will produce nitra of 0.13 - 0.21 g / day.

Nitrite (NO2):
For the nitrite parameter at (TS) -1 has a value of 0.052 mg/L , for TS-2, TS-3 and TS-4 it is not detected (ND).The nitrite value is still below the quality standard. This lake provides benefits to local residents due to freshwater fish

farming activities, but it triggers the accumulation of nitrate and nitrite values, which come from fishermen's feed. This is also confirmed by Indrayani et al (2015) that for every kilogram of domesticated fish will produce nitrate of 0.13 - 0.21 g / day.

Lead (Pb):

Lake Duma's lead metal content at TS-1 0.03 mg/L , TS-2 0.02 mg/L , TS-3 0.04 mg/L and TS-4 is 0.06 mg/L . This indicates that the Pb concentration is below the quality standard. The lack of activities of local residents, such as the uncontrollable entry of household waste into the lake, certainly suppresses the accumulation of Pb metal pollution.Connel and Miller (1995) stated that household waste liquid is one of the contributing factors for Pb metal into the waters. In addition, the low Pb metal is due to the presence of water hyacinth as a bioindicator in water pollution due to the ability to accumulate heavy metals in the body (Surawiria, 1973).The results of the Pb level test in water hyacinth plants on water hyacinth stems from Lake Duma found that the Pb metal value was very high, namely 13.08 ppm (Walanda, 2020). Even though bthe content of lead metal (Pb) should not exceed 0.03 mg/L in waters according to PP No.82 / 2001 (R. Happy Arief, et.al, 2012). If pIferairan has been polluted, alternative processing can be carried out by means of biosorption using water plants (biomaterials) known as biosorbents which have the ability to absorb through active and passive binding. One of the biosorbents that has the ability to absorb and accumulate metals is water hyacinth (Indrasti et al. 2006). So far, water hyacinth (EichhorniaCrassipes) has only been considered a wild plant (weed) that grows a lot in areas of small rivers, lakes and swamps which may often be seen in residential areas (Herawati, 2013). This plant is a plant that has an extraordinary growth rate (water hyacinth growth expands and doubles through the formation of stolons), which ranges from 400-700 tonnes of biomass per ha per day (Rakhmania et al, 2017).

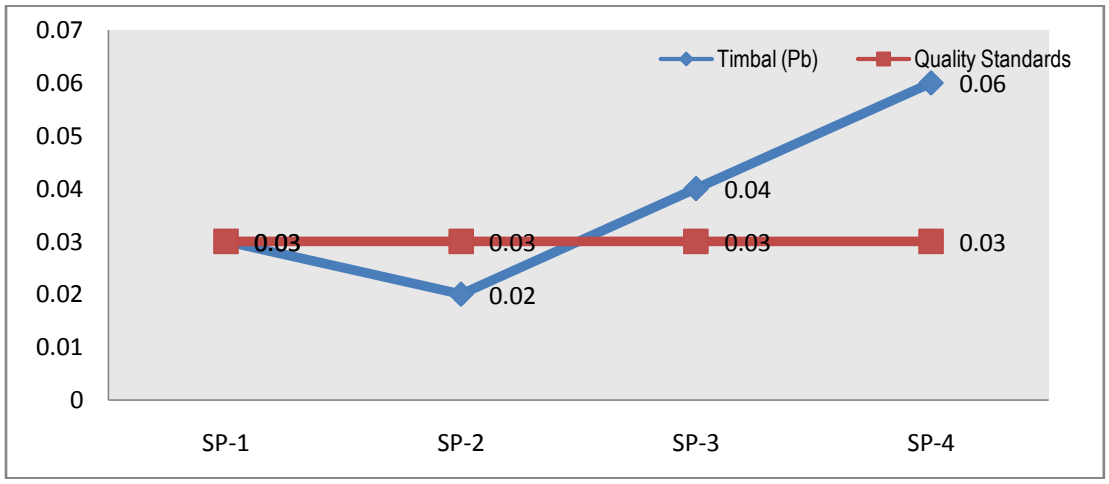

Figure 12:- Test ResultsLead (Pb) Lake Duma water.

Zinc (Zn):

The zinc (Zn) metal test results at the four points indicated that Zn still met the quality standard. TS-1 has a Zn concentration of 0.01 mg/L , TS-2 0.02 mg/L , TS-3 0.03 mg/L and TS-4 0.01 mg/L . The concentration of this Zn metal value can be explained according to observations of the absence of household waste disposal activities into the water, motorboat activity and zinc metal processing by the community (Sunti, 2012).

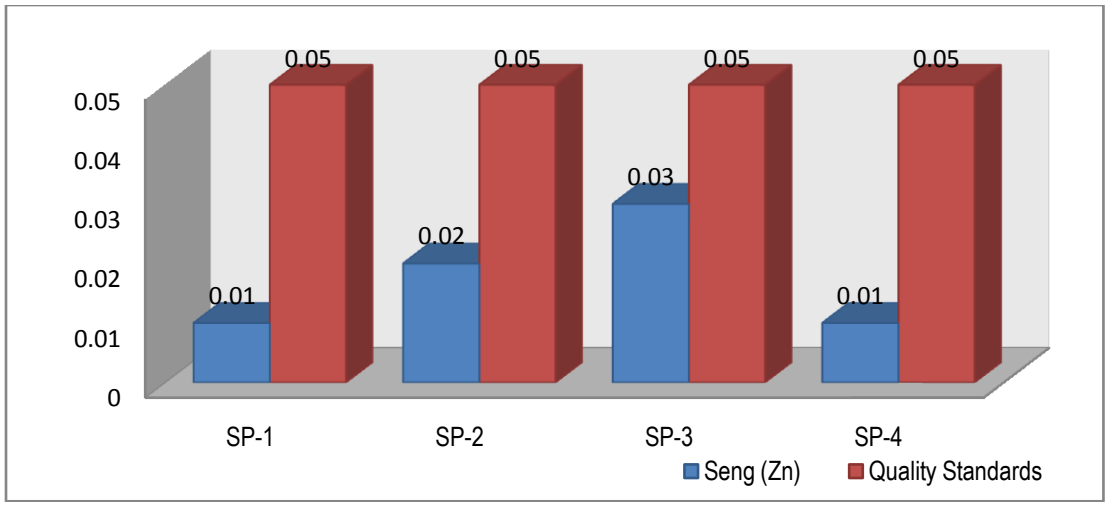

Figure 13:- Zinc Test Results (Zn) Lake Duma water.

Conclusion:-

Based on the analysis results of water quality of the Duma Galela lake it can be concluded that onphysical and chemical parameters, namely; temperature, pH, turbidity, TSS, COD, DO, SO42-, Cl-, Fe, Cd,PO4, NO3, Pb, and Zn are still in good condition according to government regulation PP No. 82 year 2001, so that it can be used for fish farming activities to support the economy of the local community.

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