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Study of Pond Waste in Sarjo Village Waters District Sarjo, Pasangkayu Regency

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Abstract

The problem in this research is the quality of the water in the waters around the Sarjo Village pond and the impact of pond waste on the environment around the Sarjo Village pond. The objectives to be achieved are (1) Assessing the water quality conditions around the Sarjo Village pond. (2) Analyze the impact of waste around the Sarjo Village pond. The type of research used is descriptive quantitative with an ecological approach. The sample used is pond wastewater. The techniques used are interview techniques, observation, and documentation. Data analysis in this research is a comparative technique. The results achieved in this research are (1) water quality that still meets quality standards, namely: temperature, brightness, pH, TSS, TDS, ammonia, phosphate, and salinity. The parameters in the waters around the ponds that do not comply with quality standards are Color and Odor at station 1 and station 2 and Nitrate at the 3 stations. (2) Based on the results of data analysis on the impact of pond waste from the nitrate content at the 3 stations which exceeds the threshold, this certainly has an impact on aquatic productivity, because it affects the biota or fish in the surrounding waters because high nitrate content can reduce oxygen levels in the water and anticipate eutrophication. Inappropriate brightness and odor at stations 1 and 2 and the brownish-black color can inhibit lighting in the waters which can inhibit the process of photosynthesis in the waters. Based on the results of calculating the pollution index (Pi), the diversity index (H'), the uniformity index (E), and the dominance index (C), these four indices show the appropriate results that the Sarjo Village pond waste disposal waters have the status of "Slightly/Moderately polluted ".

Keywords: Pond; Waste; Waters

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1. INTRODUCTION

A shrimp pond is a pond built to cultivate shrimp, both freshwater, brackish water, and saltwater shrimp. Shrimp are a type of filter animal so water quality (acidity and salt content) really determines the results obtained by farmers. Shrimp ponds are one of the coastal uses to support the economy in Sarjo Village, Sarjo District, Pasangkayu Regency. Utilization of coastal areas used for shrimp pond cultivation, both with traditional technology and with intensive technology in Sarjo Village, Sarjo District which currently exists. According to Iromo. et al (2021) ponds are containers for cultivating shrimp, crabs, or other aquatic commodities. Ideally, pond construction should not have a detrimental impact on biodiversity and the function of the surrounding ecosystem.

Vaname shrimp cultivation in Sarjo District has been running for 4 years. Most of the pond farmers who previously cultivated milkfish are starting to switch to intensive name shrimp ponds because they provide better profits. The existence of a new business certainly has the potential to have a new impact on the environment and employment, both in the surrounding community and in the community outside.

Long before the existence of intensive ponds owned by companies and communities, tens of hectares of traditional ponds owned by communities had long been a special water commodity in Sarjo Village,

where the waste outlet also had the same point at the location determined by researchers. Water quality management is the main consideration in every traditional pond shrimp cultivation, especially in intensive ponds, especially in ponds with high population levels. Water is a medium, a living medium for cultivated biota and other organisms. All life cycles of cultivated biota from egg to adult occur in water. One of the main components in human survival is water, its management requires optimal planning, development, and distribution management both in terms of quality and quantity (Amelia, et al. 2021). Cultivators must be able to create water in optimum conditions for the life and growth of the biota they cultivate. Feed is the biggest factor in efforts to produce the biota that is cultivated, especially at high stocking densities: semi-intensive, intensive, and super-intensive. Suction feed is the largest expense, 55-60% of total production costs in cultivation with high stocking densities. Feed management is very important in aquaculture, not only because it is the largest expense, but also greatly influences the quality of the water and the surrounding environment. Decreased water quality can disrupt the growth and survival of a named shrimp and other biota around the shrimp pond.

Shrimp pond waste in the form of wastewater that is released into the waters also needs to be considered, for example, the disposal of used shrimp feed waste has an unfavorable impact on the aquatic environment. Increasing the number (units) of fish cultivation infrastructure in open waters in the form of ponds or ponds on the one hand can increase fisheries production, but on the other hand, it will increase interference with other uses of these aquatic resources, including capture fisheries.

The capture fisheries sector, based on the results of initial observations carried out by researchers, from a brief interview with one of the fishermen who also represents local fisherman friends named Ridwan, assumes that the fishing area (zoning) is currently becoming increasingly distant as if there are factors influencing it. The fishermen only felt this at the edge (waste water disposal area) after the presence of shrimp pond waste disposal on one of the beaches in Sarjo Village. Considering that the Sarjo waters have been disposed of by waste from intensive shrimp ponds and traditional milkfish ponds, a symptom of environmental problems can be found in the decline in water quality. Decreasing water quality will affect the level of biodiversity of living creatures in the waters. Water conditions that do not comply with quality standards according to their intended use will have an impact on the level of diversity of various living creatures in a body of water.

So far, no study has been carried out regarding the quality of the waters as long as the waters of Sarjo Village receive waste from intensive shrimp ponds and traditional milkfish ponds which until now continue to produce, what is the status of the water quality and the level of pollution. Therefore, through the above background, this research aims to determine the status of water quality and the level of pollution.

2. RESEARCH METHODS

The type of research used in this research is descriptive quantitative research with an ecological approach. Quantitative research is a research method based on the philosophy of positivism, used to research certain populations or samples, collecting data using research instruments, and quantitative/statistical data analysis, with the aim of describing and testing predetermined hypotheses (Sugiono, 2019). The ecological approach is the study of interactions between living organisms and the environment (Hadisumarno, 1991). In determining this ecological approach, researchers see a causal relationship in the dynamics of the hydrosphere, the interaction of organisms with the aquatic environment from human activities in the aquaculture sector.

The type of data used in this research is primary data collected including water quality data (temperature, color, odor, brightness, salinity, nitrate, ammonia, phosphate, TSS, and TDS). Water quality measurements were carried out at 3 stations, namely: (1) The first station (company waste) which is meant by company waste in this study is shrimp pond water waste which is treated using modern methods and equipment (intensive ponds). (2) The second station (community waste) referred to as community waste in this research is wastewater whose outlet comes from traditional ponds owned by the local community. (3) The third station, the sampling point, is carried out at the outlet where the waste from stations one and two (estuary) meets.

Secondary data is statistical figures collected not for the purposes of the study being conducted at this time. Secondary data is data that is already available at the agency, such as general conditions at the research location, data from BPS Pasangkayu Regency, maps of government regulatory areas, data

from related agencies, namely the Sarjo sub-district office, Sarjo Village or other references in the form of journals, articles resulting from previous research and searches. data via the internet. Population is the total number of analysis units whose characteristics will be estimated. The population can also be differentiated between the sampling population and the target population. Deep planets (Singarimbun, 1989). The population in this study was pond wastewater in Sarjo Village. Mamik, (2014) part or representative of the population studied. A similar definition of sample is also put forward in Sugiono's book, (2019) A sample is part of the number and characteristics of a population. If the population is large and it is impossible for the researcher to study everything in the population, for example, due to limited energy and time, then the researcher can use samples taken from that population. The sample used in this research was 100 ml of wastewater at each specified outlet. Sampling was carried out by purposive sampling. purposive sampling is a sampling technique with certain considerations (Sugiono, 2019). The consideration in determining the sampling point is to see that this point is the main outlet for every pond waste disposal in the waters of Sarjo Village.

Data collection techniques are a way of obtaining and collecting data related to research needs and materials. The techniques used are (1) Observation, (2) Interviews, (3) Recording documents, (4) Field Measurements and Laboratory Analysis, and Data analysis this study uses comparative techniques, namely comparing the water quality in this study with water quality standards in accordance with water quality standards. Analysis comparison is used to test water samples which include temperature, brightness, color, odor, nitrate, ammonia, salinity, TDS, and TSS pH. To find out water quality standards for shrimp farming activities.

4. RESULTS D DISCUSSION

The parameters measured in this study were temperature, brightness, odor, color, pH, TDS, TSS, phosphate, and nitrate. Research to measure this parameter was carried out in the morning at 10.00 WIB in Sarjo coastal waters at 3 location points. Parameter measurements carried out directly (in situ) are temperature, brightness, odor, color, pH, salinity, and TDS. Meanwhile, the parameters whose measurements are based on laboratory test results are TSS, phosphate, and nitrate. Water samples were taken at three predetermined points and then analyzed at the Natural Resources and Environment Laboratory, Faculty of Agriculture, Tadulako University. The measurement results are presented in the following table:

Table 1. Parameter Measurement Results

Parameter	Quality standards	Station I Waste Shrimp	Station II Waste Milkfish pond	Station III estuary	Auditing
		Results	Results	Results	
Physics Parameters					
Temperature	26-32 °C	32°C	31°C	31°C	Field
Brightness	>3m	55 cm	85 cm	2.50m	Field
Smell	No smell	Smelly	No smell	No smell	Field
Water Color	Colorless	Colored	Colored	Colorless	Field
TDS	1000 ppm	62	72	73	Field
TSS	<50 ppm	1.81	1.28	1.11	Lab.

Chemical Parameters					
pH	7-8.5	7.6	7.9	8.0	Field
Salinity	10-35 ppt	31	30	30	
Fosfat	0,015 mg/l	0,0139	0,0127	0,0118	Lab.
Nitrate	0,008 mg/l	0,0098	0,0100	0,0213	Lab.
Amoniak	<0,10 mg/l	0,0040	0,0037	0,0036	Lab.
Parameter Biology					
Bentos	H' <1	1.7992	2.31458826	1.904343	Lapangan

a) Parameter fisika

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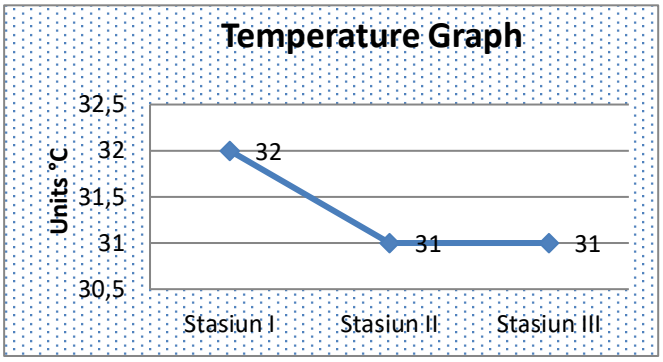

Figure 1 Temperature Measurement Results (Field Measurements 2022)

Water temperature is a very important factor for the life of organisms in water. Temperature is one of the easiest external factors to research and determine. Metabolic activities as well as the life and growth of aquatic biota are greatly influenced by water temperature (Hamuna, et al. 2018; Nontji 2005). Temperature in water bodies is influenced by season, latitude, time of day, air circulation, water movement (currents and waves), and water depth. Water temperature plays a role in controlling the condition of aquatic ecosystems. Increasing temperature causes increased decomposition of organic matter by microbes. An increase in temperature can cause stratification or layering of water. This stratification of water can affect the mixing of the water and is needed in order to distribute oxygen so that the layering of water in the base layer does not become anaerobic. Changes in surface temperature can affect physical, chemical, and biological processes in these waters (Kusumaningtyas, et al. 2014)

From the results of direct water surface temperature measurements in the field (*in situ*), it was found that the water temperature around the pond at the 3 stations was relatively the same, namely in the range of 31-32 ℃. The water temperatures obtained tend to be relatively the same between observation stations. Based on seawater quality standards for marine biota in the Decree of the Minister of Environment No. 51 of 2004, the Sarjo water temperature is still within normal limits and in accordance with the needs for the metabolism of marine biota and marine coastal ecosystems such as coral, seagrass, and mangroves.

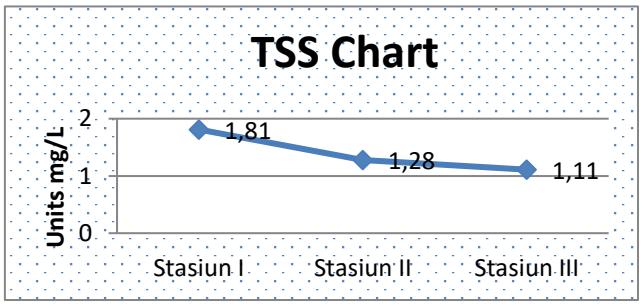

Figure 2. TSS Measurement Results (Agriculture Lab 2022)

solids (TSS) are suspended materials (>1 µm in diameter) that remain on a *millipore sieve* with a pore diameter of 0.45 µm. TSS consists of mud and fine sand as well as microorganisms, which are mainly caused by soil erosion or soil erosion carried into water bodies (Effendi, 2003). TSS can increase the turbidity value so that it will affect the penetration of sunlight into water pools and ultimately affect the photosynthesis process by phytoplankton and aquatic plants which will further reduce the supply of dissolved oxygen.

The measurement results at the 3 observation stations have varying values but are relatively the same. Where the TSS value in Sarjo waters ranges from 1.11-1.81 mg/l. The highest TSS value was found in the waters of station 1, namely 1.81 mg/l, the second highest was found at station 2, namely 1.28 mg/l, and the third highest was at station 3, namely 1.11 mg/l. The high TSS content at station 1 is thought to be due to the influence of intensive shrimp farming activities around the waters which cause high levels of sedimentation to enter the water bodies. The TSS content at station 1 may not only come from leftover feed and manure from farmed animals, shrimp carcasses and mangrove vegetation that shed leaves and decaying roots that dissolve in water can also be a source of TSS.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all TSS values at observation stations still comply with seawater quality standards for marine biota.

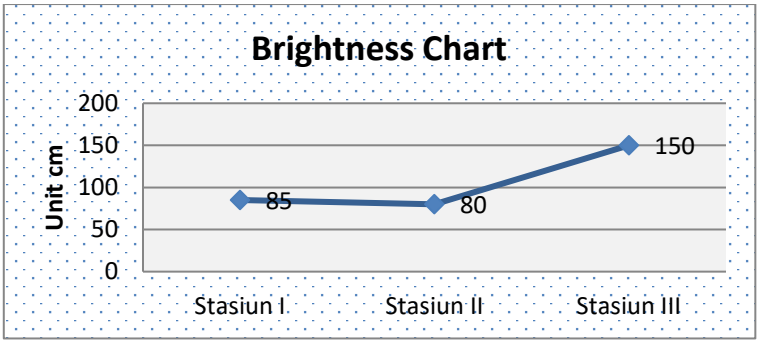

Figure 3. Brightness measurement results (2022 field measurements)

Brightness is the level of transparency of waters that can be observed visually using *a Secchi disk*. By knowing the brightness level of a body of water, we can find out to what extent there is still the possibility of an assimilation (adjustment) process occurring in the water, which layers are not turbid, and which are the most turbid. Waters that have low brightness values during normal weather can provide a clue or indication of the amount of suspended particles in those waters. Based on the results of observations, in general, the brightness level of Sarjo waters, with the water brightness level ranging between 0.55 and 2.50 meters. The three stations have observation results that are below the seawater quality standards for marine biota in the Decree of the Minister of Environment No. 51 of 2004. The low level of brightness at station 1 is caused by the large supply of sediment and dissolved particles, organic and inorganic materials, such as leftover feed and waste from intensive shrimp farming disposal. Likewise at station 2 where the brightness level is below the standard quality standards for marine biota, caused by the supply of sediment from leftover feed and waste from milkfish cultivation which is considered capable of reducing the brightness level in the surrounding waters.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all brightness values at observation stations still comply with seawater quality standards for marine biota.

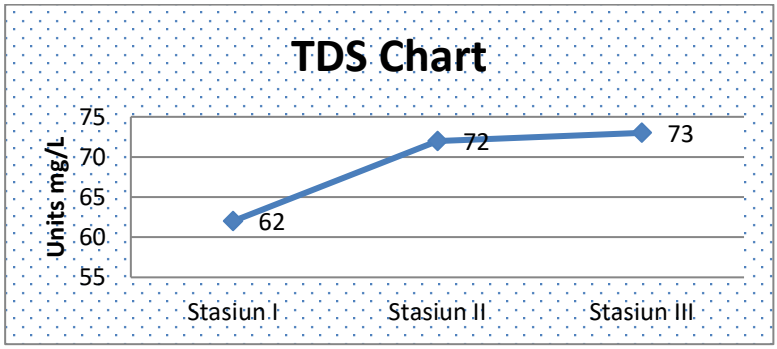

Figure 4. TDS Measurement Results (Field Measurements 2022)

Dissolved solids (TDS) are solids that are smaller in size than suspended solids. These solids consist of water-soluble inorganic and organic compounds, minerals, and their salts. TDS is an indicator for measuring chemical mass concentration which shows how many grams of a substance are present in one liter of liquid. TDS on waters can be said to be appropriate if the value is less than 1000. Based on the research results, the lowest TDS value is at station 1 (one), namely: 62 mg/l. The low TDS at station 1 is in accordance with the conditions of the station which is upstream, the condition of Station 1's water which flows towards the estuary when the sea water recedes which carries compounds. chemistry (TDS) So the TDS figure at Station 1 is relatively low. Meanwhile, the highest TDS value was at station 3, namely: 73 mg/l. The high TDS value of Station 3 is in accordance with the nature of TDS which is easily soluble in water, because it consists of compounds that make it easier for the TDS compound content at Stations 1 and 2 to flow to Station 3 which is located downstream or in the estuary. Then the TDS value at Station 2 is: 72 mg/l TDS value at station 2 this milkfish pond, apart from TDS coming from its own waste, also gets a TDS supply from the flow of station 1 which is upstream. Based

on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all TDS values at observation stations still comply with seawater quality standards for marine biota.

b) Chemical Parameters

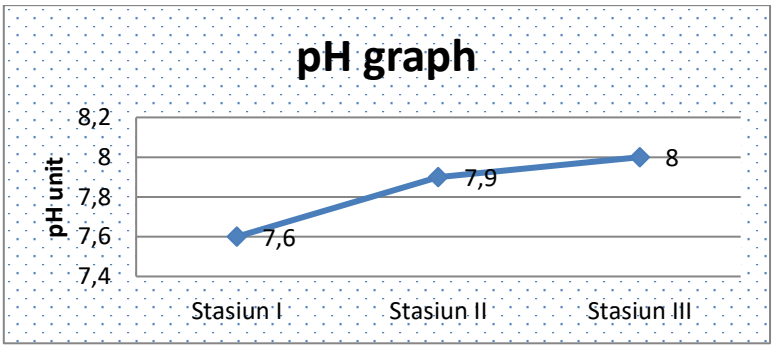

Figure 5. pH measurement results (Field Measurements 2022)

The degree of acidity (pH) is the negative logarithm of the concentration of hydrogen ions released in a liquid and is an indicator of whether water is good or bad. The pH of a body of water is a chemical parameter that is quite important in monitoring the stability of water (Simanjuntak, 2009). Variations in the pH value of water greatly influence the biota in a body of water. Apart from that, the high pH value greatly determines the dominance of phytoplankton which influences the level of primary productivity in waters where the presence of phytoplankton is supported by the availability of nutrients in marine waters (Megawati, et al. 2014). The results of pH measurements in Sarjo waters at the 3 sampling stations are relatively similar, namely ranging from 7.6-8.0 mg/l. The results of these pH measurements have become the average figure in the Pasangkayu coastal area. The pH content for the Pasangkayu Regency area of Sarjo waters includes waters that have a pH content with a fairly high average value. For example, the research results of Rani, et al. (2012) high average pH values were measured in the Sarjo and Bamballamotu locations, while the lowest average pH values were measured in the Lariang area.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all pH values at observation stations still comply with seawater quality standards for marine biota.

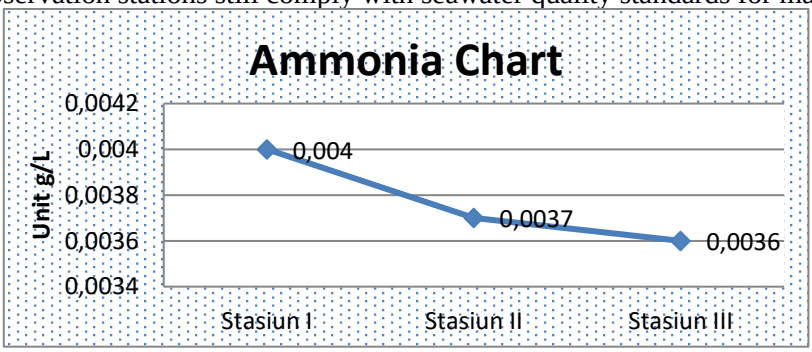

Figure 6. Ammonia measurement results (Agriculture Lab 2022)

Waste is a problem that must be handled properly because waste can contain dangerous and toxic chemicals. Ammonia levels in seawater can be toxic to biota if the levels exceed the maximum limit. Most of the food eaten by fish and shrimp is broken down into meat or body tissue, while the rest is excreted in the form of solid waste (*feces)* and dissolved (ammonia). *Feces* will be excreted through the anus, while ammonia will be excreted through the gills (*ammonotelic animal group)* (Ghufran, et al. 2020). The analysis results show that the ammonia concentration in Sarjo waters from the analysis results ranges from 0.0036-0.0040 mg/l. The lowest Ammonia k value was at station 3, namely: 0.0036 mg/l. The highest ammonia k value is at station 1, namely: 0.0040 mg/l, The high level of ammonia at station 1 comes from leftover feed and shrimp waste that settles at the waste outlet location, causing a tendency for high ammonia levels. According to S Yamsudin (2014), food remains fish waste, and

organic materials will decompose into nitrogen in the form of ammonia which is toxic to fish, ammonia at station 2 (two), namely: 0.0037 mg/l.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all ammonia values at observation stations still comply with seawater quality standards for marine biota.

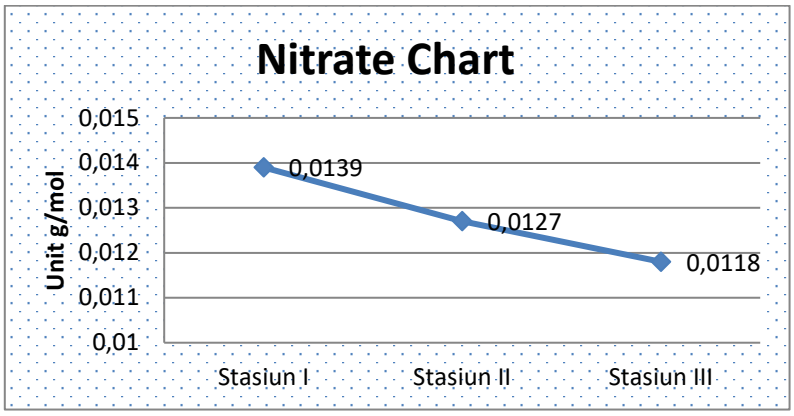

Figure 7. Nitrate measurement results (Agriculture Lab 2022)

Nitrate is a nutrient compound that is important in the synthesis of animal and plant proteins. High nitrate concentrations in waters can stimulate the growth and development of aquatic organisms if supported by nutrient availability. The analysis results show that the concentration of nitrate values at the 3 stations ranges from 0.0098 to 0.0213 mg/l. All nitrate contents at observation stations have passed the seawater quality standards for marine biota Minister of Environment Decree No. 51 of 2004, especially the nitrate concentration at station 3 with a value of 0.0213, the high nitrate value at station 3 is not only caused by supply from pond activities, agricultural runoff carried by rainwater can also trigger high nitrate concentrations in these waters. This condition is very dangerous for marine biota because according to Effendi (2003), nitrate concentrations of more than 0.2 mg/l can result in eutrophication (enrichment) and subsequently stimulate the rapid growth of *algae and aquatic plants (blooming*).

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, the nitrate content in Sarjo waters all exceeds the quality standard, where the quality standard for nitrate concentration for seawater biota is 0.008 mg/l. The calculation results indicate that waste from Sarjo ponds, *intensive ponds*, and traditional ponds has the potential to contribute to water pollution

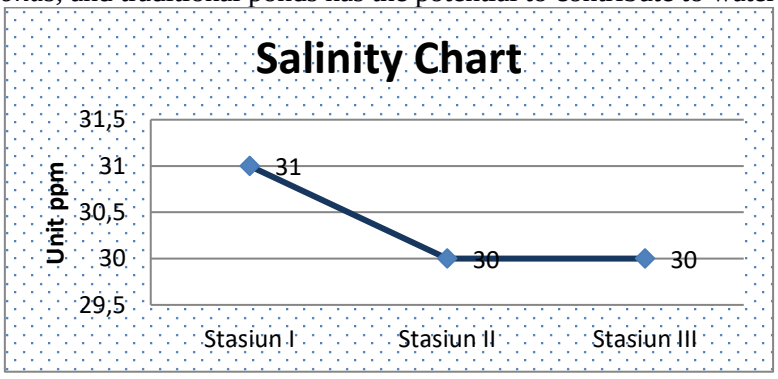

Figure 8. Salinity measurement results (2022 field measurements)

Salinity is the concentration of all salt solutions obtained in seawater, where the salinity of the water affects the osmotic pressure of the water, the higher the salinity, the greater the osmotic pressure (Widiadmoko, 2013). Differences in water salinity can occur due to differences in evaporation and precipitation. The results of salinity measurements in Sarjo waters do not differ much between observation stations (30-31 ppt) and it can be said that the results obtained are heterogeneous with variations in values that are not too large. Variations in salinity in seawater will affect aquatic living organisms based on their ability to control specific gravity and variations in osmotic pressure.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all salinity values at observation stations are still in accordance with seawater quality standards for marine biota.

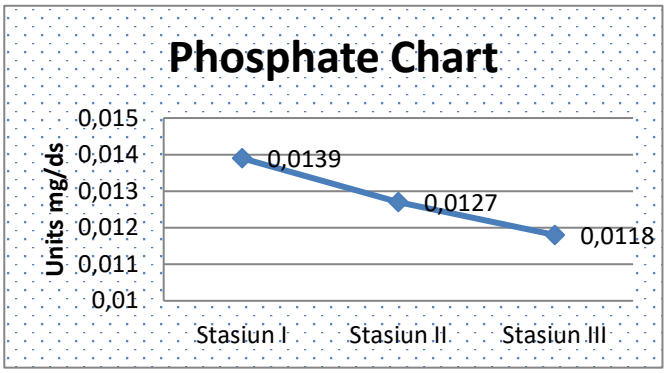

Figure 9. Phosphate Measurement Results (Agriculture Lab 2022)

Phosphate is an essential element for metabolism and protein formation. Phosphate is a very important nutrient compound in the sea. In marine waters, phosphate is in the form of dissolved inorganic and organic as well as particular phosphate (Affan. 2010). Phosphate is a nutrient that is needed for the growth and metabolism of phytoplankton and other marine organisms in determining the fertility of waters. Its condition is unstable because it easily experiences processes of erosion, weathering, and dilution. Phosphate is a form of phosphorus that can be utilized by plants. In waters, the form of the element phosphorus changes continuously, due to decomposition and synthetic processes between organic and inorganic forms carried out by microbes (Effendi 2003). The distribution of phosphate from offshore areas to coastal areas shows increasingly higher concentrations towards the coast.

Based on the analysis results, the concentration of phosphate content at the measuring stations ranged from 0.011-0.013 mg/l, the phosphate content at the three stations had varying values but was almost the same. The lowest phosphate value is at station 3, namely: 0.011 mg/l, the low phosphate value at station 3 or the estuary is in accordance with the conditions in the estuary. The highest phosphate value is at station 1 or intensive shrimp pond waste, namely: 0.0139 mg/l, the high phosphate value at station 1 comes from the remains of harvested shrimp and the bodies of aquatic animals in the waters that flow to waste disposal and plant leaves. Falling mangroves experience decomposition resulting in phosphate levels. According to Simon, (2015), The high level of phosphate in the bottom of the waters is because the bottom of the waters generally contains nutrients, both from decomposition and organic compounds originating from the bodies of dead flora and fauna. The phosphate value at station 2 is: 0.0 1 2 mg/l, the phosphate value at station 2 or traditional pond waste has phosphate content which may come from the habits of traditional fish farmers (milkfish ponds) when harvesting using poison so it is not only from only farmed fish carcasses, but many other aquatic biota also die and become rotting carcasses which could become phosphate-producing compounds.

Based on seawater quality standards in the Decree of the Minister of Environment No. 51 of 2004, all phosphate values at observation stations are still in accordance with seawater quality standards for marine biota

c) Biological Parameters

- Benthos

Based on the results of observations at each station, various types of fauna species were found which were indicated as benthos (bottom water animals), along with the results of observations and calculation results using diversity index analysis, uniformity index, and dominance index.

4. CONCLUSION

Based on the results of the research and discussions carried out, it can be concluded The quality of the waters around the Sarjo Village ponds is described by several parameters based on measurement

results that still comply with quality standards, namely: temperature, brightness, pH, TSS, TDS, ammonia and salinity. Those that do not comply with quality standards are blackish-brown color and odor at station 1 (intensive shrimp pond outlet) and station 2 (waste outlet). T traditional milkfish ponds) and Nitrate at the 3 stations which according to the Decree of the Minister of Environment No. 51 of 2004 does not comply with sea water quality standards for marine biota. Based on the results of calculating the pollution index (Pi), the diversity index (H'), uniformity index (E), and dominance index (C), these four indices show the appropriate results that the Sarjo Village pond waste disposal waters have the status of "Slightly/Moderately polluted " Based on the results of data analysis on the impact of pond waste from the nitrate content at the three stations which exceeds the threshold, this certainly has an impact on water productivity due to decreased water quality, this can also affect the growth of fish in the surrounding waters because high nitrate content can reduce levels oxygen in the water, *eutrophication* so that plant will bloom quickly. Inappropriate brightness and odor at stations 1 and 2 and the brownish-black color can inhibit lighting in the waters which can inhibit the process of photosynthesis in the waters. At any time, benthic diversity may be at its lowest level, meaning that there will be species that generations have not had the opportunity to perpetuate directly.

5. REFERENCES

Amelia. (2021). Analysis of water quality in the northern part of Serangan Island's water area based on seawater quality standards. Online http://download.garuda.kemdikbud.go.id/article.php?article=1347855&val=942&title=Analysis%20Quality%20Perairan%20Pada%20Region%20Perairan%20Island%20Serangan%20Part%20North%20Based on%20Baku%20Quality %20Water%20Sea. On Thursday, October 6, 2021.

Ghufran, et al. (2020) Water Quality Management. Jakarta: Rineka Cipta

Hamuna, et al. (2018). Study of Sea Water Quality and Pollution Index Based on Physico-Chemical Parameters in the Waters of Depapre Disti, Jayapura. Journal of Environmental Science.

Iromo, H, et al. (2021). Utilization of Traditional Ponds for Cultivating Mud Crabs. Syiah Kuala University Press.

Kusumangtyas , et al. (2014). Natuna water quality in the transition season. Depik

Mamik. (2014). Health Research Methods (p. 21). Zivatama.

Megawati, et al. (2014) distribution of water quality in terms of nutrients, dissolved oxygen, and pH in the southern waters of southern Bali. Oceanographic journal.

Simanjuntak, et al. (2009) The relationship between chemical and physical environmental factors on the distribution of plankton in the waters of East Belitung. Journal of fisheries sciences.

Simon, I. (2015). Characteristics of Phosphate, Nitrate, and Dissolved Oxygen in the Waters of the Lembeh Strait, North Sulawesi. Tropical coastal and marine journal. Online https://ejournal.unsrat.ac.id/index.php/jplt/article/viewFile/9581/9159 On 20 September 2022.

Singarimbun, M. (1989). Survey Research Methods (p. 152). In-Published Catalog.

Sugiono, S. (2019). Educational research methods (p. 23). Alphabet

Syamsuddin, R. (2014). Definition of water brightness. In Water Quality Management (p. 72). Incandescent Press.