Evaluation of Nitrate, Phosphate and Ammonia Content around BBPIAL Pond in Karang Anyar Village, Tugu District, Semarang

Dirk Y. P. Runtuboi[1], Muhammad Zainuri[2], Ervina Indrayani[3], Imam Mishbach[4]
[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Cenderawasih University, Jayapura, Papua, Indonesia
[2]Departement of Oceanography, Faculty of Fisheries and Marine Science, Diponegoro University, Semarang, Center of Java, Indonesia
[3,4]Department of Marine Science and Fisheries, Faculty of Mathematics and Natural Sciences, Cenderawasih University, Indonesia
Email: dirk.runtuboi@fmipa.uncen.ac.id, muhammad.zainuri@yahoo.co.id, ervina_indrayani@yahoo.com, imammishbach71@gmail.com
*Correspondence author: dirk.runtuboi@fmipa.uncen.ac.id

ABSTRACT
BBIAPL Pond is one of the Brackish Water Fish Budiaya Center and Karanganyar Sea located in Tugu Village, Tugu District, Semarang City. The quality of the BBIAPL pond aquatic environment is essential in supporting the survival of various types of marine life. This study evaluates nitrate, phosphate, and ammonia in the water around BBIAPL pond, Tugu District, Semarang. The method used is a survey with a quantitative approach. Sampling in Stations 1, 2 and 3 in the water around the BBIAPL pond using purposive sampling techniques using line transects. The Semarang Testing Center Laboratory and equipment analysed nitrate and phosphate content. The results showed the content of nitrate, phosphate and ammonia at stations 1,2 and 3. At nitrate content of 0.57-0.59 mg / l, 0.57-0.58 mg / l and 0.51-0.52 mg / l, respectively. Furthermore, the phosphate content is 0.77-0.78 mg/l, 0.06-0.07 mg/l and 0.35-0.36 mg/l and Ammonia 0.20-0.22 mg/l, 0.30 mg/l and 0.10-0.11 mg/l, respectively.

Keywords: Nitrate, Phosphate, Ammonia, BBIAPL pondwaters

INTRODUCTION

Ponds play a crucial role in aquaculture, providing a suitable environment for aquatic organisms to thrive. Different types of ponds are suitable for specific aquatic organisms, and the choice of the pond type depends on factors such as water quality, resource availability, and the organisms raised. The BBIAPL pond is one such pond that plays a vital role in the Brackish Water Fish Budiaya Center and Karanganyar Sea located in Tugu Village, Tugu District, Semarang City.

The quality of the BBIAPL pond aquatic environment, especially the nitrate phosphate and ammonia content, is essential in supporting the survival of various types of marine life (Fitriani et al. 2022). The concentration of nitrates, phosphates and ammonia that exceeds predetermined quality standards affects water quality and organisms in these waters (Rozalina et al. 2020; Arofah et al. 2021).

Nitrate is the main form of nitrogen in natural aquatic environments, derived from ammonium and entering river bodies through domestic waste. In contrast, phosphate (PO4) is one type of nutrient that cannot remove from the atmosphere but, in general, can be removed from the aquatic environment through chemical or biological processes by phytoplankton in sediments. The presence of phosphate in the aquatic environment comes from the runoff of agricultural fertilizers, animal or human waste, soap, vegetable processing, and the pulp and paper industry (Da Silva 2013; Singh and Craswell 2021; Mekurian et al. 2021).

The amount of nitrate and phosphate content in the aquatic environment is also often used as an indicator of fertility and pollution of the coastal aquatic environment. The classification of sea fertility levels based on nitrate content includes oligotrophic waters (0-1 mg / l), mesotrophic (1-5 mg / l) and eutrophic (5-50 mg / l), while when based on orthophosphate content, among others: oligotrophic waters (0.003-0.010 mg / l), mesotrophic (0.010-0.030 mg / l) and eutrophic (0.03-0.1 mg / l) Ammonia also has potential as a source of nutrients for microalgae growth. The difference in the amount of ammonia content as a nutrient in the form of nitrogen significantly influences the density of phytoplankton cells, so the more significant the nutrients are, the density of Nannochloropsis sp cells will increase. Nutrients in maintenance media are essential to microalgae growth (Chowdury and Nahar 2020; Singh and Craswell 2021; Ihsan et al. 2022).

The results of Singh and Craswell (2021) showed that the nitrate and phosphate content in Tanggul Clare Village Beach, Kedung District, Jepara Regency and BBPBAP (Center for Brackish Water Aquaculture Development) Jepara were around 0.882-1.711 mg / l and 0.086-0.097 mg / l, respectively. Furthermore, the research results by Sitepua et al. (2021) also showed the content of Nitrate (0.2-0.9 mg / L) and phosphate (0.1-0.4 mg / L) in water in the Telagawaja River. Similarly, the research results by Herlinawati et al. (2018) showed that the content of nitrates and phosphates in the waters of Serangan Island is around 0.92 mg / l and 0.86 mg / l, respectively.

The high content of nitrates and phosphates in the aquatic environment can also trigger nutrient enrichment (eutrophication) which can further disrupt the survival of various types of marine life. The eutrophication process is a general prosses characterized by phytoplankton or algae blooming, decreased dissolved oxygen content and mass death of marine life (Rozalina et al. 2020; Arofah et al. 2021).

In today's reform era, people's mindsets are increasingly critical, especially against irregularities in every activity carried out by the government and private institutions. Based on this description, a study on the nitrate phosphate and ammonia content in BBIAPL Pond, Semarang Regency, aims to determine aquatic fertility indicators. Although it has a tremendous positive impact on the nation and country, the construction of industrial projects often causes pollution that damages the environment.

Research on the suitability of water quality in the pond ecosystem around the BBIAPL Pond is necessary. It contributes to integrated coastal area management by providing essential information on the impact of nearby industrial activities on the surrounding environment. By conducting this research, the study can provide insights into the potential impacts of industrial activities on the surrounding environment and recommend appropriate measures to mitigate the adverse effects. This research can also benefit the pond farmers and surrounding communities by ensuring a healthy aquatic environment. In this regard, this work's innovation lies in using water quality assessment as a tool to determine the level of suitability for milkfish cultivation.

MATERIALS AND METHODS

Research Location

The research was conducted from November 2022 to January 2023 in BBIAPL Farm, Karang Anyar village, Tugu district, Semarang, Center of Java. It began with planning, preparation, data collection and analysis, then ended with reporting. Sampling locations are determined based on stations 1 (A), 2 (B) and 3 (C), with three repetitions for each station at BBIAPL Farm (Figure 1).

Figure 1. Position the sampling plot at each observation station.

Research Material

The material used in this study consists of research tools and materials. Tools used during the study included secchi disks and scale sticks to measure the water's brightness and depth. Mercury thermometers are used to measure water and air temperature. pH paper is used to measure the pH of water. Refractometers are used to measure the salinity of the water. DO meters are used to measure dissolved oxygen in the water. A 600 ml sample bottle is used to store test samples of chemical parameters (nitrate, phosphate and ammonia)—a cool box stores water sample bottles so they are not exposed to direct sunlight. Hach spectrophotometers are used to measure nitrates, phosphates and ammonia. The funnel is used to help put filtered water into the bottle. Test tubes are used to place samples to be measured on a spectrophotometer.

Research Methods

The research methods used are field survey methods and comparative methods. The survey method is one of the research methods by collecting data derived from samples that will produce relative relationships. This method is used to produce primary data that will be combined with secondary data derived from quality standards set by the government regarding the suitability of milkfish farming. Comparative methods reinforce primary data and secondary data. The comparative method is a research method that uses comparison to produce data (Bolbakov et al. 2020).

Sampling Techniques

Sampling is carried out by purposive sampling method. According to Campbell et al. (2020), purposive sampling is a sampling method that is specifically selected based on the purpose of the study. The sampling location is determined after a site survey. Sampling was conducted at stations 1, 2 and 3 at BBIAPL Ponds, where three ponds were determined as repeats. In this way, it is expected to provide equal opportunities for each population to be sampled. At a predetermined location, measurements of several physical parameters (brightness, depth, temperature) are made. The chemical parameters measured in situ are water temperature, air temperature, salinity and pH, while nitrate, phosphate and ammonia measurements are carried out in the laboratory.

RESULTS AND DISCUSSION

Measurement of Aquatic Physical Parameters
Brightness Measurement

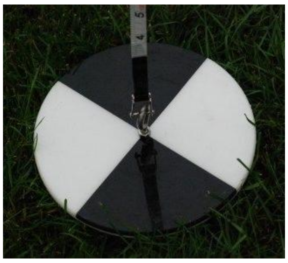

Figure 2. Secchi Disk

Water brightness measurements were carried out using secchi disks (Umasugi et al. 2021). The water brightness measurement was carried out three times. Secchi Disk is a simple disc-shaped plate, on the surface of which there are black and white colours in the form of shading with four parts. How to use Secchi Disk by slabs of Secchi Disk tied with rope and then inserted into water. When the pattern contained in the Secchi Disk is no longer visible in the water at a certain depth, the analysis results of the level of water brightness measure are obtained. The formula can measure the brightness of water: $K = \frac{d1}{d2}$

K = Brightness
d1 = Secchi depth of disk when not visible
d2 = Secchi disk depth when it starts to appear again

Temperature Measurement

The temperature is measured using a rod thermometer inserted into the water for 2 minutes, and then a temperature value reading is taken while the thermometer is still in the water. The temperature measurement time was carried out three times.

Measurement of Chemical Parameters

The chemical parameters observed in this study were the salinity and pH of the waters. Measurements of the salinity of water are carried out using refractometers. While the pH of the water is measured using a pH meter (Garini et al. 2021). The salinity measurement was carried out three times.

Nitrat Measurement

Measurement of nitrate content (NO3) refers to SNI 6989.79. 2011 using DR/2500 spectrophotometer accuracy of 0.3 –30.0 mg/lNO3-N, starting with taking 500 ml of previously taken sample water. Water is filtered using filter paper and put into a labelled test sample bottle. The vials of each sample are marked S 1.1 (sample 1 from week 1) and B 1.1 (sample 1 from week 1), as well as for other samples up to S 5.3 (sample 5 from week 3). Press the Hach Programs key, select the 355 N program, Nitrate HR, and press Start. The first test vial, S 1.1, is given NitraVer 5 Nitrate reagent powder. Select the timer icon on the spectrophotometer and select a time of one minute, then jog the bottle that has been given the reagent powder until the timer sounds. Press OK after the timer sounds and wait for the reaction on the sample bottle for 5 minutes, there will be an evident colour change. There are black grains. Form B 1.1 is inserted in the spectrophotometer, and press Zero will appear 0.0 mg / lNO3-N. After sounding, replace S 1.1, entered will appear the measurement number (in mg / l) from the spectrophotometer. Repeat the method in the following sample (Nasution et al. 2019).

Phosphate Measurement

Analysis of phosphate levels refers to the method by Tampubolon et al. (2020). Phosphate analysis was performed using test samples pipettes of 50 mL and inserted each into Erlenmeyer. A mixed solution of 8 mL is added and homogenized, then inserted into the cuvette on the spectrophotometer. One drop of phenolphthalein indicator was added H2SO4 5N is added if pink is formed and added until the colour is lost. Results were analyzed at a wavelength of 880 nm in the time range of 10 minutes-30 minutes.

Ammonia Measurement

Measurement of ammonium levels refers to the SNI 06-2479-1991 procedure. A sample of 50 ml is put into the Erlenmeyer, and then 1 ml of Nessler's solution is added and homogenized. Let the reaction process last for 10 minutes. The solution is then inserted into the cuvette on the spectrophotometer, observe and record the absorption (Widiardja et al. 2021).

Data Analysis

This research uses ArcGIS 10.6 software with IDW particular analysis interpolation. The IDW method directly implements the assumption that something close to each other will be more similar than something that is far from each other. To estimate a value at any location that is not measured, IDW will use the measure values surrounding the location to be estimated. The IDW method assumes that the degree of correlation and similarity between the estimated point and the estimator data is proportional to the distance. According to the distance to the estimator data, the weight will change linearly as a distance function (Yang and Xing 2021). This weight is not affected by the position or location of the estimator data with other estimator data (Mott 2018).

RESULTS AND DISCUSSION

Nitrate Content

The results of sampling at three stations for nitrate, phosphate and ammonia showed that the nitrate content at stations 1.2 and 3 was 0.59 mg / l, 0.59 mg / l and 0.57 mg / l, the phosphate content was 0.58 mg/l, 0.58 mg/l and 0.57 mg/l, and ammonia was 0.51 mg/l, 0.51 mg/l and 0.52 mg/l (Figure 2-6) (Table 1).

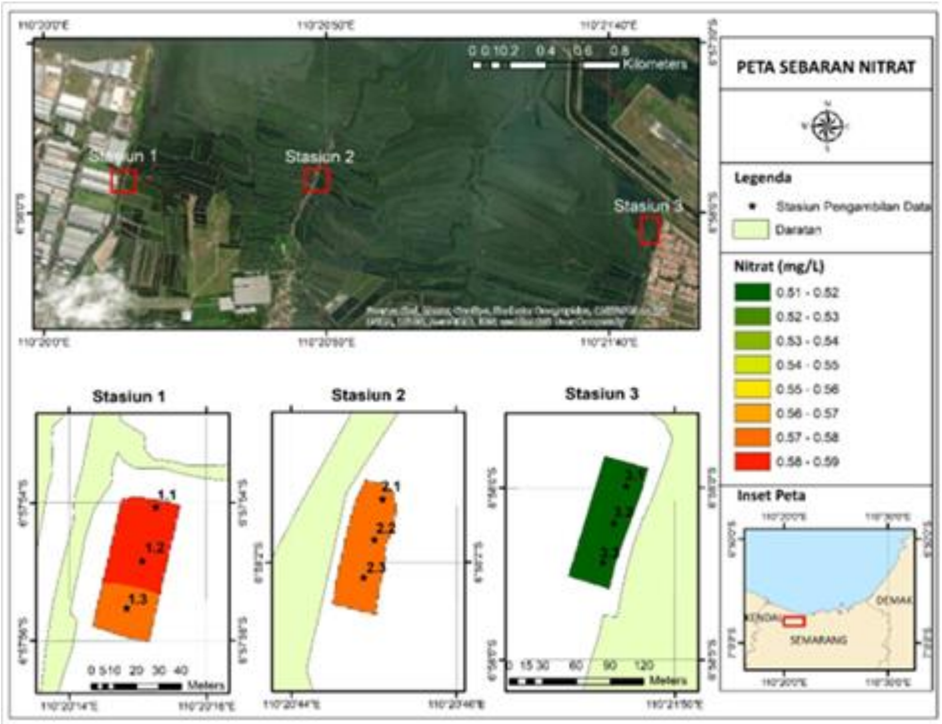

Figure 2. Nitrate Distribution Map

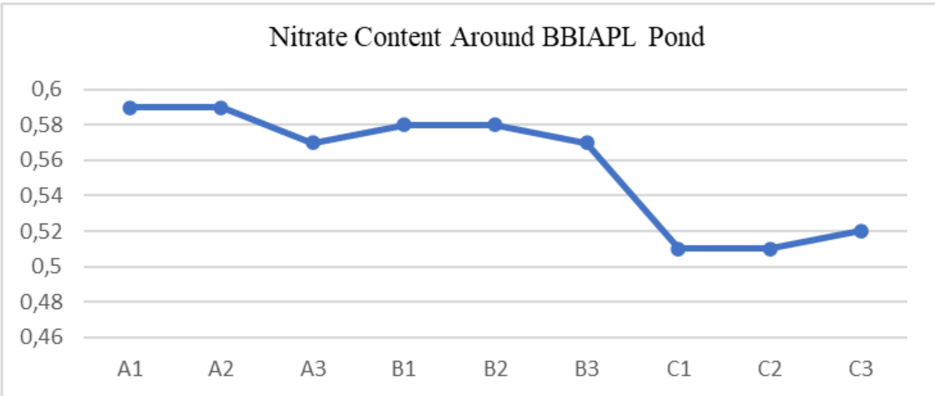

Figure 3. Nitrate Content Graph around BBIAPL Pond

The BBIAPL Pond area in Tugu District is also part of the mouth of the Tapak River, which flows from the upstream part, which is in Lele Park and Beji River, where a river is also a place for various waste disposal industries and settlements around the river. Such waste will indirectly affect the milkfish ponds in the river estuary, which will affect the quality of reared Bengal fish. Industrial waste in the Tugu District area enters the river and eventually enters the ponds, contaminating their pond. If pond waters are polluted, then it is suspected that milkfish is cultivated also polluted. Industrial waste pollution in the pond is further strengthened by the sufficient distance between the pond and the industrial area close, about 5 meters; an example is PT. Golden Manyaran. As explained by Sitepu et al. (2021), nitrogen in water originates from various human activities that produce wastes such as industrial wastewater, animal manure, agricultural waste, and emissions vehicles, where all of this can affect nitrate formation. The difference in Nitrate content may be due to increased human activity or activity differences around the river.

The high nitrate content in the BBIAPL pond is influenced by various macroalgae such as Ulva sp., Gracillaria sp., Boergesenia sp., Euchema sp., and Enteromorpha sp. In addition, the process of decomposition of macroalgae by decomposers also increases nutrients. Singh and Craswell (2021) explain that mangrove vegetation can increase water fertility through decomposers of mangrove leaf litter, especially bacteria and fungi. In addition, the decomposition process of the remaining activities of several types of marine biota found in BBIAPL ponds, such as gastropods, Polychaeta and molluscs, increase nitrate content.

The type of BBIAPL pond substrate in the form of dead coral and sand also supports the high nitrate content. This is because microbenthos in rocky beach types tends to be small compared to muddy beach types, so the decomposition of minerals and organic materials is less than optimal. Ma et al. (2021) explained further that sediment also affects the concentration of nitrates at the bottom of the waters, while nitrates in the surface layer tend to be used by phytoplankton.

Differences in water depth and sampling time also affect nitrate content. The results of research by Ma et al. (2021) showed that the highest nitrate content in the waters of the Matasiri Islands, South Kalimantan, was found in waters of 54 meters, around 0.048 mg / l, while the lowest at a depth of 42 meters around 0.024 mg / l in November 2010. In contrast to the surface layer, the highest nitrate content is found at 32 meters, around 0.069 mg / l, while the lowest is at a depth of 56 meters, around 0.023 mg / l. This condition also follows Rustiah et al. (2019), that in shallow water, nitrate content is also influenced by turbulence which can lift nitrate compounds from the bottom of the water column.

The results of the research have proved the effect of seasonal differences on nitrate content in waters by Faizal et al. (2012), which showed that the range of nitrate concentrations in the waters of the Spermonde Islands in the rainy season was around 18-418 μg / L, while in the dry season around 18-278 μg / L. Furthermore, Rustiah et al. (2019) showed that nitrate content in Tanjungpinang coastal waters in September 2013 ranged from 0.038-0.296 mg / l. This follows the explanation of Mekurian et al. (2021); Aprilia et al. (2020) that nitrate content in aquatic environments fluctuates according to season, where higher nitrate content occurs after heavy rains.

Overall, the nitrate content of BBIAPL Pond has also exceeded the seawater quality standard for marine life in the Decree of the State Minister of Environment Number 51 of 2004 of 0.008 mg / l. The result of such high nitrate content can trigger eutrophication. This follows Rustiah et al. (2019) explanation that the discharge of nitrogen loads into coastal aquatic environments can cause eutrophication, thus disrupting the balance of the system and adversely affecting the ecosystem. Furthermore, according to Purba and Nurhayati (2022) in Ihsan et al. (2022), if the nitrate content in the aquatic environment is more than 0.2 mg / l, it can cause eutrophication and stimulate the blooming of phytoplankton and algae and interfere with the process of sunlight penetration and photosynthesis. Ma et al. (2021) explained further that the blooming potential tends to be dominated by harmful alga blooms (HABs).

Phosphate Content

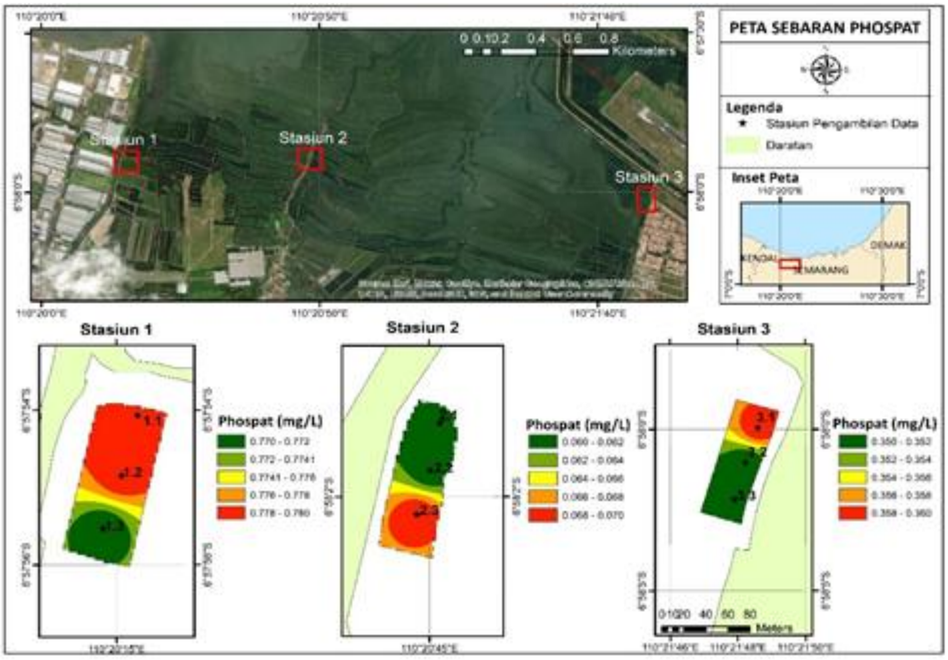

Figure 4. Phosphate Distribution Map

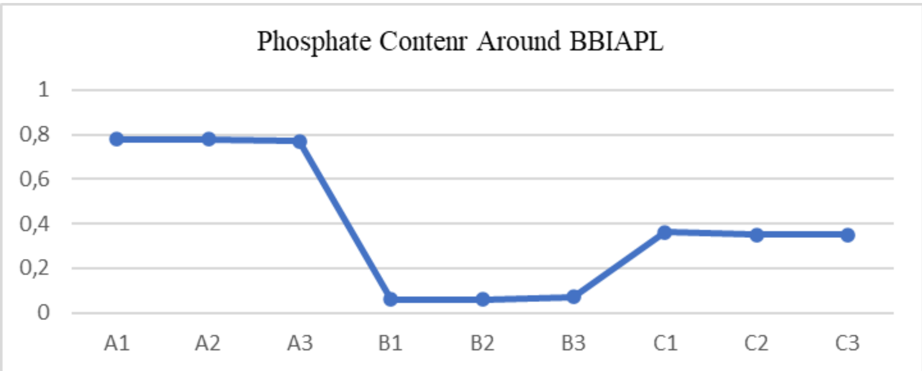

Figure 5. Phosphate Content Graph Around BBIAPL Pond

Based on the findings in the study, the phosphate content in the BBIAPL Pond ecosystem shows varying levels of oligotrophic, mesotrophic, and eutrophic conditions. Oligotrophic waters are characterized by clear, deep waters and abundant marine plants such as algae. On the other hand, mesotrophic and eutrophic waters have higher levels of nutrients, which can lead to excessive algae growth, decreased water clarity, and reduced dissolved oxygen levels (Febriana et al. 2017; Aprilia et al. 2020).

While marine life requires phosphate as a nutrient to sustain life, high phosphate content in the aquatic environment can cause excessive algae growth, which can be harmful to the ecosystem (Mekurian et al. 2021). The results of the study show that the phosphate content in the BBIAPL Pond ecosystem ranges from 0.00-0.50 mg / l, which can support the survival of macroalgae. However, exceeding the quality standard of these nutrients can cause harm to the water quality and organisms in the water. Hence, it is necessary to monitor and control the nutrient content of the BBIAPL Pond's waters to ensure the success of fish farming operations and the health of the aquatic environment.

The high phosphate content in BBIAPL Pond is related to the diffusion process from sediment. Sediment is the primary storage place for phosphorus in the ocean, especially in particulates that bind to iron oxides and hydroxide compounds. Furthermore, the difference in phosphate content is also caused by the unique behaviour of phosphorus in shallow water environments. Phosphorus will be quickly absorbed on the surface of the mud and then will re-enter the water column through an unknown process. These findings are significant as they provide insights into the nutrient cycling process in shallow water environments and can help in the development of management strategies for the sustainable use of aquatic resources (Ma et al. 2021)

Overall, the study highlights the importance of maintaining a balance in the nutrient content of aquatic ecosystems. It also underscores the need for integrated coastal area management that can help in managing the pond ecosystem to benefit pond farmers and surrounding communities. The information on the suitability of water quality in the surrounding pond ecosystem after industrial activities by nearby companies can be used to develop management strategies that can help in the sustainable use of aquatic resources.

Similar to nitrates, depth and sampling time differences also affect phosphate content. The results of research by Ma et al. (2021) have shown that the highest phosphate content in the waters of the Matasiri Islands, South Kalimantan, was found in the waters of 56 meters, around 0.016 mg / l, while the lowest at depths of 47 and 51 meters around 0.001 mg / l in November 2010. In contrast to the surface layer, the highest phosphate content is found at a depth of 44 meters, around 0.016 mg / l, while the lowest is at a depth of 47 and 51 meters, around 0.001 mg / l.

The influence of seasonal differences on phosphate content in waters has been shown by the results of research by Faizal et al. (2012), that the phosphate content in the waters of the Spermonde Islands in the rainy season is around 19-71 mg/l, while in the dry season around 19-91 mg/l. In addition, tides also affect phosphate content. The research results by Savenko (2022) show that phosphate transport in the waters of Ujungbatu Bay occurs when it recedes through the mouth of the river is the output of various community activities that have the potential to produce phosphate waste such as detergents. Furthermore, Labib et al. (2022) also explained that the highest phosphate content in Semarang Tugurejo Tapak Mangroves is in a location adjacent to the land and protected from tides, while the lowest phosphate content is in locations adjacent to coastal waters and limited by tides. Overall, the phosphate content of BBIAPL Pond has also exceeded the seawater quality standard for marine life in the Decree of the State Minister of Environment Number 51 of 2004 of 0.015 mg/l. The resulting high phosphate content can also trigger eutrophication, as with nitrates.

Ammonia Content

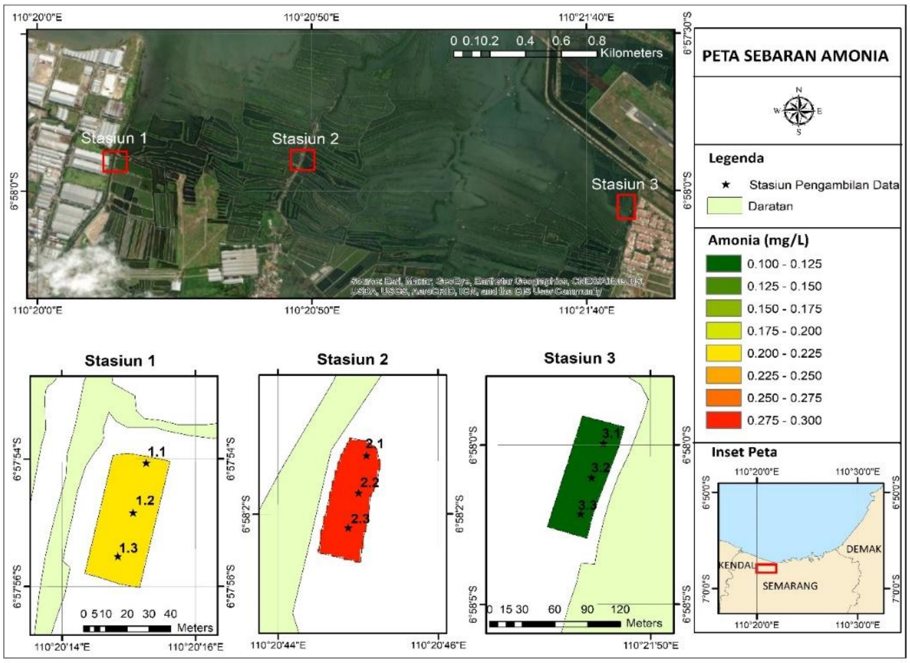

Figure 6. Ammonia Distribution Map

Table 1. Total Content of Nitrate, Phosphate and Ammonia Around BBIAPL Pond

No.	Location	Nitrate (mg/l)	Phosphate (mg/l)	Ammonia (mg/l)
1	A1	0,59	0,78	0,22
2	A2	0,59	0,78	0,20
3	A3	0,57	0,77	0,22
	Average	0,58	0,78	0,21
	SD	0,0094	0.0047	0,0094
4	B1	0,58	0,06	0,30
5	B2	0,58	0,06	0,30
6	B3	0,57	0,07	0,30
	Average	0,58	0,06	0,30
	SD	0,0047	0,0047	0
7	C1	0,51	0,36	0,10
8	C2	0,51	0,35	0,10
9	C3	0,52	0,35	0,11
	Average	0,51	0,35	0,10
	SD	0,0040	0,0040	0,0040

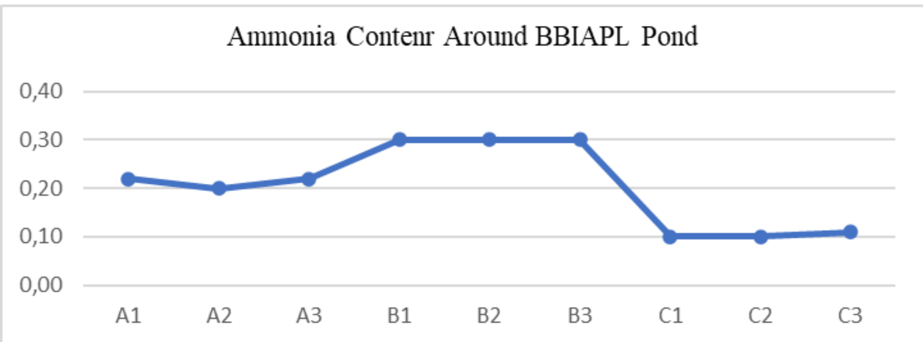

Figure 6. Ammonia Content Graph Around BBIAPL Pond

The concentration of ammonia around fishery ponds that are still included in aquaculture standards varies depending on the type of fish being farmed and the age of the fish. However, generally the concentration of ammonia that is still safe for fish is between 0-2 ppm (parts per million). Ammonia concentrations higher than two ppm can cause stress to fish and can cause damage to their vital organs, thereby reducing aquaculture productivity. For milkfish farming, the ideal ammonia concentration in the water around the pond is about 0-0.2 ppm (parts per million). Ammonia concentrations higher than this can cause stress in fish and even death if ammonia concentrations reach very high levels. Based on the results of ammonia analysis around plus, 0.10 is still relatively safe for aquaculture. This is also reinforced by the opinion of Government Regulation No.82 of 2001, ammonia concentration standards for fish farming are between 0.5 ppm.

Furthermore, Yildiz et al. (2019) study states that the standard ammonia concentration for freshwater fish farming is 0-0.02 ppm. However, the concentration of ammonia that fish can tolerate depends on the fish species, the water temperature, and the pH. If the ammonia concentration exceeds the standards considered safe for fish farming, this can cause stress to the fish and even death if the ammonia concentration reaches very high levels. Aprilia et al. (2020) state that high ammonia concentrations can affect fish's digestive, respiratory, and nervous systems, reducing aquaculture productivity.

Water Quality Parameters

Table 2. Total Air Temperature, Water Temperature, Salinity and pH Content in BBIAPL Pond

No.	Location	Air Temperature (^oC)	Water Temperature (^oC)	Salinity (‰)	pH (ppm)
1	A1	33	34	10	7,8
2	A2	32	33	11	7,8
3	A3	34	34	10	7,9
	Average	33,0	33,7	10,3	7,8
	SD	0,81	0,47	0,47	0,05
4	B1	31	34	21	7,9
5	B2	30	33	21	7,8
6	B3	30	34	20	7,7
	Average	30,3	33,7	20,7	7,8
	SD	0,47	0,47	0,47	0,08
7	C1	28	30	19	7,8
8	C2	28	30	18	7,8
8	C3	28	30	20	7,8
	Average	28,0	30,0	19,0	7,8
	SD	0	0	0,81	0

Water quality parameters such as temperature, pH and salinity can also affect the nitrate and phosphate content in the aquatic environment of Jungwok Beach. The research results by Savenko (2022) show that ocean currents and physical-chemical parameters of water, such as temperature, depth, salinity, pH and dissolved oxygen content, are thought to have influenced the value of nitrate and phosphate concentrations. Furthermore, Buana et al. (2021) explained that the high salinity value in the aquatic environment can affect the nitrate content in these waters. The results of this study are also similar to those of Rustiah et al. (2019), which showed that the values of temperature, pH, dissolved oxygen and salinity in Karangsong waters, Indramayu Regency, ranged from 26-29.8^0 C; 6.41-8.07; 2.29-5.3 mg/l and 33-35‰. The results of the research by Gaol et al. (2017), also show that the values of temperature, depth of pH, dissolved oxygen and salinity in the waters of the Southern Bangka Strait range from 28.5-30.8^{o}C respectively; 33.2 meters; 6,11-8,29; 5.75–7.29 ppm; and 29.54-31.46 psu.

Overall, based on the Decree of the State Minister of Environment Number 51 of 2004 concerning seawater quality standards, the results of temperature, pH and salinity measurements in this study can still support the survival of marine life in BBIAPL Ponds. Based on the research results above, the nitrate content in BBIAPL ponds ranges from 0.57-0.59 mg / l, while phosphate ranges from 0.77-0.78 mg / l. Overall, the nitrate and phosphate results have exceeded the seawater quality standards for marine life in the Decree of the State Minister of Environment Number 51 of 2004 of 0.008 mg / l and 0.015 mg / l. The results of in situ measurements showed that the temperature, pH, DO, and salinity in BBIAPL Pond each ranged from 30.67±0.93-32.20±0.62oC; 9.14±0.29-9.29±0.13; 8.00±1.41-8.93±1.19 mg/l and 34.83±0.46- 35.10±0.10 ppt. These results can still support the survival of various types of marine life in BBIAPL Ponds.

The study results show that the nitrate and phosphate content in BBIAPL Pond exceeds the seawater quality standard for marine life, which can trigger eutrophication and harm the ecosystem. The concentration of ammonia around the fishery ponds is still relatively safe for aquaculture, but high levels can cause stress and damage to the fish's vital organs, reducing aquaculture productivity. However, based on the Decree of the State Minister of Environment Number 51 of 2004, the study's temperature, pH, and salinity measurements can still support the survival of marine life in BBIAPL Ponds. Therefore, further action must be taken to mitigate the high nitrate and phosphate levels to prevent eutrophication and maintain the ecosystem's health.

ACKNOWLEDGEMENTS

The author would like to convey much grateful to DIPA Faculty of Mathematics and Natural Sciences, Cenderawasih University (Doctoral Development Research 2022, Grant no. 2142/UN.20.1.5/PL/2022 for funding research and the community around BBIAPL during the data collection.

REFERENCES

Aprilia D, Dianti, Arifiani KN, Cahyaningsih AP, Kusumaningrum L, Sarno, Adha KBR, Setyawan AD, 2020. Review: Biogeochemical process in mangrove ecosystem. Bonorowo Wetlans. 10 (2):126-141. DOI: 10.13057/bonorowo/w100205.

Arofah S, Sari LA, Kusdarwati R. 2021. The relationship with N/P ratio to phytoplankton abundance in mangrove Wonorejo waters, Rungkut, Surabaya, East Java. IOP Conf. Series: Earth and Environmental Science 718 (2021) 012018: 1-10. DOI: https://doi.org/10.1088/1755-1315/718/1/012018.

Bolbakov RG, Sinitsyn AV, Tsvetkov VY, 2020. Methods of comparative analysis. Journal of Physics: Conference Series. 1679 (2020). DOI:10.1088/1742-6596/1679/5/052047.

Buana S, Tambaru R, Selamat MB, Lanuru M, Massinai A, 2021. The role of salinity and Total Suspended Solids (TSS) to abundance and structure of phytoplankton communities in estuary Saddang Pinrang. IOP Conf. Series: Earth and Environmental Science 8. DOI :10.1088/1755-1315/860/1/012081.

Campbell S, Greenwood M, Prior S, Shearer T, Walkem K, Young S, Bywaters D, Walker K, 2020. Purposive sampling: complex or simple? Research case examples. Journal of Research in Nursing. 25 (8) : 652-661.

Chowdury KH, Nahar N, Deb UK, 2020. The Growth Factors Involved in Microalgae Cultivation for Biofuel Production: A Review. Computational Water, Energy, and Environmental Engineering. 9 : 185-215. DOI: 10.4236/cweee.2020.94012.

Faizal A, Jompa J, Nessa N, Rani C. 2012. Dinamika Spasio-Temporal Tingkat Kesuburan Perairan di Kepulauan Spermonde, Sulawesi Selatan. Seminar Nasional Tahunan IX Hasil Penelitian Perikanan Dan Kelautan-Semnaskan UGM, 1–18. Yogyakarta: UGM.

Febbrianna V, Muskananfola MR, Suryanti. 2017. Water Primary Productivity Based on Content Chlorophyll-a and Phytoplankton Abundance in River Estuaries at Bedono Demak. Journal of Maquares. 6(3): 318–324. DOI: https://doi.org/10.14710/marj.v6i3.20593.

Fitriani K, Nufutomo TK, Putra R, 2022. Water Quality Analysis Based on Land Use in Sekampung River, Lampung, Indonesia. IOP Conf. Series: Earth and Environmental Science. Doi:10.1088/1755-1315/1041/1/012052.

Gaol ASL, Diansyah G, Purwiyanto AIS. 2017. Analysis of Seawater Quality in the Southern Bangka Strait Waters. Maspari Journal, 9(1): 9–16. DOI: http://dx.doi.org/10.56064/maspari.v9i1.4159.

Garini BN, Suprijanto J, Pratikto I. 2021. Chlorophyll-a content and abundance in Kendal waters, Central of Java. Journal of Marine Research, 10(1): 102-108. DOI: https://doi.org/10.14710/jmr.v10i1.28655.

Herlinawati NDPD, Arthana IW, Dewi APWK. 2018. Natural Seaweed Diversity and Density in Serangan Island Waters, Denpasar, Bali. Journal of Marine and Aquatic Sciences, 4(1), 22–30. DOI: https://doi.org/10.24843/jmas.2018.v4.i01.22-30.

Ihsan YN, Yuniarti MS, Nuril F, Zallesa S, Fellatami K, Pribadi TDK, 2022. Profile of nutrient and water fertility level at nusawiru Pangandaran west java. Jurnal Ilmu Kelautan SPERMONDE. 8(2): 43-49. DOI: https://doi.org/10.20956/jiks.v8i2.21514.

Labib W, El‐ Dahhar AA, Shahin SA, Ismail MM, Hosny S, Diab MH, 2022. Water quality indices as tools for assessment of the Eastern Harbor’s water status (Alexandria, Egypt). SN Applied Apliances. 5-89 : Water quality indices as tools for assessment of the Eastern Harbor’s water status (Alexandria, Egypt). DOI:10.1007/s42452-023-05304-z.

Ma SN, Wang HJ, Wang HZ, Zhang M, Li Y, Bian SJ, Liang XM, Søndergaard M, Jeppesen E, 2021. Effects of nitrate on phosphorus release from lake sediments. 194 : 1-30. DOI : 10.1016/j.watres.2021.116894.

Mekurian DM, Kassegne AB, Asfaw SL, 2021. Assessing pollution profiles along Little Akaki River receiving municipal and industrial wastewaters, Central Ethiopia: implications for environmental and public health safety. 7 : 1-14. DOI : 10.1016/j.heliyon.2021.e0752.

Montt G, Fraga F, Harsdorff M, 2019. The future of work in a changing natural environment: Climate change, degradation and sustainability. International Labour Organization.

Mott RL, Vavrek EM, Wang J, 2018. Machine Elements In Mechanical Design Sixth Edition. Pearson Education.

Nasution, A., Widyorini, N., & Purwanti, F. 2019. Relationship Analysis of Phytoplankton Abundance to Nitrate and Phosphate in the Morosari Waters, Demak. Management of Aquatic Resources Journal (MAQUARES). 8(2): 78-86. DOI: https://doi.org/10.14710/marj.v8i2.24230.

Purba IR, Nurhayati, 2022. Water Quality of Lake Toba by Space and Time Based on Environmental Physics, Chemical Factors and Community Phytoplankton. Journal of Universal Studies. 2 (11): 2380-2396. DOI: https://doi.org/10.59188/eduvest.v2i11.

Rustiah W, Noor , Maming, Lukman M, Baharuddin, Fitriyah AT, 2019. Distribution Analysis of Nitrate and Phosphate in Coastal Area: Evidence from Pangkep River, South Sulawesi. International Journal of Agriculture System. 7 (1) : 9-17. DOI: 10.20956/ijas.v7i1.1835.

Rozalina, Nedi S, Nurachmi I. 2020. Analysis Of Nitrate Concentration, Phosphate And Silicate Relationship With The Abundance Of Planktonic Diatoms In Meral Waters, Karimun District. Asian Journal of Aquatic Sciences. 3(1): 60-68 . DOI: https://doi.org/10.31258/ajoas.3.1.60-68.

Savenko VS, Savenko AV, 2022. The Main Features of Phosphorus Transport in World Rivers. Water. 14 (16): 1-32. DOI: 10.3390/w14010016.

Singh B, Craswell E, 2021. Fertilizers and nitrate pollution of surface and ground water: an increasingly pervasive global problem. 3(518): 1-30. DOI: 10.1007/s42452-021-04521-8.

Sitepua DMBR, Perwira IY, Kartika IWD, 2021. Nitrate and Phosphate Content in Water in Telagawaja River, Karangasem Regency, Bali. Current Trendsin Aquatic Science. 4(2): 212-218. DOI: https://ojs.unud.ac.id/index.php/CTAS/article/view/66234.

Supriyantini E, Santoso A, Soenardjo N, 2018. Nitrate and Phosphate Contents on Sediments Related to the Density Levels of Mangrove Rhizophora Sp. in Mangrove Park Waters of Pekalongan, Central Java. IOP Conference Series: Earth and Environmental Science. 116 (1). DOI : 10.1088/1755-1315/116/1/012013.

Tampubolon, E. W. P., Nuraini, R. A. T., & Supriyantini, E. (2020). Nitrate and Phosphate Content in Sediment Pore Water and Water Column in the Seagrass Bed Area of Prawean Beach, Bandengan, Jepara. Journal of Marine Research, 9(4), 464-473. DOI: https://doi.org/10.14710/jmr.v9i4.28261.

Umasugi S, Ismail I, Irsan I. 2021. Kualitas Perairan Laut Desa Jikumerasa Kabupaten Buru Berdasarkan Parameter Fisik, Kimia Dan Biologi. Biopendix: Jurnal Biologi, Pendidikan dan Terapan, 8(1): 29-35.

Widiardja AR, Nuraini RAT, Wijayanti DP. 2021. Water Fertility Based on Nutrient Content in the Mangrove Ecosystem of Bedono Village, Demak. Journal of Marine Research, 10(1): 64-71. DOI: https://doi.org/10.14710/jmr.v10i1.28480.

Xu G, Zhang Z, Deng L, 2018. Adsorption Behaviors and Removal Efficiencies of Inorganic, Polymeric and Organic Phosphates from Aqueous Solution on Biochar Derived from Sewage Sludge of Chemically Enhanced Primary Treatment Process. Water. 10 (869): 1-12. DOI: 10.3390/w10070869.

Yang R, Xing B, 2021. A Comparison of the Performance of Different Interpolation Methods in Replicating Rainfall Magnitudes under Different Climatic Conditions in Chongqing Province (China). Atmosphere. 12(10):1-24. DOI: 10.3390/atmos12101318.

Yildiz HY, Robaina L, Pirhonen J, Mente E, Domínguez D, Parisi G, 2019. Fish Welfare in Aquaponic Systems: Its Relation to Water Quality with an Emphasis on Feed and Faeces—A Review. Water. 9 (13): 2-17. DOI: 10.3390/w9010013.