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Relationship between water quality parameters and the abundance of phytoplankton in intensive vannamei shrimp farming in Situbondo, East Java

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ABSTRACT

Optimal shrimp growth and harvest are greatly influenced by water quality, which is the dominant factor affecting shrimp growth and survival. This research aims to analyze the relationship between water quality and phytoplankton abundance. This research uses a survey method. Determination of stations and sampling points using the purposive sampling method. The composition of phytoplankton found in the waters of vaname shrimp ponds consists of 5 classes with a total of 9 genera, while when it is sunny, the number is greater (12 genera). Bacillariophyceae dominate waters when it rains, while Chlorophyceae dominate waters when it is sunny. The percentage composition of plankton species was as expected, except for the Cyanophyceae group when it was sunny. The genus Rhizosolenia was found, which is thought to be an indicator of eutrophication. The average phytoplankton concentration reported from the three sampling stations during rain ranges from 3.06x10^6 to 5.48x10^6 ind/L. Not much different: the bright times obtained ranged from 4.03×10^6 to 6.61×10^6 ind/l. Abundance at all sampling points indicates eutrophic waters (>15000). Air quality, in general, meets quality standards, except for nitrate and phosphate levels. The temperature and brightness parameters show the strongest relationships with plankton delivery. The quality of coastal waters is generally good, except for pH and nitrate levels. The PCA results showed differences in abundance between observation stations and between rainy and sunny conditions.

Keywords: Abundance, Composition, Harvest, Rhizosolenia

INTRODUCTION

The success of aquaculture is greatly influenced by environmental carrying capacity. If water quality is poor, the cultured biota will experience stress, and their immune systems will weaken, making them more susceptible to disease (Latuconsina, 2020). Some negative impacts noted across several locations indicate that Ammonia, nitrate, and phosphate levels that do not meet quality standards interfere with growth, as the shrimp's physiology is disturbed, and appetite is reduced. Mass mortality may occur (p. 3). Ammonia is known as the most dominant parameter affecting the growth rate and survival of shrimp (Junaidi dan Hamzah, 2014)

With good water quality management in intensive cultivation, the value of water quality parameters, growth rate and survival rate of *Litopenaeus vannamei* shrimp can be increased as reported by Fuady *et al*. (2013). Therefore, Ariadi *et al*. (2021) explained that water's physical and chemical parameters exhibit strong correlations. Water quality parameters are monitored daily to guide overall pond management and prevent negative effects on cultured biota (Supomo, 2017). Success in cultivation practices depends heavily on effective management of water conditions. Water pollution can cause failure in aquaculture activities (Rahma *et al,* 2022).

The ability of phytoplankton to photosynthesize and produce oxygen from these activities to support the life of aquatic biota makes phytoplankton function as the main indicator of aquatic productivity (Dwirastina dan Atminarso, 2021), besides their sensitive nature and differences in tolerance between species to environmental changes further support their role as biological indicators (Farinas et al., 2015). Photosynthesis in phytoplankton occurs because

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they contain several types of chlorophyll, such as a, b, and c (Arifin, 2009).

Several studies show that plankton presence in a water body can indicate whether the water is eutrophic (Pratama *et al.,* 2017). The number and type of plankton greatly influence water brightness and colour (Renitasari et al., 2021). In addition, some types of phytoplankton, such as diatoms and green algae, can effectively inhibit the growth and spread of *Vibrio* sp. (Lio-Po *et al*, 2005). However, in other studies, Ramili *et al*. (2023) reported *that Rhizosolenia* has the potential to cause Harmful Algal Blooms (HABs) (p. 4). This means that monitoring phytoplankton composition and the succession of dominant species is key to managing aquaculture systems. This research aims to analyze the abundance and composition of phytoplankton found in ponds and their relationship to water quality.

MATERIALS AND METHODS

Time and Place of Research

The research was conducted from November 2022 to August 2023 in an intensive vannamei shrimp pond at PT. Tanjung Cipta Pratama, Buduhan Village, Suboh District, Situbondo Regency, East Java. Plankton identification and water quality analysis were carried out *ex situ* at the Situbondo Feed and Care Indonesia Laboratory.

Tools and Materials

The tools used include: sample bottles, haemocytometer, microscope, object glass, dropper pipette, thermometer, Ph meter, hand refractometer, Secchi disk, plankton identification book, Global Positioning System (GPS), cellphone camera, stationery. The research materials include: water and plankton samples, Lugol's 1%, test kits (Ammonia, nitrate, phosphate), distilled water, and tissues.

Method

The research used a survey method, collecting a total of 18 samples (9 during rain and 9 during sunny weather) from three stations (1,500 m2/pond). Determination of stations and sampling points used the purposive sampling method. The stations were determined based on the colourpond's colour and distance from the beach: station 1 (green; near), station 2 (green; between), and station 3 (brown; far). Meanwhile, sampling points were established around the Anco Bridge, inlet, and outlet stations. The. The aim was to make sampling easier and to ensure compliance with standards for taking water and waste samples.

Samples included plankton and water collected at the same sampling point, namely, three replicates at each station. Plankton and water samples were collected simultaneously. Sampling during sunny weather was conducted the next day after sampling during rain to determine the presence or absence of phytoplankton in the water. Plankton samples were observed in the laboratory, while water samples were observed in situ and ex situ.

Parameters measured *in situ* included: water brightness and temperature. Parameters measured *ex situ* included: pH, salinity, Ammonia, nitrate and phosphate (p. 4). Water brightness was measured using a Secchi disk; water temperature was measured using a DO meter; acidity (pH) was measured using a pH meter (p. 4). Salinity was measured using a refractometer. Measurement of Ammonia, nitrate, and phosphate using a test kit was carried out at the CJ Feed and Care Situbondo Laboratory. Plankton identification was carried out up to the genus level at the Situbondo CJ Feed and Care Indonesia Laboratory using a haemocytometer on an Olympus CX23 binocular microscope with a magnification of around 400x.

Data Analysis

The calculation of plankton abundance was carried out under a microscope using a haemocytometer, using the formula (Mansyah *et al*, 2020) as follows:

$$Plankton\ Abundance = \frac{n\ (ind)}{Width\ x\ depth}$$

Eutrophic conditions can be evaluated by plankton abundance. According to Landner (1978) and Rahmah (2022), phytoplankton abundance can be used to categorisecategorize waters into three types based on trophic level: Oligotrophic: 0- 2000 (very low trophic); Mesotrophic: 2000-15000 (medium trophic); and eutrophic: > 15000 (eutrophic waters). The observed parameters were phytoplankton abundance and composition. Then, a descriptive analysis was conducted to compare water quality parameters between sampling points at the three stations, in accordance with the Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia No. 75/Permen-Kp/2016. Descriptive data analysis in the form of Tables and Graphs to compare water quality parameters between sampling points from the three stations with water quality standards referring to the Regulation of the Minister of

Marine Affairs and Fisheries of the Republic of Indonesia No.75/Permen-Kp/2016.

Principal Component and Cluster Analysis

Visualisation: The visualization relationship between water quality and phytoplankton abundance can be visualised using Principal Component Analysis (PCA). This analysis is often used to identify and eliminate measurement errors in environmental monitoring data. This analysis can show patterns of the relationship between water quality and phytoplankton abundance. In addition, cluster analysis is used to classify the proximity of phytoplankton abundance characteristics influenced by water quality. Several sampling points can be classified based on water quality and phytoplankton abundance. This analysis also facilitates the identification of water quality patterns at each sampling point.

RESULT AND DISCUSSION

Results

The results of the comparison of the composition of phytoplankton species during rainy conditions and sunny conditions are shown in Figure 1, which shows that there are different compositions of phytoplankton species at the 3 observation stations between rainy and sunny conditions.

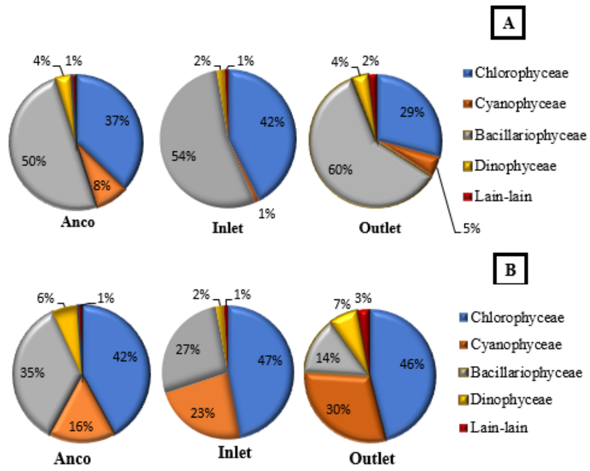


Figure 1. Comparison of Phytoplankton Species Composition during rain (A) and during sunny weather (B).

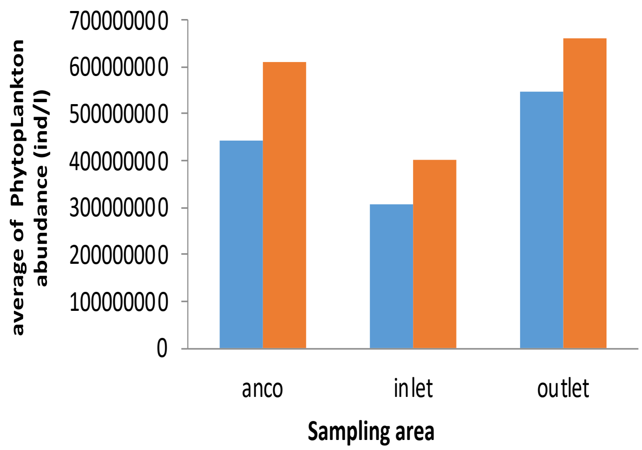


Figure 2. Average of Phytoplankton Abundance between stations in rainy and sunny conditions

For the average abundance of phytoplankton between observation stations during rainy conditions and sunny conditions, as shown in Figure 2 above. From figure 2 compares the average phytoplankton abundance between observation stations under rainy and sunny conditions, revealing differences. The highest average abundance was in sunny conditions, and the highest abundance was also found at the Outlet station. This condition is strongly related to fluctuations in water quality parameters, both between observation stations and between rainy and sunny conditions. The water quality parameters observed at the observation stations during rain and sunny weather are shown in Table 1.

Table 1. Water quality parameters in vannamei shrimp culture ponds.

Parametre	Standard	Anco		Inlet		Outlet	
		Rainy	Sunny	Rainy	Sunny	Rainy	Sunny
Temperature (°C)	24 - 29	27.23±0.1	28.53±0.2	27.17±0.1	28.47±0.2	27.30±0.1	28.60±0.2
Transparency (cı	30 - 40	58.3±5.7*	73.3±7.6*	58.3±5.7*	70.0±8.6*	63.3±5.7*	73.3±5.7*
pH	7,5 - 8,5	7.73±0.06	7.77±0.12	8.00±0.1	7.70±0.1	7.70±0.1	7.73±0.06
Salinity (ppt)	15 - 25	16±2.65	16±3.61	15±2.65	16±2.65	15±2.65	16±2.65
Amonia (ppm)	< 0.1	0.02±0.02	0.06±0.03	0.03±0.02	0.05±0.2	0.03±0.01	0.01±0.37
Nitrat (ppm)	< 20	54±0*	63±25*	53±14.43*	54±0*	55±0*	67±14.43*
Fosfat (ppm)	0.05	1.08±0.4*	1.50±0.6*	1.42±0.6*	1.67±0.6*	1.37±0.8*	2.33±0.6*

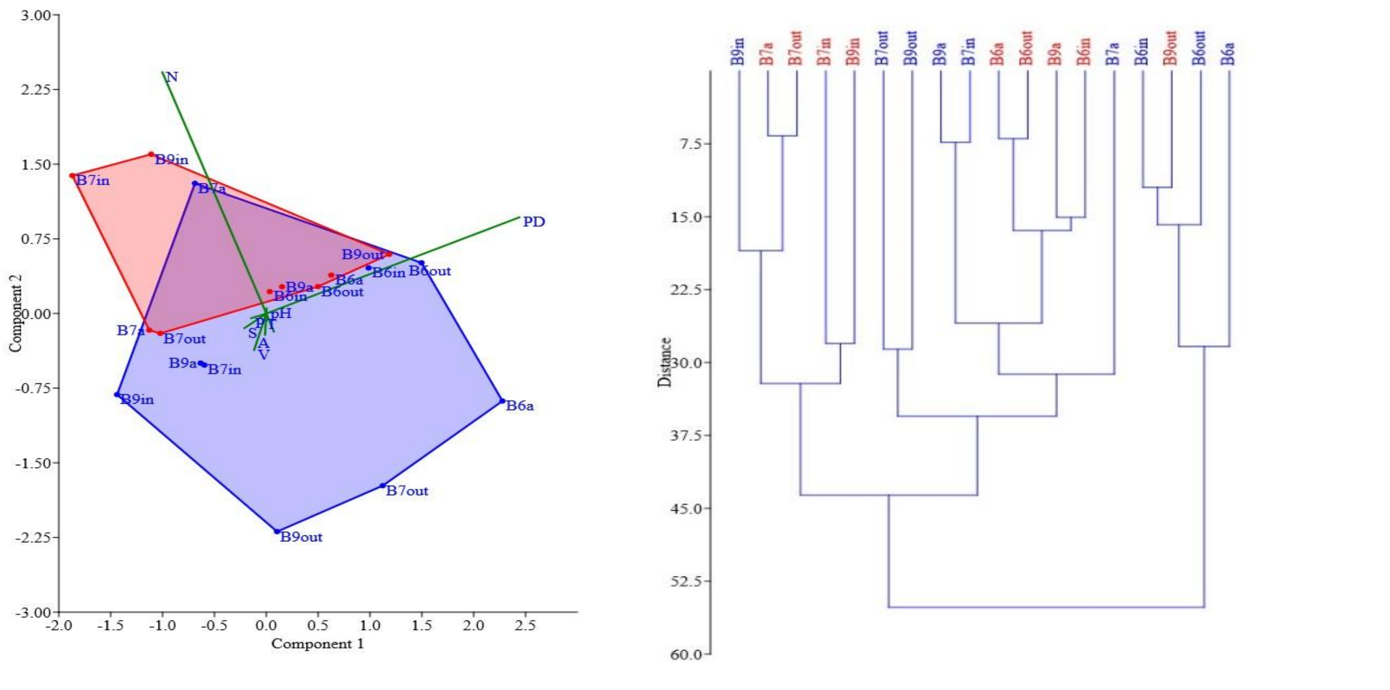
*Note: *) Does not meet the Quality Standards of PERMEN-KP NO 75 of 2016.*

Table 1 shows variations in water quality parameters between observation stations and between rainy and sunny conditions. This phenomenon will certainly affect the abundance of the observed phytoplankton community. The results of the correlation analysis between phytoplankton abundance and water quality parameters are shown in Table 2.

Table 2. Correlation analysis of plankton abundance with water quality

Water Quality Parameter	**Corelation**	t_{tes}	**Correlation type**
Temperature (ºC)	0.577	0.230	Medium
Transparency (Cd)	0.718	0.108	Strong
pH	-0.587	0.221	Medium
Salinity (ppt)	0.397	0.436	Low
Amonia (ppm)	0.511	0.301	Medium
Nitrat (ppm)	-0.836	0.038	Strong
Fosfat (ppm)	0.474	0.342	Medium

Table 2 shows a strong positive correlation between brightness and plankton abundance, and there is a strong negative correlation between nitrate concentration and phytoplankton abundance. For further details regarding the relationship between water quality and phytoplankton abundance, it is presented in the form of a dendrogram and relationship graphs as shown in Figure 3."



(a) (b)

Figure 3. PCA Biplot (a) and Cluster (b) of the relationship between phytoplankton abundance and water quality parameters

Figure 3 illustrates the relationship pattern between water quality and phytoplankton abundance. The biplot in Figure 3. a shows two weather conditions: Blue (Sunny) and Red (Rainy). The overlapping shapes of red and blue indicate a similarity in characteristics. The green lines represent the parameters used in the analysis. It is known that the PD line represents phytoplankton abundance, which shows a high value. This is evident from the length of the PD line compared to other biplot lines. Similarly, the N line (nitrate parameter) also has a long line. The PD and N lines form a 90° angle, indicating no correlation between phytoplankton abundance and nitrate. However, the PD line is negatively correlated with the P line (phosphate parameter), S line (salinity parameter), V line (brightness), and A line (ammonia parameter). The negative correlation visualizedin the biplot indicates that lower values of phosphate, salinity, brightness, and ammonia are associated with higher phytoplankton abundance.

The cluster dendrogram shows the profile of characteristic proximity between water quality and phytoplankton abundance across sampling points. There are three groups with similar profiles. Group 1 (blue) shows similarities between station 1 (B6in, B6a, B6out) during sunny weather and the outlet of station 3 (B9out) during rainy weather. Group 2 (green) shows similarities between station 1 (B6in, B6a, B6out) during rainy weather, station 2 (B7in, B7a, B7out) during sunny weather, and station 3 (B9a, B9out) during sunny weather and (B9a) during rainy weather. Group 3 shows similarities between station 2 (B7in, B7a, B7out) during rainy weather and station 3 (B9in) during both sunny and rainy weather. Based on the cluster results above, both water quality and phytoplankton abundance at stations 1 and 2 (at the inlet, anco, and outlet) differ between sunny and rainy weather. Station 3 tends to have water quality and phytoplankton abundance characteristics similar to those of stations 1 and 2. Station 3 is located furthest from the coast.

Discussion

Phytoplankton Identification and Composition

Phytoplankton identified during rain comprised 5 classes and 9 genera: Chlorophyceae (2 genera), Cyanophyceae (1 genus), Bacillariophyceae (3 genera), Dinophyceae (1 genus), and others (2 genera). Meanwhile, during sunny weather, the number was higher (12 genera), consisting of: Chlorophyceae (2 genera), Cyanophyceae (1 genus), Bacillariophyceae (3 genera), Dinophyceae (1 genus), and others (5 genera). Results of the phytoplankton species composition showed that from the 5 classes at the anco, inlet, and outlet sampling points during rain, the highest percentage was Bacillariophyceae (54.7%), which was also obtained in a previous study by Hadi *et al*. (2016), and the lowest was the "others" class (1.3%). Meanwhile, during sunny weather, it was dominated by Chlorophyceae (45%), as also reported by Arifin (2018).

The dominance of Chlorophyceae can indicate signs of eutrophication in a water body. One indicator of eutrophication is a shift in the phytoplankton population from initially being dominated by the Bacillariophyceae (Diatom) group to being dominated by the Chlorophyceae group (Nopem *et al*., 2020). More specifically, the highest genus of the Bacillariophyceae group found at the anco, inlet, and outlet during rain was *Rhizosolenia*. Meanwhile, during sunny weather, it was mostly composed of the genus *Chlorella*. Specific species in each pond are influenced by various environmental factors, one of which is the physicochemical factors of the water, which are found to be high in the water body during sunny weather (Table 1). Meanwhile, the expected dominance percentage for plankton is Chlorophyceae and Bacillariophyceae at 50-90%, while Cyanophyta is <10% and Dinoflagellates are <5%. The obtained phytoplankton composition percentages were higher than those reported by Krisiyanto *et al*. (2021), where the Bacillariophyceae class reached 43%, the Cyanophyceae class 28%, and the Dinophyceae class 29%.

The groups of phytoplankton found are in accordance with the statement by Edhy *et al.* (2003) in their book that there are 5 divisions of phytoplankton often found and dominating in marine waters or aquaculture ponds, including: Chlorophyta, Cyanophyta, Bacillariophyta, Dinoflagellata, and Euglenophyta. Cyanophyta (Blue-Green Algae, BGA) and Dinoflagellata species in aquaculture ponds are not expected to dominate, as they can harm the aquatic ecosystem. From all the phytoplankton groups found, the species composition percentage is still suitable for shrimp cultivation, except for the Cyanophyceae group during sunny weather at the anco, inlet, and outlet, which exceeded cultivation standards with the highest percentage at the outlet sampling point, at 30% compared to the limit of <10%. According to Lodang & Kurnia (2019), Green Algae have a high composition due to high nutrients in the water body, such as high nitrate ($NO3^-$) content. Cyanophyceae were abundant because they are cosmopolitan. High levels of the Cyanophyceae group were also reported by Widigdo (2013); one reason behind the high prevalence of Cyanophyceae at stations 3 and 4 is the high phosphate concentration in this region. This statement is consistent with the phosphate concentrations that exceeded water quality standards during sunny weather at the anco, inlet, and outlet (Table 1).

Previous research has revealed that the early stages of cultivation are usually dominated by diatoms and green algae. However, as cultivation progresses, Cyanobacteria and Dinoflagellates also multiply and gradually begin to become the dominant groups (Chen *et al*., 2018). The presence of diatoms and green algae is highly desirable in cultivation ponds because they have high nutritional value and contribute to water quality (Brito *et al*., 2016), while the presence of

Cyanobacteria and Dinoflagellates is not very desirable because of their low nutrient content and their ability to produce toxins (Perez-Morales *et al.,* 2017; Sinden & Sinang, 2016).

Phytoplankton Community Abundance

This study produced average phytoplankton abundance values from the three sampling stations during rain, ranging from 3.06×10^6 to 5.48×10^6 ind/L. The abundance is not much different; during sunny weather, it ranged from $4.03x10^6$ to $6.61x10^6$ ind/l, with the highest value at the outlet and the lowest at the inlet in both rainy and sunny conditions. The abundance calculations at all sampling points showed values >15,000 ind/L, indicating that the waters are eutrophic. The high abundance of phytoplankton in the outlet area is because there is a lot of accumulated metabolic waste originating from feed residue, shrimp faeces, shrimp shells from moulting, dead shrimp, and dead plankton, which are the starting materials for the formation of nitrogen and phosphate, then utilisedutilized by phytoplankton to grow in the pond. In addition, the water conditions are relatively calm. Calm water conditions provide an opportunity for phytoplankton to remain in that location for a longer period, allowing them to reproduce more effectively and ultimately leading to a higher accumulation of phytoplankton there. Meanwhile, plankton density in the area around the inlet is lower due to natural dilution from regular water additions.

The abundance of phytoplankton in a body of water describes the fertility level of those waters. In contrast, the phytoplankton composition that underlies diversity, evenness, and dominance describes the state of the phytoplankton community in a body of water (Aryawati *et al.,* 2017). Plankton abundance in ponds affects the growth, survival rate, biomass, and feed conversion of vannamei shrimp (Pratama *et al*., 2017). Furthermore, the phytoplankton community in the shrimp pond environment interacts synergistically with bacterial populations, which, in turn, help decompose organic matter (Budiardi *et al*., 2007). Oxygen supply through the use of paddlewheels and blowers in the pond can facilitate the breathing and respiration process of plankton (zooplankton and phytoplankton), so that it can stimulate the growth and development of plankton, which results in increased plankton diversity and abundance. Nutrient waste from feed residue that settles at the bottom of intensive ponds, such as 3 Nutrients (($NH3$, $NO2$ dan $H2SO4$) as well as suspended solids, can be discharged at any time through the central drain to maintain water quality stability in good condition; this has an impact on the speed of the phytoplankton community in responding to the increase in 3 Nutrients which can further increase plankton diversity and abundance.

Water Quality Parameters

Water quality measurements are conducted to assess water conditions, as they can affect the survival of aquatic biota. In a habitat, physical and chemical characteristics support the growth and life of the community structure of organisms within it, including phytoplankton. The results of the water quality parameter observations are shown in Table 1. Values for temperature, pH, salinity, and Ammonia remain within the Quality Standards set by Permen-KP No. 75/2016. Meanwhile, values for turbidity, nitrate, and phosphate exceed water quality standards, making them unsuitable for supporting aquaculture, specifically Vannamei shrimp.

Temperature values during rain ranged from 27.20 to 27.40 °C, and during clear weather from 28.47 to 28.60 °C, with the highest value at the outlet and the lowest at the inlet in both conditions. This is relatively similar to the research of Ariadi (2021), which reported 26-32 °C; Krisiyanto (2021), 27.1-28.5 °C; and 27-30 °C in the research of Akbarurrasyid *et al*. (2022). From the measurements obtained, the temperature between sampling points did not differ significantly, but it is still feasible for the survival of shrimp farming. Sidabutar *et al*. (2019) reported that the factors affecting high and low temperatures are sunlight and water depth. According to Sahrijannah (2017), the optimal temperature range for the growth of vaname shrimp is 26-32 °C, and 20-30 °C for the survival of plankton (Rahman *et al*., 2016). Temperature plays a crucial role in regulating the balance of the aquatic ecosystem. This is evidenced by the statement of Supriatna *et al*. (2020), that when the temperature exceeds the optimum limit, metabolic activity in the shrimp's body increases significantly. On the other hand, when the environmental temperature falls below the optimal level, shrimp growth tends to slow, and their appetite decreases.

The average brightness values obtained during rain ranged from 58.33 to 63.33 cm, while during clear weather they ranged from 70 to 73.33 cm. The brightness value is higher during clear weather than during rain. This is not different from the average brightness values reported by Afdilla (2022), namely 46 cm, 52 cm, and 55 cm. However, it differs from the brightness reported by Krisiyanto

(2021), 18-32 cm, and Ariadi (2021), 30-40 cm, which are more suitable for the shrimp farming process. The level of water clarity in vaname shrimp ponds is highly dependent on plankton abundance and the number of dissolved particles in the water. Low clarity conditions can reduce oxygen solubility in the pond, potentially affecting environmental conditions for shrimp growth. According to Supangat (2000), the penetration of light into pond water increases with increasing light intensity, creating conditions of high brightness. In addition, the level of brightness is also influenced by the age of the young shrimp, because at this stage, feed consumption by shrimp is relatively low. Hence, faecal waste production is still limited.

For the pH of the water during rain and clear weather, average values were obtained in accordance with aquaculture standards, ranging between 7.70-8.00 and 7.70-7.77, respectively. This is not much different from the research of Krisiyanto (2021) at 7.5-8.2 and 7.1-8.1, and from the research of Akbarurrasyid *et al*. (2022), which was even higher in Ariadi's (2021) research at 7.5-8.5. The optimal pH range for vaname shrimp farming, according to PERMEN-KP No. 75 of 2016, is 7.0-8.5. In addition, the ideal pH range for supporting phytoplankton life is 6.5-8.0. By maintaining water pH within this range, shrimp farming can be managed more sustainably, as appropriate environmental conditions will support shrimp growth and the abundance of phytoplankton, which serves as a food source.

Relationship Between Plankton Abundance and Water Quality Parameters

Based on the correlation analysis, temperature and brightness show the highest correlation with plankton abundance among all water quality parameters in the pond. The table shows that the relationship between temperature and plankton abundance is moderately positive, with a correlation coefficient of 0.577. This means that an increase in temperature will increase plankton abundance. This result is higher than the study by Wafi *et al.* (2021), which reported a correlation index of 0.298, indicating a weak relationship between temperature and plankton abundance in intensive shrimp aquaculture ponds in Tongas, Probolinggo.

According to Nugraha *et al.* (2010) and Latuconsina (2020), an increase in temperature increases the metabolic and respiratory rates of aquatic organisms, which in turn increases oxygen consumption and affects the solubility of dissolved oxygen in the water column. In addition to affecting shrimp, temperature also affects phytoplankton, as they require sunlight for photosynthesis. If the temperature is <28°C due to frequent cloudy and rainy weather, try to keep the water not too deep, and if the temperature is >33°C, operate the paddlewheels at maximum capacity (Amri Khairul, 2008). According to Sahrijanna and Septiningsih (2017), the ideal temperature range for vannamei shrimp growth is 26°C to 32°C. According to Supriatna et al. (2020), when the temperature exceeds the optimal level, metabolism in the shrimp's body will increase. However, when environmental temperatures are below optimal levels, shrimp growth will decrease because their appetite also declines. Latuconsina (2020) added that if a drastic temperature change occurs, the fish will die or their growth will be stunted; the same applies to other organisms living within.

The relationship between brightness and phytoplankton abundance is classified as strong. This means that the higher the light intensity or brightness in the water, the greater the abundance of phytoplankton will be. This is in line with the report by Noverita *et al*. (2019), which found that the brightness value shows a very strong positive correlation with phytoplankton abundance. High primary productivity of phytoplankton is closely related to the amount of sunlight reaching the water, which serves as the energy source for photosynthesis. This is supported by the statement of Dimenta *et al*. (2020) that the positive correlation between water brightness and phytoplankton abundance occurs because phytoplankton are highly dependent on sunlight for photosynthesis. When water is low in brightness, sunlight has difficulty penetrating the water, which inhibits phytoplankton's ability to photosynthesisephotosynthesize effectively. According to Boyd (1991), the ideal brightness level for shrimp aquaculture is usually between 35 and 45 cm. The level of water brightness in vannamei shrimp ponds is highly dependent on the amount of phytoplankton, zooplankton, and particles present in dissolved form in the water.

The correlation between pH and phytoplankton abundance shows a moderate negative relationship, meaning that higher pH levels are associated with lower phytoplankton abundance. In Noverita *et al*.'s (2019) study, a negative correlation of -0.144 was also obtained. Phytoplankton abundance will fluctuate in response to pH changes, as extreme pH levels can disrupt metabolic processes.

CONCLUSION

Phytoplankton found in vannamei shrimp pond waters consisted of 5 classes with a total of 9 genera: Chlorophyceae (2 genera), Cyanophyceae (1 genus), Bacillariophyceae (3 genera), Dinophyceae (1 genus), and others (2 genera). Meanwhile, during sunny weather, the number was higher (12 genera), consisting of: Chlorophyceae (2 genera), Cyanophyceae (1 genus), Bacillariophyceae (3 genera), Dinophyceae (1 genus), and others (5 genera). During rain, Bacillariophyceae (54.7%) dominated the waters, while during sunny weather, it was dominated by the Chlorophyceae class (45%). The genus *Rhizosolenia* was found, which is suspected to be a bio-indicator of eutrophication. The average phytoplankton abundance from the three sampling stations during rain ranged between $3.06x10^6$ - $5.48x10^6$ ind/L. There is no significant difference. During sunny weather, the abundance ranged between 4.03x10^6 and 6.61x10^6 ind/l. Abundance at all sampling points indicates eutrophic waters (>15,000). Water quality, in general, did not differ and met quality standards, except for nitrate and phosphate levels. Temperature and brightness parameters show the highest correlation with plankton abundance among the parameters. Brightness and nitrate parameters have a strong relationship with plankton abundance; while temperature, pH, Ammonia, and phosphate have a moderate relationship; whereas salinity has a weak relationship. Water quality is positively correlated except for pH and nitrate.

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