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Identification of Plankton Abundance as an Indicator of Water Quality in Intensive Vannamei Shrimp (*Litopenaeus vannamei*) Pond at PT. XYZ

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Keywords
plankton; water quality; whiteleg shrimp; intensive pond; Chlorophyta

ABSTRACT
This research aims to identify plankton abundance as a supporting indicator of water quality in intensive white leg shrimp (*Litopenaeus vannamei*) ponds at PT. XYZ. The research applied a descriptive method using survey, field observation, interviews, direct participation, and analysis of primary and secondary data. Plankton observation was conducted using a hemocytometer with big block and small block counting methods, while water quality was assessed through transparency, water color, dissolved oxygen (DO), pH, ammonium (NH4), and nitrite (NO2) parameters. The identification results showed that the plankton groups found consisted of Chlorophyta, Cyanophyta, Bacillariophyta, Pyrrophyta, Cryptophyte, and Protozoa. Chlorophyta was the most dominant group, ranging from 30–80%, followed by Pyrrophyta at 20–36%, Cyanophyta at 3–26%, Bacillariophyta at 1–28%, and Protozoa at 1–5%. The DO values ranged from 4.6–6.38 mg/L, while pH values ranged from 7.9–8.5, indicating that both parameters remained suitable for plankton and shrimp growth. However, ammonium and nitrite concentrations exceeded the optimal standards, suggesting organic matter accumulation from uneaten feed and shrimp feces. Therefore, plankton abundance can serve as an important biological indicator for monitoring water quality in intensive shrimp pond management.

INTRODUCTION

Vannamei shrimp is a superior species The cultivated globally, including in Indonesia. Production vanamei shrimp worldwide has been increasing over the past two decades. Production vanamei shrimp the world reached 9.5 million tons in 2020 (FAO, 2022). In the same year, the portion of cultivated shrimp to the total production vanamei shrimp is increasing and reaching 61.5%. Vannamei shrimp (Litopenaeus vannamei) is the most economical species of shrimp. Vannamei shrimp account for more than half of the total global shrimp production. Total vannamei shrimp production reached 5,812.2 thousand tons in 2020, this number has increased when compared to 2015 production of 52.8% (FAO, 2022). Vannamei shrimp is called a superior variety because it has several advantages, including being more resistant to disease, faster growth, resistant to fluctuations in environmental conditions, relatively short maintenance time, which is around 90-100 days per cycle, survival rate (SR) or life rate is relatively high, feed efficient, and high productivity level. In addition, vannamei shrimp are also able to utilize the entire water column from the bottom of the pond to the surface layer (Aulia, 2018; Putra et al., 2023).

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The vannamei shrimp cultivation system can be carried out extensively or intensively. The intensive cultivation system is carried out in a high-stocking dense manner and 100% using artificial feed (Diao et al., 2023; Komal et al., 2024). Sources of nutrients such as protein, fat, carbohydrates, vitamins and minerals needed by shrimp can be fulfilled from feed so that the growth and development of vannamei shrimp can be optimal and can also increase feed productivity with 100% pellets and ensure a source of feed nutrition (Panjaitan et. al., 2014). In addition to feed, the presence of plankton is one of the most important supporting factors in vannamei shrimp cultivation ponds, especially autotrophic systems which mainly rely on the growth of phytoplankton as oxygen producers in the pond from the plankton photosynthesis process during the day. The existence of plankton is also the first tropic level that is the main producer of phytoplankton (Madinawati, 2010). The rate of plankton reproduction in the water can be used to estimate the stability of water quality. A stable pond aquatic environment is characterized by high plankton diversity, a high and even number of individuals of each species and a suitable water quality for the growth of aquaculture organisms (Khalik, 2021).

Numerous previous studies on shrimp pond water quality have predominantly focused on physical-chemical parameters such as dissolved oxygen (DO), pH, ammonia, nitrite, temperature, and salinity (Ariadi et al., 2019; Do et al., 2025; Vicencio et al., 2025). However, relatively few studies have emphasized plankton as a biological indicator for water quality monitoring in intensive vannamei shrimp ponds. This study addresses that gap by highlighting plankton abundance and composition as an additional indicator that can strengthen water quality monitoring, thereby bridging the purely physical-chemical approach and the ecological-biological approach. Furthermore, this research was conducted at PT. XYZ in Sumenep Regency, East Java Province, providing specific local data from the Madura region that has rarely been reported in the scientific literature (Budianto et al., 2025; Susanto[1] et al., 2023). The novelty of this study lies in its integration of methods, as it not only measures water quality but also links it to plankton community structure using the haemocytometer method with both big block and small block counting techniques. The finding that Chlorophyta dominates (30–80%) provides new insight into the ecological conditions of intensive ponds in Madura, which may differ from ponds in other locations. The identification that high ammonia and nitrite levels originate from uneaten feed and shrimp feces strengthens the linkage between feed management, water quality, and plankton dynamics. Thus, this study offers a more applicable plankton-based monitoring approach for the intensive shrimp farming industry.

Based on the description above, the author chose the title Identification of Plankton Abundance as a Support for Water Quality of Intensive Vannamei Shrimp Ponds (Litopenaeus vannamei) at PT. XYZ is due to factors that affect the growth of vannamei shrimp in ponds, namely feed availability and water quality. Plankton is one of the important indicators that must be analyzed in vannamei shrimp cultivation activities (Kamilia et al., 2021). In addition to plankton, the quality of aquaculture media can be measured by water physics and chemical parameters that affect water quality, growth and abundance of plankton and cultivated vannamei shrimp (Musa et al., 2021, 2023; Pratiwi et al., 2023; Rahmi et al., 2023).

The purpose of this research is to participate in all vannamei shrimp rearing activities at PT. XYZ, especially in plankton identification activities. The purpose of implementing research is to increase knowledge and skills in identifying plankton types in vannamei shrimp ponds, as well as increase knowledge and ability to analyze the relationship between plankton

abundance and water quality parameters, such as DO, brightness, water color, pH, ammonium (NH_4), and nitrite (NO_2) in vannamei shrimp ponds at PT. XYZ (Azizah & Samaadan, 2024; Kilawati et al., 2022; Mahmudi et al., 2021; Prasetiyono et al., 2024; Seftiany et al., 2025).

The use of plankton as a biological indicator enables early detection of water quality changes, thereby supporting preventive management strategies. By understanding the relationship between plankton and organic matter accumulation, feed management can be improved to reduce waste. The dominance of certain plankton groups, such as Chlorophyta, can support oxygen availability and micro-ecosystem stability, which is essential for production sustainability. Furthermore, this study encourages the paradigm that sustainable aquaculture not only maintains physical-chemical water quality but also preserves biological balance through plankton. Accordingly, plankton abundance can serve as an important biological indicator for monitoring water quality in intensive shrimp pond management.

METHOD

The research method used in the research is a descriptive method with a survey approach, direct observation, and internship in the field. The descriptive method is used to describe the conditions of plankton abundance and water quality in vannamei shrimp ponds systematically and factually. PKL III activities will be held from January 26 to March 6, 2026 at PT. XYZ. The survey approach is carried out through direct observation, interviews, and water quality data collection during cultivation activities. According to Nazir (2005) in Nofianti (2017), the survey method is an investigation carried out to obtain facts from existing symptoms and seek factual information from a group or individual. In addition, the internship method is also used as a form of deepening the material obtained from the learning process and applied directly at the internship location. Internship can be seen as a form of research because at the internship location there are phenomena or symptoms that are observed using scientific principles (Sugiyono, 2012 in Setiawan, 2020).

The data sources in this activity consist of primary data and secondary data. Primary data according to Nazir (2011) is data obtained through observation, interviews, and active participation. Observation is carried out through direct observation with the eye senses without the use of certain aids, while interviews are conducted to obtain initial information and find problems that need to be researched. Active participation is direct involvement in activities that take place in the field. Meanwhile, secondary data is data obtained from other sources, such as books, literature, and readings that are relevant to the problem being researched (Andriyanto et al., 2013). Data collection techniques in PKL III are carried out through observation, interviews, and direct participation. Observation is carried out by observing and systematically recording the observed symptoms (Hasanah, 2016). Interviews were conducted with respondents using a pre-prepared list of questions or interview guidelines to obtain information about vannamei shrimp cultivation activities. In addition, direct participation is carried out by actively participating in activities at street vendor locations so that the author can understand the process of activities in real life in the field.

Statistical analysis was employed to process observational data on plankton and water quality parameters. The procedure included calculating the percentage composition of plankton based on the number of individuals per group (Chlorophyta, Sampling replication is essential to ensure that the data obtained is representative and reliable. In this plankton study, replication

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was performed by taking water samples from several points in the pond, including the surface, middle, and bottom areas. Plankton counting was conducted more than once using a haemocytometer with both big block and small block methods. This replication reduces bias due to spatial and temporal variations, thereby producing more accurate results that reflect actual pond conditions.

All instruments used in this study, including the haemocytometer, DO meter, pH meter, and secchi disk for transparency measurement, were validated and calibrated before use. The DO meter was calibrated using a standard oxygen solution or the air saturation method. The pH meter was calibrated using standard buffer solutions at pH 4, 7, and 10. The haemocytometer was validated through control counting using a standard plankton culture to ensure accuracy. Proper validation and calibration ensure that measurement results are consistent, reliable, and conform to scientific standards.

Plankton observation at PT. XYZ was carried out from two aspects: qualitative and quantitative. Qualitative analysis included a cursory examination of the five boxes of the haemocytometer without counting the number of each type of plankton, only to assess whether plankton pigmentation was good and which type of plankton was the most dominant. Meanwhile, quantitative analysis aimed to determine the density of plankton per unit volume precisely. Quantitative observations used the haemocytometer, a cell counting device consisting of glass with scaled lines to hold samples. For example, if N individual phytoplankton are found in 16 boxes, then the phytoplankton density is calculated using the big block method with a formula according to Legresley & Mcdermott (2010 in Hapsari & Elistanti, 2024), namely Number of Cells from a Large Box / Number of Large Boxes × 10^4, or the small block method according to Febrinawati et al. (2020), namely N = Total Number of Cells × 10^5 individuals/ml. This tool allows calculating the number of plankton per volume of water and knowing the diversity of plankton, usually expressed as a percentage for each species.

The size of the small box on the haemocytometer is 0.0025 mm^2 with a depth of 0.1 mm, so the volume of each small box is 0.00025 mm^3 or 2.5×10^{-7} ml. The 1×1 mm^2 box with a depth of 0.1 mm used for plankton calculations has a volume of 0.1 mm^3 or 10^{-4} ml. The box is bounded by a double line consisting of 16 small squares at the corners. The observation method is as follows: (1) prepare a microscope, haemocytometer, glass cover, and droplet pipette; (2) use a clean droplet pipette, then take a water sample and drop it into the area of the haemocytometer that has a scale line; (3) cover with a glass cover and observe the sample under a microscope with 10× magnification for large plankton sizes and 40× magnification for small plankton sizes; (4) count the number of each type of plankton in each box of known size; (5) calculate the density and percentage of each type of plankton.

Cyanophyta, Bacillariophyta, Pyrrophyta, Cryptophyta, and Protozoa). Descriptive analysis was conducted to obtain mean values, ranges, and standard deviations for water quality parameters (DO, pH, NH_4, and NO_2). Simple correlation analysis was applied to examine the relationship between plankton abundance and water quality parameters. The purpose of these statistical procedures was to provide a clear quantitative overview of the pond ecosystem conditions. The data that has been collected is then processed through editing and tabulating processes. Editing is an activity of checking and correcting data that has been collected so that it becomes systematic data. The purpose of editing is to avoid flaws or errors in the raw data

obtained. Data shortages can be supplemented by repeating the data collection process, while data errors can be eliminated by discarding unqualified data (Sugiyono, 2015). After that, the data is compiled through the tabulating process, which is the compilation of data into tabular form to make it easier to understand.

Water quality parameters measured in this study included transparency (brightness), water color, dissolved oxygen (DO), degree of acidity (pH), ammonium (NH_4), and nitrite (NO_2). Transparency was measured using a secchi disk, while water color was observed visually. DO was measured using a calibrated DO meter, pH using a calibrated pH meter, and NH_4 and NO_2 using test kits according to standard procedures.

RESULT AND DISCUSSION

Sampling Techniques

Water sampling at PT. XYZ is carried out in the morning, which is at 06.00. The tools used are sample bottles with a capacity of 500 ml, plankton sampling by tying bottles to piles using rope then the bottles are lowered into the pond under the water and the water is allowed to enter the bottle. This is in line with the opinion of Wardhana, (1997) the way to collect plankton is by tying bottles to piles with rope. Then the bottle is lowered into the pond with a specified depth and the water is allowed to enter the bottle. The water contained in the bottle is then filtered with plankton nets. Observation and checking of plankton at PT. XYZ is carried out every 5 days. The water samples obtained are directly analyzed in the water quality laboratory.

Plankton Analysis and Calculation

Plankton, as a key component in aquatic ecosystems, can be used as a parameter to monitor water quality. Plankton observation at PT. XYZ is carried out from two aspects, namely qualitative and quantitative. The qualitative analysis included a cursory examination of the 5 boxes of Hemocytometers without counting the number of each type of plankton, only to assess whether the pigmentation of plankton was good and which type of plankton was the most dominant. Meanwhile, quantitative analysis aims to determine the density of plankton per unit volume precisely.

Quantitative observations used the Hemocytometer, a cell counting device consisting of glass with scaled lines to hold samples. For example, if N individual phytoplankton is found in 16 boxes, then the phytoplankton density is calculated using the **Big Block method** with a formula according to Legresley & Mcdermott., (2010 in Hapsari & Elistanti, 2024) namely with the **formula Number of Cells from a Large Box/Number of Large Boxes×10^4** or the **Small Block method** according to Febrinawati et al., (2020) which is with the formula **N = Total Number of Cells×10^5** individual/ml. This tool allows calculating the number of plankton per volume of water and knowing the diversity of plankton that is usually expressed in percent for each species.

The size of the small box on the Hemocytometer is 0.0025 mm^2 with a depth of 0.1 mm, so the volume of each small box is 0.00025 mm^3 or 2.5×10‾7 ml. The 1x1 mm^2 box with a depth of 0.1 mm used for plankton calculations has a volume of 0.1 mm^3 or 10−4 ml. The box is bounded by a double line consisting of 16 small squares at the corners.

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The observation method is as follows:

1. Prepare a microscope, hemocytometer, glass cover, droplet pipette.
2. Use a clean droplet pipette, then take a sample of water and drop it into the area of the Hemocytometer that has a scale line.
3. Cover with a glass cover and observe the sample under a microscope with a magnification of 10× for large plankton sizes and 40× magnification for small plankton sizes.
4. Count the number of each type of plankton in each box that is already known to be of size.
5. Calculate the density and percentage of each type of plankton.

Figure 1. Plankton Checking Using a Microscope

Source: Primary Data (2026)

Plankton Abundance

When carrying out the research PT. XYZ has not yet stocked. So, the data taken at the time of preparing the report is secondary data in cycle 4 starting from June to November 2025.

The results of plankton identification in the vannamei shrimp cultivation pond of PT. The 4th cycle of Madura Arona Madura, which starts from June to November 2025, is obtained from the groups Chlorophyta (Green Algae), Cyanophita (Blue Green Algae), Bacillariophyta (Diatom), Phyrrophyta (Dinoflagellata), Cryptophyta (Golden Green Algae), and Protozoa. Broadly speaking, the plankton that has the highest abundance is the Chlorophyta (Green Algae) group. The average amount of plankton abundance per 10 days from DOC 1 – 150 in plots A2, A3 and B2 of the shrimp pond of PT. XYZ as shown in **Table 1.**

Table 1. Plankton Abundance by Type in Plots A2, A3 and B2

Friday	DOC	GA(%)	Diatom(%)	Dyno(%)	BGA(%)	FOR(%)	DENSITY
A2	10	70,3	11,3	29,3	7,3	0	118×10^3
A3		44,4	32,4	21,2	0	3,7	102×10^3
B2		65	21,9	25	0	0	112×10^3
A2	20	65,7	2,2	27,8	2,9	5	104×10^3
A3		74,9	3,6	21,7	2,5	1	103×10^3
B2		76,6	3,1	16,5	11,8	2,9	110×10^3
A2	30	82,4	1,5	13,7	3,2	0	101×10^3
A3		75,7	0	12,8	8	3,2	100×10^3
B2		77,6	0	18,6	3,7	0	100×10^3
A2	40	64,8	1,7	28,9	5,3	3,1	104×10^3
A3		64,2	2,5	25,9	7,1	2,7	103×10^3
B2		44,0	4,2	17,3	6	2,9	75×10^3

A2	50	59,1	9,1	25,6	10,6	0	105×10^3
A3		53,4	7,4	31,6	8,6	2,6	104×10^3
B2		54,9	11,7	28,1	2,7	4,6	102×10^3
A2	60	50,1	8,1	36,1	7,5	2,1	104×10^3
A3		37,6	6,7	33,5	15,9	6,1	100×10^3
B2		43,7	12,3	29,2	12,5	2,1	100×10^3
A2	70	29,5	7,9	41,2	18,6	3,1	100×10^3
A3		45,1	6,1	22,6	25,3	1,4	101×10^3
B2		33,3	9,3	27	27,9	2,3	100×10^3
A2	80	36,6	10,6	31	19,7	1,9	100×10^3
A3		42,5	10,1	26,3	19,2	3,4	102×10^3
B2		37	1,4	21,4	39,4	2,7	102×10^3
A2	90	58,8	4,8	26	10,8	1,7	102×10^3
A3		47,1	0	29,3	23,5	0	100×10^3
B2		49,8	3,1	34,7	9,2	3,1	100×10^3
A2	100	65,7	3,7	20,5	10,5	1,3	102×10^3
A3		54,4	2,1	27,2	10,7	5,4	100×10^3
B2		64,1	0	22,4	10,7	2,7	100×10^3
A2	110	55,5	2,9	32,6	5,9	2,9	100×10^3
A3		46,7	11,9	29,3	11,9	0	100×10^3
B2		42,7	28,5	29,7	12	2,3	115×10^3
A2	120	53,3	5	36,4	7,6	0	102×10^3
A3		50,3	3,2	36,3	10,4	2,1	102×10^3
B2		53,5	5,4	31,5	12,1	0	102×10^3
A2	130	47,3	5,7	22,2	24,5	3	102×10^3
A3		66,2	5,4	15,1	12	2,3	101×10^3
B2		36,0	5,2	22,6	36,8	1,6	102×10^3
A2	140	49,1	0	29,1	21,8	0	100×10^3
A3		49,1	3,7	22,6	22,6	1,8	100×10^3
B2		67,3	0	21,7	10,8	0	100×10^3
A2	150	51,1	3,2	18,8	25,9	1,5	101×10^3
A3		42,8	7	33,3	11,4	5,2	100×10^3
B2		55,4	10,7	25,6	12,7	1,4	106×10^3

Source: Secondary Data (2025)

From the data mentioned above, the composition of the plankton found consisted of the divisions of Chlorophyta (Green Algae), Cyanophyta (Blue Green Algae), Bacillariophyta (diatom), and Pyrrophyta (dinoflagellata).

Among phytoplankton, the most abundant comes from Chlorophyta (Green Algae), followed by Pyrrophyta (Dynoflagellata) being the second most abundant. While Cyanophyta (Blue Green Algae), Bacillariophyta (Diatoms) have less abundance. Based on table 3, it shows that Chlorophyta (Green Algae) dominates with an average of 30-80%. Pyrrophyta (Dynoflagellata) dominates with an average of 20-36%. Cyanophyta (Blue Green Algae) dominates with an average of 3-26%. Bacillariophyta (Diatoms) dominate with an average of 1-28%. Then protozoa 1-5%.

Here is the dominance of the type from the average per 10 days with the primary and secondary dominance.

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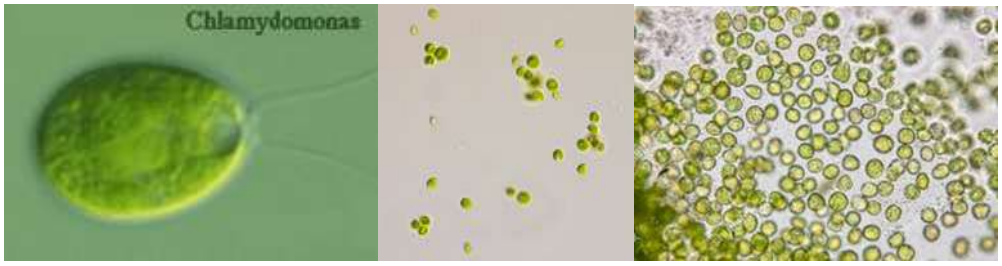
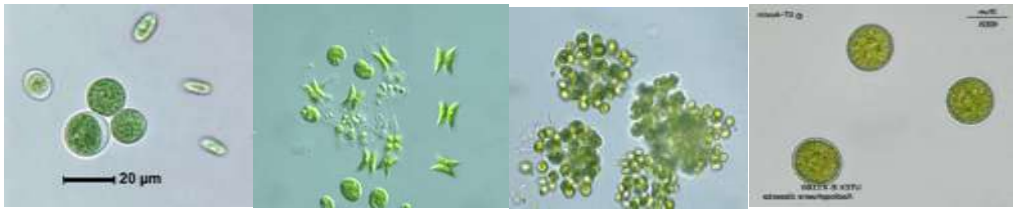
Table 2. Primary Domination and Second Dominance

Primary Dominance	
Jenis Plankton	**Genus**
Chlorophyta (Green Algae)	Chlamydomonas
	Nannochloropsis
	Chlorella
	Chlorococcum
	Tetradesmus
	Dictyosphaerium
	Radiosphaera
Second Dominance	
Dinoflagellate	Gyrodinium
	Ochromonas
	Gymnodinium
	Cryptoperidiniopsis

Source: Secondary Data (2025)



Chlamydomonas Nannocloropsis Chlorella



Chlorococcum Tetradesmus Dictyosphaerium Radiosphaera

Figure 2. Genus Chlorophyta which Dominates Plots A2, A3 and B2

Source

: Secondary Data (2025)

Water Quality Parameters

1. Brightness

Water brightness is one of the important indicators in intensive pond cultivation because it describes the penetration of sunlight entering the pond which is influenced by the photosynthesis process. Brightness is affected by the level of turbidity or the presence of suspended particles such as plankton and organic matter. Water brightness measurement at PT. The 4th cycle of PT. XYZ which starts from June to November 2025 which is secondary data, is carried out twice a day, namely in the morning and evening using a Secchi disk.

In plots A2, A3 and B2 while in DOC 10, the water brightness in the morning reached 71-79cm and in the morning and evening, indicating a high level of light as the plankton population was still low. (Sofarini, 2012) explained that the high brightness value indicates that the water tends to be clear with low dissolved particle content and there is still little

plankton. This brightness naturally decreases as DOC increases and plankton activity increases during cultivation. The measurement results on A2 plots of morning and evening brightness ranged from 75–33 cm, with an average of 10.9 cm and 43.1 cm, respectively. in A3 tiles the morning and evening brightness ranges from 79–33 cm, with an average of 44.4 cm and 46.8 cm, respectively. in plot B2 the morning and evening brightness ranges from 75–30 cm, with an average of 40 cm and 41.3 cm, respectively. According to SNI 01-7246-2006, the optimum level of brightness is 30–45 cm. Although it is still within the tolerance limit, there are fluctuations in values that need to be considered, especially the trend of decreasing brightness as the cultivation age increases.

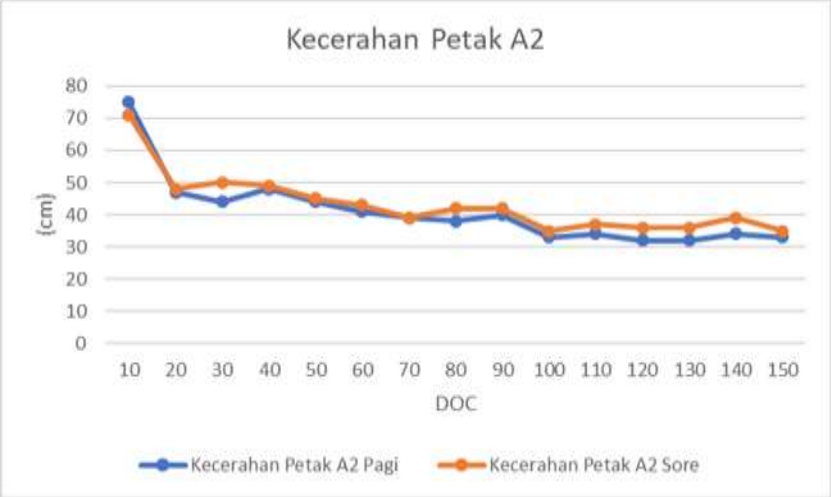


Figure 3. Brightness Graph on A2 Tiles

Source : Secondary Data (2025)

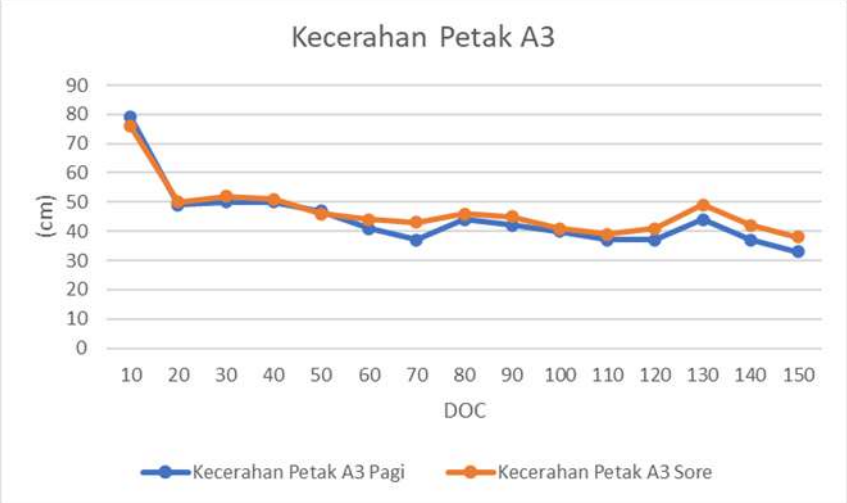


Figure 4. Brightness Graph on A3 Tiles

Source : Secondary Data (2025)

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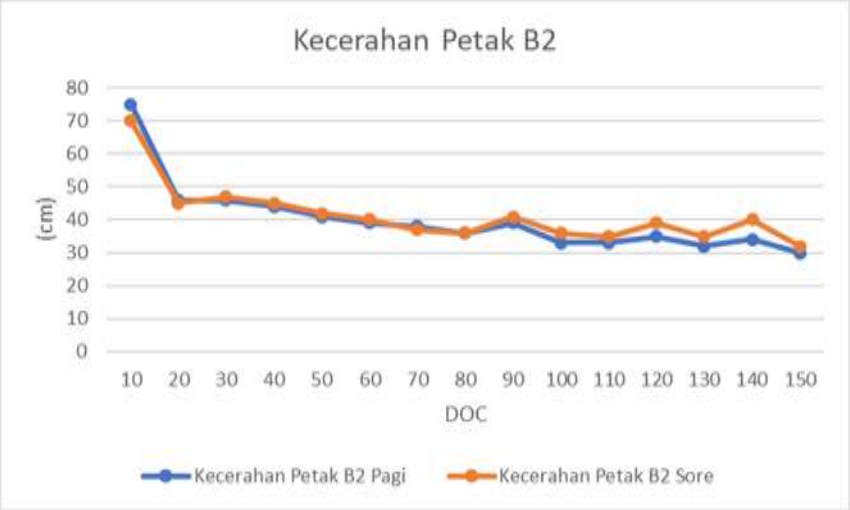

Figure 5. Brightness Graph on Tile B2
Source: Secondary Data (2025)

According to Halim et al., (2021) Low Pond brightness can affect the decrease in oxygen levels in shrimp ponds and can affect the survival of vannamei shrimp. The high brightness of a body of water will cause the value of the intensity of light entering a body of water to increase so that photosynthesis runs smoothly and plankton growth is maximized. This is in line with the opinion of Prana et al., (2024) that low brightness can inhibit the penetration of light required by phytoplankton to carry out photosynthesis.

2. Water Color

Checking the color of the water at PT. The 4th cycle of the PT. XYZ cycle which starts from June to November 2025 which is secondary data, which is carried out visually in the morning and evening. The change in water color is caused by photosynthetic activities that cause the dominance of plankton in the plot. But sometimes this is the opposite of the dominant type of plankton and the color of the water in the field, the plankton that dominates is Chlorophyta while the color of the water on the map is light brown and dark brown. This can happen because in addition to Chlorophyta There are also genera Bacillariophyta which have different color pigmentation, as well as the presence of other sediments in the pond. Water color changes can change every day, this is caused by the presence of predominantly plankton, dead plankton, uneaten feed residue and other organic matter. The color of the water is determined by the photosynthetic pigment of plankton, i.e. Chlorophyta contains chlorophyll-A/B (green), while Bacillariophyta It has chlorophyll-c + fucoxanthin (brown). The optimal green or brown color ensures light penetration for photosynthesis (Rahmatullah and Karina, 2021). The average comparison of water color on plots A2, A3 and B2 during the cultivation process can be seen in **Appendix 5.**

3. Dissolved Oxygen (DO)

Dissolved oxygen is one of the chemical parameters of the waters that is closely related to the presence of phytoplankton. Dissolved oxygen is needed by aquatic biota for respiration. Oxygen is also one of the limiting factors, so if its availability in water is insufficient for the needs of biota, then all biota activities will be inhibited. The dynamics of oxygen in waters are influenced by phytoplankton, where phytoplankton are atrophic organisms that in addition to

producing organic matter, also serve as an oxygen supply (Zainuri et al., 2023). During the day phytoplankton produce oxygen through photosynthesis, which is phytoplankton use sunlight to convert CO_2 and water into glucose and oxygen. Meanwhile, at night, phytoplankton use oxygen for respiration, namely by absorbing O_2 levels in the water and converting them into CO_2, therefore O_2 levels at night are low. The following is the average DO on plots A2, A3 and B2 in PT. XYZ cycle 4 which starts from June to November 2025 which is secondary data, which can be seen in **Appendix 6.**

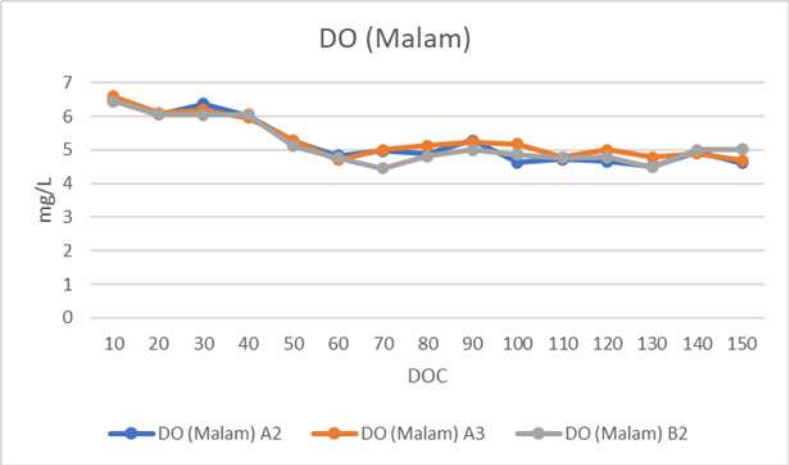

Figure 6. DO Checking at Night Plots A2, A3 and B2
Source: Secondary Data (2025)

The DO value at night at the practice site has an average range of 4.6 – 6.38 mg/L. According to the opinion of Zainuri et al., (2023), that this value is classified as good because it is in accordance with the DO level at the quality standard, which is 4 - 5 mg/l. One of the DO contents in the waters is produced by the photosynthesis process carried out by phytoplankton, as well as the many uses of pinwheels on the plot.

4. Degree of Acidity (pH)

pH or acidity degree indicates the concentration of hydrogen ions in a water. According to Effendi (2023), the process of photosynthesis in water is carried out by phytoplankton and aquatic plants that utilize CO2 during the process. During the day, when the photosynthesis process occurs, plankton consume CO2 so that it will lower the H+ concentration and increase the pH of the water. Meanwhile, at night, aquatic organisms respirate which produces CO2 so that the pH drops. pH check at PT. The 4th cycle of the Arona Madura matra starting from June to November 2025 which is secondary data, namely with the average value can be seen in **Appendices 7 and 8.**

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Figure 7. pH Check Activities
Source : Primary Data (2026)

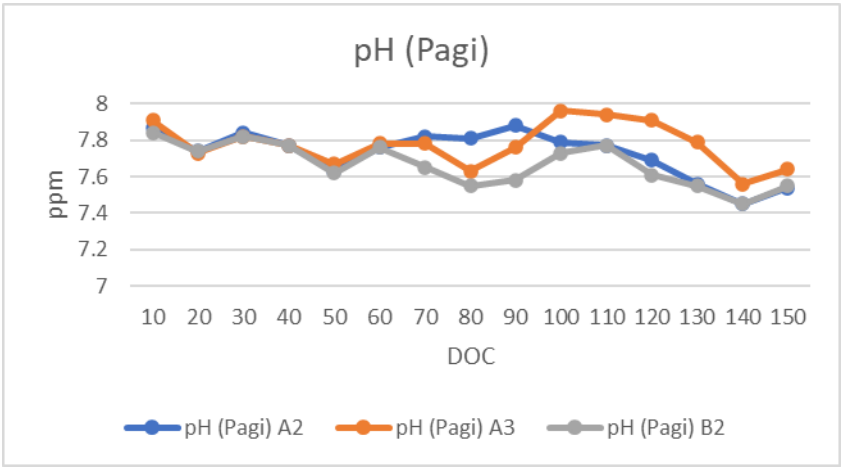

Figure 8. pH Check Results in the Morning
Source: Secondary Data (2025)

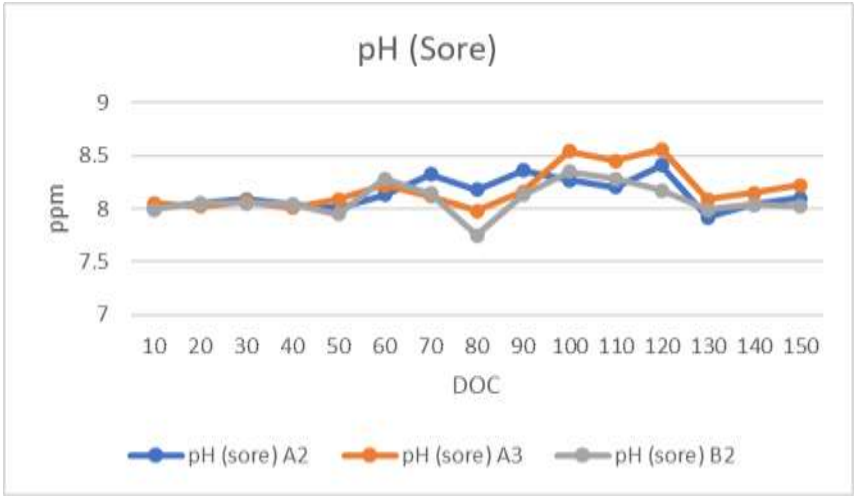

Figure 9. Results of pH Check in the Afternoon
Source: Secondary Data (2025)

The pH value measured at the practice site is in the average range between 7.9 – 8.5. This pH value is still in the good category for phytoplankton growth. According to Zainuri et al., (2023) waters with a pH between 6 – 9 correspond to the growth of phytoplankton. However,

according to Effendi (2023), it is stated that if the pH value tends to be acidic, which ranges from 6.0 – 6.5, it will affect the decline in plankton diversity in the waters.

5. Ammonium (NH4)

Ammonium is the result of protein overhaul from feed residues and shrimp metabolism. Ammonium measurement results at PT. XYZ cycle 4 which starts from June to November 2025 which is secondary data, namely NH4 in plot A2 ranges from 0.5 - 8 mg/L with an average of 2.92 mg/L, NH4 plot A3 ranges from 0.5 – 8.5 mg/L with an average of 2.27 mg/L, and NH4 plot B2 ranges from 0.5 – 8.5 mg/L with an average of 2.28 mg/L. This is due to the accumulation of organic matter from feed residues that are not properly utilized and the lack of activity of decomposing bacteria. Although at low pH ammonium is relatively harmless, at high pH, ammonium can be converted to ammonia, which is highly toxic to vannamei shrimp. The graph of the NH4 measurement results of plots A3 and A5 can be seen on **Figure 13.**

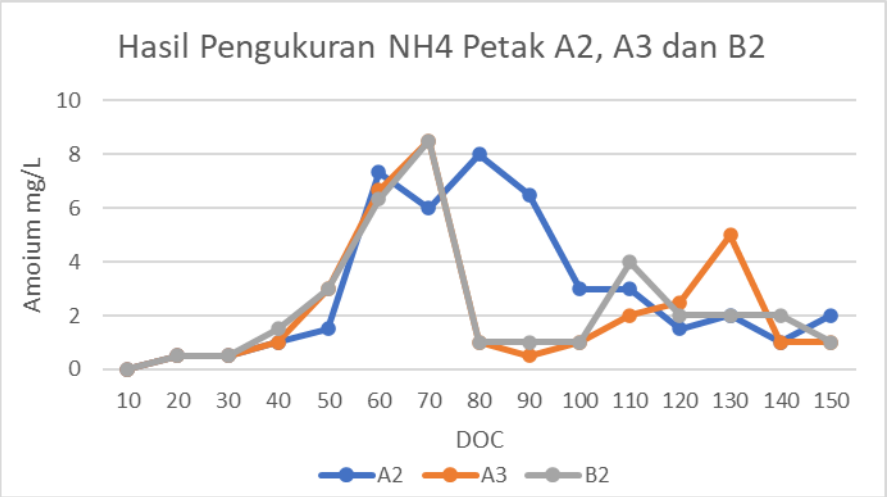

Figure 10. NH4 Measurement Results on Plots A2, A3 and B2
Source: Secondary Data (2025)

Based on the graph in Figure 24, showing the results of the measurement of the value of NH4 in PT. Matra Aaron Madura. In plots A2, A3 and B2, the value of NH4 tends to increase. The highest NH4 value of plot A2 in DOC 80 is 8 mg/L, plot A3 and B2 in DOC 70 which reaches 8.5 mg/L. In accordance with the reference of Lusiana et al. (2021) which states that the optimal value of ammonium is 0.5 mg/L. However, SNI 01-8037-2014 stipulates that the ideal ammonium value for vannamei shrimp is less than 0.1 mg/L, which suggests that higher ammonium levels could potentially harm the health of vannamei shrimp.

Water temperature and ammonium content have an effect on increasing the number of individuals and genera while nitrate content, salinity and dissolved oxygen have an effect on decreasing the number of individuals and genera (Pirzan, 2008). Some types of green-blue algae such as Anabaena can utilize N2 gas directly from the air as a source of nitrogen (Tancung, 2007). These forms of nitrogen undergo transformation as part of the nitrogen cycle. Nitrogen sources that can be directly utilized by aquatic plants are nitrate, ammonium, and nitrogen gas (Muhazir, 2004).

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6. Nitrit (NO2)

The results of NO2 measurements using a test kit at PT. XYZ cycle 4 which starts from June to November 2025 which is secondary data, namely in plot A2 ranges from 0.05 - 9 mg/L with an average of 3.74 mg/L, NO2 plot A3 ranges from 0.05 - 5 mg/L with an average of 2.43 mg/L, and NO2 plot B2 ranges from 0.05 – 9.5 mg/L with an average of 4.06 mg/L. Referring to Suhendar et al. (2020) that nitrite (NO2) at the limit maximum (0.06 mg/L), Where this value is the maximum limit for vannamei shrimp cultivation. The results of Nitrite Measurement at the practice site can be seen at **Figure 11.**

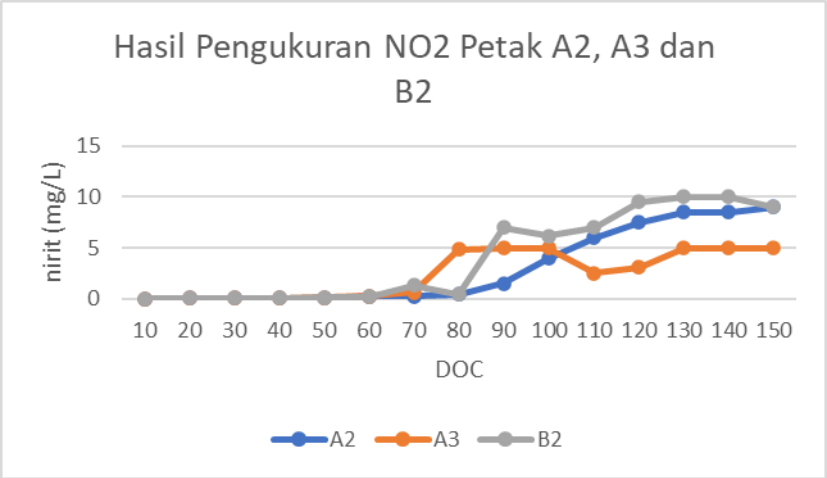

Figure 11. NO2 Measurement Results on Plots A2, A3 and B2
Source: Secondary Data (2025)

Nitrite levels in plot A3 increased from the 80th DOC. The B2 plot increased from the 90th DOC. This increase in nitrite levels is accompanied by an increase in DOC, which affects the amount of inedible feed, which is then converted into feces. This buildup of organic matter leads to the accumulation of nitrites in the waters. High nitrite levels have an impact on the increase Total Organic Matter (TOM) and dissolved oxygen (DO) decreases, which interferes with the nitrification process. In oxygen-deprived conditions, the nitrification process can shift to denitrification, which accelerates the conversion of nitrites to nitrates, thereby increasing nitrite levels further (Yunarty et al., 2022).

CONCLUSION

Conclusions that can be drawn from the research at the vannamei shrimp pond of PT. XYZ show that the results of plankton identification in the vannamei shrimp farming pond cycle 4 consist of several groups, namely Chlorophyta or Green Algae, Cyanophyta or Blue Green Algae, Bacillariophyta or Diatom, Pyrrophyta or Dinoflagellata, Cryptophyta or Golden Green Algae, and Protozoa. In general, the group of plankton that has the highest abundance is Chlorophyta or Green Algae, with an average abundance of 30–80%. In addition, Pyrrophyta was found with an average abundance of 20–36%, Cyanophyta of 3–26%, Bacillariophyta of 1–28%, and Protozoa of 1–5%. These results show that the composition of plankton in ponds is dominated by green algae groups that play an important role in supporting the process of photosynthesis and the balance of pond aquatic ecosystems. Observations of water quality on plots A2, A3, and B2 during vannamei shrimp cultivation show that aquatic conditions are

influenced by plankton activity and organic processes in the pond. The water brightness at the beginning of cultivation, namely DOC 10, reached 71–79 cm, then decreased as the cultivation age increased due to the increase in the density of plankton and organic matter. The color of light brown to dark brown water dominated by Chlorophyta and Bacillariophyta shows the existence of photosynthetic activity that still supports the condition of pond waters. The average DO level of 4.6–6.38 mg/L and pH of 7.9–8.5 are still within the good range for the growth of plankton and vannamei shrimp. However, ammonium values with an average of 2.27–2.92 mg/L to reach 8.5 mg/L and nitrites with an average of 2.43–4.06 mg/L to reach 9.5 mg/L have exceeded SNI standards, which are less than 0.1 mg/L for NH4 and less than 0.06 mg/L for NO2. This condition is suspected to occur due to the accumulation of feed residues, feces, and the suboptimal process of decomposition of organic matter, so that it has the potential to reduce dissolved oxygen levels, inhibit the nitrification process, and threaten the survival of vannamei shrimp as a whole.

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