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Phytoplankton Abundance in the Coastal Waters of Apar Village, Pariaman City, West Sumatra

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ABSTRACT

Apar Village, located in Pariaman City, is home to a mangrove forest ecosystem that plays a crucial role in maintaining water quality and providing natural spawning grounds for various marine organisms. Phytoplankton serve as important bioindicators of aquatic environmental conditions because they are primary producers and major contributors of oxygen in aquatic ecosystems. This study aims to identify the composition and abundance of phytoplankton and their relationship with nutrient concentrations, particularly nitrate and phosphate. The research employed a survey method with direct field sampling for primary data and a literature review for secondary data. The results revealed 22 phytoplankton species from four main classes, with Bacillariophyceae (diatoms) being the most dominant, comprising 17 species. Phytoplankton abundance ranged from 361.11 to 479.17 individuals per litre, while nitrate and phosphate concentrations ranged from 0.058 to 0.085 mg/L and 0.047–0.072 mg/L, respectively. Regression analysis indicated that nitrate and phosphate accounted for 21% of the variation in phytoplankton abundance. In comparison, the remaining 79% was influenced by other environmental factors yet to be studied, such as temperature, salinity, and light penetration. Based on the abundance and nutrient concentration data, the waters of Apar Village are categorized as having low fertility, with indications of phosphate enrichment likely resulting from anthropogenic activities. This study recommends further research incorporating additional water quality parameters and encourages active community participation in preserving the balance of coastal ecosystems.

Keywords: Nitrate, Phosphate, Phytoplankton

1. INTRODUCTION

The coastal waters of Apar Village are located adjacent to a sea turtle conservation area in Apar Village, North Pariaman District, Pariaman City. Apar Beach is home to various community activities, such as fishing, residential settlements, and beach tourism. These activities have the potential to affect the ecosystem in the coastal waters of Apar, Pariaman City, particularly the water's fertility. These waters have a rich and diverse ecosystem, including coral reefs, seagrass beds, and mangrove forests. This biodiversity supports the sustainability of water fertility by providing a breeding ground for various types of marine life.

Damage to the marine ecosystem can be assessed by the abundance and composition of phytoplankton, which can serve as indicators of water quality in the sea (Samiaji, 2018). Phytoplankton are autotrophic and are also the primary source of energy in the aquatic food chain, converting inorganic materials into organic materials with energy from sunlight and chemical processes. According to Nontji (2008), phytoplankton are microscopic plants that live floating or drifting in water, inhabiting areas from the surface to depths where sunlight can penetrate. These organisms are an important component of the ecosystem because phytoplankton are the largest producers of organic matter in the water. According to Jannah & Muchlisin (2012), the distribution of phytoplankton is influenced by several factors, namely the physical and chemical factors of the water. The level of pollution and damage to the aquatic ecosystem is characterised by low phytoplankton diversity and the dominance of certain individuals in the water. Input loads cause damage to the ecosystem and water pollution.

Nedi et al. (2020) stated that the higher the nutrient content of the water, the greater the abundance of phytoplankton. Nutrients are substances required for phytoplankton growth, such as nitrate, phosphate, and silicate, which play an important role in the development of marine biota. Nutrients also play a role in the formation of cells in living marine organisms. Nitrate and phosphate can be found in fertilisers, household waste, and inorganic industrial liquid waste (Nugroho et al. 2023). Nutrients originating from land have a physical effect on water fertility. The higher the nitrate and phosphate content, the higher the abundance of phytoplankton in a body of water (Ayuningsih et al. 2014).

There are many human activities in the waters of Apar Village, Pariaman City, such as fishing and unregulated harvesting of marine biota. There is also marine tourism (beach tourism, boating, snorkelling). For example, tourist waste can pollute the sea, and household waste can pollute water through detergents, reducing water quality and marine fertility. These human activities affect the balance of the ecosystem and the fertility of the waters. Water fertility can be inferred from phytoplankton abundance, but currently, there is no research on phytoplankton nutrient content in Apar waters.

Therefore, it is very important to determine the fertility of these waters based on phytoplankton abundance, which is influenced by nitrate and phosphate levels. This necessitates research on ‘The Abundance of Phytoplankton in the Coastal Waters of Apar Village, Pariaman City, West Sumatra.

2. RESEARCH METHOD

Time and Place

This research was conducted from January to April 2025 in the coastal waters of Apar Village, North Pariaman District, Pariaman City, West Sumatra. Phytoplankton analysis was conducted at the Marine Biology Laboratory, while nitrate and phosphate analysis were conducted at the Marine Chemistry Laboratory, Universitas Riau.

Method

This study used a survey method with a quantitative descriptive approach. The location was determined using purposive sampling based on the intensity of anthropogenic activity. Four stations were selected: Station I in the fishing community area, Station II in the turtle conservation area, Station III in the beach tourism area, and Station IV at the river mouth near mangrove vegetation. Each station had three sampling points.

Procedures

Measurement of Water Quality Parameters

Parameters include temperature (thermometer), pH (pH meter), salinity (refractometer), brightness (Secchi disk), and current (current meter).

Phytoplankton

Surface water (100 L) was filtered through a No. 25 plankton net, preserved with 4% Lugol's solution, and observed under a microscope using the 12-field method (Davis, 1955; Yamaji, 1976). Abundance was calculated based on the APHA formula (1989).

$$N = Zx\frac{X}{Y}x\frac{1}{V}$$

Explanation:

N = Abundance of phytoplankton individuals (ind/L)
Z = Number of individuals found (ind)
X = Volume of filtered sample water (125 ml)
Y = Volume 1 drop of water (0,06)
V = Volume of filtered water (100 L)

Nutrients (Nitrates and Phosphates)

The procedure for analysing nitrate and phosphate is based on that of Alaerts & Santika (1984): 15 mL of the sample is filtered under vacuum using Whatman No. 42 paper. For nitrate samples, 4 drops of EDTA solution are added, then filtered through a Cd column, followed by the addition of 10 drops of sulfamethazine solution, which is left to stand for 1-2 minutes. Next, 10 drops of N-naphthyl solution are added, stirred, and left to stand for 5-10 minutes. For phosphate samples, 5 drops of ammonium molybdate solution are added, then the mixture is homogenized and left to stand for about 2 minutes. After that, the nitrate and phosphate samples are measured using a spectrophotometer.

Data Analysis

To determine significant differences between stations, a one-way ANOVA test with a significance level of 5% ($\alpha = 0.05$) was used using Microsoft Excel software. Furthermore, the relationship between phytoplankton abundance and nitrate and phosphate concentrations was analyzed using linear regression, both simple and multiple, with the equation model $Y = a + bx_1 + bx_2$, where Y is phytoplankton abundance, x_1 is nitrate concentration, x_2 is phosphate concentration, b is the regression coefficient, and a is the constant. To assess the strength of the relationship between these variables, the correlation coefficient (r) was used, in accordance with Sugiyono's (2010) interpretation. In addition, the. The water fertility category was determined by referring to Medinawati's (2010) classification of phytoplankton fertility and Hakanson & Bryann's (2008) classification of nutrients.

3. RESULT AND DISCUSSION

Water Quality Parameters

The field-measured water-quality parameters at each station included salinity, pH, temperature, brightness, and current velocity. The results of the water quality parameter measurements in the waters of Apar Village are shown in Table 1.

Table 1. Water quality

No.	Parameters	Average value for each station			
		I	II	III	IV
1	Salinity (ppt)	29	25	21	18
2	pH	7	7	7	7
3	Temperature (^oC)	33	33	32	32
4	Brightness (m)	3,35	3,17	3,49	3,24
5	Flow velocity (m/s)	0,16	0,24	0,12	0,20

Abundance of Phytoplankton

The results of the phytoplankton identification in the coastal waters of Apar Village, Pariaman City, are shown in Table 2.

Table 2. Identification of Phytoplankton

No.	Class	Ordo	Famili	Spesies
1	*Bacillariophyceae*		*Asterionellaceae*	*Asterionella* sp
2		*Pennales*	*Naviculaceae*	*Navicula* sp
3			*Synigillariaceae*	*Synedra* sp
4			*Arachnoidiscaceae*	*Arachnoidiscus* sp
5		*Centrales*	*Coscinodiscaceae*	*Coscinodiscus* sp
6				*Melosira* sp
7			*Leptocylindraceae*	*Leptocylindrus* sp
8		*Hemiaulales*	*Hemiaulaceae*	*Hemiaulus* sp
9			*Biddulphiaceae*	*Isthmia* sp
10		*Thalassiosirales*	*Thalassiosiraceae*	*Thalassiosira* sp
11		*Rhizosoleniales*	*Rhizosoleniaceae*	*Rhizosolenia* sp
12		*Bascillariales*	*Thalassionemataceae*	*Thalassiothrix* sp
13		*Chaetocerotales*	*Chaetocerotaceae*	*Chaetoceros* sp
14		*Naviculales*	*Pleurosigmataceae*	*Pleurosigma* sp
15		*Bacillariales*	*Bacillariaceae*	*Nitzschia* sp
16		*Melosirales*	*Stephanopyxidaceae*	*Stephanopyxis* sp
17		*Corethrales*	*Corethraceae*	*Corethron* sp
18	*Cyanophyceae*	*Chroococcales*	*Chroococcaceae*	*Chroococcus* sp
19		*Oscillatoriales*	*Oscillatoraceae*	*Oscillatoria* sp
20		*Nostocales*	*Rivulariaceae*	*Gloeotrichia* sp
21	*Chlorophyceae*	*Chlorococcales*	*Oocystaceae*	*Chlorella* sp
		Peridiniales	*Protopediniaceae*	*Protopedinium*
22	*Dinophyceae*	*Gonyaulacales*	*Ceratiaceae*	*ceratium* sp

The results of phytoplankton observations in the coastal waters of Apar Village, Pariaman City, during the study identified 4 classes comprising 22 phytoplankton species. From each class, 17 species of *Bacillariophyceae*, 3 species of *Cyanophyceae*, 1 species of *Chlorophyceae*, and 1 species of *Dinophyceae* were obtained. From the number of classes, various species were obtained. The results of observations on phytoplankton abundance at each station in the coastal waters of Apar Village, Pariaman City, are shown in Table 3.

Table 3. Abundance of Phytoplankton

No.	Species Type	Station			
		1	2	3	4
1	*Asterionella* sp	-	-	+	+
2	*Navicula* sp	+	-	+	+
3	*Synedra* sp	+	+	-	-
4	*Arachnoidiscus* sp	+	-	-	-
5	*Coscinodiscus* sp	+	+	+	+
6	*Melosira* sp	-	-	+	+
7	*Leptocylindrus* sp	+	+	+	+
8	*Hemiaulus* sp	-	+	-	-
9	*Isthmia* sp	-	-	+	+
10	*Thalassiosira* sp	+	+	+	+
11	*Rhizosolenia* sp	+	-	+	+
12	*Thalassiothrix* sp	+	-	-	-
13	*Chaetoceros* sp	-	+	-	+
14	*Pleurosigma* sp	-	+	-	+
15	*Nitzschia* sp	-	+	-	-
16	*Stephanopyxis* sp	-	+	-	-
17	*Corethron* sp	-	-	-	+
18	*Chroococcus* sp	-	+	+	+
19	*Oscillatoria* sp	-	+	-	-
20	*Gloeotrichia* sp	-	+	+	+
21	*Chlorella* sp	-	-	+	-
22	*Protopedinium ceratium* sp	-	-	+	-
	Number of Species	8	12	12	13

Description: + = Found, - = Not found

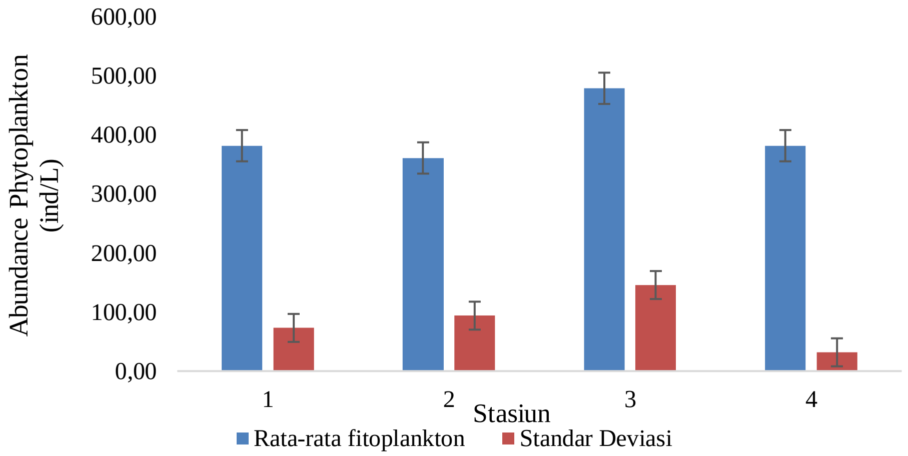

Figure 1. Average phytoplankton abundance

Table 3 shows that Station I found 8 species, Stations II and III found 12 different species, and Station IV found 13 species. From the number of phytoplankton species at each station, differences in the types of species found can be seen, such as the species *Arachnoidiscus* sp and *Thalassiothrix* sp found only at Station I, *Hemiaulus* sp, *Nitzschia* sp, *Stephanopyxis* sp, *Oscillatoria* sp found only at Station II, *Chlorella* sp., and *Protopedinium ceratium* sp. found only at Station III. *Corethron* sp was found only at Station IV. The species *Coscinodiscus* sp, *Leptocylindrus* sp, and *Thalassiosira* sp were found at every station.

Station III had the highest average phytoplankton abundance with a value of 478.17 ind/L, but also had the largest standard deviation (145.83), which means that the abundance at the sampling points varied significantly. Point 1 at this station had the highest abundance value

(645.83 ind/L).

Stations I and IV had nearly identical average phytoplankton abundance, around 381.94 ind/L. However, the standard deviation at Station I (73.16) was much greater than that at Station IV (31.82), indicating that the data at Station I were more scattered and varied between sampling points. Station II had the lowest average phytoplankton abundance value of 361.11 ind/L. This indicates fluctuations in organism abundance at sampling points within this station.

The phytoplankton composition found consisted of four classes with 22 species of phytoplankton at four observation stations. The phytoplankton composition in the coastal waters of Apar Village, Pariaman City, came from the classes Bacillariophyceae, Cyanophyceae, Chlorophyceae, and Dinophyceae. Of these four classes, we can see that many species were found in the class Bacillariophyceae, with 17 species of *Coscinodiscus* sp. being the most dominant. This is because the class Bacillariophyceae, or diatoms, is the most commonly found phytoplankton in marine waters (Samiaji, 2018). Bacillariophyceae is a group of phytoplankton that is widely distributed in both extreme and polluted waters. The Bacillariophyceae class is dominant because phytoplankton of the Bacillariophyceae class have a good ability to adapt to the environment and reproduce rapidly. In addition, diatoms can survive in slow- to fast-flowing waters and play a very important role in fisheries, especially in aquatic ecosystems (Juadi et al., 2018).

The highest phytoplankton abundance was found at Station 3 with a value of 479.17 ind/L, and the lowest at Station II with 361.11 ind/L. The low phytoplankton abundance at Station II is thought to be due to the lack of nutrients, namely nitrate and phosphate. This is evidenced by Aryawati et al. (2023), who found that one factor affecting phytoplankton growth is the presence of nutrients such as nitrate and phosphate, as well as stable water quality. High phytoplankton abundance in a water body occurs when there is a high availability of organic matter (Nurrachmi et al., 2021). The nutrient levels of nitrate and phosphate at Station II are relatively low. The low abundance of phytoplankton at Station II compared to other stations is thought to be due to poor water conditions, which limit optimal photosynthesis at low light levels. The light intensity at Station II is lower than at other stations, with a value of 3.17 m.

In the process of photosynthesis, phytoplankton require sunlight, making sunlight a major factor in phytoplankton reproduction. In addition, water concentration depends heavily on several physical and chemical parameters, such as light intensity and nutrient levels, which also affect its abundance (Ridhawani et al., 2017). In other words, water quality is a benchmark for the growth and abundance of phytoplankton. Adhani et al. (2022) stated that phytoplankton growth can be influenced by several environmental factors, including water light intensity, which has a significant effect. When light intensity can easily be diminished by reflection and absorption, it will affect primary productivity. Another parameter that affects phytoplankton abundance is current velocity. At Station II, the current velocity was higher than at other stations, and the strong currents meant that only certain species were able to survive.

The high abundance of phytoplankton at Station III occurs when the availability of organic matter is high (Nurrachmi et al., 2021). Factors that influence phytoplankton abundance can also be seen from water quality parameters. The parameter that influences phytoplankton abundance is current velocity. At Station III, the current velocity is 0.12 m/s. This is because this station has a calm current. High current velocity will prevent phytoplankton from developing properly, whereas low current velocity will promote their development. This opinion is reinforced by Sumartini (2013). Thus, phytoplankton abundance will increase in weak currents because phytoplankton will be carried away and dispersed throughout the water body if the current is too strong. If the current is too strong, it will cause turbidity and affect water brightness. Brightness also affects phytoplankton abundance.

Station III is located far from residential areas. According to Maturbongs (2015), the turbidity of a water body is the opposite of its brightness, so that if the brightness level is low, the turbidity value is high, and vice versa. Low brightness in water bodies occurs because the surface water contains a lot of suspended material, such as sand and household waste. At Station III, the brightness value was higher than at other stations, namely 3.49 m.

Nitrate and Phosphate Content

Based on the analysis of nitrate and

phosphate levels in the coastal waters of Apar Village, Pariaman City, the levels varied across stations. The average nitrate and phosphate concentrations are shown in Table 4.

Table 4. Nitrate and Phosphate Concentration

Stasiun	Average concentration (mg/l)	
	Nitrate	Phosphate
1	0,069±0,020	0,053±0,017
2	0,058±0,006	0,047±0,021
3	0,085±0,023	0,072±0,024
4	0,081±0,029	0,067±0,001

Station I shows relatively low concentrations of nitrate and phosphate, but the variation in nitrate data is slightly higher than that of phosphate. This indicates moderate fluctuations in nitrate concentration. Station II has the lowest nitrate concentration among all stations, with very little variation (stable). Although phosphate levels are quite low, they show greater variation, indicating an unstable phosphate source. Station III has the highest concentrations of both nitrate and phosphate. The standard deviation is also the highest, indicating large fluctuations in the content of substances in the water. This is most likely due to anthropogenic activities such as agriculture or domestic waste. At Station IV, nitrate levels are also relatively high and more variable. However, phosphate levels here are very stable (standard deviation of only 0.001), indicating a consistent phosphate source.

Nitrate is the main form of nitrogen in natural waters (Mustofa, 2015). One nutrient that can promote marine biomass growth is nitrate, which can directly control primary production. Therefore, high and low nitrate concentrations are closely related to water fertility (Haikal et al., 2012). The highest nitrate concentration was found at Station III (0.85 mg/L), located near the river mouth. This is thought to be because the area is a river mouth, which can carry household waste and agricultural residues into the sea. Hindaryani et al. (2020) stated that nitrate concentrations are higher in coastal areas due to river runoff, which causes substantial material from the mainland to accumulate in the sea. In addition, they noted that nitrate levels tend to be higher in the estuary and decrease towards the open sea.

The lowest nitrate concentration was measured at Station II, located in front of the UPTD Penyu Conservation office complex, at 0.58 mg/L. The low nitrate concentration is thought to be due to the distance from sources of nitrate from land, such as agricultural and domestic waste. Nitrate originates from ammonium that enters the river, mainly through domestic waste. Its concentration in the river decreases the further it is from the point of discharge (Mustofa, 2015). Low nitrate concentrations can also occur when phytoplankton utilise nitrate as a limiting factor for growth and development (Ainul et al., 2022).

Low nitrate concentrations in water can be influenced by water temperature. Yolanda et al. (2016) stated that temperature affects nitrate concentrations in water because high temperatures can cause nitrates to evaporate in water. Low temperatures usually contain nutrients, so many marine microorganisms also inhabit them. Based on this, it can be seen that nitrate values are lower at 33 °C than at 32 at Stations I and II, but higher at 32 °C than at 33 °C at Stations III and IV.

The highest phosphate concentration was found at Station III, which was 0.072 mg/l, located near the river estuary. The phosphate concentration was equal to the nitrate concentration, with the highest concentration at Station II. The high phosphate concentration at Station II is thought to be due to the proximity of the river estuary to land that carries other land-based sources of phosphate, so that the phosphate in the river estuary is higher than in the seawaters further out.

The area near the river mouth also receives the highest phosphate supply among other zones (Rahmadani et al., 2021). The source of phosphate in coastal waters is rivers. River water carries waste and other terrestrial sources of phosphate, so the source of phosphate at the river mouth is greater than in the surrounding area. According to Sutamihardja et al. (2018), increased pollution inputs to water bodies drive higher phosphate concentrations.

Another environmental parameter that may contribute to the high phosphate concentration at Station III is the high flow velocity there. High flow velocity can cause resuspension. Resuspension can cause sediments at the bottom of the sea to rise, lifting chemical elements, including phosphate, along with them (Rahmadani et al., 2021). The lowest phosphate concentration was measured at Station II (0.047 mg/L), located in front of the UPTD Penyu Conservation office complex. This is because the observation station is located far from residential areas and river estuaries, resulting in low household waste levels and, consequently, low phosphate concentrations.

The further the phosphate sampling point is from river estuaries or densely populated areas, the lower the phosphate concentration. Phosphate concentration is also influenced by current speed. This is because Station II has a calm current, so sediment at the bottom of the water cannot rise or float, preventing chemical elements, including phosphate, from being lifted. In general, phosphate concentration will decrease the further away from the sea centre.

From the results of the study, it can be seen that the waters of the study location are classified as oligotrophic, with an average phytoplankton abundance value at each station of 361.11-479.17 ind/L. This means that the phytoplankton abundance in the waters of Apar Beach, Pariaman City, is low. The fertility status of the waters can be seen from the abundance of plankton.

This study shows that the coastal waters of Apar Village, Pariaman City, are oligotrophic (low fertility). Meanwhile, in the swamps of Apar Village, Pariaman City, at the mouth of the river, more precisely behind the beach, mangroves grow lushly. This is because phytoplankton samples were taken during the day above the sea surface. Sampling in this study was carried out too far offshore.

Medinawati (2010) states that every place has different plankton abundances, so that waters can be divided based on phytoplankton abundance, namely: 1. Oligotrophic waters are waters with low fertility with phytoplankton abundance ranging from 0–1,000 ind/l, 2. Mesotrophic waters are waters with moderate fertility, with phytoplankton abundance ranging from 1,000 to 40,000 ind/l, 3. Eutrophic waters are waters with high fertility, with phytoplankton abundance ranging from >40,000 ind/L.

The nitrate concentration at the study site is very low, ranging from 0.058 to 0.085 mg/L. According to Hakanson & Bryann (2008), the classification of water fertility based on nitrate concentration is as follows: Oligotrophic waters with a content of 0–0.11 mg/L, mesotrophic waters with a content of 0.11–0.29 mg/L, eutrophic waters with a content of 0.29–0.94 mg/L, and hypertrophic waters with a content of >0.94 mg/L.

From this study, it can be seen that the coastal aquatic ecosystem of Apar Village, Pariaman City, has low productivity, with few organisms living and growing in it, and often supports species that require a cold and oxygen-rich aquatic environment. The results of the phosphate concentration measurements in this study ranged from 0.047 to 0.072 mg/L. Based on these results, the study location was classified as eutrophic, with phosphate concentrations high in nutrients (0.047–0.072 mg/L). According to Hakanson & Bryann (2008), the classification of water fertility based on phosphate concentration is as follows: oligotrophic waters with a concentration of <0.015 mg/L, mesotrophic waters with a concentration of 0.015–0.040 mg/L, eutrophic waters with a concentration of 0.040–0.13 mg/L, and hypertrophic waters with a concentration of >0.13 mg/L. This study shows that the nutrient-rich waters of Apar Beach in Pariaman City can affect water quality, possibly due to agricultural waste.

The Relationship between Phytoplankton Abundance and Nitrate and Phosphate Concentrations

To determine the relationship between phytoplankton abundance and nitrate and phosphate concentrations, a multiple linear regression test can be performed using Microsoft Excel software.

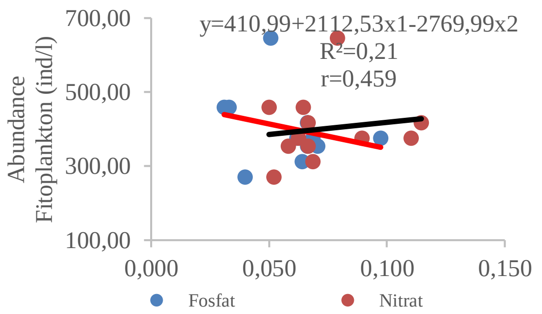

Figure 3. Relationship between phytoplankton abundance and nitrate and phosphate concentrations

The regression equation obtained was Y = 410.99 + 2112.53x1 – 2769.99x_2. The test results showed a moderate positive correlation between the dependent variable and the predictor variables together. The coefficient of determination (R^2) was 0.21, indicating that nitrate and phosphate accounted for 21% of the variation in phytoplankton abundance, while other factors influenced 79%. This suggests that phytoplankton abundance has a weak relationship with nitrate and phosphate concentrations.

The relationship between phytoplankton abundance and nitrate and phosphate concentrations in the coastal waters of Apar Village, Pariaman City, can be determined using a multiple linear regression test. From the test results, the regression equation obtained is $Y = 410.99 + 2112.53x1 - 2769.99x_2$. The test results yielded a value of (R^2) =0.21, which means that nitrate and phosphate affect phytoplankton abundance by 21%, while other factors influence 79%. Meanwhile, the correlation coefficient (r) of 0.459 indicates that phytoplankton abundance has a weak relationship with nitrate and phosphate concentrations.

The abundance of phytoplankton in water is closely related to the concentration of nutrients (nitrate and phosphate), which play a role in phytoplankton abundance. Azis et al. (2020) stated that the content of nitrate and phosphate nutrients can affect the presence of phytoplankton because these nutrients are utilised by phytoplankton for their growth. Nutrient content can affect phytoplankton abundance and vice versa, as phytoplankton can reduce nutrient concentrations in water. In addition, brightness is a major factor in phytoplankton growth, especially in the smooth functioning of photosynthesis. The perfection of this process depends on the intensity of light entering the water. Meanwhile, the intensity of light entering the water is influenced by the water's brightness and turbidity.

In a body of water, the presence of nitrate and phosphate is necessary to meet the nutritional needs of phytoplankton so that it can produce energy. Excessive levels of nitrate and phosphate in a body of water can cause eutrophication (algae blooms*)*.

4. CONCLUSION

Based on the study results, the abundance of phytoplankton in the waters of Apar Village Beach, Pariaman City, ranged from 361.11 to 479.17 individuals per litre. Measured nutrient concentrations indicate that nitrate levels range from 0.058 to 0.085 mg/L, while phosphate levels range from 0.047 to 0.072 mg/L. Based on phytoplankton abundance data, the waters in this area are classified as low-fertility (oligotrophic). From the perspective of nutrient concentration, nitrate levels indicate oligotrophic or infertile waters, while phosphate levels indicate fertile or eutrophic waters. This indicates an imbalance of nutrients that can impact the dynamics of the aquatic ecosystem, as well as the possible influence of anthropogenic activities on local fertility conditions.

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