InJAST
Volume 3, Number 2, October 2022
Pages: 120-130

P - ISSN: 2722 - 0133
E - ISSN: 2722 - 0141
DOI: 10.33751/injast.v3i2.5985

Seawater quality and diversity of phytoplankton species in the waters of the North Coast of Jakarta

MOH. HAMDANI[1,*], KHOE SUSANTO KUSUMAHADI[1,2], TATANG MITRA SETIA[1,2]

[1]Master of Biology Program, Graduate School, Universitas Nasional, Jakarta
[2]Faculty of Biology, Universitas Nasional, Jakarta

[*]Corresponding author: *hamdani.duro@gmail.com*

Submitted 31 August 2022; Accepted 24 October 2022

ABSTRACT

The North Coast of Jakarta is a strategic area to support the economy of the DKI Jakarta Province and as a place to live for organisms, one of which is phytoplankton. Phytoplankton is a primary producer in aquatic ecosystems that have an essential role in maintaining aquatic ecosystems and as an indicator of water quality. This study aims to determine the quality of seawater (turbidity, TSS, BOD, Phosphate, and Nitrate) and the diversity of species (H') of phytoplankton in the waters of the North Coast of Jakarta around the reclamation islands C and D from 2006 to 2021. Types of data used in this study is secondary data from Environmental Impact Analysis (ANDAL) documents and reports on the implementation of the Environmental Management Plan and Environmental Monitoring Plan for Reclamation and Development on Islands C and D. Concentrations of turbidity, TSS, BOD, phosphate, and nitrate in coastal waters North of Jakarta around the reclamation islands C and D are fluctuation and several sampling times exceed the quality standard. The species diversity index (H') of phytoplankton in the coastal waters of North Jakarta around the reclamation islands C and D is dominantly included in the criteria for community stability in stable conditions ($H > 3$). Based on the partial correlation test, phosphate with the diversity of phytoplankton species in the waters of the North Coast of Jakarta around reclamation island C and D had a significant relationship ($P < 0.05$).

ABSTRAK

Pantai Utara Jakarta merupakan kawasan strategis untuk menunjang perekonomian Provinsi DKI Jakarta dan sebagai tempat hidup organisme salah satunya fitoplankton. Fitoplankton merupakan produsen primer di dalam ekosistem perairan yang memiliki peran penting untuk mempertahankan ekosistem perairan dan sebagai salah satu indikator kualitas perairan. Penelitian ini bertujuan untuk mengetahui kualitas air laut (kekeruhan, TSS, BOD, Fosfat dan Nitrat) dan keanekaragaman jenis (H’) fitoplankton di perairan Pantai Utara Jakarta di sekitar pulau reklamasi C dan D dari tahun 2006 hingga tahun 2021. Jenis data yang digunakan dalam penelitian ini merupakan data sekunder yang bersumber dari dokumen Analisis Dampak Lingkungan (ANDAL) dan laporan pelaksanaan Rencana Pengelolaan Lingkungan Hidup dan Rencana Pemantauan Lingkungan Hidup Reklamasi dan Pembangunan di atas Pulau C dan D. Konsentrasi kekeruhan, TSS, BOD, fosfat dan nitrat di perairan Pantai Utara Jakarta sekitar pulau reklamasi C dan D yaitu fluktuatif dan terdapat beberapa waktu sampling yang melebihi baku mutu. Indeks keanekaragaman jenis (H’) fitoplankton di perairan Pantaiu Utara Jakarta sekitar pulau reklamasi C dan D dominan masuk pada kriteria stabilitas komunitas dalam kondisi stabil ($H > 3$). Berdasarkan uji korelasi secara parsial, fosfat dengan keanekaragaman jenis fitoplankton di perairan Pantai Utara Jakarta sekitar pulau reklamasi C dan D memiliki hubungan yang signifikan ($P < 0,05$).

Keywords: *BOD, nitrate, North Coast of Jakarta, phosphate, phytoplankton, TSS, turbidity*

INTRODUCTION

The North Coast of Jakarta has a strategic role in the economy of the DKI Jakarta Province (Puspasari et al., 2017) and as a place to live organisms, one of which is phytoplankton. Phytoplankton is a primary producer in aquatic ecosystems that have an essential role in maintaining the health of the structure and function of aquatic ecosystems (Sulastri, 2018).

Nontji (2008) states that phytoplankton is also referred to as primary producers because they can produce organic materials from inorganic materials. The energy in phytoplankton can be channeled to various other ecosystem components through the food chain so that all ecosystem functions can occur.

Apart from being primary producers, phytoplankton is the beginning of the formation of the food chain in the waters. Phytoplankton is essential for the food chain in the ocean because it provides the most significant contribution to total primary production, determines fertility, and is an aquatic biological resource (Nugroho, 2006).

Phytoplankton is a biological parameter that can be used as an indicator to evaluate the quality and level of fertility of water. The critical role of phytoplankton as the initial binder of solar energy makes phytoplankton play an important role in aquatic life (Fachrul, 2005 in Sirait et al., 2018).

The use of phytoplankton as an indicator of the quality of the aquatic environment can be used by knowing the diversity of its species, also called species heterogeneity. A community is said to have high diversity if the abundance of each species is high, and species diversity is low if only a few species are abundant (Fachrul, 2012).

Species diversity is a parameter used in knowing a community. This parameter characterizes species richness and balance in a community. Ecosystems with low diversity are unstable and vulnerable to the influence of external pressures compared to ecosystems with high diversity (Boyd, 1999 in Pirzan et al., 2008). One of these pressures is water quality.

Water is a natural resource necessary for all living things' survival. One of the main problems related to water resources is declining water quality. Many activities cause a decrease in water quality, causing disturbance, damage, and danger to living things that depend on water resources (Effendi, 2003).

Several water quality parameters are used to see water quality following Indonesian Government Regulation Number 22 of 2021 About the Implementation of Environmental Protection and Management (Attachment VIII about Seawater Quality Standards; Marine Living Things), including turbidity, BOD, TSS, phosphate, and nitrate.

This study aims to determine seawater quality and the diversity of species (H') of phytoplankton in the waters of the North Coast of Jakarta around the reclamation islands C and D from 2006 to 2021.

METHOD

Research Time and Location

For the seawater quality and diversity of phytoplankton, this study employed secondary data from the Amdal document's laboratory tests and PT Kapuk Naga Indah's Report on implementing the Environmental Management Plan and Environmental Monitoring Plan for Island C and Island D Reclamation. The seawater quality data is from 2006 until 2021, namely before construction (pre-construction), during construction (construction), and after Island C and Island D (post-construction). Details of the secondary data used in this study can be seen in Table 1.

The research location for parameters of seawater quality and phytoplankton diversity is in the waters of the North Coast of Jakarta in the North of Penjaringan Subdistrict, North Jakarta Administration City (around the location of Island C and Island D). The seawater quality sampling points can be seen in Figures 1, Figure 2, and Figure 3.

Table 1. Sampling time for seawater quality and phytoplankton.

Pre-Construction	Construction	Post-Construction
June 2006, January 2011 and July 2011	February 2012, June 2012, June 2013, September 2013, March 2014, June 2014, December 2014, March 2015, May 2015, September 2015, November 2015, February 2016, June 2016, September 2016, December 2016, April 2017, July 2017, September 2017, December 2017, March 2018, June 2018, September 2018, January 2019, April 2019, July 2019, October 2019, January 2020, and April 2020	July 2020, October 2020, January 2021, April 2021 and June 2021

Notes: PT Kapuk Naga Indah (2007), PT Kapuk Naga Indah (2012), PT Kapuk Naga Indah (2017) and PT Kapuk Naga Indah (2020)

Data Collection Materials

The materials used in this study were water quality data, namely turbidity, TSS, Biological Oxygen Demand (BOD), phosphate, nitrate, and phytoplankton diversity collected from 2006 to 2021.

Procedure

Data on seawater quality and diversity of phytoplankton species were collected from laboratory test results in the Amdal document, and the implementation report of the Environmental Management Plan and Environmental Monitoring Plan for Island C and Island D Reclamation made by PT Kapuk Naga Indah then determined the midpoint of the island reclamation location C and D and the points of the compass directions. Furthermore, the data is grouped according to the cardinal directions, namely:

a. South side (135°-225°)

b. East side (45°-135°)

c. North Northeast side (0°-45°)

d. North Northwest side (315°-360°)

e. West side (225°-315°)

Data Analysis

a. Trend analysis by using graphs and then analyzing descriptively.

b. Comparing with the quality standards according to the Indonesian Government Regulation Number 22 of 2021 About the Implementation of Environmental Protection and Management (Attachment VIII about Seawater Quality Standards; Marine Living Things)

c. Criteria for diversity index (H')

The criteria for the Shannon-Weiner diversity index (Basmi, 1999 in Fachrul, 2012) are:

H'< 1 = Unstable biota community
1 < H' < 3 = Medium living things community stability

H'> 3 = Stability of the living things community in prime condition (stable)

d. Analysis of the correlation between seawater quality and the diversity of phytoplankton species

Analysis of the relationship between seawater quality and diversity of phytoplankton species using Multiple Linear Regression statistical analysis.

According to Uyanik and Gule (2013) in Padilah and Adam (2019), multiple linear regression is an algorithm used to explore the pattern of relationships between the dependent variable and two or more independent variables. As affirmed by Yuliara (2016), multiple linear regression is an equation that describes the relationship between two or more independent variables (X1, X2, X3 …Xn) and one dependent variable (Y). Multiple linear regression analysis aims to determine the direction of the relationship between the independent and dependent variables.

The multiple linear regression equation is mathematical as follows:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n$$

Note:
Y= dependent variable
a = Constant
$b_1, b_2 \ldots b_n$ = Regression coefficient
$X_1, X_2 \ldots X_n$ = Independent variable

Determination of the relationship between the concentrations of seawater quality with the diversity of phytoplankton species will use the F test and t-test.

The data processing of this research begins with entering the data into excel and then analyzing using the Multiple Linear Regression method with the help of IBM SPSS Statistics 23 software.

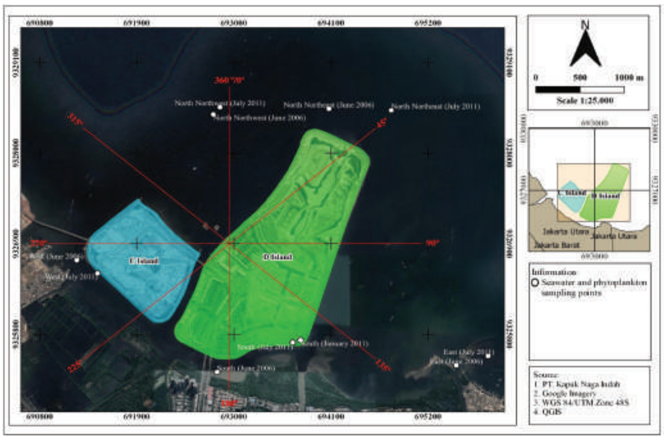

Figure 1. Seawater and phytoplankton sampling locations before construction (pre-construction) (Processed from ANDAL 2007, ANDAL 2012 and report on the implementation of RKL/RPL for reclamation island C and D, PT. Kapuk Naga Indah)

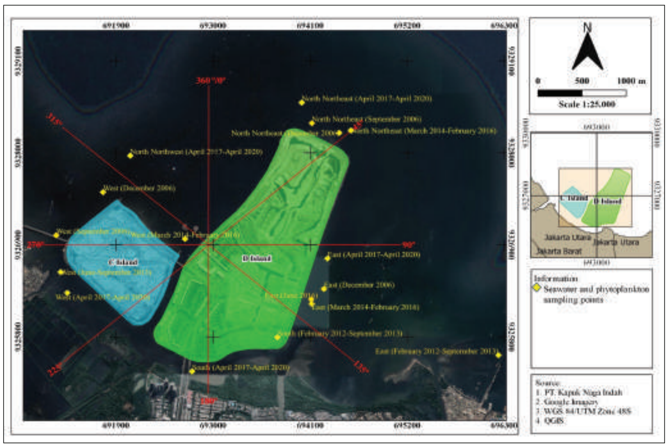

Figure 2. Location of Sampling of Seawater and Phytoplankton during Construction (Processed from Andal 2012 and Report on the Implementation of RKL RPL for Reclamation Island C and D, PT. Kapuk Naga Indah)

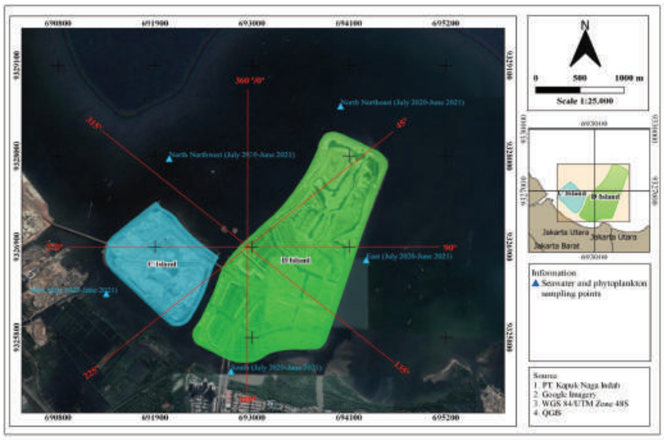

Figure 3. Seawater and Phytoplankton Sampling Locations After the Island Reclamation (Post Construction) (Processed from the Report on the Implementation of RKL RPL for Reclamation Island C and D, PT. Kapuk Naga Indah)

RESULTS AND DISCUSSION

Seawater Quality Parameters

Turbidity

The concentration of turbidity in the waters of the North Coast of Jakarta around Reclamation Islands C and D can be seen in Figure 4 and Figure 5.

Figure 4 shows that the turbidity concentration in the South, East, North Northeast, North Northwest, and West fluctuates and tends to decrease, and several samples are above the quality standard.

Based on Figure 5, the turbidity concentration in pre-construction was 1 mg/L to 30 mg/L. Most concentrations were at 2 mg/L to 9.5 mg/L and 27% above the quality standard. At the construction time, it was 0.5 mg/L to 52 mg/L; most concentrations were at 2 mg/L to 6 mg/L and 26% above the quality standard. In post-construction, the turbidity value was 0.76 mg/L (meets quality standards).

Turbidity describes the optical properties of air which are determined based on the amount of light emitted and emitted by the materials contained in the air. Turbidity is caused by dissolved organic and inorganic materials (APHA, 1976; Davis and Cornwell, 1991 in Effendi, 2003).

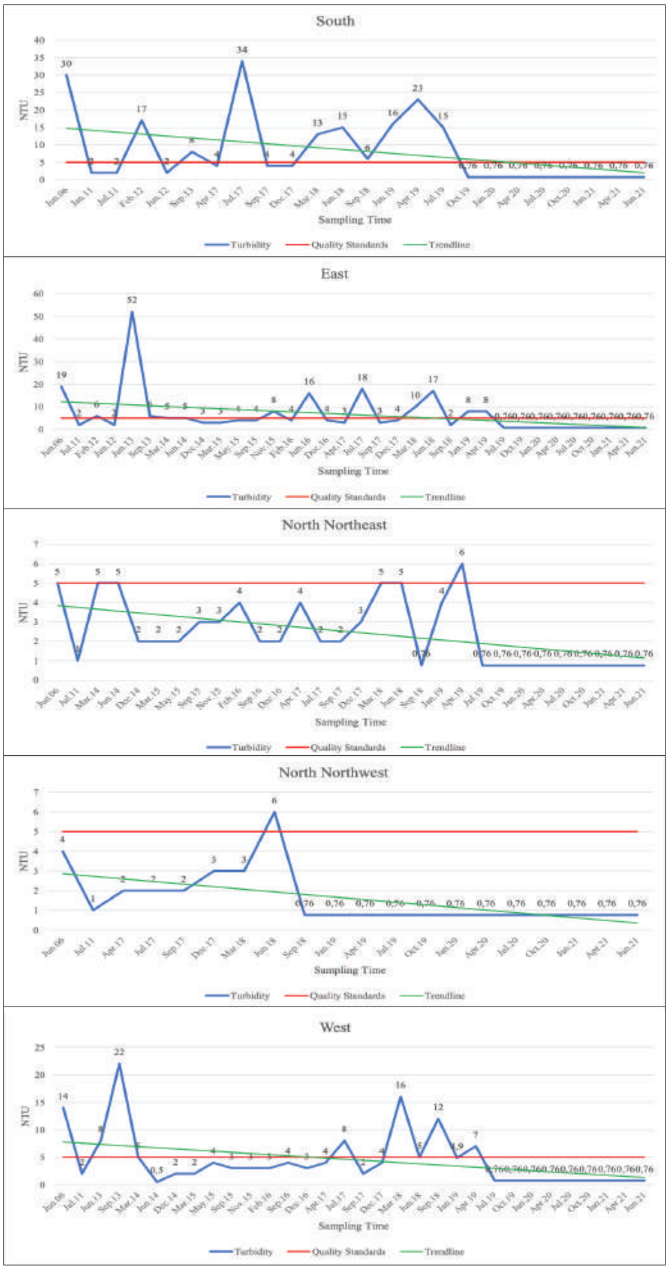

Figure 4. Concentration of Turbidity

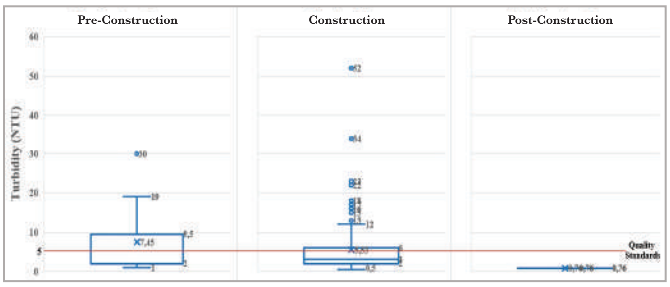

Figure 5. The concentration of Turbidity in Pre-Construction, Construction, and Post-Construction

Suspended materials can cause turbidity in the form of colloids, fine particles, and more extensive suspended materials. High turbidity can disrupt the osmoregulation system, such as respiration and the visibility of aquatic organisms, and can inhibit the penetration of light into the water (Effendi, 2003).

Total Suspended Solid (TSS)

The concentration of TSS in the waters of the North Coast of Jakarta around Reclamation Islands C and D can be seen in Figure 6 and Figure 7.

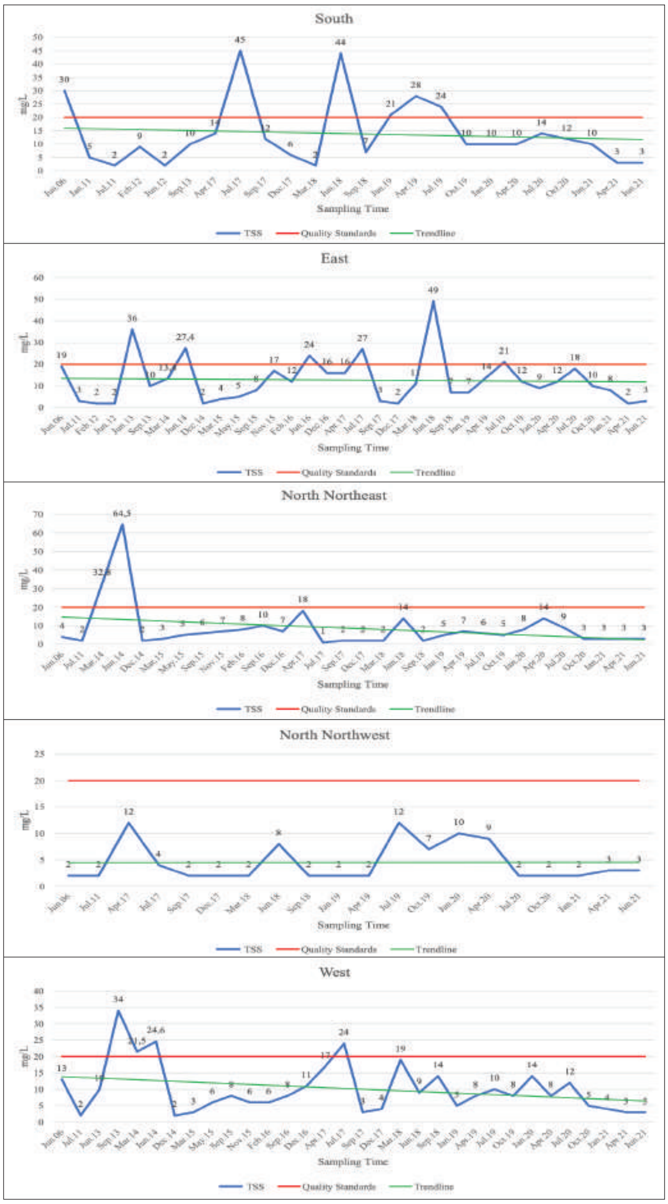

Figure 6. TSS Concentration

Figure 6 shows that the concentration of TSS in the South, East, North Northeast, and West fluctuates and tends to decrease, except for the North Northwest, which tends to be flat. Besides that, several samples are above the quality standard.

Based on Figure 7, the pre-construction TSS concentration is 2 mg/L to 30 mg/L; most TSS

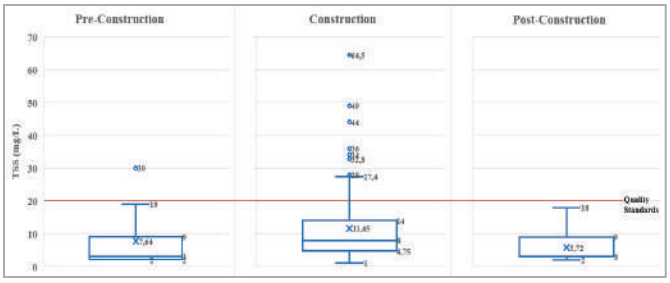

Figure 7. TSS Concentration in Pre-Construction, Construction, and Post-Construction

concentrations are at 2 mg/L to 9 mg/L and 9.1% above the quality standard. At construction time, it was 1 mg/L to 64.5 mg/L, and most TSS concentrations were at 4.75 mg/L to 14 mg/L and 16% above the quality standard. In post-construction, it is 2 mg/L to 18 mg/L (below the quality standard), and most TSS concentrations are at 3 mg/L to 9 mg/L.

The presence of suspended solids (TSS) is closely related to the brightness of the waters. The existence of TSS can block the penetration of light entering the waters (Gazali et al., 2013 in Purnamasari, 2017).

Suspended solids are positively correlated with turbidity; the higher the value of suspended solids, the higher the turbidity value. However, highly suspended solids are not always accompanied by high turbidity (Effendi, 2003).

Biochemical Oxygen Demand (BOD)

BOD levels in the waters of the North Coast of Jakarta around Reclamation Islands C and D can be seen in Figures 8 and Figure 9.

Figure 8 shows that BOD levels in the South, East, North Northeast, North Northwest, and West fluctuate and tend to decrease, and several samplings are above the quality standard.

Based on Figure 9, the pre-construction BOD levels were 1.3 mg/L to 11 mg/L, and most BOD levels were from 1.65 mg/L to 9 mg/L (below the quality standard). At the time of construction, 2 mg/L to 41.69 mg/L, most BOD levels were at 2 mg/L to 9 mg/L and 5.8% above the quality standard. In post-construction, BOD levels were at 2 mg/L (below the quality standard).

Biochemical Oxygen Demand (BOD) describes organic matter levels, namely the oxygen aerobic microbes need to oxidize organic matter into carbon dioxide and water (Davis and Cornwell, 1991 in Effendi, 2003). BOD describes organic matter that can be decomposed biologically (biodegradable) (Effendi, 2003). BOD is used as an indicator of the occurrence of pollution in waters. The high value of BOD in water indicates that the water is polluted (Agustira, 2013 Purnamasari, 2017).

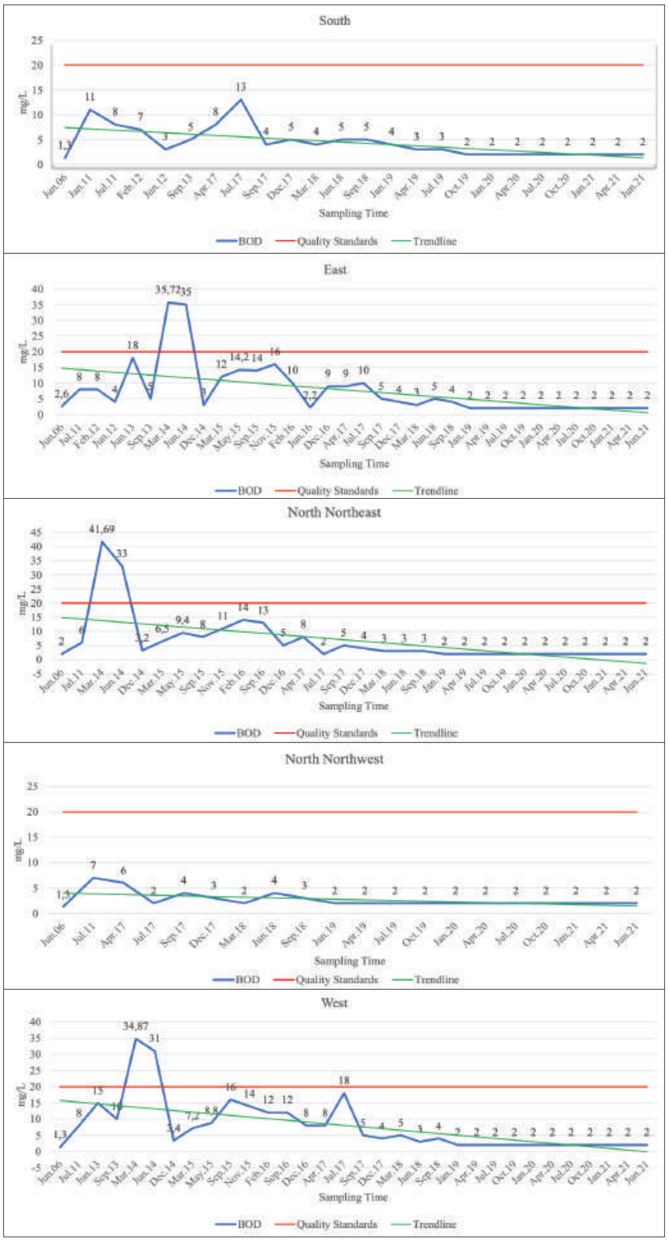

Figure 8. BOD Levels

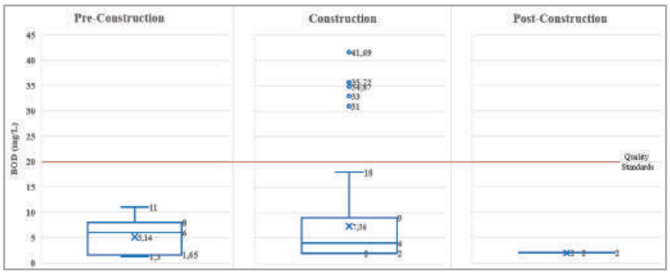

Figure 9. BOD levels in Pre-Construction, Construction, and Post-Construction

Phosphate

The concentration of phosphate in the waters of the North Coast of Jakarta around Reclamation Islands C and D can be seen in Figures 10 and Figure 11.

Figure 10 shows that the concentration of phosphate in the South, East, North East, North West, and West fluctuates and tends to decrease, and several samplings are above the quality standard.

Figure 11 shows that the concentration of phosphate in the pre-construction is 0.01 mg/L to 0.11 mg/L; the majority of the phosphate concentration is at 0.01 mg/L and 9.1% above the quality standard. At the time of construction, namely 0.006 mg/L to 1.56 mg/L, most concentrations were at 0.011 mg/L to 0.047 mg/L and 48% above the quality standard. In post-construction, it was 0.009 mg/L to 0.011 mg/L (below the quality standard).

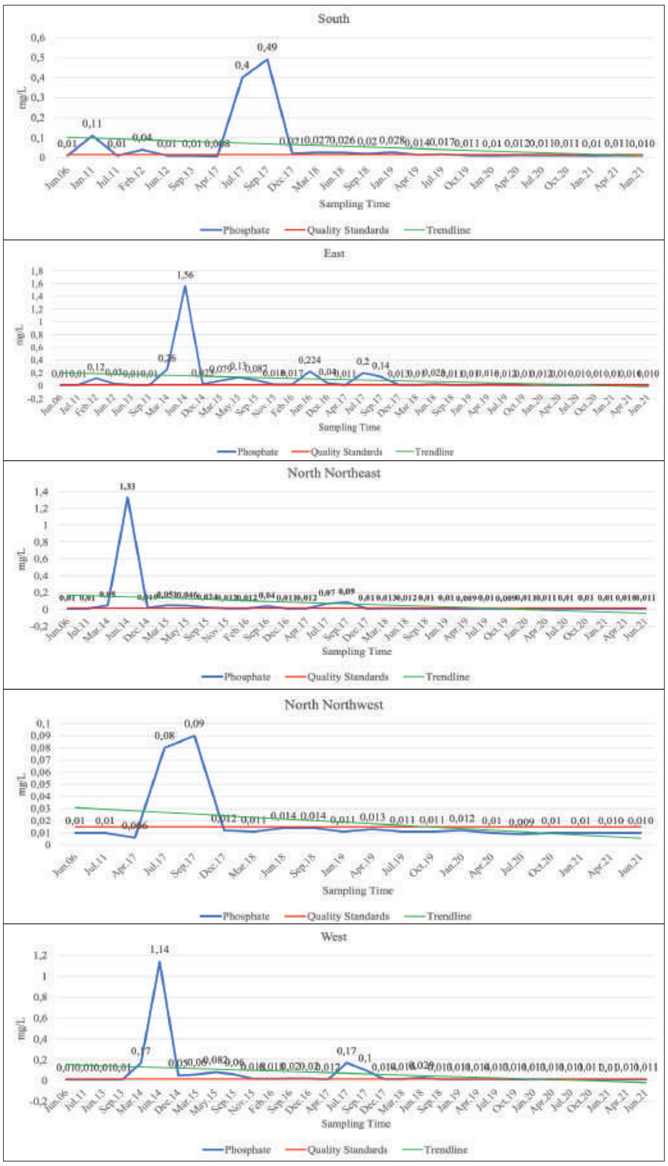

Figure 10. Phosphate concentration

The sea is an extensive body of water and can be the estuary of activities on land, such as phosphate. According to Odum (1998) in Faturohman et al. (2016), the primary source of phosphate in the sea comes from rivers, the decomposition of residual organisms, and the stirring of the seabed. A phosphate is a form of phosphorus that can be utilized by plants (Dugan, 1972 in Effendi, 2003).

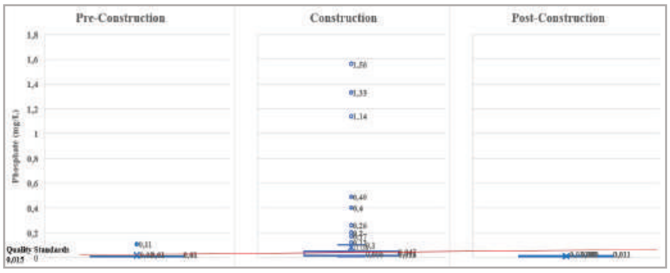

Figure 11. Phosphate Concentration in Pre-Construction, Construction, and Post-Construction

Phosphate is a nutrient needed for the process and development of phytoplankton life. These nutrients play an essential role in photosynthesis (Mustofa, 2015).

Nitrate

The concentration of nitrate in the waters of the North Coast of Jakarta around Reclamation Islands C and D can be seen in Figures 12 and Figure 13.

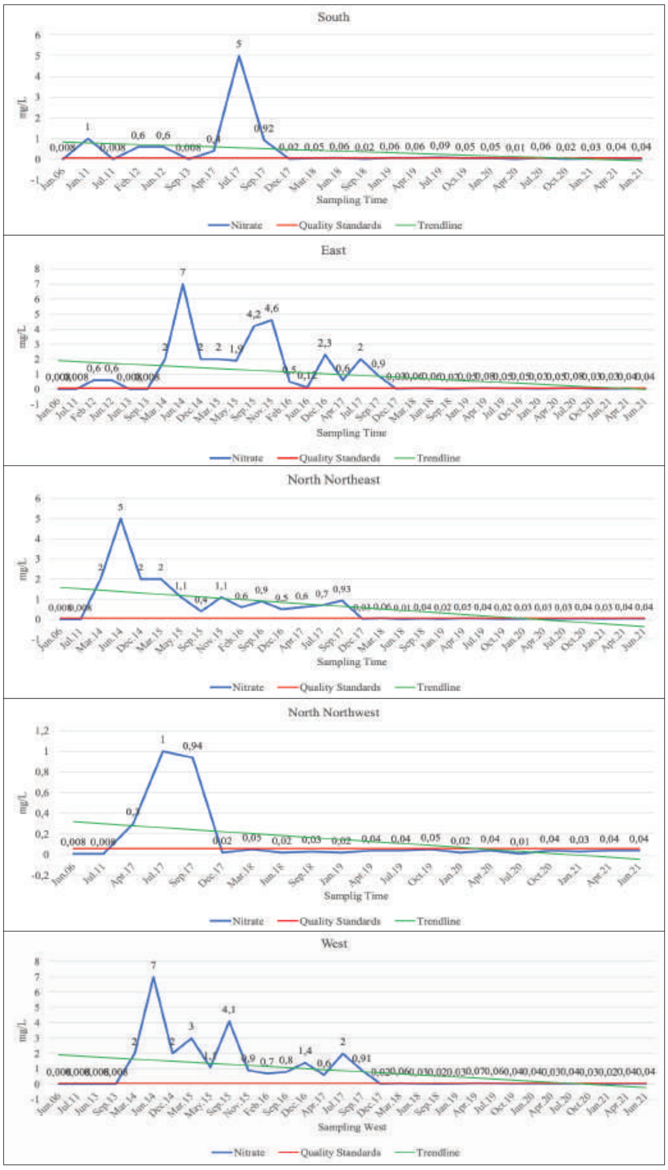

Figure 12. Nitrate concentration

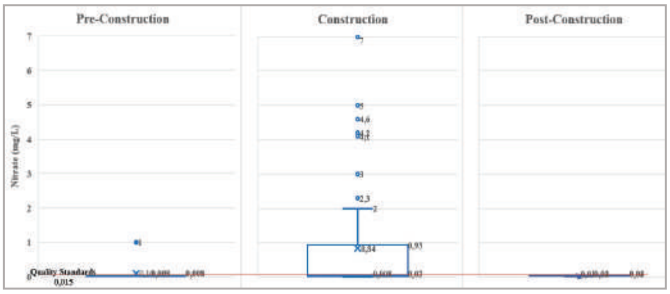

Figure 13. The concentration of nitrate in pre-construction, construction, and post-construction

Based on Figure 13, the nitrate concentration in pre-construction was 0.008 mg/L to 1 mg/L; most of the nitrate concentration was 0.008 mg/L and 9.1% above the quality standard. At the time of construction, namely 0.008 mg/L to 7 mg/L, most concentrations were at 0.03 mg/L to 0.94 mg/L and 50% above the quality standard. In post-construction, namely 0.01 mg/L to 0.08 mg/L, the majority of concentrations were at 0.03 mg/L to 0.04 mg/L and 4% above the quality standard.

Nitrate comes from ammonium that enters water bodies mainly through domestic waste (Mustofa, 2015). Nitrates are essential nutrients for plants. Excess nitrate will accelerate eutrophication and cause an increase in the growth of aquatic plants. It affects dissolved oxygen levels, temperature, and other parameters (Irwan et al., 2017; Patricia et al., 2018).

Sources of nitrate can be sourced from activities on land or sea coast which then flows into the sea (Odum, 1998) in Faturohman et al., 2016) stated that dissolved nitrate is a supply from the mainland through rivers.

Diversity of Phytoplankton Species

The results of phytoplankton research conducted from 2006 to 2021 around Reclamation Islands C and D recorded as many as 190 species. In comparison, the number of phytoplankton types based on the observation locations, namely South, East, North Northeast, North Northwest, and West in pre-construction, construction, and post-construction, can be seen in Figure 14.

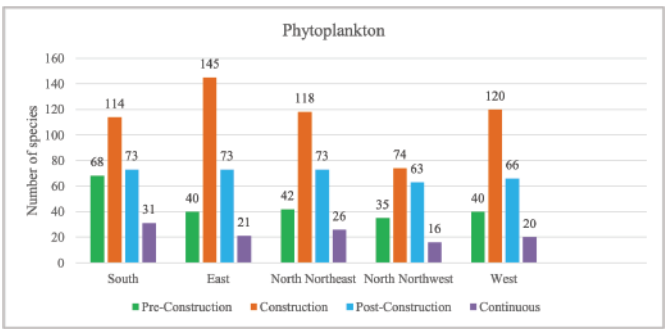

Figure 14. Number of phytoplankton species

Figure 14 shows that the number of phytoplankton species in the South in pre-construction, during construction, and post-construction recorded 68, 114, and 73 species, respectively, and continuous 31 species. In the East, pre-construction, during-construction, and post-construction recorded 40, 145, and 73 species, respectively, and a continuous 21 species. In the North Northeast at pre-construction, during construction, and post-construction recorded, 42, 118, and 73 species, respectively, and continuous 26 species. In the North Northwest at pre-construction, during construction, and post-construction recorded, 35, 74, 63 species, and 16 species of continuous. In the West, at the pre-, during- and post-construction recorded 40, 120, 66 species, and continuous 20 species.

Several species of continuous phytoplankton recorded from pre-construction, construction, and post-construction (after the reclamation of islands C and D) can be seen in Table 2.

As in Table 2, the number of continuous phytoplankton species based on the observation locations was 43. Moreover, the number of continuous species in all observation locations was six, namely *Chaetoceros affine*, *Coscinodiscus asteromphalus*, *Coscinodiscus sp6*, *Navicula sp1*, *Pleurosigma normanii*, and *Rhizosolenia calcar-avis*. The number of continuous species in all the observation locations is 3.2% of the total number of species.

Odum (1996) in Nento et al. (2013) stated that diversity is identical to an ecosystem; if an ecosystem's diversity is relatively high, the condition of the ecosystem tends to be stable. Diversity includes two main things: variations in the number of species and the number of individuals in an area. According to Sugianto (1994), a community has high species diversity if the community is composed of many species with the same or almost the same species abundance.

The species diversity index (H') of phytoplankton at pre-construction, during construction, and post-construction on the North Coast of Jakarta around the reclamation islands (Islands C and D) can be seen in Figure 15.

Figure 15 shows that the pre-construction phytoplankton diversity index is 0.31 to 4.17, and most of the diversity index is from 0.55 to 3.9. At the time of construction, 0.88 to 5.09, and the majority of the diversity index was at 3.55 to 4.59. Post-construction is 2.24 to 4.62, with the majority diversity index at 3.4 to 4.12.

The species diversity index (H') of phytoplankton in the five locations from 2006 to 2021 was dominantly included in the criteria for community stability in stable conditions (H > 3). The diversity index (H') included in the unstable biota community (H' < 1) is South, North Northeast, North Northwest, and West in June 2006 and at the East point in June 2006 and June 2016.

Table 2. Species of phytoplankton recorded from pre-cnstruction to post-construction

No	Species	South	East	North Northeast	North Northwest	West
1	*Amphiprora* sp.		√	√		
2	*Biddulphia mobiliensis*	√				
3	*Biddulphia sinensis*	√		√	√	√
4	*Chaetoceros affine*	√	√	√	√	√
5	*Chaetoceros curviselum*	√	√	√	√	
6	*Chaetoceros lorenzianum*		√	√		
7	*Chaetoceros pseudocurvisetum*		√	√		√
8	*Chaetoceros* sp1	√	√			√
9	*Chaetoceros* sp2	√	√	√		√
10	*Coscinodiscus asteromphalus*	√	√	√	√	√
11	*Coscinodiscus* sp6	√	√	√	√	√
12	*Euglena* sp*1*	√				
13	*Guinardia flaccida*	√	√		√	√
14	*Hemiaulus*			√		
15	*Lauderia borealis*	√		√		√
16	*Melosira* sp			√	√	√
17	*Navicula* sp1	√	√	√	√	√
18	*Navicula* sp5	√				
19	*Nitzschia longissima*	√		√	√	
20	*Nitzschia sigma*	√		√	√	√
21	*Oscillatoria* sp1	√	√	√		√
22	*Oscillatoria* sp2	√	√			
23	*Pediastrum duplex*	√				
24	*Pediastrum simplex*	√				
25	*Pediastrum* sp3	√	√			
26	*Phacus* sp		√			
27	*Pleurosigma compactum*	√				
28	*Pleurosigma elongatum*	√		√	√	√
29	*Pleurosigma normanii*	√	√	√	√	√
30	*Rhizosolenia acuminata*	√		√		√
31	*Rhizosolenia alata*		√	√	√	√
32	*Rhizosolenia calcar-avis*	√	√	√	√	√
33	*Rhizosolenia setigera*	√		√	√	
34	*Rhizosolenia* sp7			√		
35	*Rhizosolenia stolterfothii*		√	√	√	
36	*Rhizosolenia styliformis*					√
37	*Scenedesmus acuminatus*	√				
38	*Scenedesmus dimorphus*	√	√			
39	*Stephanopyxis* sp3			√		
40	*Streptotheca thamensis*	√				
41	*Thalassionema nitzschiodes*	√				
42	*Thalassiosira* sp		√			
43	*Thalassiothrix frauenfeldii*	√		√		√
	Number of Species	31	21	26	16	20

Meanwhile, the criteria for the stability of the moderate living things community (1 < H' < 3) are the South (March 2018 and January 2020), the East (June 2014, March 2018, January 2020, and June 2021), the North Northeast (July 2011, March 2018 and January 2020), North Northwest (March 2018, January 2020 and April 2021), and the West (July 2017, March 2018, January 2020, April 2021 and June 2021) (**Figure 16**).

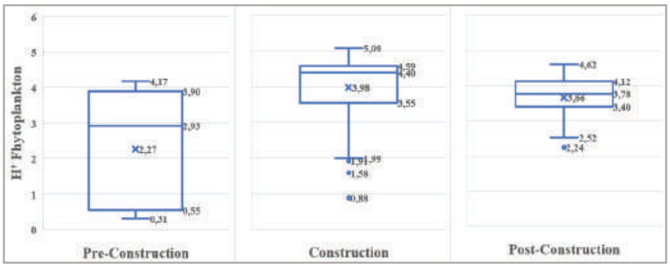

Figure 15. Phytoplankton species diversity index in pre-construction, construction and post-construction

Figure 16. Phytoplankton species diversity index

Correlation between Seawater Quality Parameters and Phytoplankton Diversity

The correlation test results simultaneously showed the relationship between seawater quality and phytoplankton species diversity, as seen in Table 3.

Based on the results of the simultaneous correlation test (**Table 3**) show that there is a significant relationship between seawater quality and the diversity of phytoplankton species (F_{count} 3,586 > F_{table} 2.28 and a significant value of 0.004 < 0.05). However, the relationship is not strong (r value of 0.34). A partial relationship between seawater quality and phytoplankton species diversity can be seen in Table 4 and Figure 17.

Table 3. F test of seawater quality parameters and diversity of phytoplankton.

ANOVA[a]

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	18.258	5	3.652	3.586	.004[b]
Residual	136.451	134	1.018		
Total	154.709	139			

Notes:
a. Dependent Variable: H' Phytoplankton
b. Predictors: (Constant), Nitrate, Turbidity, TSS, BOD, Phosphate

Table 4. Seawater quality parameters t-test and diversity of phytoplankton.

Coefficients

Model	Unstandardized Coefficients		Standardize Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.682	.132		27.901	.000
Turbidity	-.018	.016	-.117	-1.081	.282
TSS	-.002	.013	-.023	-.188	.851
BOD	.034	.017	.236	1.943	.054
Phosphate	-2.265	.696	-.435	-3.253	.001
Nitrate	.231	.117	.277	1.969	.051

Notes:
a. Dependent Variable: H' Phytoplankton

The results of the partial correlation test (**Table 4** and **Figure 17**) show that phosphate with phytoplankton species diversity has a significant relationship (t_{count} > t_{table} 1.97783 and significant value <0.05). Phosphate with the diversity of phytoplankton species has a negative relationship, which means that the higher the phosphate, the lower the diversity of phytoplankton species.

Phosphate content will affect the growth of algae and aquatic plants. An increase in phosphorus content will increase the growth of algae and aquatic plants so that if the growth is too significant, it will create algae bloom and can result in the death of other aquatic organisms in

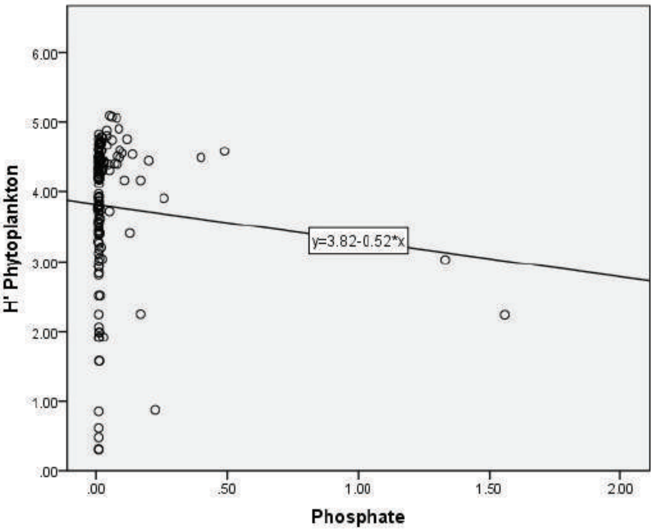

Figure 17. Correlation between phosphate and phytoplankton diversity

the environment (Erina, 2006 in Ikhsan et al., 2020). Therefore, certain species may be more dominant, harming the life of phytoplankton species.

METHOD

Concentrations of turbidity, TSS, BOD, phosphate, and nitrate in the waters of the North Coast of Jakarta around the reclamation islands C and D are fluctuating, and several sampling times exceed the quality standard.

The species diversity index (H') of phytoplankton in the waters of North Jakarta, around the reclamation islands C and D from 2006 to 2021, was dominantly included in the criteria for community stability in stable conditions (H' > 3).

There is a significant and negative relationship between phosphate and the diversity of phytoplankton species in the waters of the North Coast of Jakarta around Reclamation Islands C and D.

ACKNOWLEDGMENT

We would like to thank PT. Geo Mitrasamaya and PT. Kapuk Naga Indah whom has allowed us to analyze data on seawater quality and the diversity of phytoplankton species.

REFERENCES

Effendi, H. (2003). *Telaah Kualitas Air Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan*. Penerbit PT. Kanisius (Anggota IKAPI).

Peraturan Pemerintah RI Nomor 22 Tahun 2021 Tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup, (2021).

Fachrul, M. F. (2012). *Metode Sampling Bioekologi*. PT. Bumi Aksara.

Faturohman, I., Sunarto, & Nurruhwati, I. (2016). Korelasi Kelimbapan Plankton dengan Suhu Perairan laut di Sekitar PLTU Cierbon. *Jurnal Perikanan Kelautan*, VII(1), 115–122.

Ikhsan, M. K., Rudiyanti, S., & Ain, C. (2020). Hubungan Antara Nitrat dan Fosfat dengan Kelimpahan Fitoplankton di Waduk Jatibarang Semarang. *Jurnal of Maquares*, 9(1), 23–30.

Mustofa, A. (2015). Kandungan Nitrat dan Pospat Sebagai Faktor Tingkat Kesuburan Perairan Pantai. *Jurnal DISPROTEK*, 6(1), 13–19.

Nento, R., Sahami, F., & Nursinar, S. (2013). Kelimpahan, Keanekaragaman dan Kemerataan Gastropoda di Ekosistem Mangrove Pulau Dudepo, Kecamatan Anggrek, Kabupaten Gorontalo Utara. *Jurnal Ilmiah Perikanan Dan Kelautan, Vol. 1*, No, 41–47.

Nontji, A. (2008). *Plankton Laut*. Pusat Penelitian Oseanografi. LIPI. LIPI Press.

Nugroho, A. (2006). *Bioindikator Kualitas Air*. Penerbit Universitas Trisakti.

Padilah, T. N., & Adam, R. I. (2019). Analisis Regresi Linier Berganda dalam Estimasi Produktivitas Tanaman Padi di Kabupaten Karawang. *FIBONACCI Jurnal Pendidikan Matematika Dan Matematika*, 5(2), 117–128.

Patricia, C., Astono, W., & Hendrawan, D. I. (2018). Kandungan Nitrat dan Fosfat di Sungai Ciliwung. *Seminar Nasional Cendikiawan Ke-4, Buku 1: Teknik Kedokteran Hewan, Kesehatan, Lingkungan Dan Lanskap*, 179–185.

Pirzan, A. M., & Pong-Masak, P. R. (2008). Hubungan Keragaman Fitoplankton dengan Kualitas Air di Pulau Bauluang, Kabupaten Takalar, Sulawesi Selatan. *Biodiversitas, Vol. 9*, No(217–221).

PT. Kapuk Naga Indah. (2007). *Analisis Dampak Lingkungan (ANDAL) Reklamasi Pantai Kapuk Naga Indah di Kawasan Pantai Utara Jakarta, Kelurahan Kapuk Muara dan Kamal Muara, Kecamatan Penjaringan, Kota Administrasi Jakarta Utara*.

PT. Kapuk Naga Indah. (2012). *Analisis Dampak Lingkungan (ANDAL) Reklamasi Pantai Kapuk Naga Indah (Pulau 2A, 2B dan 1) di Kawasan Pantai Utara Jakarta, Kelurahan Kapuk Muara dan Kamal Muara, Kecamatan Penjaringan, Kota Administrasi Jakarta Utara*.

PT. Kapuk Naga Indah. (2017). *Analisis Dampak Lingkungan (ANDAL) Reklamasi dan Pembangunan di atas Pulau C dan D di Kawasan Pantai Utara Jakarta, Kelurahan Kamal Muara, Kecamatan Penjaringan, Kota Administrasi Jakarta Utara*.

PT. Kapuk Naga Indah. (2020). *Laporan Pelaksanaan Rencana Pengelolaan Lingkungan Hidup (RKL) dan Rencana Pemantauan Lingkungan Hidup (RPL) Reklamasi dan Pembangunan di Atas Pulau C dan D di Utara Kelurahan Kelurahan Kamal Muara, Kecamatan Penjaringan, Kota Administrasi Jakarta Utara*.

Purnamasari, D. E. (2017). *Penentuan Status Mutu Air Kali Wonokromo dengan Metode Storet dan Indeks Pencemar*. Departemen Teknik Lingkungan, Fakultas Teknik Sipil dan Perencanaan, Institut Teknologi Sepuluh November.

Puspasari, R., Hartati, S. T., & Anggawangsa, R. F. (2017). Analisis Dampak Reklamasi Terhadap Lingkungan dan Perikanan di Teluk Jakarta. *Jurnal Kebijakan Perikanan Indonesia*, 9(2), 85–94. https://doi.org/10.15578/jkpi.9.2.2017.85-94

Sirait, M., Rahmatia, F., & Pattulloh. (2018). Komparasi Indeks Keanekaragaman dan Indeks Dominansi Fitoplankton di Sungai Ciliwung Jakarta. *Jurnal Kelautan*, 11(1), 75–79. http://journal.trunojoyo.ac.id/jurnalkelautan

Sugianto, A. (1994). *Ekologi Kuantitatif Metode Analisis Populasi dan Komunitas*. Usaha Nasional.

Sulastri. (2018). *Fitoplankton Danau-Danau di Pulau Jawa*. Pusat Penelitian Limnologi. LIPI. LIPI Press.

Yuliara, I. M. (2016). *Modul Regresi Linier Berganda*. Jurusan Fisika, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Udayana.