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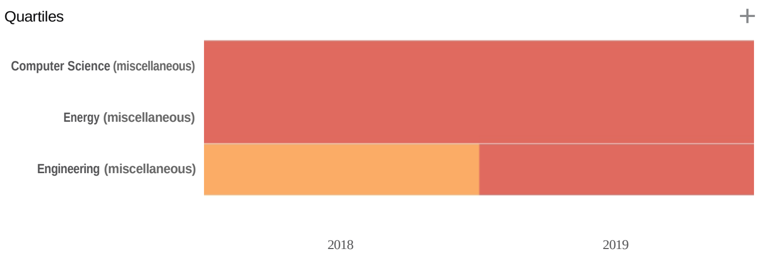

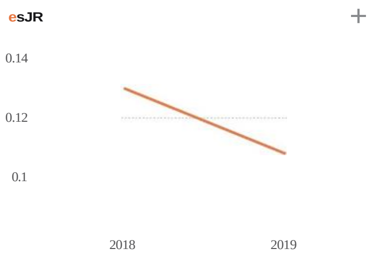

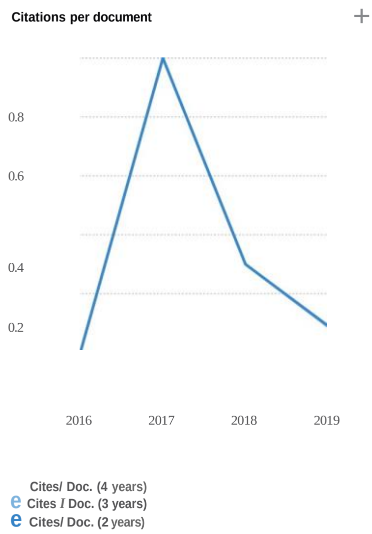

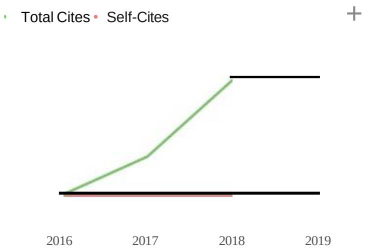

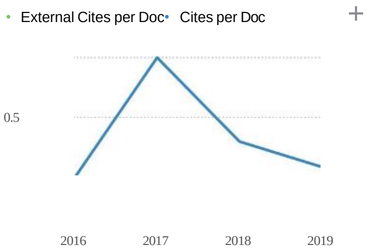

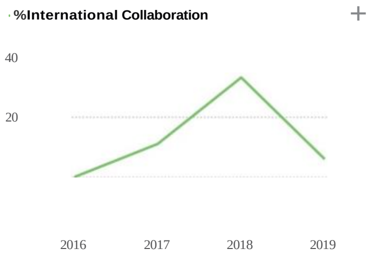

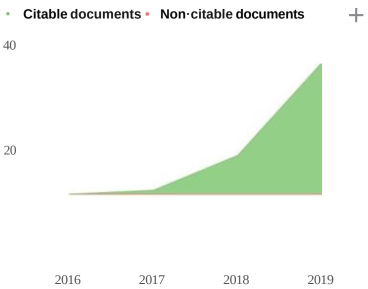

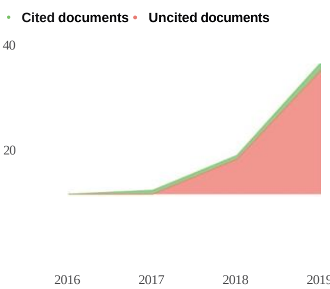

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Assessing Water Quality by Bioindicator Inat Pluit Reservoir in Jakarta Urban Area, Indonesia

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Abstract

Pluit Reservoir (6°6'58.13" S; 106°47'54.69" E) is an aquatic ecosystem in Jakarta City that functions as a flood control reservoir, water reservoir, as well as the water source for residents of North Jakarta. This study aims to assess the pollution level of Pluit Reservoir Waters using microalgae as the bioindicator and Saprobity Index as the calculation method. The research was conducted from April to July 2016, covering 11 sampling points. The morphological identification results found 6 microalgae phyla, i.e., Cyanophyta, Chrysophyta, Chlorophyta, Euglenophyta, Dinophyta, and Bacillariophyta. The microalgae abundance reached 400–73,700 cell/liter. The average value of Saprobity Index (X) of -0.93 indicates that the water body is categorised as moderately polluted due to organic and inorganic contaminants. The condition of Pluit Reservoir needs to be improved by implementing more intensive management, e.g., reducing pollution-potential activities including washing and waste disposal into the water body. Hence, the determination of pollution.

Keywords: *ecological index, phytoplankton, Pluit reservoir, pollution of water, water quality*

1. Introduction

In assessing the quality of waters, generally using physical and chemical parameters. In addition, using biological indicators or bio-indexes could be used as well [1]-[4], including using microalgae for waters quality. Owing to its nutritional peculiarities with direct absorption from the liquid medium, and its basic position in the aquatic food chain, microlagal indicator have several advantages in ecosystem evaluation when compared with indicator of larger size and physiological complexity [5].

One of those indicators is Saprobity Index-an index used to determine the organic pollution level in waters. It analyzes the presence of organisms to evaluate the water quality status based on a formula developed by [6]. Several studies conducted in recent years can assist in the sustainable management of an aquatic ecosystem [7], [8].

Despite algae being diverse organism inhabiting marine, estuarine, and freshwater habitats and having sizes from micrometers to several meters. In freshwater ecosystem like river, lake, microalgae from phytoplankton are by far the most important and widely used for the evaluation of water quality than macrolagae [9]. Aquatic ecosystems, including lakes and reservoirs, function both directly and indirectly as water resources for various life needs. They serve as water retention in the dry season, clean water sources, recreational areas, sometimes also as waste disposal sites. Water quality deterioration due to its improper uses changes the water characteristics, leading to the decrease of its functionality, productivity, product quality, as well as its carrying capacity. Thoughtful management and pollution control are needed to maintain the natural condition of water resources.

Pluit Reservoir (6°6'58.13" S; 106°47'54.69" E) is an aquatic ecosystem in the city of Jakarta that functions as a flood control reservoir, water reservoir, and as the water source for residents of North Jakarta. There have been indications of its water quality degradation due to improper utilization. This reservoir is located amidst residential, trading, industrial, as well as service districts, covering an area of ±80 hectares and a depth of ±10-12 meters. The inlet comes from Ciliwung River, Cideng River, and Angke River. Its surroundings are green open spaces and some illegal residential settlements. Its water surface is covered in weeds and garbage. With so many activities carried out around its vicinity, there is a possibility that the water reservoir condition will experience setbacks which affect the balance of the existing ecosystem.

This study aims to assess the pollution level of Pluit Reservoir through the approach of using microalgae as the bioindicator. The calculation method used for determining the contamination status is Saprobity Index of *microalgae.*

2. Methodology

The research was carried out in April-July 2016. Microalgae samples were taken on surface of water as horizontally with a depth of 1 up to 2 meters where photosynthesis can still take place. As many as 11 different sample points (Table 1) stretching along the inlet, center, and outlet of the reservoir were determined as they are considered to represent the source of pollution according to SNI 6989.57:2008. Samplings were done using a microalgae net (plankton net). Water samples were poured 20 times using a 5-liter bucket, then the incoming water was filtered, and the microalgae floated in 10-ml size vials which were preserved with Lugol afterward. Later, samples were taken to the laboratory to be analysed.

This research was conducted in aquatic ecosystem in Pluit Reservoir (6°658.13"S; 106°47'54.69"E) (Figure 1) this was a man-made ecosystem located in Jakarta Province (Java Island). This ecosystem holds water from the Cilliwung River, Krukut River, Angke River, rainwater, and waste from surrounding reservoirs and the functions of this lake are as recreation facilities, water catchment area.

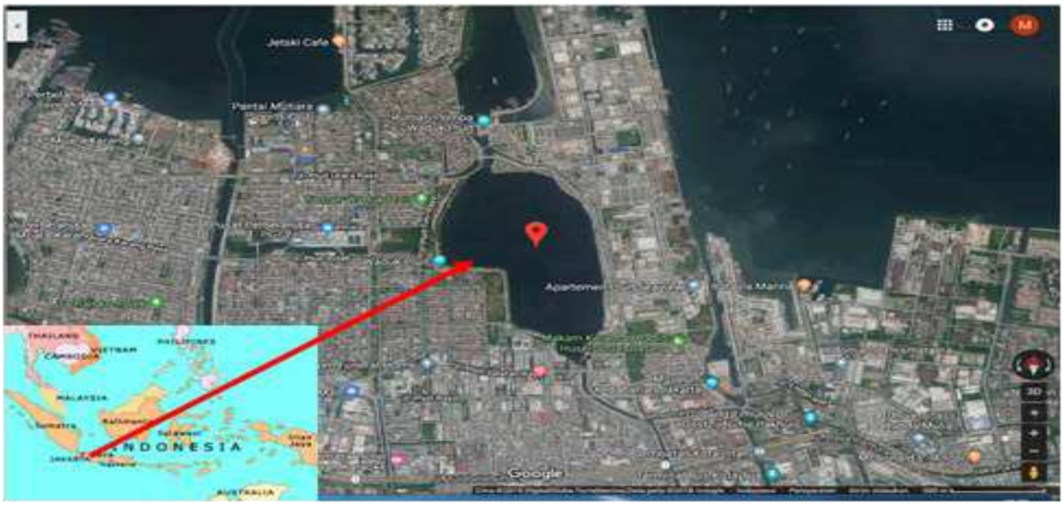

Figure 1. Pluit Reservoir (6°658.13"S; 106°47'54.69"E)

Table 1. Sampling Point Coordinate

Sampling Point	Coordinate	
1	6^0 7' 29.123" S	106^0 48' 5.610" E;
2	6^0 7' 25.668" S	106^0 48' 2.792" E
3	6^0 7' 19.607" S	106^0 47' 55.376" E

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4	6^0 7' 23.170" S	106^0 48' 6.838" E
5	6^0 7' 3.370" S	106^0 48' 4.658" E
6	6^0 7' 1.998" S	106^0 47' 42.409" E
7	6^0 6' 53.333" S	106^0 48' 7.590" E
8	6^0 6' 57.000" S	106^0 47' 42.353" E
9	6^0 6' 51.856" S	106^0 47' 54.065" E
10	6^0 6' 44.951" S	106^0 47' 58.369" E
11	6^0 6' 41.234" S	106^0 47' 50.664" E

2.1. Abundance Analysis

The microalgal abundance was determined using the swap method on Sedgewick- Rafter glass counting cells [10] with a unit of cell per liter (cell/l). The formula used to calculate the microalgae abundance is written as follows:

$$N = n\ x\ \frac{Vr}{Vo}\ x\ \frac{1}{Vs} \tag{1}$$

where N = abundance of microalgae (cell/l); n = number of microalgae observed; Vr = volume of filtered water (30 ml); Vo = concentration volume of Sedgwick Rafter Counting Cell (ml); Vs = the volume of filtered water sample (100 l).

2.2. Saprobity Index Analysis

To identify groups of dominant organisms can be used with the Saprobity Index. This index can be widely applied to determine different levels of pollution ranging from pure to polluted waters through the presence and activity of aquatic organisms. The Saprobity Index was calculated according to [6].

$$X = \frac{C + 3D - B - 3A}{A + B + C + D} \tag{2}$$

where X= Saprobity Index (X); A = Microalgal classes Cyanophyta - indicate polysaprobity; B= Microalgal classes Euglenophyta - indicate a-mesosaprobity; C = Microalgal classes Chlorophyta, - indicate mesosaprobity; D= Microalgal classes Chrysophyta - indicate oligosaprobity. So the quotient runs from -3 (polysaprobic) to + 3 (oligosaprobic). For a complete interpretation of the different values of X we refer to [6].

Based on the Saprobity Index value, there are five pollution-level classifications as shown in Table 2.

Table 2. The Pollution Level

Materials of Pollutants	**Level of Pollutants**	**Saprobic Phase**	**Saprobity Index**
Organic Material	Very heavy	Polisaprobic	(-3.0) - (-2.0)
		Poly/-mesosaprobic	(-2.0) - (-1.5)
	Quite heavy	a-meso/polisaprobic	(-1.5) - (-1.0)
		a-mesosaprobic	(-1.0) - (0.5)
Organic and inorganic material	Moderate	a/P-mesosaprobic	(-0.5) - (0.0)
		P/a-mesosaprobic	(0.0) - (0.5)
	Light	P-mesosaprobic	(0.5) - (1.0)
		P-meso/oligosaprobic	(1.0) - (1.5)
	Very Mild	Oligo/P-mesosaprobic	(1.5) - (2.0)
		Oligosaprobic	(2.0) - (3.0)

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3. Results and Discussion

3.1. Microalgae Composition in Pluit Reservoir

The composition of microalgae always changes from time to time until it comes to succession. In waters, the alteration of nutrients can occur throughout the year, which can cause the alteration of microalgae community composition as well [11]. According to [12], the evolution and adaptation to the ecological conditions of certain waters can be seen from various phases and stages of the life cycle of single-celled organisms such as microalgae. Certain types will eventually appear, sometimes experiencing a population explosion, and at other times they will disappear altogether. It shows from the types of microalgae found in the waters of Pluit Reservoir during April - July 2016 in Figure 1-4.

Based on Figure 2, the highest composition of microalgae is *Cyanophyta* at 99.22%, whereas the lowest is *Euglenophyta* at only 0.05%. Figure 3 depicts that the highest composition of *microalgae* is *Chlorophyta* at 53.47% and the lowest is *Euglenophyta* at 0.36%. Figure 4 shows a similar trend as Figure 2 that the highest composition is *Cyanophyta* at 80.75% and the lowest is *Euglenophyta* at merely 2.48%. Overall, the highest composition of microalgae is *Cyanophyta* at 93.41% and the lowest is *Euglenophyta* at only 1.42%.

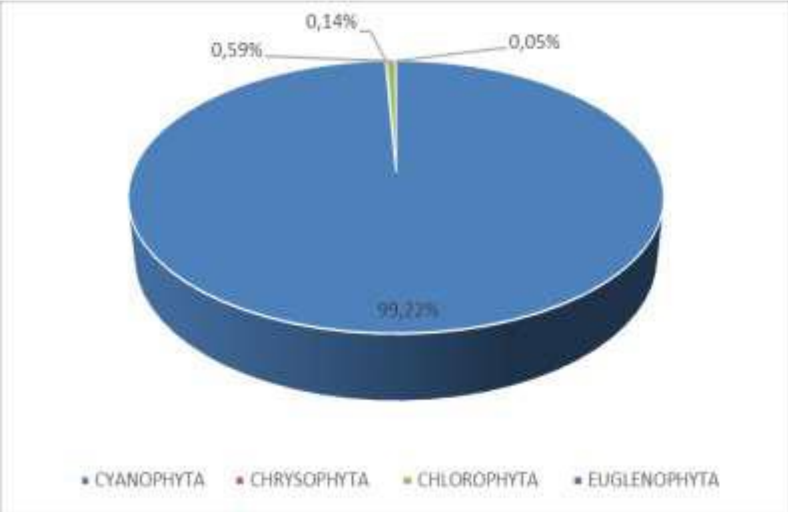

Figure 2. Composition of *Microalgae* in April 2016

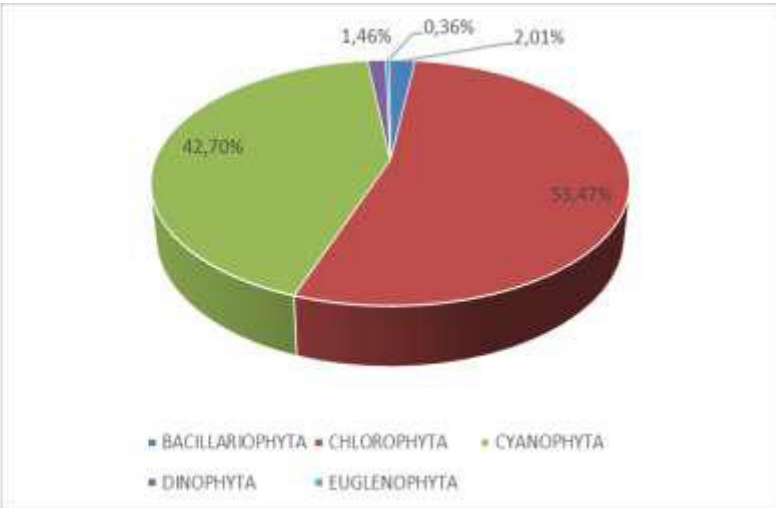

Figure 3. Composition of *Microalgae* in May 2016

The identification results in June revealed that the highest composition of microalgae was found at the first sampling point (inlet section), comprising *Lyngbia* sp. and *Oscillatoria* sp. (*Cyanophyta*); while the lowest is *Euglena* sp. (*Euglenophyta*). In July, the largest composition was gathered at the first point (inlet section) as well, consisting of *Lyngbia* sp. and *Oscillatoria* sp. (*Cyanophyta*); while the lowest was also *Euglenophyta*. The total composition of microalgae individuals taken in each sampling point show in Figure 6.

Different conditions apply for every sampling indeed. According to [13]-[14], the microalgae composition in an ecosystem is not always evenly distributed. Several species are abundant in a certain ecosystem while others are not. The presence of microalgae highly depends on the conditions of the aquatic environment that can conform to their requirements to sustain their lives [15]. However, in this research, *Oscillatoria* sp. of *Cyanophyta* Division was frequently found in each sampling point due to its impressive adaptability to various environmental factors-such as high or low temperatures-that enables it to live freely in diverse conditions. Some of environmental parameters and the physiological characteristics of microalgae species can influence the disparity of the abundance of microalgae in waters. In addition, in response to physical, chemical, and biological alteration in environmental conditions caused changes the composition and abundance of microalgae at various levels [16].

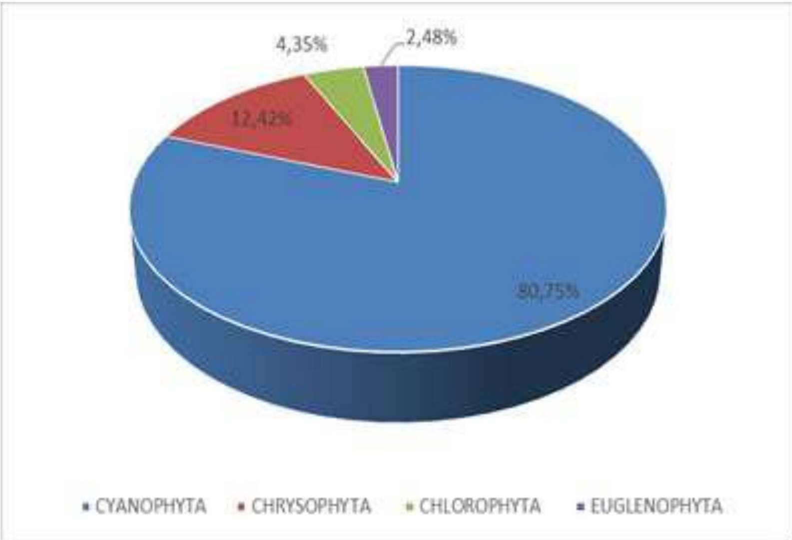

Figure 4. Composition of *Microalgae* in June 2016

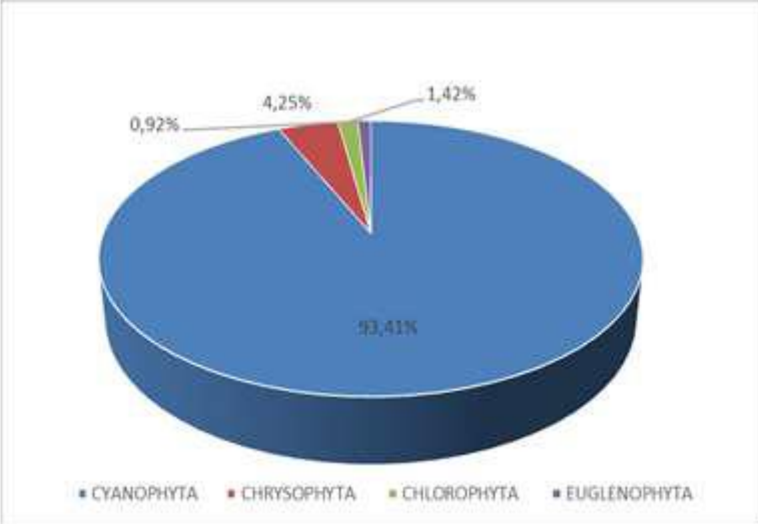

Figure 5. Composition of *Microalgae* in July 2016

The calculation results of microalgae abundance in Pluit Reservoir in April - July are 400 - 73,700 cells/L as detailed the microalgae abundance during the research show in Figure 5 as follows.

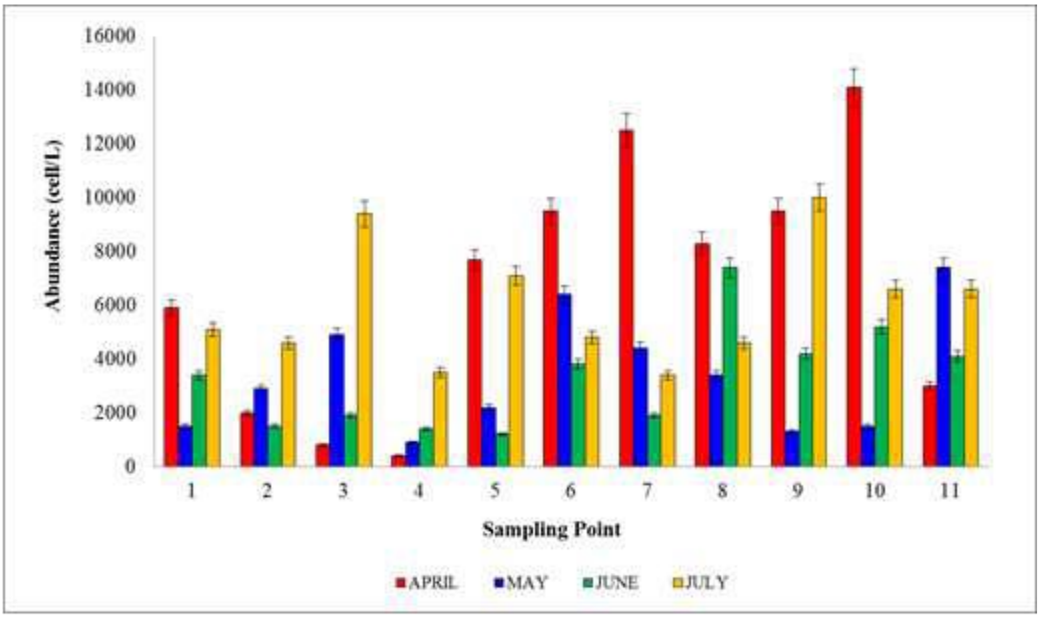

Figure 6. The Abundance of Microalgae in Pluit Reservoir Waters

In general, out of four sampling batches, the highest total abundance value was obtained from the inlet and its nearby midpoint section (mixing area of the inlet) as they contain a plentiful amount of organic substances. On the other hand, the lowest total abundance value was found in the outlet point and the central part close to it due to the current flowing out to the outlet.

The most dominant and abundant type is *Oscillatoria* sp., a *microalgae* species that can survive in contaminated waters. It is likely to occur because they optimally utilized phosphate elements, proven by the high values of phosphate parameter and COD in the sampling points where this *microalgae* was dominant during the first batch (April) and the second (May) in Pluit Reservoir. This also shows that Oscillatoria sp. resistant to

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persistent organic pollutants. It is known that the entry of nutrients into the Pluit Reservoir is caused by the use of detergents and the entry of wastewater from the surrounding area. To assess the deterioration of water quality and the characteristics of planktonic communities. Thus, this type of *microalgae* can be used as a bioindicator of water quality in organically polluted aquatic ecosystems [17], [18].

3.2. Saprobity Index (X) of Microalgae

The Saprobity Index is used to determine the pollution level using the equation developed by [6] stated that certain organisms show a certain relationship toward clean (not contaminated) waters and polluted (contaminated) waters. In other words, there will be different organisms living show in Figure 7 as follows:

Figure 7 denotes that the Saprobity Index values in Pluit Reservoir vary between -3.0 - 1.67. The highest value at the 2nd sampling point (water inlet) of 1.67 indicates a severe contamination degree. The lowest value at the 4th sampling point (the middle part) of -3.00 signifies a moderate pollution level in the a-mesosaprobic category. The organic substances introduced to the inlet of Pluit Reservoir are allegedly originated from household activities in the surrounding residential areas, involving both organic and inorganic waste. Organic waste can indirectly increase the abundance of certain types of microalgae. Sufficient nutrients are needed for the growth of microalgae, including nitrates and phosphates derived from the household and industrial waste disposal [19]. Inhibiting the penetration of sunlight into the water can disrupt the process of photosynthesis, and the amount of DO in the waters can be reduced. The low DO will then interfere with the lives of other aquatic organisms, especially the growth of microalgae [20].

The presence of organisms studied *in-situ* can describe the integrated effect of all impacts on water bodies, and can be used to compare the alteration of water quality from site to site, or over a certain period of time. The physiological or behavioural reactions of aquatic organisms depend on the concentration of natural substances and pollutants in the environment, and the time required for these substances to affect the internal systems of the organisms [21].

Thus, the Pluit Reservoir can be considered to be mesosaprobic conditions. The phytoplankton community is dominated by Cyanophyta and Chlorophyta, and the combination of factors that trigger the blooms cannot be accurately predicted at present. There is no limiting nutrient as such in the lake to control the growth of organisms.

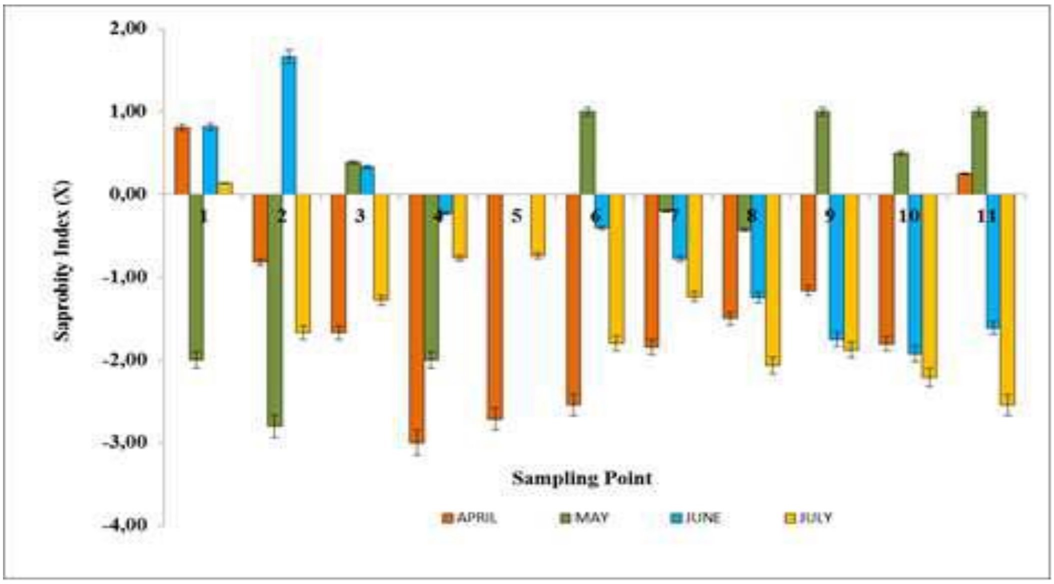

Figure 7. Saprobity Index of Microalgae in Pluit Resevoir

4. Conclusion

The composition of microalgae during four months of research consists of 6 phyla namely *Cyanophyta*, *Chlorophyta*, *Euglenophyta*, *Bacillariophyta*, *Dinophyta*, and *Chrysophyta* divisions. The dominating type is *Cosmarium* sp. from the division of *Chlorophyta* which acts as an indicator of low to moderate contamination level. The microalgae abundance in Pluit Reservoir ranges from 400-73,700 cells/liter with the largest composition of *Cynophyta*. The Saprobity Index (X) average value of -0.93 indicates that Pluit Reservoir is classified as mesosaprobic conditions and moderate pollution level containing organic and inorganic contaminants.

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Assessing Water Quality by Bioindicator at Pluit Reservoir in Jakarta Urban Area, Indonesia

by Melati Ferianita Fachrul

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Assessing Water Quality by Bioinclicator at Pluit Reservoir in Jakarta Urban Area, Indonesia

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Abstract

Pluit Reservoir (6°6'58.13" S; 106°47'54.69" E) is an aquatic ecosystem in Jakarta City that jimctions as a flood control reservoir, water reservoir, as well as the water source for residents of North Jakarta. This study aims to assess the pollution level of Pluit Reservoir Waters ***u9g*** *microalgae as the bioindicator and Saprobity Index as the calculation method. The research was conducted from April to July 2016,* **coverinlf** *1 sampling points. The morphological identification results found 6 microalgae phyla, i.e., Cyanophyta, Chrysophyta, Chlorophyta, Euglenophyta, Dinophyta, and Bacillariophyta. The microalgae abundance reached 400-73,700 cell/liter. The average value of Saprobity Index (X) of-0.93 indicates that the water body is categorised as moderately polluted due to organic and inorganic contaminants. The condition of Pluit Reservoir needs to be improved by implementing more intensive management, e.g., reducing pollution-potential activities including washing and waste disposal in/0 the water body. Hence, the determination of pollution.*

Keywords: *ecological index, phytoplankton, Pluit reservoir, pollution of water, water quality*

1. Introduction

In assessing the qua.lity of waters, genemlly using physical and chemicaJ parameters. In addition, using biological indicators or bio-indexes could be used as well [I]-[4], including using microalgae for waters quality. Owing to its nutritional peculiarities with direct absorption from the liquid medium, and its basic position in the aquatic food chain, microlagal indicator have several advantages in ecosystem evaluation when compared with indicator of larger size and physiological complexity [5].

One of those indicators is Saprobity Index-an index used to determine the organic pollution level in waters. It anaJyzes the presence of organisms to evaJuate the water quality status based on a formula developed by [6]. Several studies conducted in recent years can assist in the sustainable management of an aquatic ecosystem [7], [8].

Despite algae being diverse organism inhabiting marine, estuarine, and freshwater habitats and having sizes from micrometers to severaJ meters. In freshwater ecosystem like river, lake, microalgae from phytoplankton a.re by far the most important and widely used for the evaluation of water qua.lity than macrolagae [9]. Aquatic ecosystems, including lakes and reservoirs, function both directly and indirectly as water resources for various life needs. They serve as water retention in the dry season, clean water sources, recreationaJ areas, sometimes also as waste disposal sites. Water quality deterioration due to its improper uses changes the water characteristics, leading to the decrease of its functionality, productivity, product quality, as well as its carrying capacity. Thoughtful management and pollution control are needed to maintain the naturaJ condition of water resources.

Pluit Reservoir (6°6'58.13" S; 106°47'54.69" E) is an aquatic ecosystem in the city of Jakarta that functions as a flood control reservoir, water reservoir, and as the water source for residents of North Jakarta. There have been indications of its water quality degradation due to improper utilization. This reservoir is located amidst residential, trading, industrial, as well as service districts, coveting an area of ±80 hectares and a depth of ±10-12 meters. The inlet comes from Ciliwung River, Cideng River, and Angke River. Its surroundings are green open spaces and some illegal residential settlements. Its water sutface is covered in weeds and garl:Jage. With so many activities carried out around its vicinity, there is a possibility that the water reservoir condition will experience setbacks which affect the balance of the existing ecosystem.

This study aims to assess the pollution level of Pluit Reservoir through the approach of using microalgae as the bioindicator. The calculation method used for determining the contamination status is Saprobity Index of *microalgae.*

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2. Methodology

The research was carried out in ApriJ-July 20I6. Microalgae samples were taken on surface of water as horizontally with a depth of I up to 2 meters where photosynthesis can still take place. As many as 11 different sample points (fable I) stretching along the inlet, center, and outlet of the reservoir were determined as they are considered to represent the source of pollution according to SN! 6989.57:2008. Samplings were done using a microa.lgae net (plankton net). Water samples were poured 20 times using a 5-liter bucket, then the incoming water was filtered, and the microalgae floated in 10-ml size via.ls which were preserved with Lugo] afterward. Later, samples were taken to the laboratory to be ana.lysed.

This research was conducted in aquatic ecosystem in Pluit Reservoir (6°658. I 3"S; I06°47'54.69"E) (Figure I) this was a man-made ecosystem located in Jakarta Province (Java Island). This ecosystem holds water from the Cilliwung River, Krukut River, Angke River, rainwater, and waste from surrounding reservoirs and the functions of this lake are as recreation facilities, water catchment area.

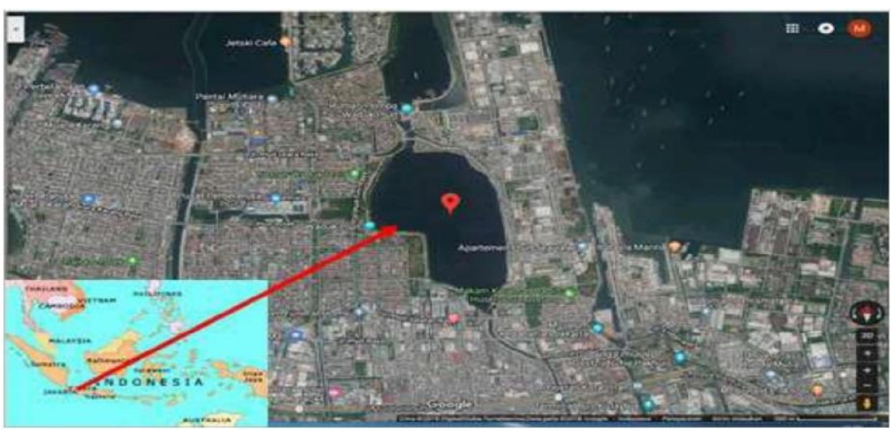

Figure 1. Pluit Reservoir (6°658.13"S; 106°47'54.69"E)

Table 1. Sampling Point Coordinate

Sampling Point	Coordinate	
I	6°7' 29.123" S	106°48' 5.610" E;
2	6°7' 25.668" S	106°48' 2.792" E
3	6°7' 19.607" S	106°47' 55.376" E

4	6°7'23.170" S	106°48' 6.838" E
5	6°7' 3.370" S	106°48' 4.658" E
6	6°7' 1.998" S	106°47' 42.409" E
7	6° 6' 53.333" S	106°48'7.590" E
8	6°6' 57.000" S	106°47' 42.353" E
9	6°6'51.856"S	106°47' 54.065" E
10	6°6'44.951" S	106°47' 58.369" E
II	6°6'41.234'1S	106°47' 50.664" E

2.1. Abundance Analysis

The microaJgal abundance was determined using the swap method on Sedgewick- Rafter glass counting cells [10] with a unit of cell per liter (celVl). The formula used to caJculate the microaJgae abundance is written as follows:

Vr

=1::ir- lJ s (I)

, ere N = abundance of microaJgae (celVl); n = number of microaJgae observed; Yr = volume of filtered water (30 mJ); Yo = concentration volume of Sedgwick Rafter Counting Cell (ml); Vs= the volume offiJtered water sample (100 I).

2.2. Saprobity Index Analysis

To identify groups of dominant organisms can be used with the Saprobity Index. This index can be widely applied to determine different levels of pollution ranging from pure to polluted waters through the presence and activity of aquatic organisms. The Saprobity Index was ca.lculated according to [6].

$$= \frac{+30-B-3A}{A+B+C+D} \qquad (2)$$

where X= Saprobity Index **(X);** A = MicroaJgaJ classes Cyanophyta - indicate polysaprobity; B= MicroaJgal classes Euglenophyta - indicate a-mesosaprobity; C = MicroaJgal classes Chlorophyta, - indicate mesosaprobity; D= MicroaJgaJ classes Chrysophyta - indicate oligosaprobity. So the quotient runs from -3 (polysaprobic) to+ 3 (oligosaprobic). For a complete interpretation of the different values of X we refer to [6].

Based on the Saprobity Index vaJue, there are five pollution-level classifications as shown in Table 2.

Table 2. The Pollution Level

Materials of Pollutants	Levelof Pollutants	Saprobic Phase	Saprobity Index
Organic MateriaJ	Very heavy	Polisaprobic	(-3.0) - (-2.0)
		Poly/-mesosaprobic	(-2.0) - (-1.5)
	Quite heavy	a-meso/polisaprobic	(-1.5) -(-1.0)
		a-mesosaprobic	(-1.0) - (0.5)
Organic and inorganic material	Moderate	a/ -mesosaprobic	(--0.5) - (0.0)
		/a-mesosaprobic	(O.G) -(0.5)
	Light	-mesosaprobic	(0.5) - (1.0)
		-meso/oligosaprobic	(1.0) - (1.5)
	Very MiJd	Oligo/ -mesosaprobic	(1.5) - (2.0)
		Oligosaprobic	(2.0) - (3.0)

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3. Results and Discussion

3.1. Microalgae Composition in Pluit Reservoir

The composition of microalgae always changes from time to time until it comes to succession. In waters, the alteration of nutrients can occur throughout the year, which can cause the alteration of microalgae community composition as well [I I]. According to [12], the evolution and adaptation to the ecologicaI conditions of certain waters can be seen from various phases and stages of the life cycle of single-celled organisms such as microalgae. Certain types will eventually appear, sometimes experiencing a population explosion, and at other times they will disappear altogether. It shows from the types of microaigae found in the waters of Pluit Reservoir during April - **July** 2016 in Figure 1--4.

Based on Figure 2, the highest composition of microalgae is *Cyanophyta* at 99.22%, whereas the lowest is *Euglenophyta* at only 0.05%. Figure 3 depicts that the highest composition of *microalgae* is *Chiorophyra* at 53.47% and the lowest is *Euglenophyta* at 0.36%. Figure 4 shows a similar trend as Figure 2 that the highest composition is *Cyanophyta* at 80.75% and the lowest is *Euglenophyta* at merely 2.48%. Overall, the highest composition of microaigae is *Cyanophyta* at 93.41 % and the lowest is *Euglenophyra* at only 1.42%.

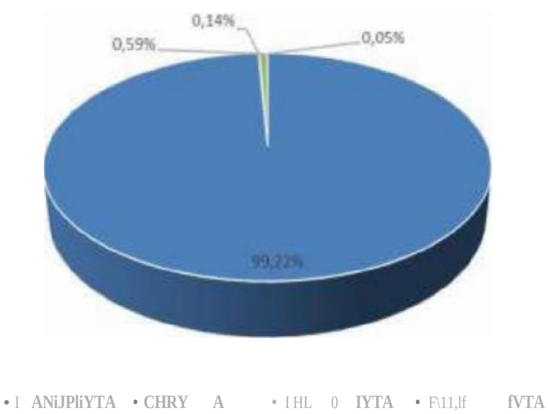

Figure 2. Composition of ***Microa/gae*** in April 2016

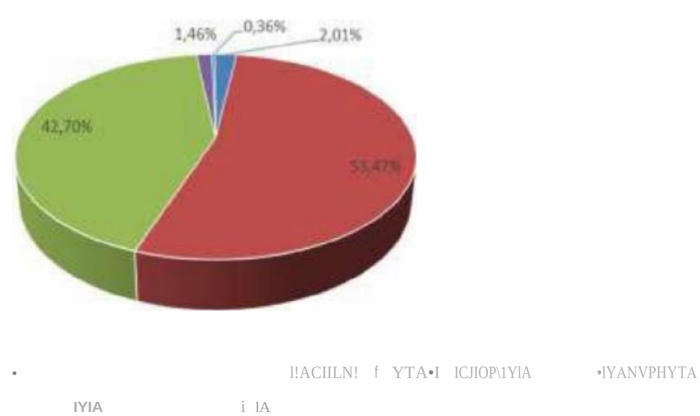

Figure 3. Composition of *Microa/gae* in May 2016

The identification results in June reveaJed that the highest composition of microalgae was found at the first sampling point (inlet section), comprising *Lyngbia* sp. and *Oscil/atoria* sp. *(Cyanophyta);* while the lowest is *Euglena* sp. *(Euglenophyta).* In July, the largest composition was gathered at the first point (inlet section) as well, consisting of *Lyngbia* sp. and *Oscillatoria* sp. *(Cyanophyta);* while the lowest was aJso *Euglenophyta.* The totaJ composition of microa.lgae individua.ls taken in each sampling point show in Figure 6.

Different conditions apply for every sampling indeed. According to [13]-(14], the microalgae composition in an ecosystem is not always evenJy distributed. Severa.I species are abundant in a certain ecosystem whiJe others are not. The presence of microaJgae highly depends on the conditions of the aquatic environment that can conform to their requirements to sustain their lives (15]. However, in this research, *Oscil/atoria* sp. of *Cyanophyta* Division was frequently found in each sampling point due to its impressive adaptability to various environmental factors----such as high or low temperatures-that enables it to live freely in diverse conditions. Some of environmentaJ parameters and the physiologicaJ characteristics of microaJgae species can influence the disparity of the abundance of microaJgae in waters. In addition, in response to **ph8caJ,** chemicaJ, and biological aJteration in environmental conditions caused changes the composition and abundance of microaJgae at various levels [16].

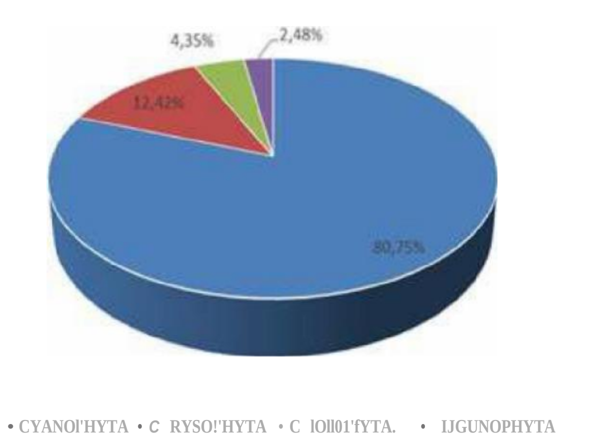

Figure 4. Composition of *Microa/gae* in June 2016

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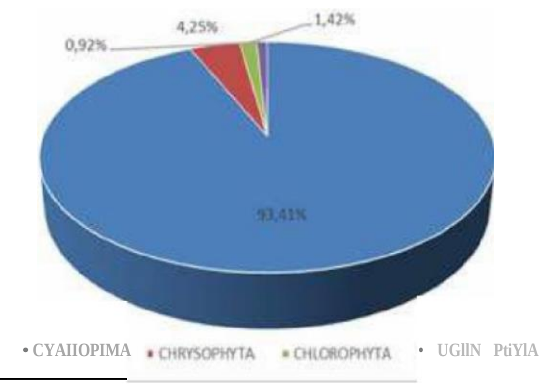

Figure 5. Composition of *Microa/gae* in July 2016

The calculation results of microalgae abundance in Pluit Reservoir in April - July are 400 - 73,700 cells/L as detailed the microalgae abundance during the research show in Figure 5 as follows.

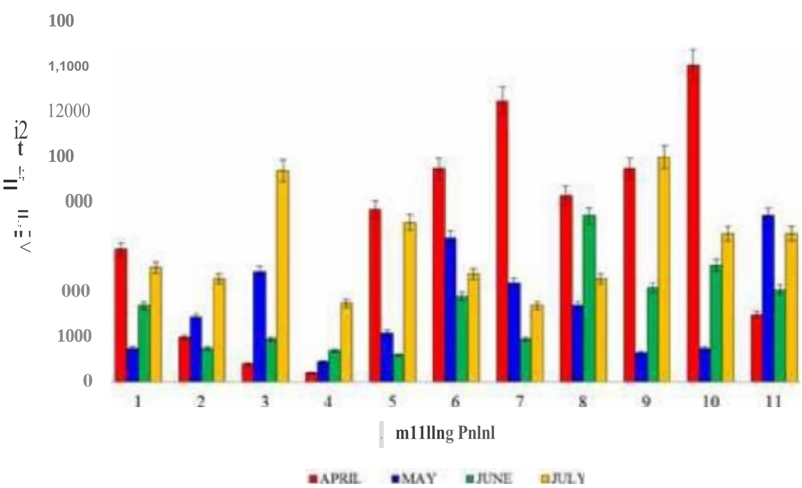

Figure 6. The Abundance ofMicroalgae in Pluit Reservoir Waters

In genernl, out of four sampling batches, the highest total abundance value was obtained from the inlet and its nearby midpoint section (mixing area of the inlet) as they contain a plentiful amount of organic substances. On the other hand, the lowest total abundance value was found in the outlet point and the centraJ part close to it due to the current flowing out to the outlet.

The most dominant and abundant type is *Osci/latoria* sp., a *microalgae* species that can survive in contaminated waters. It is likely to occur because they optimaJly utilized phosphate elements, proven by the high values of phosphate parameter and COD in the sampling points where this *microalgae* was dominant during the first batch (April) and the second (May) in Pluit Reservoir. This also shows that OscilJatoria sp. resistant to persistent organifJmllutants. It is known that the entry of nutrients into the Pluit Reservoir fJcaused by the use of detergents and the entry of wastewater from the surrounding area. To assess the deterioration of water quality and the characteristics of planktonic communities. Thus, this type of *microalgae* can be used as a bioindicator of water quality in organically polluted aquatic ecosystems [17], [18].

3.2. **Saprobity Index (X) of Microalgae**

The Saprobity lndex is used to determine the pollution level using the equation developed by [6] stated that certain organisms show a certain relationship toward clean (not contaminated) waters and polluted (contaminated) waters. In other words, there will be different organisms living show in Figure 7 as folJows:

Figure 7 denotes that the Saprobity Index values in Pluit Reservoir vary between -3.0 - 1.67. The highest value at the 2nd sampling point (water inlet) of 1.67 indicates a severe contamination degree. The lowest value at the 4th sampling point (the middle part) of -3.00 signifies a moderate pollution level in the 11-mesosaprobic category. The organic substances introduced to the inlet of Pluit Reservoir are aJlegedly originated from household activities in the surrounding residential areas, involving both organic and inorganic waste. Organic waste can indirectly increase the abundance of certain types of microa.lgae. Sufficient nutrients are needed for the growth of microalgae, including nitrates and phosphates derived from the household and industrial waste disposal [19]. Inhibiting the penetration of sunlight into the water can disrupt the process of photosynthesis, and the amount of DO in the waters can be reduced. The low DO wilJ then interfere with the lives of other aquatic organisms, especially the growth of microa.lgae [20].

The presence of organisms studied *in-situ* can describe the integrated effect of all impacts on water bodies, and can be used to **co0re** the alteration of water quality from site to site, or over a certain period of time. The physiological or behavioural reactions of aquatic organisms depend on the concentration of natural substances and pollutants in the environment, and the time required for these substances to affect the internal systems of the organisms [21].

Thus, the Pluit Reservoir can be considered to be mesosaprobic conditions. The phytoplankton community is dominated by Cyanophyta and Chlorophyta, and the combination of factors that trigger the blooms cannot be accurately predicted at present. There is no limiting nutrient as such in the lake to control the growth of organisms.

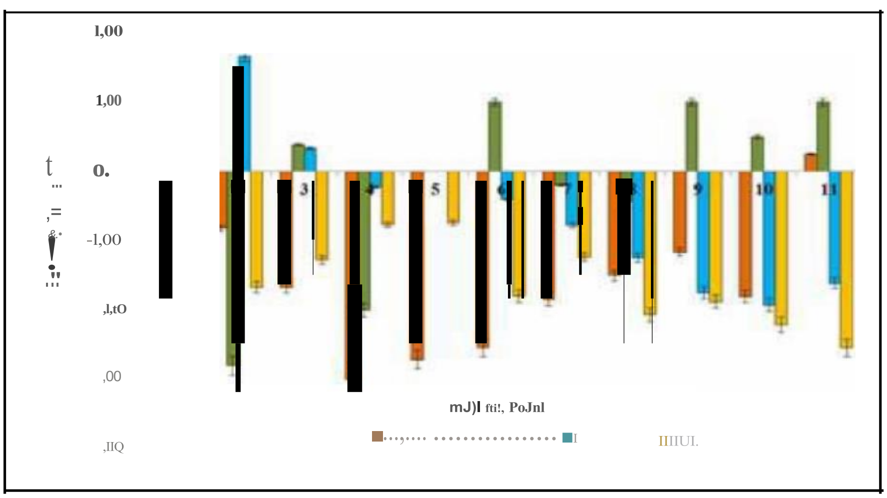

Figure 7. **Saprobity Index of Microalgae** in **Pluit Resevoir**

4. Conclusion

The composition of microaJgae during four months of research consists of 6 phyla namely *Cyanophyta*, *Chlorophyta*, *Euglenophyta*, *Bacillariophyta*, *Dinophyta*, and *Chrysophyta* divisions. The dominating type is *Cosmarium* sp. from the division of *Chlorophyta* which acts as an indicator of low to moderate contamination level. The microa.lgae abundance in Pluit Reservoir ranges from 400-73,700 cells/liter with the largest composition of *Cynophyta*. The Saprobity Index (X) average va.lue of --0.93 indicates that Pluit Reservoir is classified as mesosaprobic conditions and moderate polJution level containing organic and inorganic contaminants.

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