BUKTI KORESPONDENSI ARTIKEL PROSIDING INTERNASIONAL TERINDEKS SCOPUS

: Environmental Study on Phytoplankton in Garang Watershed, Central Java, Indonesia and Its Water Quality

: IOP Conference Series: Earth and Environmental Science, Volume 246, 4th International Conference on Tropical and Coastal Region Eco Development 30–31 October 2018, Semarang, Indonesia

https://iopscience.iop.org/article/10.1088/1755-1315/246/1/012070/meta

No	Perihal	Tanggal
1	Acceptance Letter for Oral Presentation	16 Juli 2018
2	Bukti Konfirmasi Submit Artikel dan Artikel yang Disubmit	17 Juli 2018
3	Information about paper	31 Juli 2018
4	Upload Manuskrip	31 Juli 2018
5	Abstrak revision	1 Agustus 2018
6	Paper Upload	31 Agustus 2018
7	Invitation Letter	6 Oktober 2018
8	Review	18 Oktober 2018
9	Revisi 2	13 Desember 2018
10	Submit Revisi	15 Desember 2018
11	Published	10 April 2019

Gmail

Rizky Muliani Dwi Ujianti <rizkymuliani@gmail.com>

[ICTCRED 2018] Your abstract #1570474345 ('Environmental Assesment of Garang Watershed, Central Java Indonesia using Phytoplankton Biodiversity and Water Quality')

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Dear Mrs. Rizky Ujianti:

Congratulations - your abstract #1570474345 ('Environmental Assesment of Garang Watershed, Central Java Indonesia using Phytoplankton Biodiversity and Water Quality') for ICTCRED 2018 has been accepted and you are asked to submit a full manuscript for review.

The reviews are below or can be found at http://edas.info/showPaper.php?m=1570474345.

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> *** Novelty and Contribution: Rate the degree of scientific contribution provided by this extended abstract. Do the authors offer new findings? Do they give proper explanation and detailed analysis? Good (3)

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Minor revision for some grammatical and word errors.

> *** Recommendation: Your overall rating. Weak Accept (4)

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> *** Novelty and Contribution: Rate the degree of scientific contribution provided by this extended abstract. Do the authors offer new findings? Do they give proper explanation and detailed analysis? Good (3)

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There are many grammatical errors and inefficient sentences in the abstract : as indicator of waters environment quality > as indicator for water environment quality The aims of this research were study > The aims of this research are to study their relationship of waters quality > their relationship to water quality Sampling location based on > Sampling location was determined based on They are relathionship > there are? Sampling tecniques in Garang Watershed using Plankton net no. 25 was used to phytoplankton collection > Plankton net no 25 was used for collecting phytoplankton in Garang Watershed. Varies phytoplankton density at the range of 13-53 ind / L > Phytoplankton density ranged from 13 to 53 ind / L

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Regards, Prof. Tri Winarni Agustini, Ph.D
General Chair

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Rizky Muliani Dwi Ujianti <rizkymuliani@gmail.com>

information about paper ICITACEE 2018

M Arfan <arfan@ft.undip.ac.id> 23 Juli 2018 pukul 14.13
Kepada: rizkymuliani@gmail.com

Dear Authors,
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Cc: Sutrisno Anggoro <sutrisnoanggoro52@gmail.com>, Azis Bambang <azis_undip_2013@yahoo.com>, Frida Purwanti <frpurwanti@gmail.com>

Dear Mrs. Rizky Ujianti:

Information about your paper #1570474345 ('Environmental Assesment of Garang Watershed, Central Java Indonesia using Phytoplankton Biodiversity and Water Quality') for ICTCRED 2018 was changed by Rizky Ujianti:

Abstract: Phytoplankton can be used as an indicator for water environment quality in the watershed area. This research was conducted in Garang Watershed, Central Java, Indonesia. The aims of this research are to study the environmental assessment of Garang Watershed Central Java, Indonesia using phytoplankton diversity and their relationship to water quality. Sampling location was determined based on the Governor Regulation of Central Java Provincial No. 156/2010 about the segmentation of Garang Watershed. Plankton Net No.25 was used for collecting phytoplankton in Garang Watershed. Phytoplankton density ranged from 13 to 53 ind/L. The number of species in the range of 4-8. Diversity index in the range 0.430-1.443. Phytoplankton stabilization was moderate while phytoplankton evenness was spread. Water quality index in this research are: Phosphate, NO3 - N, NH3 - N, NO2 - N, and Fe. There are relationships between Phytoplankton and water quality to maintain the good condition!
in Garang watershed.
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Gmail **Rizky Muliani Dwi Ujianti <rizkymuliani@gmail.com>**

Abstract Revision ICTCRED RMD Ujianti

rizky muliani <rizkymuliani@gmail.com> 1 Agustus 2018 pukul 12.15
Kepada: ictcred@live.undip.ac.id, ictcred@live.undip.ac.id.edas.info, M Arfan <arfan@ft.undip.ac.id>

Dear ICTCRED 2018 COMITE,
In this email, I attach abstract revision based on the format and my note of payment.
Thank you

--
Regards,
Rizky Muliani Dwi Ujianti
Food Technology Department
Engineering and Informatics Faculty
PGRI University Semarang
Indonesia

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The 4th International Conference on Tropical and Coastal Region Eco-Development (ICTCRED) 2018
Semarang, Indonesia, October 30th – 31st, 2018

ENVIRONMENTAL ASSESSMENT OF GARANG WATERSHED, CENTRAL JAVA, INDONESIA USING PHYTOPLANKTON BIODIVERSITY AND WATER QUALITY

Rizky M. D. Ujianti[1]*, Sutrisno Anggoro[2], Azis Nur Bambang[2], Frida Purwanti[2]

[1]*Food Technology Departement, Faculty of Engineering and Informatics, PGRI University Semarang, Jl. Sidodadi Timur 24. Dr. Cipto Semarang, Indonesia*
[2]*Faculty of Fisheries and Marine Science Diponegoro University, Jl. Prof. Soedharto, SH, Tembalang, Semarang Indonesia 50275*
** Rizky M. D. Ujianti, (024) 8316377, fax: 8448217 e-mail address: rizkymuliani@gmail.com / rizkymuliani@upgris.ac.id*

Abstract

The Phytoplankton can be used as an indicator for water environment quality in the watershed area. This research was conducted in Garang Watershed, Central Java, Indonesia. The aims of this research are to study the environmental assessment of Garang Watershed Central Java, Indonesia using phytoplankton diversity and their relationship to water quality. Sampling location was determined based on the Governor Regulation of Central Java Provincial No. 156/2010 about the segmentation of Garang Watershed. Plankton Net No.25 was used for collecting phytoplankton in Garang Watershed. Phytoplankton density ranged from 13 to 53 ind/L. The number of species in the range of 4-8. Diversity index in the range 0.430-1.443. Phytoplankton stabilization was moderate while phytoplankton evenness was spread. Water quality index in this research are: Phosphate, NO_3 – N, NH_3 – N, NO_2 – N, and Fe. There are relationships between Phytoplankton and water quality to maintain the good condition in Garang watershed.

Keywords : plankton, river, biodiversity, water quality, watershed

Gmail **Rizky Muliani Dwi Ujianti <rizkymuliani@gmail.com>**

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Regards,
Prof. Tri Winarni Agustini, Ph.D
General Chair

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Rizky Muliani Dwi Ujianti <rizkymuliani@gmail.com>

<<Invitation Letter>>

ICTCRED UNDIP <ictcred.2018@gmail.com> 6 Oktober 2018 pukul 17.25
Kepada: rizkymuliani@gmail.com

Please see the attached PDF File.

Invitation_Letter_.pdf
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Semarang, August 9th, 2018

Subject: Invitation Letter for **presenter** on the 4th International Conference on Tropical and Coastal Region Eco-development 2018 **(Tentative Schedule attached)**

Dear Presenter

Name of presenter : Rizky Ujianti

Name of authors : Rizky Ujianti; Sutrisno Anggoro; Azis Bambang; Frida Purwanti

Paper title : Environmental Assesment of Garang Watershed, Central Java Indonesia using Phytoplankton Biodiversity and Water Quality

It is our great pleasure to formally invite you to present your research in "The 4th International Conference on Tropical and Coastal Region Eco-development 2018" on October 30-31, 2018 in Patra and Convention Semarang, Indonesia. In a case, your agenda does not allow you to attend this conference, you may delegate to your co-author **for oral or poster present of your work (guideline for poster attached)**. The full schedule of the Conference can be check on the web site (www. ictcred@undip.ac.id).

Please feel free to contact us via e-mail to **ictcred@live.undip.ac.id** if you require any further information or clarification regarding with your presentation. We look forward to welcoming you to our conference and wish you a fruitful and pleasant stay in Semarang.

Sincerely Yours,

Prof. Tri Winarni Agustini, Ph.D
Chair, Organizing Committee
Faculty of Fisheries and Marine Science, Diponegoro University

The 4th International Conference on Tropical and Coastal Region Eco Development 2018

*Note : Please send proof of payment to **ictcred@live.undip.ac.id** before the conference for easy registration

Tentative Schedule

Time	Program
Day 1 (30 Oktober 2018)	
16.00-18.00	Registration
Day 2 (31 Oktober 2018)	
07.30-08.30	Registration
	Opening session
08.30-08.35	Opening
08.35-08.40	Welcome address
08.40-08.50	Opening speech
08.50-09.00	***Coffee break***
	Plenary session
09.00-09.30	Keynote Speaker I (Prof Ocky: Marine Biotech)
09.30-10.00	Keynote Speaker II (Prof Igarashi)
10.00-10.30	Keynote Speaker III (Prof Irwandi Jaswir)
10.30-10.45	Discussion
10.45-11.15	Keynote Speaker IV (Dr. Eleonor)
11.15-11.45	Keynote Speaker V (Prof Nadaoka)
11.45-12.00	Discussion
12.00-12.10	Introduction Peer
12.10-13.15	***Lunch and praying break***
13.15-14:15	Scientific session I (Presenter 1,2,3,4)
14.15-15:15	Scientific session II (Presenter 1,2,3,4)
15.15-15.30	***Tea break***
15.30-16:30	Scientific Session III (Presenter 1,2,3,4)
16.30-17:30	Scientific Session III (Presenter 1,2,3,4)
17:30-17:45	Clossing

Conference Secretariat:
Faculty of Fisheries and Marine Science, Diponegoro University, Jl. Prof. Soedarto,SH-Tembalang Semarang 50275, INDONESIA
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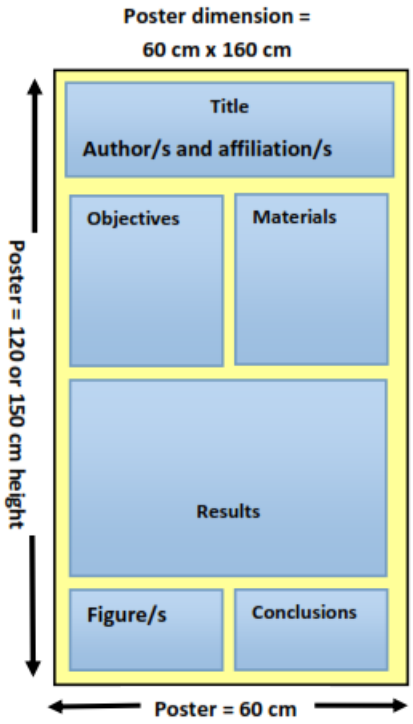
The 4th International Conference on Tropical and Coastal Region Eco Development 2018

GUIDELINES FOR POSTER PRESENTATIONS

1) The maximum poster / banner dimensions of approx. 160 cm height x 60 cm must be respected.
2) Each poster must have a top label indicating the title of the poster, the names of the authors and their affiliations. The size of the characters for the title should be at least 0.8" (2 cm) high.
3) Poster text should be large enough to be read from a distance of 3' (1 meter) or more. This is possible using a letter size of at least 0.4" (1 cm).
4) Keep illustrative material simple. Simple use of colour is effective for adding emphasis.
5) Simple "Introduction" and "Conclusion" sections are usually helpful. When feasible, use graphs for demonstrating qualitative relationships, use tables for precise numerical values.
6) Please note that there will be no audio-visual equipment in the poster area.
7) Poster numbers will be provided by Conference and will be available on your poster board.
8) The presenter should bring the poster stand.



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Opening Hours of the Poster:
Main entrance: Patra and Convention Semarang

Mounting time - in Patra and Convention Semarang:
Start From Tuesday, October 30th 2018 at 17.00 pm

Removal time – in in Patra and Convention Semarang,
Until Wednesday, October 31st 2018 at 18.00 pm

NOTE :

Presenters are responsible for the removal of their poster. Posters not removed by the indicated time above will be discarded at the end of the Conference. The Conference Secretariat cannot accept liability for lost or damaged posters and will not mail posters to authors after the Conference.

Participants will view posters during coffee and lunch breaks and the Poster Reception. Presenters shall be at their poster during the Poster Reception and are encouraged to be at their posters during breaks. Please note that session chairs will encourage the audience to visit the posters during breaks and to attend the Poster Reception.

For more information, please contact:
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Jl. Prof. Soedarto, SH Tembalang 50245
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Revise Manuscript - AR1570474345

ICTCRED Undip <ictcred@live.undip.ac.id> 13 Desember 2018 pukul 00.00
Kepada: rizky muliani <rizkymuliani@gmail.com>

Dear author,

Kindly find attachment of your manuscript that has been reviewed by our reviewer.

Please revised according to suggestion given by our reviewer and return it to us by Friday, 14th December 2018 at 01.00 pm.

Thank you for your cooperation.

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ENVIRONMENTAL ASSESSMENT OF GARANGRIVER ?, please revise all in the text.... WATERSHED, CENTRAL JAVA, INDONESIA USING PHYTOPLANKTON BIODIVERSITY AND WATER QUALITY

Rizky M. D. Ujianti[1]*, Sutrisno Anggoro[2], Azis Nur Bambang[2], Frida Purwanti[2]

[1]Food Technology Departement, Faculty of Engineering and Informatics, PGRI University Semarang, Jl. Sidodadi Timur 24. Dr. Cipto Semarang, Indonesia
[2]Faculty of Fisheries and Marine Science Diponegoro University, Jl. Prof. Soedharto, SH, Tembalang, Semarang Indonesia 50275
** Rizky M. D. Ujianti, (024) 8316377, fax: 8448217 e-mail address: rizkymuliani@gmail.com / rizkymuliani@upgris.ac.id*

Manuscript received: 18-03-2018. Revision accepted: .....

ABSTRACT

Phytoplankton can be used as an indicator for water environment quality in the watershed area. This research was conducted in Garang RiverWatershed, Central Java, Indonesia. The aims of this research are to study the environmental assessment of Garang Watershed Central Java, Indonesia using phytoplankton diversity and their relationship to water quality. Sampling location was determined based on the Governor Regulation of Central Java Provincial No. 156/2010 about the segmentation of Garang Watershed. Plankton Net No.25 was used for collecting phytoplankton in Garang Watershed. Phytoplankton density ranged from 13 to 53 ind/L. The number of species in the range of 4-8. Diversity index in the range 0.430-1.443. Phytoplankton stabilization was moderate while phytoplankton evenness was spread. Water quality index in this research are: Phosphate, NO_3 – N, NH_3 – N, NO_2 – N, and Fe. There are relationships between Phytoplankton and water quality to maintain the good condition in Garang watershed.

Keywords: plankton, river, biodiversity, water quality, watershed

INTRODUCTION

Garang river watershed located at Central Java Province, Indonesia. Upstream Garang watershed is located in the area of Mount Ungaran, Central Java, Indonesia. Downstream located at the mouth of the Java Sea. The distance of the river on the Garang watershed is 35 km. Garang watershed is divided into 3 zones, namely upper zone, middle zone and lower zone. Upper zone has a topography of the mountains with the slope of the river bottom is very steep. The flow velocity includes a supercritical flow type. The hydraulic characteristic in the upper zone is the high flow rate so that sediment transport and erosion are also high. Sediment transport is a complex phenomenon associated with nature, randomness and spatial-temporal discontinuity (Berghout and Meddi, 2016). The middle zone has a hilly topography. The slope of the river bed is not as sharp as the upper zone. The lower zone exists in urban areas. This zone has a very sloping riverbed. The symptoms that occur are sedimentation or sedimentation at the bottom of the channel.

Estuary of Garang Watershed is used for cultivation of fishery owned by the citizen. The characteristics of the estuary are muddy areas. The estuary is susceptible to household waste and industrial waste (Mulik et al., 2017), and port activities (Tjahjono et al., 2018). There are many fish ponds at the river border. Fish that is cultivated is tilapia. Fishery cultivation activity is a beneficial activity for the community. This activity provides economic benefits for the community. Environmental feasibility for cultivation can be estimated through quantitative and qualitative measurement of the biota that inhabits these waters. One biota often used in this need is plankton. Plankton used its ecological studies cheaply in cost, and easily. Knowledge of the abundance, diversity and environmental conditions of the resource can be used for the determination of water fertility for cultivation. Phytoplankton in aquatic systems requires nitrogen and phosphorus as a limiting factor for its growth, in addition to other factors (McCarthy, 1980; Nelewajko and Lean, 1980; Pirzan, et al. 2008).

3 districts of Garang Watershed are Semarang City, Kendal Regency, and Semarang Regency. The population in the three districts/cities through Garang watershed is increasing steadily year by year.. In 2015 the population

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of the 3 regions is 1.284.967 people, the year 2016 is 1.370.906 people. Thus, the increased ofthe population of 85.939 people/year. Land use has an impact on downstream water quality in the watershed (Giri et al., 2018). The presence of a large population increase, require the addition of settlements areas. Settlements and waste are a problem in river management. Settlements in Semarang City, Central Java, Indonesia are a source of domestic waste pollutants. There are many settlements in the Garang Watershed. Close to the estuary area, there are residents who defecate directly in the river or dispose of stool waste directly into the river without processing. The purpose of this study was to analyze the relationship of phytoplankton biodiversity with water quality in order to manage the sustainable river. Good water quality for the river is very important because it affects humans, plants, animals and all the elements that utilize the river (Sutadian *et al*., 2018). So they need research about water quality and plankton biodiversity to maintain the watershed ecosystems.

MATERIALS AND METHODS

Study area

Garang watershed stretches across 3 districts. Upstream is located in Semarang, Central Java, Indonesia, downstream and centered in Semarang City, and Kendal Regency Central Java, Indonesia. The Upper Garang watershed is a super priority watershed. Upstream is a location to water supplier for Semarang and surrounding areas. Thus, it is very important to preserve the function of the environment. The upstream part of Garang Watershed there is many springs. Springs are used as water providers for household and industrial needs. (Figure 1).

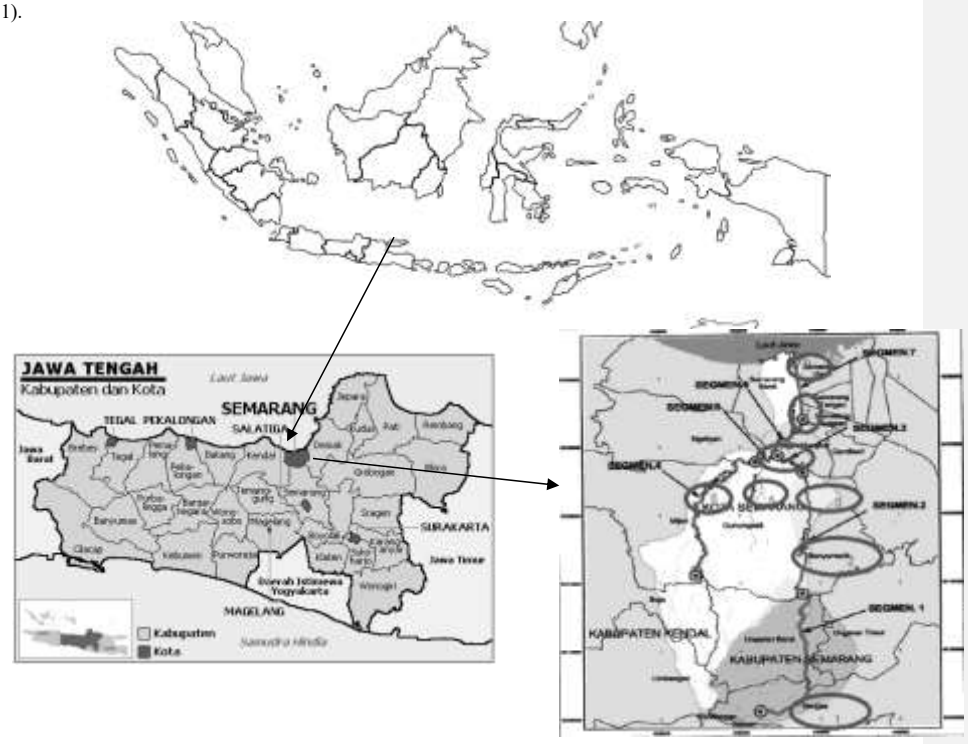

Figure 1. Location of Garang Watershed Point 1-8 , coordinate 6˚59'32,5" S and 110˚24'10,0" E.

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Sampling techniques

Plankton collect in Garang watershed, with 8 sampling station with 7 segments area. Based on the Governor Regulation of Central Java Provincial No. 156/2010 about the segmentation of Garang; the watershed is divided

into 7 segments as a management unit. The purpose of this regulation is to preserve water function and water quality management furthermore the river can be utilized according to its allocation. Segment 1 is an upstream area used for: agriculture area, coffee plantation, settlement, and industries (biscuit, soft drink, textile, and tofu industry). Segment 2 is used for: settlement, agriculture, and industry (iron smelting industry). Segment 3 is used for settlement. Segment 4 is used for: agriculture, settlement, fishery, fishing, and forest. Segment 5 is used for settlement, fisheries. Segment 6 is used for settlement, fishery, industry, and agriculture. Segment 7 is watershed downstream is used for settlement, estuary, fishery, and port (Figure 1). Sampling used Plankton net No 25, with materials: alcohol, Lugol solution, sampling bottles(1 liter) (Sihombing, 2017). Phytoplankton abundance is calculated by the following formula (Sournia, 1978: Sidabutar, et. al. 2017):

Table 1. The number of individuals, species, diversity index, evenness Index, and phytoplankton dominance in

No	Species Name	1	2	3	4	5	6	7	8
1	Arthrodesmus sp.	-	-	-	-	-	-	-	5
2	*Biddulphia* sp	6	-	-	8	8	2	-	-
3	*Ceratium* sp	4	-	-	6	5	-	-	-
4	*Chaetoceros* sp	-	9	-	-	8	6	-	-
5	*Coscinodiscus* sp	6		2	6	9	5	2	4
6	Cyclotella sp	-	-	-	7	-	-	-	-
7	Dinophysis sp.	-	-	-		-	-	-	3
8	*Grammatophota sp*	-	-	-	4	-	-	-	-
9	*Guinardia* sp.	-	-	8		-	-	5	6
10	*Nitzschia* sp	6	-	-	8	-	-	5	2
11	*Oscillatoria* sp.	-	-	3	-	-	-	-	-
12	Pediastrum sp.	-	-	-	-	-	-	-	1
13	*Pleurosygma* sp	6	1	12	6	-	2	1	-
14	*Rhizosolenia* sp	-	2	-	-	-	3		4
15	Synedra sp.	-	-	-	-	-	-	-	2
16	*Thalasiothrix* sp	7	-	-	8	-	-	-	-
17	*Triceratium* sp	-	2	-		-	-	-	-
	Total individu	35	14	25	53	30	18	13	27
	Total species	6	4	4	6	4	5	4	8
	Diversity (H)	1,78	1,07	1,17	2,06	1,36	1,50	1,22	1,96
	Evenness (e)	0,99	0,77	0,85	0,99	0,98	0,93	0,88	0,94
	Dominance (d)	0,17	0,43	0,35	0,13	0,26	0,25	0,33	0,15

Garang waters of Central Java, Indonesia

$$N = nx\frac{V1}{Vs}x\frac{1}{V}$$

Where,
N: the amount of all phytoplankton
V: volume of filtered water
Vt: the initial sample volume
Vs: sub-sample volume (fraction)
N: number of phytoplankton in sub-sample Water

Data analysis

Biodiversity Index

Shannon-Wiener index (H′) is used to summarize the functional diversity of the ciliate communities, and is computed following the equation:

$$H' = -\sum_{i=1}^{s} Pi(\ln Pi)$$

where

H′ = observed diversity index;

Pi = proportion of the total count arising from the ith functional group;

S = total number of functional group

Evennes Index

Evenness Index J′ (Pielou, 1975, Zhang, et. al. 2012), which is expressed by the Shannon information scaled by the maximum information, to measure species evenness for each community:

$$J' = \frac{H'}{\ln(S)'}$$

where

H′ = observed diversity index

S = total number of species observed

RESULTS AND DISCUSSION

Diversity Index

The number of individuals, species, diversity index, evenness Index, and phytoplankton dominance in Garang waters of Central Java, Indonesia is shown in Table 1. The number of individuals per station in the range of 13-53 ind / L. Number of species in the range of 4-8. Diversity index in the range 1.07 - 2.06. The results of the phytoplankton diversity (H ') analysis showed that H' in all sampling areas included moderate stable criteria. According to Stirn (1981); Pirzan, et al. (2008) when H '<1, then the community of biota is declared unstable. If H 'ranges from 1-3 then the stability of the biota community is moderate (moderate). If H '> 3 means the stability of the biota community is in a prime (stable) condition. The waters condition is good, if it has an increasing H value (Pirzan, et al. 2008).

Evenness index 0.77 - 0.99. This evenness index shows the evenness of the number of each species is not the same and there is a tendency of dominance in the phytoplankton community. The value of evenness index was calculated to find out how big the equality of the spread of the number of individuals at the community level (Odum, 1993) both at each location and season. The evenness index obtained shows the evenness of the spread of the number of individuals. Evenness indexes

Table 1.Phytoplankton Biodiversity in Garang Watershed, Central Java, Indonesia

close to 1 indicate evenness among species is evenly distributed, whereas when close to 0 indicates evenness among species is low (Adinugroho, 2014). The dominance index is 0.17 - 0.43. The index value of dominance in each location indicates the dominance of a certain species in an ecosystem. The dominant index value close to 0 indicates that there are no dominant species, whereas close to 1 indicates the dominance of certain types within the community (Krebs, 2001 in Sumarto, 2014, Adinugroho, 2014). This dominance index indicates that there is no tendency of the dominance of certain phytoplankton type.

The number of individuals and species of phytoplankton found in this study is relatively lower compared to previous studies in the waters of Semarang Bay which is the mouth of the Garang watershed. The diversity index on phytoplankton ranges from 0.90 to 1.52. The evenness index on phytoplankton ranged from 0.38 to 0.71. The dominance index on phytoplankton ranged from 0.38 to 0.62. The dominant index of zooplankton ranges from 0.08 to 0.16. In phytoplankton, there are the most dominant species of Pleurosygma sp., Coscinodiscus sp., Biddulphia sp. and Chaetoceros sp.

Water Quality Analysis

In this sampling area, they are 5 water quality sample, such as Phospate, NO3 – N, NH3 – N, NO2 – N and Fe (Table 2.)

Table 2. Variety of Water Quality in Garang watershed

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Sampling Station	Phospate	NO_3 - N	NH_3 - N	NO_2 - N	Fe
1	0,562	0,010	0,010	0,002	0,000
2	4,185	0,120	0,510	0,066	0,450
3	0,283	0,110	0,510	0,008	0,350
4	0,366	0,060	0,130	0,016	0,120
5	2,177	0,020	0,370	0,017	0,820
6	0,687	0,530	0,970	0,283	0,040
7	0,366	0,140	0,470	0,078	0,280
8	0,464	0,220	2,030	0,101	0,420
Average	1,14	0,15	0,63	0,07	0,31
Deviation Std	±1,38	±0,17	±0,64	±0,09	±0,27

Phosphate range in research study are 0,366 – 2,177 mg/L. Household wastewater containing auxiliary residues and cleaning agents, agricultural runoff containing fertilizers and industrial waste from fertilizer, detergent, and soap industries are the main sources of phosphates in aquatic environments. Most sources of industrial waste and domestic waste in urban areas (Kundu, et. al. 2015). NO_3-N range in research study are 0,010 – 0,530 mg/L. The effects of high nitrate and phosphate can increase the toxic phytoplankton severely in waters near the waters around the world (Lomoljo, et. al. 2009). Nitrate is the main form of nitrogen in the water. Nitrate is a major nutrient for plant growth. Nitrate concentrations of more than 0.2 mg / L may result in the occurrence of eutrophication (enrichment) of the waters. The oligotrophic waters have a nitrate content between 0-1 mg / L (Humaira, et.al. 2016). Upstream of Garang watershed used for agriculture, furthermore they are many pesticides in this area. In waters receiving runoff from agricultural areas containing fertilizers and pesticides, nitrate levels can reach 1,000 mg / L. Nitrate levels for drinking water are not allowed to exceed 10 mg / L (Efendi 2003; Humaira, et. al. 2016). NH_3N range in research study are 0,010 – 2,030 mg/L. Microbial degradation of the nitrogenous organic matter is one of the most important sources in producing NH3-N in the watershed area. These compounds are transferred to the environment through different sources including by-products of waste decomposition. Ammonia concentrations in waters above 0.2 mg / l can be harmful to many aquatic organisms (Ibrahim, et. al. 2017). NO_2-N in research area are 0,002 – 0.283 mg/L. Good condition in the watershed area of NO_2 is from 0.4 to 0.8 mg/l (Hernández, et. al. 2013).

The morphology of diatom that was protected by the cell walls was an important factor to tolerate the environmental changes. This factor also enabled diatom to win the competition in occupying the living space and obtaining nutrients. The diatoms living in tropical areas had structures (spicules, seat, and hard cell walls) and chemical defense beneficial to survive in the environment that has numerous predators. The chemical defense was used to survive from the smaller predators, while the structural defense was used to survive from the bigger predators. Even the cell wall structure could absorb 30% of UVB radiation; hence, it could survive from high light exposure (McClintock et al., 2001; Paul et al., 2001; Karentz, 2001; Setiabudi et al., 2016).

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Relationship between Phytoplankton and Water Quality

Abiotic factors can cause dominance of Ceratium sp in sampling station 6. The decomposition process releases mineral elements such as nitrogen, phosphorus, and other essential nutrients. Result sampling station 6 has a high phosphate concentration. A condition often indicated by a high measured concentration of phosphate to dominated phytoplankton (Sihombing, et.al. 2017). Several research has shown that ecological features of planktonic silica, such as species diversity, taxonomic uniqueness, and diversity of sizes/uniqueness, can be used as potential bioindicators of water quality status. (Jiang et al., 2011; Xu et al., 2011, 2016).

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Dear reviewer n commite , this is my manuscript revision 1. I submit my manuscript to Biodiversitas Journal. Thank You

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Environmental Study on phytoplankton in Garang Watershed, Central Java, Indonesia and its water quality

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Abstract Phytoplankton can be used as an indicator for water environment quality in the watershed area. This research was conducted in Garang Watershed, Central Java, Indonesia. The aims of this research are to study the environmental assessment of Garang Watershed Central Java, Indonesia using phytoplankton diversity and their relationship to water quality. Sampling location was determined based on the Governor Regulation of Central Java Provincial No. 156/2010 about the segmentation of Garang Watershed. Plankton Net No.25 was used for collecting phytoplankton in Garang Watershed. Phytoplankton density ranged from 13 to 53 ind/L. The number of species in the range of 4-8. Diversity index in the range 1.07-2.06. The result of diversity index shown that this rivers is lightly polluted. Phytoplankton stabilization was moderate while phytoplankton evenness was spread. Water quality index in this research are: Phosphate, Nitrate, Nitrite, Ammonia and Fe.
Keywords : plankton, river, biodiversity, water quality, watershed

1. Introduction

Garang watershed located at Central Java Province, Indonesia. Upstream Garang watershed is located in the area of Mount Ungaran, Central Java, Indonesia. Downstream is located at the mouth of the Java Sea. The distance of the river on the Garang watershed is 35 km. Garang watershed is divided into 3 zones, namely the upper zone, the middle zone, and the lower zone. Upper zone has a topography of the mountains with the slope of the river bottom is very steep. The flow velocity includes a supercritical flow type. The hydraulic characteristic in the upper zone is the high flow rate so that sediment transport and erosion are also high. Sediment transport is a complex phenomenon associated with nature, randomness and spatial-temporal discontinuity [2]. The middle zone has a hilly topography. The slope of the slope is not as sharp as the upper zone. The lower zone exists in urban areas. This zone has a very sloping riverbed. The symptoms that occur are sedimentation or sedimentation at the bottom of the channel.

Three districts of Garang Watershed are Semarang City, Kendal Regency, and Semarang Regency. The characteristic of the estuary of Garang watershed is a muddy area, and it used for aquaculture of Tilapia Fish. Aquaculture is a beneficial activity to provides economic benefits for the community. Aquatic waste comes from domestic, industrial waste [13], port activities [23], and anthropogenic activities [14]. Waste from anthropogenic activities can be caused by overpopulation. In 2015 the population of the 3 regions (Semarang City, Kendal Regency, and Semarang Regency) is 1.284.967 people, the year 2016 is 1.370.906 people. Thus, that has increased the population of 85.939 people/year. Large population needs of settlements areas, so the changes in upstream land use into settlements. Land use change has an impact on water quality in the estuary/downstream [5]. Close to the estuary, there are residents who defecate directly in the river or dispose of stool waste directly into the river without processing.

Environmental feasibility for aquaculture can be estimated through quantitative and qualitative measurement of the biota that inhabits these aquatic environment. Plankton used its ecological studies cheaply in cost, and easily. Knowledge of the abundance, diversity and environmental conditions of the resource can be used for the determination of water productivity for aquaculture.

Phytoplankton in aquatic systems requires nitrogen and phosphorus as a limiting factor for its growth, in addition to other factors [16]. The purpose of this study was to analyze the relationship of phytoplankton biodiversity with water quality in order to manage the sustainable river. Good water quality for the river is very important because it affects humans, plants, animals and all the elements that utilize the river [22]. Futhermore, they need research about water quality and plankton biodiversity to maintain the watershed ecosystems.

2. Methods

2.1. Study Area

Garang watershed stretches across 3 districts. Upstream is located in Semarang, Central Java, Indonesia, downstream and centered in Semarang City, and Kendal Regency Central Java, Indonesia. The upper of Garang watershed is a super priority watershed. Upstream is a location to water supplier for Semarang and surrounding areas. Futhermore, it is very important to preserve the function of the environment. The upstream part of Garang Watershed there is many springs. Springs are used as water providers for household and industrial needs. (Figure 1).

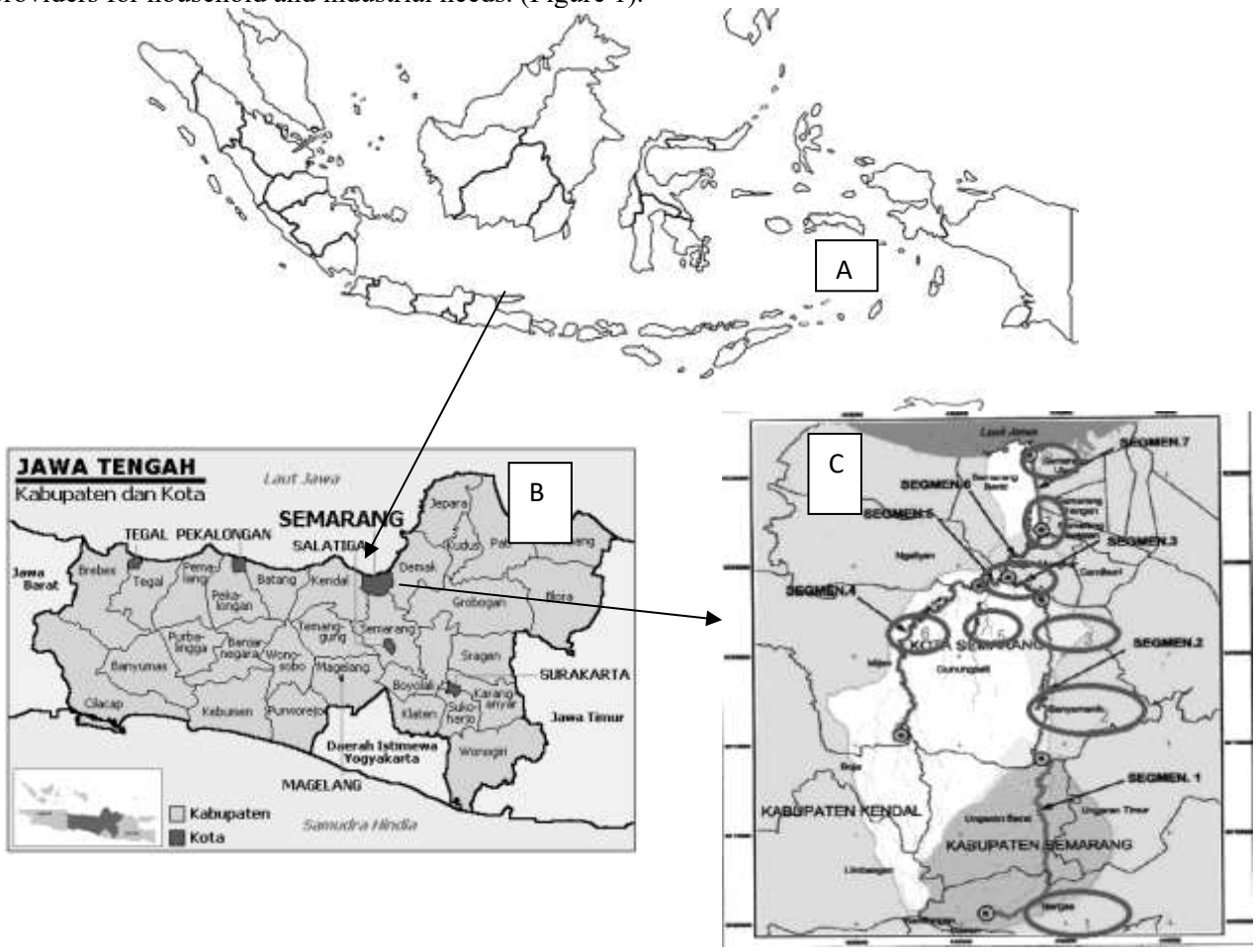

Figure 1. Study area: the map of the Indonesia (A), Central Java Province (B), Location of Garang Watershed Sampling Station 1-8, coordinate 6˚59'32,5" S and 110˚24'10,0" E (C)

2.2. Sampling techniques

Plankton collects in Garang watershed, with 8 sampling station with 7 segments area based on Governor Regulation of Central Java Provincial No. 156/2010. The purpose of this regulation is to manage the river segmentation based on utilization. Segment 1 is an upstream area used for: agriculture area, coffee plantation, settlement, and industries (biscuit, soft drink, textile, and tofu industry). Segment 2 is used for: settlement, agriculture, and industry (iron smelting industry). Segment 3 is used for settlement. Segment 4 is used for: agriculture, settlement, fishery, fishing, and forest. Segment 5 is

used for settlement, fisheries. Segment 6 is used for settlement, fishery, industry, and agriculture. Segment 7 is watershed downstream is used for settlement, estuary, fishery, and port. The sampling location is 8 points. Sampling station 1 is a river in the downstream area at Gebugan Village, Bergas sub-district, Semarang Regency. Sampling station 2 is Garang River (Pramuka Street), Banyumanik sub-district near plantations and settlements. Sampling station 3 is Garang River in Tinjomoyo Village, this area near the plantation. Sampling station 4 called Tugu Suharto river, this area is confluent zone between Kreo river and the Garang river. In this area, there is an influence between sediment transport, flow dynamics and river morphology [18]. Waste comes from domestic and industry, thus affecting the water quality of the river [24]. Sampling station 5 is Garang river near fishing pond Sikopek Village, Gunung Pati Sub-district, this area near the plantation. Sampling station 6 is Garang river near Gisik Sari Village, Gunung Pati Sub-district near plantations and settlements. Sampling station 7 is Garang river, they river called Banjir Kanal Barat River, this river near settlements and downstream area. Sampling station 8 is the downstream area, estuary Laut Jawa. Sampling Station is shown in Figure 1(b).

Sampling used Plankton net No 25, with materials: alcohol, lugol, sampling bottles (1 liter) [21], and keep the sample in a cool box to the laboratory for analyzing the sample [16]. Filtered water is 10 liters using a 10-liter tube. Phytoplankton abundance is calculated by the following formula [20].

$$N = nx\frac{V1}{Vs}x\frac{1}{V}$$

where:
N: the amount of all phytoplankton
V: volume of filtered water
Vt: the initial sample volume
Vs: sub-sample volume (fraction)
N: number of phytoplankton in sub-sample Water

2.3. Biodiversity Index

Shannon-Wiener index (H′) is used to summarize the functional diversity of the ciliate communities, and is computed following the equation:

$$H' = -\sum_{i=1}^{s} Pi(\ln Pi)$$

where
H′ = observed diversity index;
Pi = proportion of the total count arising from the ith functional group;
S = total number of functional group

2.4. Evennes Index

Evenness Index J′ [29], which is expressed by the Shannon information scaled by the maximum information, to measure species evenness for each community:

$$J' = \frac{H'}{\ln(S)'}$$

where
H′ = observed diversity index
S = total number of species observed

3. Result and Discussion

3. 1. Result

3.1. 1. Diversity index

Total Individu, Total Species, Diversity Index, Eveness Index and Dominance Index in Sampling Location shown in Figure 2.

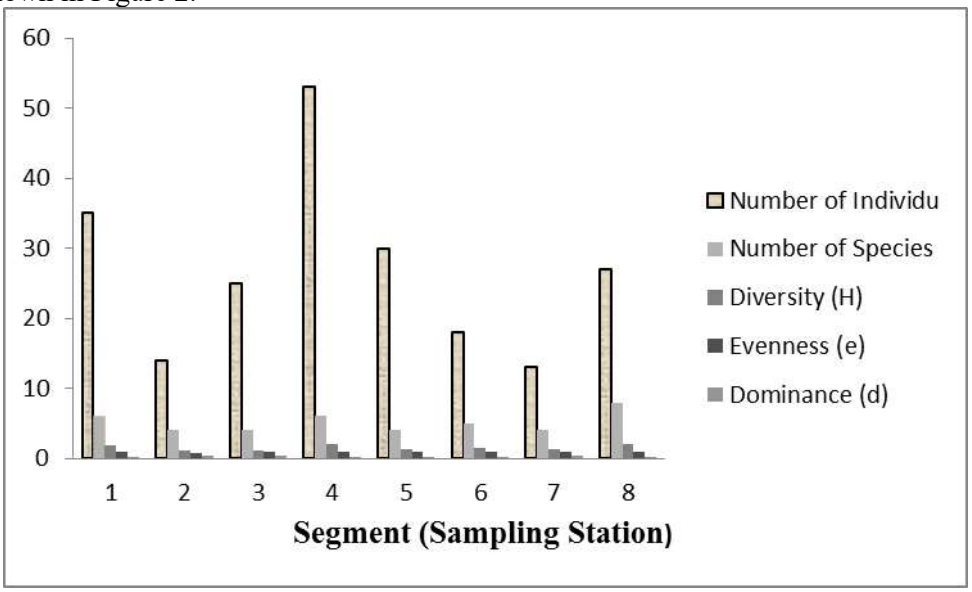

Figure 2. Total individu, total species, diversity index, evenness index and dominance index in sampling location

The number of individuals, species, diversity index, evenness Index, and phytoplankton dominance in Garang watershed of Central Java, Indonesia are shown in Figure 1. The number of individuals of phytoplankton in Garang watershed was about of 13-53 ind/L. The number of species of phytoplankton in Garang watershed was about 4-8. The diversity index of phytoplankton Garang watershed was about 1.07 - 2.06. The evenness index of phytoplankton in Garang watershed was about 0.77 - 0.99. The dominance index of phytoplankton in Garang watershed was about 0.17 - 0.43.

Table 1. Types of phytoplankton found in Garang Watershed, Semarang, East Java Indonesia

Class	Name of Spescies	Average
Chlorophyceae	*Arthrodesmus* sp.	0-5(0.63±1.65)
	Pediastrum sp.	0-1(0.13±0.33)
Bacillariophyceae	*Biddulphia* sp	0-8(3.00±3.46)
	Chaetoceros sp	0-9(2.88±3.79)
	Coscinodiscus sp	0-9(4.86±2.29)
	Cyclotella sp	0-7(0.88±2.32)
	Grammatophota sp	0-4(0.50±1.32)
	Guinardia sp.	0-8(2.71±3.24)
	Nitzschia sp	0-8(2.63±3.04)
	Pleurosygma sp	0-12(3.5±3.94)
	Rhizosolenia sp	0-4(1.13±1.54)
	Synedra sp.	0-2(0.25±0.66)
	Thalasiothrix sp	0-8(1.88±3.26)
	Triceratium sp	0-2(0.25±0.66)
Cyanophyceae	*Oscillatoria* sp.	0-3(0.38±0.99)
Dynophyceae	*Ceratium* sp	0-6(1.88±2.47)
	Dinophysis sp.	0-3(0.38±0.99)

Table 1 shown that data types of phytoplankton found in Garang Watershed. Semarang. East Java Indonesia. there are four classes found in Garang watershed are: Chlorophyceae, Bacillariophyceae,

Cyanophyceae and Dynophyceae. The most phytoplankton was found in Garang watershed is *Chaetoceros* sp.

3.1.2. Water Quality Analysis

In this sampling area. they are 5 water quality samples. such as Phospate, Nitrate, Ammonia Nitrite and Fe (Table 2.)

Table 2. Variety of water quality in Garang Watershed

Sampling Station	Phospate	Nitrate	Ammonia	Nitrite	Fe
1	0.562	0.010	0.010	0.002	0.000
2	4.185	0.120	0.510	0.066	0.450
3	0.283	0.110	0.510	0.008	0.350
4	0.366	0.060	0.130	0.016	0.120
5	2.177	0.020	0.370	0.017	0.820
6	0.687	0.530	0.970	0.283	0.040
7	0.366	0.140	0.470	0.078	0.280
8	0.464	0.220	2.030	0.101	0.420
Average	1.14	0.15	0.63	0.07	0.31
Deviation Std	±1.38	±0.17	±0.64	±0.09	±0.27

Table 2 show that the study of water quality in Garang Watershed are: Phosphate, Nitrate, Ammonia, Nitrite and Fe. Phosphate range in a research study is 0.366–2.177 mg/L. Nitrate range in a research study is 0.010-0.530 mg/L. Nitrate is affected by rainwater runoff, industrial waste and domestic waste [15]. Nitrite range in a research study is 0.002-0.283 mg/L. Faeces of grazing animals carry pathogenic bacteria, protozoa and can be contaminated with nitrites and nitrates. This is an environmental problem for people who only use groundwater for their lives [4]. At sampling station 6 there are residents who have chicken farms, this is thought to have an effect on the high content of nitrate and nitrite. Ammonia range in a research study is 0.010–2.030 mg/L. Suspended solids affect ammonia in the waters. It is important to know the abundance of ammonia-oxidizing microorganisms and their response to the environment [27]. Fe range in the research study is 0.04-0.82 mg/L.

3.2. Discussion

3.2.1. Diversity index. evennees index and dominance index

When phytoplankton diversity (H'), if H'<1 then the community of biota is declared unstable [16]. H' ranges from 1-3 then the stability of the biota community is moderate (moderate). H'> 3 means the stability of the biota community is in a prime (stable) condition. In all sampling area, H' is moderate stable criteria. The waters condition is good if it has an increasing H value [16]. The evenness of the number of species is not the same and there is a tendency of dominance in the phytoplankton community. The diversity index on phytoplankton ranges from 0.90 to 1.52. The evenness index was calculated to find out how big the equality of the spread of the number of individuals at the community level both at each location and season. The evenness index close to 1 indicates evenness among species is evenly distributed when close to 0 indicates evenness among species is low [1]. The evenness index on phytoplankton ranged from 0.38 to 0.71.

The dominance in each location indicates the dominance of a certain species in an ecosystem. The dominance index close to 0 indicates that there are no dominant species, whereas close to 1 indicates the dominance of certain types within the community [1]. This dominance index indicates that there is no tendency of the dominance of certain phytoplankton type. The number of individuals and species of phytoplankton found in this study is relatively lower compared to previous studies in the waters of Semarang Bay which is the mouth of the Garang watershed (downstream/estuary area) by the research [1]. This research has shown that the dominance index on phytoplankton ranged from 0.38 to 0.62. The dominant index of zooplankton ranges from 0.08 to 0.16

The dominant phytoplankton species are *Pleurosygma* sp., *Coscinodiscus* sp., *Biddulphia* sp. and *Chaetoceros* sp. Algae blooms can be caused by algae from the genus Chaetoceros and Ceratium. blooming algae harmful to fish life. Red tide is caused by plankton *Chaetoceros* sp. [23]. Diatom *Coscinodiscus* sp. lives in a turbulent environment. not in calm waters that contain low nutrient concentrations [3]. The morphology of diatom that was protected by the cell walls was an important factor to tolerate the environmental changes. This factor also enabled diatom to win the competition in occupying the living space and obtaining nutrients. The diatoms living in tropical areas had structures (spicules, seat, and hard cell walls) and chemical defense beneficial to survive in the environment that has numerous predators. The chemical defense was used to survive from the smaller predators while the structural defense was used to survive from the bigger predators. Even the cell wall structure could absorb 30% of UVB radiation. It could survive from high light exposure [19].

3.2.2. Water quality

Household wastewater containing auxiliary residues and cleaning agents, agricultural runoff containing fertilizers and industrial waste from fertilizer, detergent, and soap industries are the main sources of phosphates in aquatic environments. Most sources of industrial waste and domestic waste in urban areas [9]. Phosphate can be caused by detergent concentration. Detergent affects the aquatic environment, caused by foam, limit oxygen production, and cause eutrophication [12]. Foam on the surface can limit oxygen production, inhibit aeration in the aquatic environment which causes an increase in oxygen demand which causes the dissolution of dissolved oxygen. High concentrations affect the life cycle of the organism: ovum and larval phase [12]. Overall, the detergent effect reduces oxygen concentration, changes in watercolor, increases turbidity and sedimentation, and decreases biological activity [12]. The highest concentration of phosphate in the sampling station 2, they are many industrial and domestic settlement in the near river. Nitrate is the main form of nitrogen in the water. Nitrate is a major nutrient for plant growth. Nitrate concentrations of more than 0.2 mg/L may result in the occurrence of eutrophication (enrichment) of the aquatic environment. The oligotrophic waters have a nitrate content between 0-1 mg/L [7]. Upstream of Garang watershed used for corn and cassava agriculture, furthermore they are many pesticides in this area. In the aquatic environment receiving runoff from agricultural areas containing fertilizers and pesticides, nitrate levels can reach 1.000 mg/L. Nitrate levels for drinking water are not allowed to exceed 10 mg/L [7]. These compounds are transferred to the environment through different sources including by-products of waste decomposition. The effects of high nitrate and phosphate can increase the toxic phytoplankton severely in waters near the waters around the world [10]. Ammonia concentrations in the aquatic environment above 0.2 mg/L can be harmful to many aquatic organisms [8]. In sampling station 8 which is an area of aquaculture [25], is thought to have an effect on the amount of ammonia waste derived from fish feed. This can cause a bad influence on the aquatic environment. Nitrite in the sampling area: 0.002-0.28, good condition in the watershed area of nitrite is from 0.4 to 0.8 mg/l [16]. Fe as a nutrient for life processes in plants and microorganisms but becomes toxic at higher concentrations. Fe range in fish at sampling station 7-8 is 15.86 mg/kg to 306.3 mg/kg. Concentration limit Fe according to World Health Organization is 0.3 mg/kg.

3.2.3. Relationship between phytoplankton and water quality

Abiotic factors can cause dominance of *Ceratium* sp. [21]. In sampling station 6. the decomposition process releases mineral elements. Nitrogen, phosphorus, and other important nutrients, this causes high phosphate concentrations [21]. Several research has shown that the ecological features of planktonic silica, such as species diversity, taxonomic uniqueness, and diversity of sizes/uniqueness, can be used as potential bioindicators of water quality status [28]. Plankton biomass is influenced by nitrogen, phosphorus, silica, and eutrophication. *Nitzschia* sp and *Dinophysis* sp can be caused dinoflagellate blooms. It is a bad condition for the aquatic environment [14].

The most dominating phytoplankton are *Rhizosolenia* Sp., *Chaetoceros* Sp., and *Bacteriastrum* Sp. this phytoplankton is natural foods for fish that live in the sea [1]. Cyanobacteria, for example, *Oscillatoria* Sp. is is a plankton that can photosynthesize. Morphology of *Oscillatoria* sp. is in the form of filaments. An abundance of *Oscillatoria* sp. affect DO concentrations in the aquatic environment, the habitat in fresh water and calm water area [19]. Increases of green algae (*Pediastrum* Sp., *Scenedesmus* Sp., *Coelastrum* Sp. etc.) can be caused harmful algal

blooms (HABs) in coastal waters, and open sea. *Synedra* Sp is algae are bioindicators showing that aquatic ecosystem has high nitrate and phosphate levels. *Ceratium* sp is non-toxic but requires high O_2, furthermore, it can reduce dissolved oxygen. It can be concluded, land degradation has encouraged the use of inorganic fertilizers by farmers, which is finally washed out of the land through surface runoff and residual irrigation water. Residues from inorganic fertilizers, in the form of nitrate and phosphate solutions, are carried to the water flow in the river, which ultimately impacts on water quality [26].

4. Conclusion and Recommendation

This research has described the physical, chemical and biological variables of aquatic ecosystems to assess water pollution and ecological status. The results showed that the aquatic environment was moderately polluted with a phytoplankton diversity index of 1.07-2.06. This research needs to be continued because it is useful for maintaining the ecological status of aquatic environments. Pollution of the aquatic environment by domestic and industrial waste is a problem that needs to be soluted by the relevant government in collaboration, with the purpose of reducing the risk of disease in the community.

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