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The relationship of phytoplankton density to nitrate and phosphate content in the Small Kei Sea waters of Southeast Maluku District

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Abstract

The sea waters of the small Eastern Kei subdistrict and the small southern kei districts are two of the few sub-districts in the small seas of the island. The condition of these two waters is highly dependent on the activities of the people living around them. Domestic waste disposal in the form of domestic waste into the waters is very influential on the condition of the waters and the life of the organism. The impact of waste discharges will affect the quality of the waters among which allegedly can affect the content of nitrate and phosphate. The purpose of this study was to determine the abundance of phytoplankton and its relation with nitrate and phosphate content in the sea waters Kei Keci, Southeast Maluku Regency. The method used for calculation of plankton abundance per liter using APHA formulation (1998 in Rumanti 2013), Nitrate and phosphate analyzes contained in water samples were tested in the laboratory and data analysis was performed using SPSS 20 software. The results showed the type of phytoplankton dominating both stations is Nitzschia nitzschilla with cell density of 167 - 192ind/l, the nitrate content ranges between 1.025 - 1.65mg/l, the phosphate content ranges from 0.34 to 0.38mg/l. The nitrate variable with ketata phytoplankton in sea waters of Kei Kecil is 0,992 with probability 0,041 <0,05, and phosphate variable with phytoplankton density 0,948 with probability 0,103 <0,05, then H0 is rejected, meaning that there is correlation/correlation between phosphate content in the small Kei sea with the density of phytoplankton.

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Introduction

Southeast Maluku is an archipelago region divided into two islands namely small kei island and island magnitude. Both islands are divided into several subdistricts. The sea waters of the small Eastern Kei subdistrict and the small southern kei districts are two of the few sub-districts in the small seas of the island. Both sub-districts have large marine waters and are rich in marine resources that can be utilized by coastal communities. The condition of these two waters is highly dependent on the activities of the people living around them. Domestic waste disposal in the form of domestic waste into the waters is very influential on water conditions and organism life. The impact of these waste discharges will affect the quality of waters among them allegedly can affect the content of nitrate and phosphate.

Substances are necessary and have an influence on the process and the development of living organisms such as plankton, especially nutrients nitrate and phosphate. The high low productivity of a waters is determined by the availability of nutrients in the waters. Nitrate and phosphate nutrients have an important role to the living tissue of living organisms and photosynthesis process. Nitrate ion (NO3-) is the most dominant form of nitrogen compounds in natural waters and is essential for the growth of plants and algae. Nitrogen compounds are produced from the perfect oxidation process of nitrogen compounds in the water. According to Effendi, (2003) nitrification is an important oxidation process in the nitrogen cycle. One of the important elements needed to sustain aquatic life is the phosphorus nutrients. Soil erosion, industrial effluents, discharges of animal waste and weathering of rocks that form phosphates. Detergent compounds are the largest compounds to produce contamination caused by phosphorus (Yudya, 1991). The diversity of species and the indicator species of plankton can be used as biological indicators that can determine the quality of the waters. Biological indicators, water levels of fertility, and also water pollution phases can be determined by the presence of plankton (Elfinurfajri, 2009). This study aims to determine the content of nitrate and phosphate, as well as abundance of plankton in the small eastern kei sea and small southern eastern kei.

Materials and methods

Tools and Materials

The tools used in the study planktonnet, scoop, sample bottles, markers, paper lebel. The materials used are water samples, plankton samples from small East Kei sea waters and small South East Kei, lugol and aquades. This research was conducted in both waters of Southeast Maluku Regency. This research is suvei field. According to Suharto and Miryanti (2003), research methods are undertaken to obtain facts found in the field through survey methods.

Analysis

Analysis of nitrate and phosphate present in water samples was tested in the laboratory, identification of plankton using Toshihiko plankton identification key (1964). Plankton calculation using microscope with 10 x 10 magnification. Samples placed on caver glas. Use the APHA formulation (1998) in Rumanti (2014).

Results and discussion

Abundance and Phytoplankton Biological Index

Based on the research that has been done, the result of the abundance of phytoplankton type observed in laboratories in the waters of Kei Kecil Timur and Kei Kecil Timur Selatan are submitted in table 1 below.

Table 1. Data of Abundance of Jensi Phytoplankton on Kei Sea Kecamatan.

Class	Name Species	Station I	Station II
Bacilliariophyceae	*Nitzschia nitzschilla*	192	167
	Rhizosolinia longista	125	132
	Leptocylindrus minimus	60	-
	Melosira arenaira	41	-
	Bacillaria paxillifera	17	-
	Odontella aurit	16	-
	Rhizosolenia alata forma curvirastris	83	-
	Nitzschia sigma	184	-
	Melosira arenaira	-	10
	Bacillaria paxillifera	-	21
	Surirella ovata var	-	12
	Bacillaria paradoxsa	-	9
Zygnematophyceae	*Hyalotheca mucosa*	59	20
Mediophyceae	*Skeletonema costatum*	67	-

Class	Name Species	Station I	Station II
Trebouxiophyceae	*Nanochlorella*	75	-
Coscirodiscophyceae	*Chaetoceros radiscans*	59	-
	Chaetoceros rotosparus sp.	33	-
	Chaeteceros calcitram	42	-
Fragilariophyceae	*Asterionella formosa*	24	-
	Abundance of Individuals (ind/l)	1077	371
	Number of Species	13	7
	H (Diversity Index)	2.887	2.137
	D (Dominance Index)	0.1009	0.2417

The results of phytoplankton observations found in the small Kei sea waters that have been presented in Table 1 show that, on station one there are 16 species of phytoplakton divided into 6 classes of phytoplakton. The number of *Bacillariophyceae* class consists of 13 species of phytoplankton which have the largest number of species compared to the other five phytoplankton classes. Bacillariophyceae is one of the phytoplankton classes often found in waters.

The most dominant algae phyla in both stations in the small Kei sea waters is the Bacillariophyceae class. *Nitzschia nitzschilla* is one of the species of the *Bacillariophyceae* class whose individuals dominate both stations compared with the other twelve types. In the polluted waters are often found Bacillariophyceae class of phytoplankton because *Bacillariophyceae* has the best body resistance and can adapt to poor water conditions. This is in accordance with Wetzel (1983) in Rudiyanti (2014) *Bacillariophyceae* class phytoplankton which has a high tolerance growth rate and is able to adapt to environmental growth and is able to utilize nutrients well compared to other species.

Fertility from a waters can be determined through the abundance value of phytoplankton present in these waters. The total abundance value of phytoplankton at station one is 1077Ind/L and at station two is 371Ind/L. *Nitzschia nitzschilla* is the highest type found in both stations. This is consistent with that proposed by Thessen *et al.*, (2005) explains that growth of *Nitzschia* sp. Occurs relatively frequently in some areas that have several seasons and in various locations. In addition, the unequal distribution of phytoplankton at both stations is influenced by water quality parameters. This is in line with the opinion expressed by Hamahu (2004), that the physical and chemical factors of waters such as wind, currents, and nutrient content greatly affect the distribution and distribution of phytoplankton in the waters. The results showed a higher abundance of phytoplankton found in station one compared to station two. This is in accordance with Effendi (2003) said that the decrease in phosphate levels in waters along with the increase in the number of phytoplankton cells and diatoms in the waters. One essential element for high-level plants and algae is phosphate, so this element also becomes one of the limiting factors for plants and algae and greatly affects the level of water productivity.

The calculation of the diversity index value (H') in this study indicates that at one station the value of diversity index of 2,887 and station two of 2,137, this means the diversity value at stations one and two does not address significant differences so that the diversity of phytoplankton in both stations attributes the diversity of phytoplankton medium. Basmi (1999) in Fachrul (2007) stated that the value of diversity 1 <H"<3 indicates moderate community stability. One of the factors suspected to affect the diversity of phytoplankton in waters due to ecological factor pressure of coastal waters around it due to disposal of household industry waste and other ecological factors that resulted in pollution, but also because the dynamics of physical, chemical and biological factors that occur in the water during observation.

The value of the dominance index at station one is 0.1009 and station two is 0.2417. The results of the dominant value of these two stations showed no significant difference between the two stations. The value of dominance index in the sea waters Kei Kecil for both stations there is no type of phytoplankton dominating these waters. According to (Odum, 1971) in (Rumanti, 2014) states that the index value of dominance <0.5 means no dominant type, if the index of dominance> 0.5 means there is a certain type that dominates.

The dominance index ranges from 0 to 1 if it is lower close to 0 then it is assumed that no species dominate other species although there are more species than the other species.

Content of Nitrate and Phosphate in Small Kei Sea Waters

Based on the results of research nitrate and phosphate content in the sea waters Kei Kecil can be presented in table 2 below.

Table 2. Measurement Data of Nitrate and Phosphate Content in Small Kei Sea Waters.

No	Concentration	Station			Reference
		I	II	Category	Book quality grade wastewater. II (PP No. 82 Tahun 2001)
1	Nitrat (mg/l)	1.65	1.025	Low	10mg/l
2	Fosfat (mg/l)	0.38	0.34	High	0.02mg/l

The results in Table 2 show that, the value of nitrate content in two stations ranged from 1.025 to 1.65mg/l. Based on the standard quality of class II wastewater (PP No. 82 of 2001), it shows that in a waters have a threshold value of 10mg/l this means that the results of nitrate content obtained in the sea waters Kei Kecil jahu below the limit of the abang determined and is included in the low category.

Availability of nitrate content in a waters is estimated to be influenced by water quality parameters that is dissolved oxygen content. This is in accordance with Yuliana *et al*., (2012) which states that one of the factors that may affect the activity of microorganisms in the process of decomposition of organic matter is the low dissolved oxygen content in the waters. The nitrate content will be a limiting factor when the value is less than 0.114 ppm, since the optimal nitrate content for phytoplankton growth is in the range of 3.9ppm - 15.5ppm (Mackentun 1969 in Sanaky 2003).

Based on the results of phosphate testing in Kei Kecil waters shows the value of phosphate deposits of 0.38 to 0.34mg/l. The highest phosphate content is at station I. Based on PP. No. 82 Year 2001 standard waste water quality class II, the value of phosphate threshold in the water is 0.02mg/l.

This means that the value of phosphate content in the sea waters Kei Kecil into the high category. Disposal of industrial wastes and domestic wastes around the coastal areas is suspected to affect the high and low phosphate content in the waters. Phosphate content in the small Kei sea waters exceeding the quality standard threshold is allegedly not only derived from industrial and domestic waste disposal but juaga comes from weathering plants or water itself. This is in accordance with the opinion of Sanaky (2003) that the natural sources that can produce phosphate content in the water come from soil erosion, animal waste, industrial waste, domestic and weathering of plants or waters themselves, phosphate in the waters. In the phytoplankton growth process requires phosphate content ranging from 0.27 to 5.51ppm, while the phosphate content less than 0.02mg/l will be the limiting factor in the waters. The results of measurement of phosphate content in small Kei waters still can be tolerated by phytoplankton in its growth process.

Relationship Abundance of Phytoplankton with Nitrate and Phosphate Content

The result of the test of the relation of phytoplankton abundance with the content of nitrate and phosphate in small Kei waters by using SPSS 21 swofer can be presented in table 3.

Table 3. Correlation between density of phytoplankton with nitrate and phosphate content in sea waters Kei Kecil.

		Phytoplankton Density	Nitrate	Phosphate
Pearson Correlation	Phytoplankton Density	1,000	,992	,948
	Nitrate	,992	1,000	,981
	Phosphate	,948	,981	1,000
Sig. (1-tailed)	Phytoplankton Density	.	,041	,103
	Nitrate	,041	.	,063
	Phosphate	,103	,063	.
N	Phytoplankton Density	3	3	3
	Nitrate	3	3	3
	Phosphate	3	3	3

The result of regression test using shower SPSS 20 showed that the correlation matrix between nitrate variables with the density of phytoplankton in sea waters of Kei Kecil was 0.992 with probability 0.041 <0.05, then Ho was rejected, meaning that there was

a significant correlation between the nitrate content and density of phytoplankton in sea waters of Kei Kecil, and for phosphate content variable with density of phytoplankton equal to 0,948 with probability 0,103 <0,05, then Ho is rejected, meaning that there is correlation between phosphate content in small seas Kei Kecil with density of phytoplankton. The presence of phytoplankton in waters is influenced by the availability of nitrate and phosphate, and other water quality parameter factors. This is thought to be caused by nutrients are used well for the growth of phytoplankton. Nutrient content such as nitrates, phosphates, silicates, and other nutrients are closely related to the abundance of the phytoplankton community in aquatic (Prescott, 1970 in Rudiyanti 2014).

Conclusion

The type of phytoplankton dominating the two stations was Nitzschia nitzschilla with cell density of 167-1192ind/l, the nitrate content ranged from 1.025 to 1.65mg/l, the phosphate content ranged from 0.34 to 0.38mg/l. The nitrate variable with ketata phytoplankton in sea waters of Kei Kecil is 0,992 with probability 0,041 <0,05, and phosphate variable with phytoplankton density 0,948 with probability 0,103 <0,05, then Ho is rejected, meaning that there is correlation/correlation between phosphate content in the small Kei sea with the density of phytoplankto.

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