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Composition and Diversity Phytoplankton in Inner Ambon Bay

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Abstract: Ambon Bay water have potencial fisherry. Especially small pelagic fish. That fish depend on phytoplankton as have food. This study aims to Determine the composition, and density of phytoplankton in relation to the characteristics of the waters. Phytoplankton sampling was done vertically by using a plankton net Kithara to Pebruary 2015. Th at study found 83 speci es of phytoplankton roomates Consist of Bacillariophyceae (58 species), Dinophyceae (24 species), and Silicoflagellata (1 species). Diversity indexs (H') of phytoplankton between 1.927-2.522. In that waters dominated by *Chaetoceros Diversus, Chaetoceros compressus, Chaetoceros affinis, Chaetoceros curvicetus,* and *Rhizosolenia styliformis.* Beside that phy toplankton harmfull *Alexandrium* found with density of 0.02%. T he correlation of the physical and chemical characteristics of the waters with an abundance of phytoplankton Showed that Group I Consist of Station 5, 6, and 7 dominated by *Chaetoceros didymus, Pseudoguinardia recta* and *Rhizosolenia decipiens* the which is influenced by the DO, temperature, NH_3, DIN: DIP and DIN: DSi, group II Consist of Station 2 and 3 dominated by *Thalassiothrix longissima, Ceratium macroceros, Chaetoceros coarctatus* and *Eucampia cornuta* the which is influenced by secchi depth and salinity.
Keyw ords: Phy toplankton, composition, Diversity, *Inner Ambon Bay (TAD).*

Introduction

Ambon Bay is an area of fishing potential, in particular in Inner Ambon Bay (TAD) to the beginning of 1984 is known as bait fish farm[10]. According Syahailatua[8] Ambon Bay is one of the catching small pelagic fish in the Moluccas, as well as the fields of bait fish anchovies *(Stelophorus* sp) in this bay too much caught fish *Sardinella* sp), *Rastreliger* sp, *Decapterus* sp and *Selar* sp. The development progress more rapidly resulting in the condition of the bay of Ambon, especially Inner Ambon Bay (TAD) gets heavy pressure, with the use of the land over to residential areas resulting in sedimentation in coastal areas, the activity of sea transport cause oil spills, disposal of household waste and industrial, and enter the nutrients from land via rivers and the Outer Ambon Bay (TAL), especially during an *upwelling,* resulting in changes in the aquatic environment. These changes further affect marine organisms that live in it, one of the marine organisms that play an important role for the productivity of a body of water is the plankton community.

Phytoplankton vital role in aquatic ecosystems as the basis of life. Through the food chain of organic materials can reach the consumer organisms of higher trophic levels (fish). The purpose of this study was to

determine the composition and density of phytoplankton and relationship with the physical-chemical parameters in the waters of the Inner Ambon Bay (TAD)

Research Method

The research was conducted in the waters of Inner Ambon Bay (TAD) The island of Ambon, Maluku province. Geographically located at position 128 ° 19'4.03 "- 128 ^{0} 24'33" east longitude and 03.66 ^{0} 39'29 "- 03.63 ^{0} 30'30" latitude. Sampling was conducted in February 2015 at 10 research stations (Figure 1)

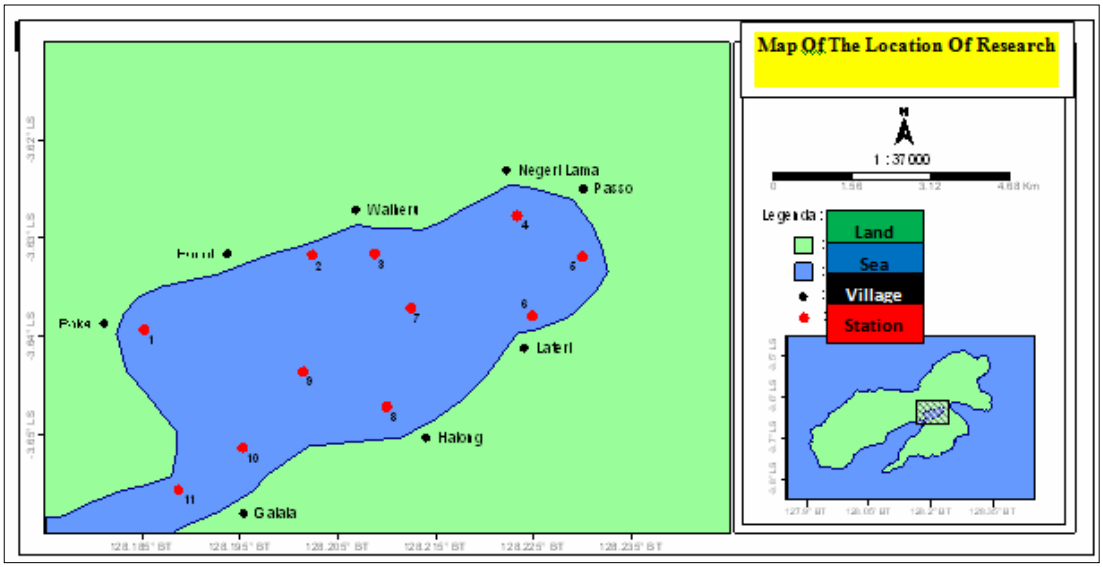

Figure 1. The Research Location In The Waters Of The Inner Ambon Bay (TAD)

Determination of the position of the station using GPS-Garmin, 76CSx Model. Water samples were used to measure salinity, pH, dissolved oxygen, nitrate, nitrite, ammonia, phosphate and silica taken with Nansen bottles. The temperature is measured with a thermometer, with refractometer salinity, pH is measured by a pH meter, brightness measured by sechi disc *(disc secchi)* diameter 30 cm, dissolved oxygen is calculated by Winkler titration, while nitrate, nitrite, ammonia, phosphate and silica using standard methods[5]. Sampling is done vertically phytoplankton at a depth of 4 meters up to the surface by using a plankton net type with a diameter KITAHARA net mouth 0:30 m, length of 1 m, and a mesh size of 60l m. Preserved plankton samples obtained using 4% formalin.

Identification of phytoplankton are carried out according to Yamaji[11], Newell and Newell[2], and Thomas[9] until the species level. The abundance of phytoplankton cells is calculated by the equation dikemuka Perry (2003) as modified by Huliselan et al[1] as following:

$$\mathbf{D} = \frac{Nf x Vp}{V}$$

Where: D = abundance of phytoplankton (ind / m $^{3)}$
N_f = Number of individuals per 1 ml
V_p = Volume enumeration
V = volume of filtered water (m $^{3)}$
Filtered water volume is calculated using the formula proposed by Newell and Newell[2] as follows:

$$\mathbf{V = \pi . r^2 . l}$$

where, **V** = the volume of filtered water (m $^{3)}$
π = constant worth 3:14
r = radius of the mouth of the net plankton net
l = distance covered by nets (meters)

Calculation of indices ecology such as the density of species (species density, d), species diversity (Shannon Wiener diversity index, H ') dominance species (Simpson's index, λ) and harmony species (Pielou's evenness index, J'), using the program PRIMER -5

Further to the variation determiner variabel environmental characteristics with phytoplankton community calculations used ordinated Canonical Correspondence Analysis (CCA) was performed using MVSP software version 3.1.

Results and Discussion

Phytoplankton Composition

H acyl phytoplankton identification of 10 research stations in Inner Ambon Bay (TAD found 83 species of phytoplankton and classified into 3 classes, 7 orders, 22 famil i, 40 gen era (Table 3). In general, phytoplankton is dominated by class *Bacillariophyceae* (diatoms) there is a high variation of species 58 species (68, 23% of the total species), Dinophyceae 2 4 species (30,59% of the total species) and Silicoflagellata 1 species (1,18% of the total species) (Figure 2).

Based on the distribution of the amount of phytoplankton species found in the waters Inner Ambon Bay (TAD) (Figure 2), Station 1 (Poka) and Station 10 (Galela) has the highest number of species (respectively 42 and 39 species). Instead Station 2, 3 and 4 had the lowest number of species. Station 2 is only found 20 species of phytoplankton, while Station 3 and 4 respectively found 23 species of phytoplankton.

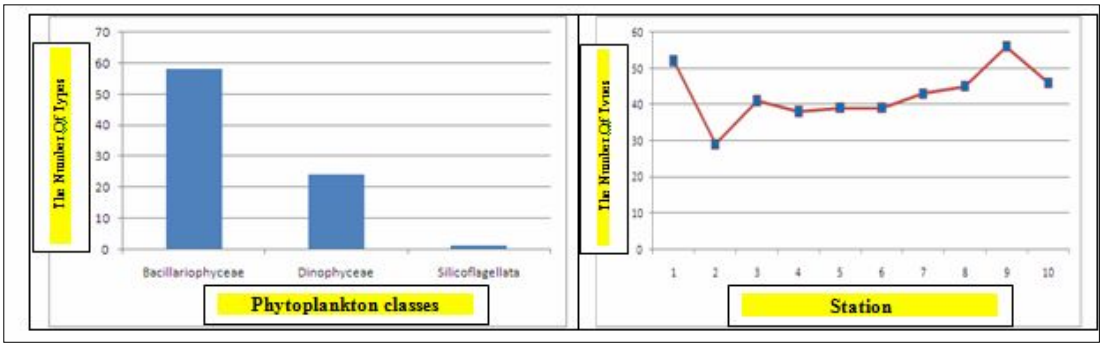

Figure 2. Phytoplankton Groups And The Number Of Species Found In Inner Ambon Bay (TAD)

Diatoms are generally abundant in the waters in the world and usually dominate the phytoplankton community in coastal waters (Lalli and Parsons[3], 1993 and Romimohtarto and Juwana, 2005). Based on the distribution of the number of species, the station 9 has a number of species of phytoplankton highest (56 species) and the lowest at station 2 (29 species).

Twenty-one species of phytoplankton found in all the research station in Inner Ambon Bay (TAD) (the percentage of attendance of 100%) is *Bacteriastrum furcatum, Bacteriastrum hyalinum, Chaetoceros affinis, Chaetoceros curvisetus, Chaetoceros Diversus, Chaetoceros lorenzianus, Hemiaulus sinensis, Eucampia cornuta, Pseudozolenia calcar-avis, Rhizosolenia decipiens,Rhizosolenia imbricata, Rhizosolenia styliformis, Planktoniella sol, Pseudoguinardia recta, Thalassionema nitzschiodes, Thalasiothrix longisima, Ceratium fucus, Ceratium macroceros, Ceratium tripos, Dinophysis miles* and *Protoperidinium depressum.* There are some phytoplankton species that are only found in stations in particular that *Asteromphalus sp, Gossleriella tropica, Biddulphia sinensis, Melosira nummuloides, Bacillaria paxillifera, Odontella aurita, delicatula Navicula, Nitzschia spp* and *Prorocentrum gracile.* The types of phytoplankton found in all stations of this research show that generally these species has spread widely in the marine waters and are thought able to adapt to the environmental conditions. Instead types of rare or are only found in certain stations indicate that these species have a narrow spread.

Results of analysis of phytoplankton species similarity index between stations in the waters Inner Ambon Bay (TAD) (Table 1) show that the phytoplankton species similarity between stations ranged between 51, 84% and 88.27%. This indicates that more than 50% of the same species of phytoplankton found in the

station will be found also at another station. The highest similarity index of species was found at station 7 and 8 stations (88, 273%) which means that there are about 88, 273% of phytoplankton found in station 7, is also found in the station 8. If the value of Index This is imilaritas in Table 1 associated with the species proposed criteria similarity Hutauruk (2009), the similarities between the species phytoplankton research stations both in the waters Inner Ambon Bay (TAD) category iRip m (S = 50 to 75%) to very similar (S = 75-100%).

Table 1. Phytoplankton Species Similarity Index Between Stations Ambon In The Gulf Waters

	1	2	3	4	5	6	7	8	9	10
1										
2	51.84									
3	58.045	69.726								
4	70.815	68.027	72.705							
5	64.575	66.882	73.145	80.269						
6	67.715	58.682	63.054	78.254	77.322					
7	70.674	58.462	63.052	82.168	74.229	81.518				
8	69.996	64.038	66.43	79.83	75.07	77.019	88.273			
9	68.499	57.458	60.549	75.828	70.389	76.495	77.54	76.265		
10	65.291	61.432	60.97	76.879	70.988	77.024	82.102	80.897	77.628	

Phytoplankton Abundance

The abundance of phytoplankton in the waters Inner Ambon Bay (TAD) (Figure 3) ranged between 1.29 x 10^6 cells / l - 6.06 x 10^6 cells / l with an average abundance of 3.0 x10^6 cells / l. The highest phytoplankton abundance was found in Station 1 (6,06x10^6 cells / l) and the lowest abundance found in Station 2 (1,29x10^6 cells / l). High phytoplankton abundance at each station research related to presence some species of phytoplankton abundant with the highest percentage (Table 2). Based on the abundance of phytoplankton species, then *Chaetoceros Diversus* have a high proportion abundance at Station 2 up to 10 stations, while *Chaetoceros affinis* at station 1

3 of 8 phytoplankton species found in the waters TAD at the time of this study, *Chaetoceros Diversus* is the most dominant species. Parsons *et al.*[5] states that generally diatoms dominate the waters in the world and *Chaetoceros* is the dominant genus.

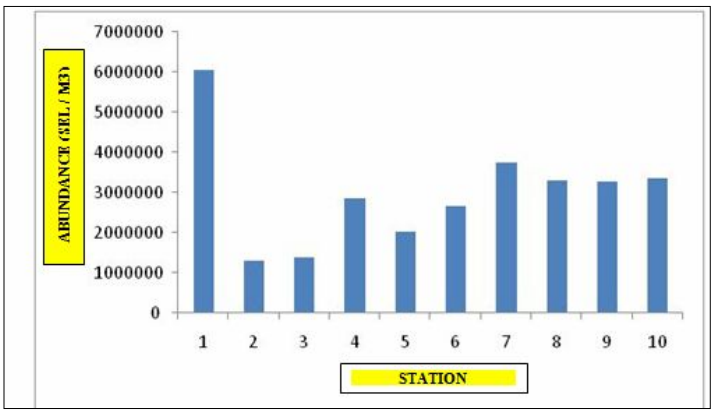

Figure 3. Abundance Of Phytoplankton Found In Every Station

Based on the abundance of phytoplankton dominate the class Bacillariophyceae each station. Table 2 shows that the abundance of phytoplankton species that dominated the waters are Bacilariophyceae class with the highest percentage. The dominant species are of *Chaetoceros Diversus, Chaetoceros compressus, Chaetoceros affinis, Chaetoceros curvicetus* and *Rhizosolenia styliformis.* F itoplankton toxic namely *Alexandrium* was found with abundance slightly (0.02%). Different conditions occurred in 2012 where there is a population explosion of phytoplankton dominated by genus *Trichodesmium, Chaetoceros, Alexandrium* and *Bacteriastrum* (Pello *et al* 2014)[6]. The occurrence of succession in Inner Ambon Bay (TAD) waters caused by changes in physical-chemical conditions of the waters.

Table 2. Species Abundance Of Phytoplankton With The Proportions (%) Dominant In Inner Ambon Bay (TAD)

Spesies Fitoplankton	St 1	St 2	St 3	St 4	St 5	St 6	St 7	St 8	St 9	St 10
Chaetoceros affinis	18.95	6.95		9.96	16.06	10.67	13.96	13.81	5.64	7.54
Chaetoceros diversus	18.58	33.39	46.03	41.83	41.29	30.11	41.05	40.31	35.30	53.98
Chaetoceros compressus	15.49		5.51	11.36	15.05	22.48	13.15	13.43	9.81	9.03
Rhizosolenia styliformis	10.62	3.31		4.91	3.29	6.62	3.32	2.35	8.43	3.96
Chaetoceros curvicetus	10.31	23.73	7.32	7.14	7.30	4.22	5.37	7.22	5.02	2.52
Thalassiothrix longissima	9.07	6.78	11.44	2.73				2.89		
Pseudosolenia calcar-avis	5.92	4.21		2.99	1.94	5.31	2.46		6.22	2.04
Thalassionema nitzschioides	4.18	4.97	4.61	3.28	3.87	2.42	3.05	3.82		3.38
Chaetoceros lorenzianus	1.46	3.52	2.26		1.13	5.45	2.32		2.95	2.02
Chaetoceros coarctatus	0.76		1.86							
Rhizosolenia imbricata		3.06	2.25	4.81	2.17		2.11			
Ceratium macroceros		2.75	3.20							
Eucampia cornuta			4.20					2.38		
Bacteriastrum furcatum				2.16	1.53	3.39	3.82	3.78	3.14	5.40
Rhizosolenia decipiens						1.23				
Hemiaulus sinensis								1.35		
Pseudoguinardia recta									4.16	
Chaetoceros didymus									3.07	1.31

Diversity Type Phytoplankton

Results of calculation of the index value keanekar their beliefs type (H') of phytoplankton between 1,927 - 2,522 (Figure 4). The value of the highest species diversity was found in Station 9 with a value of 2.522. This shows that the waters Inner Ambon Bay (TAD) has a diversity of phytoplankton are classified as moderate, whereby if 1.0 <H <3 Inya diversity of art being (produktiv itas pretty good, fairly balanced ecosystem, ecological pressure balanced) (Odum, 1975). This is supported by the species dominance index which ranges between 0.1302 - 0.313.

Value uniformity index types (J') of phytoplankton ranged from 0.50 – 0.64 and averaged 0.58 (Image 4). A value of 'the highest in station 2 with a value of 0.64. This index value is above 50% of the population of phytoplankton in the waters Inner Ambon Bay (TAD). This is supported by the value H 'which indicates that the diversity of phytoplankton are in a moderate value. Theoretically, the value of Index This dominance species (λ) ranging between 0-1. If the dominance index (Λ) is close to 0 means almost no dominant species in the community. Conversely, if the index of dominance (Λ) approaching 1 means there is a dominant species in the community (Odum, 1975). N use values dominance index (λ) in February 2015 in the waters Inner Ambon Bay (TAD) range between 0.13- 0.31 (Figure 4). N use values obtained dominance index shows the level of dominance that the species is low. This can be seen in Table 2 where the species of phytoplankton *Chaetoceros* sepe RTI *Diversus, Chaetoceros affinis, Chaetoceros compressus, Chaetoceros curvicetus* and *Rhizosolenia styliformis* found in large enough quantities compared to other species. The species of phytoplankton gives a contribution of 73.84% to the value of the dominance of phytoplankton in the Inner Ambon Bay (TAD). Instead 7 8 phytoplankton species that are rare (low abundance) only contributes 26.16% of the abundance of phytoplankton in these waters. This is consistent with the statement Odum (1975)[4] that species are common biota (dominant) contributed greatly to the value of the dominance of biota in the marine community.

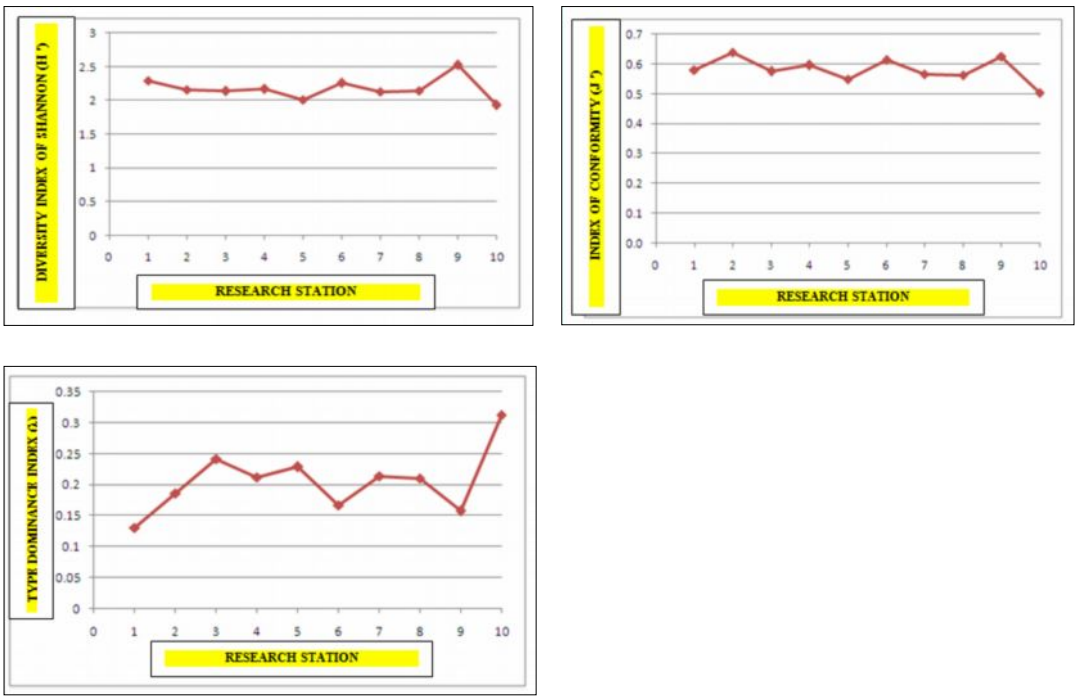

Figure 4. Index of Diversity, Harmony And Dominance Type Phytoplankton In The Inner Ambon Bay (TAD Found In Water

Characteristics of environmental variables on Phytoplankton community

Results ordination between phytoplankton community with environmental variables in each season with CCA triplot presented in the graph (Figure 5). On three main axes chart triplot obtained the eigenvalue of 0.16; 0.08 and 0.0 8 with information about the cumulative percentage of unexplained by 73,51 %. S ecara tiplot common chart shows two groupings of observation stations. Group I represents the St 5, St 6, and St. 7 dominated by *Chaetoceros didymus, Pseudoguinardia recta* and *Rhizosolenia decipiens* influenced by the DO, temperature, NH3, DIN: DIP and DIN: DSi, while K elompok II represents St 2 and St 3 dominated by *Thalassiothrix longissima, Ceratium macroceros, Chaetoceros coarctatus* and *Eucampia cornuta* which is influenced by the brightness and salinity. The longer the arrow the variables that lead to the type and observation stations, the contribution of these variables on the types and the greater the observation station.

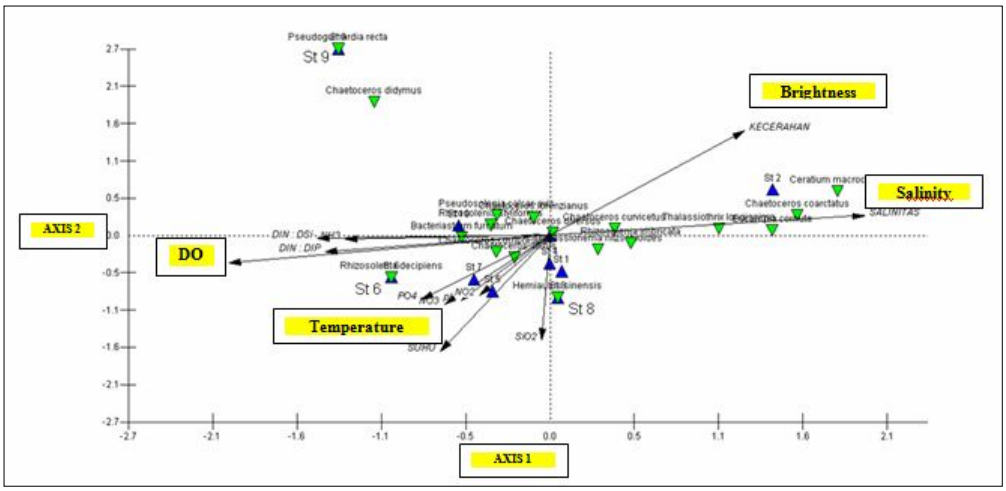

Figure 5. Graph triplot results ordinated by the phytoplankton density environment variables In Inner Ambon Bay

Conclusion

1. 83 phytoplankton species found in the waters of the Inner Ambon Bay (TAD) in February 2014 and is dominated by the class Baccilariophyceae
2. The abundance of phytoplankton in the waters of the Inner Ambon Bay (TAD) was found highest in station 1, and the lowest at station 2.
3. Index of phytoplankton species diversity found in the waters of the Inner Ambon Bay (TAD) is classified, but there is no dominance of certain species.
4. Two groups were formed based stations physical-chemical characteristics of the aquatic environment which is characterized by different types of phytoplankton dominant at each station.

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