Study of Plankton Community and Environmental Factors in Connection with Sea Water of Bontang City, East Kalimantan Province, Indonesia.

Nilam Sari

Sekolah Tinggi Teknologi, Bontang, Kalimantan Timur, Indonesia

Abstract

Have do research of plankton communities study And conjunction with environmental Factors in Aquatic Bontang, East Kalimantan, which was conducted in May through September. In that study, the problems to be observed is a condition characterized Bontang waters of the plankton community related to water quality conditions. The purpose of this study was to calculate the index of diversity and eveness of plankton, knowing the quality of the water into waters Bontang environmental factors, and the correlation between diversity and eveness index plankton to marine water quality in the city of Bontang. Contribution of this research is done can be a reference in the management of coastal areas in the city of Bontang in an integrated and sustainable. The approach taken is to review the conditions of visual spaciousness location will done the station point, and what activities are going on at that location. Marine waters along the Bontang determined five station which is considered to represent the condition of marine waters Bontang. Station 1 is the location on the south end of town Bontang which is not far from the location of the coal industry there, Station 2 is the selected location is not far from the gas industry, location 3 is the location of the fishing community activity is quite crowded, Station 4 is the location there are many mangrove forests, and Station 5 is a location not far from the fertilizer industry. The method used is to identify plankton at station specified in Bontang city water then compute the diversity and eveness index, and analyze water quality. After that look for correlations. The results of this study are outlined, 1,2,3 and 5 stations need a lot of attention because of the location it was found several indications of poor water quality and low plankton diversity index values. For station 4 the condition of waters better than the four locations to another station. This is because there are still many mangrove forest at the location of the station. By looking at the results of these studies and inputs to the Bontang city government to give more attention to the location that is considered poor water quality and low diversity index, can perform monitoring and more intensive evaluation, as well as a persuasive approach to companies that are around each location stations 1,2 and 5, as well as to communities around the location of the station 3, in order to avoid contamination of water in the sea city of Bontang.

.

1: Introduction.

1.1.Background Issue

Bontang is located in the province of East Kalimantan and has an area of 220 km coastal waters (extending 20 miles north to south and 11 km to the sea or east). Aquatic ecosystems peraian rocky Bontang is associated with seagrass and mangroves as well as the beauty beneath the sea have shown that there's also a variety of ornamental fish and other marine life that live in the waters of Bontang.

Bontang also has vast natural resources (producer of natural gas, coal and oil) and own a few strategic industries that manage these natural resources. The industry is in some areas along the coast Bontang. The presence of the industry provide significant environmental burden in the presence of industrial activity that occurred along the coast. The environment can be a burden and waste ship activity in the industrial area.

Bontang community activities that are along the coast also provide environmental impact with domestic sewage and solid waste dumped in the waters . This activity causes turbidity in the water . These conditions make coastal ecosystems Bontang be disturbed.

One of the biological parameters are monitored in conjunction with the presence waters of the environmental burden arising from industrial activities and the community is plankton . Selected plankton because plankton are unicellular aquatic organisms have an important role in the ecosystem (Fahrul , 2005) . The existence of plankton reflects the condition of a body of water (Dianthani , 2003).

Plankton consisting of phytoplankton and zooplankton have a sensitivity to environmental changes that occur in waters (Dahuri , 2003) . Each species of plankton have adaptability and tolerance to environmental changes differently (Fahrul , 2005) . To determine the condition of the plankton in the waters of Bontang city , then to identify the type and quantity to determine the diversity index and uniformity index .

Bontang community activities that are along the coast also provide environmental impact with domestic sewage and solid waste dumped in the waters . This activity causes turbidity in the water . These conditions make coastal ecosystems Bontang be disturbed.

One of the biological parameters are monitored in conjunction with the presence waters of the environmental burden arising from industrial activities and the community is plankton . Selected plankton because plankton are unicellular aquatic organisms have an important role in the ecosystem (Fahrul , 2005) . The existence of plankton reflects the condition of a body of water (Dianthani , 2003).

Plankton consisting of phytoplankton and zooplankton have a sensitivity to environmental changes that occur in waters (Dahuri , 2003) . Each species of plankton have adaptability and tolerance to environmental changes differently (Fahrul , 2005) . To determine the condition of the plankton in the waters of Bontang city , then to

identify the type and quantity to determine the diversity index and uniformity index .

Environmental factors that are considered important in the plankton community and represent mempengaruhin profile Bontang city water environment are temperature, pH, brightness, DO, and BOD. The fifth parameter is a fundamental parameter in characterizing the condition of a body of water (Akrimi, 2002).

Interactions between plankton with environmental factors in coastal waters Bontang can be used to assess the condition of the aquatic ecosystem Bontang. Therefore, it is necessary to study of the plankton community and its relationship with environmental factors in the area of municipal waters Bontang. The depiction of the plankton community can dipakiai as a reference in the management of coastal areas in the city of Bontang in an integrated and sustainable.

II : Literature Review

2.1 Marine Aquatic Ecosystems

2.1.1 . The properties of water

Water is there any substance that surrounds all marine organisms , and also the biggest part of the body forming plants and marine animals (Effendi , 2003) . Water is also the medium in which the various chemical reactions both inside and outside the body of marine organisms (Effendi , 2003) .

Hydrogen atoms (H) and oxygen atoms (O) contained in water tied to a bond called a hydrogen bond (Sanusi , 2004) . The strength of this bond is very weak , only 6 % of the strength of the bond between the atoms O and H atoms in water molecules (Sanusi , 2004) . This bond is easily formed and easily separated again (Sanusi , 2004) . Hydrogen bonds between two adjacent water molecules and the polarized nature of these water molecules are responsible for many properties of the chemical and physical properties of water are unique (Effendi , 2003).

Due to the hydrogen bonds between water molecules have the tendency to bind together to form a force called cohesion (Effendi 2003) . At the boundary between water and air , the strength of cohesion to form a " skin " on the surface of the water is strong enough to hold small items , called surface tension (Sabo et al , 2007) . The surface tension is the highest of all liquid and allow continuity of association generally good organisms that live under it or move on it (Sabo et al , 2007) . Cohesion is also responsible for the viscosity of water (Effendi,2003).

Water also has a heat of vaporization and high latent heat of fusion (Sanusi , 2004) . The cause of the high values of water requires more heat to cause temperature changes on sejum , was given weight than almost any other substance (Sanusi , 2004) . This high heat capacity which means that water is a strong buffer against temperature fluctuations (Sarwono , 2006) , it also means that the temperature range in suatui smaller bodies of water than in air.

Water has a density relationship - strange temperature . Most liquids become increasingly meeting if it gets colder fluid . If cooled to solid , solid form this fluid becomes more dense than in the form of melting . This does not apply to water , the water becomes more tightly when cooled to 4 ° C , but further

cooling will decrease it and when freezing occurs , it will be a striking decrease in density (Effendi , 2003) . By wort was more ice than water and float in the water (Effendi , 2003) . These properties are important to the life in the oceans because if it were not so, most of the volume of the oceans uninhabitable by the form of clumps of ice that big (Sabo et al , 2007).

Chemical properties of water are important properties with respect to the capacity of the solvent (Purnomo , et al , 2004) . Water is almost a universal solvent with the ability to dissolve more substances than any liquid (Purnomo , et al , 2004).

2.1.2.SeaWater

The sea water is pure water in which various substances dissolved solids and gases (Hayanto , et al , 2008) . The amount of the solute with salinity (Hayanto , et al , 2008) . Some scientists prefer salinity states with one unit per thousand (% o) . Therefore , a typical seawater sample weighing 1000 g containing 35 g of soluble compounds having a salinity of 35% o . Below is a table 2.1 of the main elements and rare elements from sea water 34.8 % (Agusnar , 2007).

Table 2.1 Key Elements and Rare Elements of sea water

ION	% WEIGHT
A. Main	
Klor (Cl^-)	55.04
Natrium (Na^+)	30.61
Sulfat (SO_4^{2-})	7.68
Magnesium (Mg^{2+})	3.69
Kalsium (Ca^{2+})	1.16
Kalium (K^+)	1.10
Sub Total	**99.28**
B. Rare	
Bikarbonat (HCO_3^-)	0.41
Bromida (Br^-)	0.19
Asam Borat (H_3BO_3)	0.07
Stronsium (Sr^{2+})	0.04
Sub Total	**0.71**
TOTAL	**99.99**

Salinity at various places in the open ocean far from shore the narrow variation , ranging from 34-37 % o with an average of 35 ‰ (Agusnar , 2007) . Salinity differences occur because of differences in evaporation and precipitation (Agusnar , 2007) . Higher salinity in the tropics because of higher evaporation (Agusnar , 2007).

Salt content has a definite and obvious influence on the properties of sea water . The maximum density of pure water occurs at a temperature of 4° C , but the density of sea water continued to rise until the freezing point (Agusnar , 2007) . Because it contains salt , lower the freezing point below 0 ° C. This decline becomes a function of salinity . Seawater salinity 35 ‰ freezing point -1.9°C. But with the onset of freezing , the density decreases so that ice floating in the ocean . The significance of the increase in density below 4° C is very cold surface water and the weight can be formed and sinks to the bottom of the ocean (Agusnar , 2007).

The solubility of gases in seawater is a function of temperature . The lower the temperature the greater the solubility . Therefore a colder body of water , the more oxygen it contains . At a temperature of 0°C , seawater has a salinity of 35 ‰ containing ±8 ml / L of O_2 , and at a temperature of 20°C content of 5.4 mL / L O_2 (Effendi , 2003).

2.1.3. Plankton.

Plankton consists of phytoplankton and zooplankton such as plants that are like animals (Afiati , et al , 2007) and are usually caught by the plankton net consists of two major groups , namely

diatoms and dinoflagellates (Afiati , et al , 2007) . Other phytoplankton which is a member of the minority is as blue-green algae (Cyanophyceae) , cocolitofor (cocolithophoridae , Haptophyceae) , and silikoflagelata (Dictyochaceae , Chrysophyceae).

Contrary to phytoplankton dominated by two groups of plants , zooplankton animal nature is very diverse and consists of various larval and adult forms that represent almost all animal phyla (Barners , et al , 2007) . But ecologically subclass of copepods has great significance because it is a very important link between phytoplankton primary production with the large and small carnivores (Barners , et al , 2007) .

2.2. Environmental factors affecting the life of plankton

Various environmental factors such as chemical and physical factors can affect the growth, survival , and productivity of phytoplankton. Environmental factors are referred to as turbidity , pH , temperature , salinity , and oxygen content (DO and BOD).

Photosynthesis can only occurred when the intensity of light reaching a productive phytoplankton cells only in the top layer of a body of water where light intensity sufficient for the continuity of photosynthesis . The depth of light penetration in the sea which is the depth where phytoplankton production can still occurred , depends on several factors , among others, the reflection of light by the surface of the sea and the particles contained in the water, geographic latitude , and season (Dianthani , 2003).

III: Goals and Benefit of Research

3.1 . Research Objectives.

The purpose of this research has been done is to calculate the index of plankton diversity and uniformity , knowing water quality into the aquatic environment factors , and the correlation between diversity and uniformity index plankton with water quality in marine waters Bontang city .

Contribution of this research is conducted may be a reference to the management of coastal areas in the city of Bontang in an integrated and sustainable.

3.2. Benefits of Research.

The benefits of this study was to obtain a data base on plankton and its relationship with water quality in marine waters Bontang city, so that it becomes the input to perform a management policy for coastal areas Bontang city.

IV: Research Methodology

4.1. Description of Study Area.

Selection of study sites based on consideration of the ease in obtaining and reveal important information as well as information about management waste processing results fishery for all members of society, particularly the City Bontang.

Bontang area of the city's land area consists of ± 14.780 ha, wide ocean ± 34. 977 hectares, and has a long beach ± 24.4 km, geographical Bontang lies between latitudes 0^o01’ U - 0^o14’U and between longitudes 117^o23 'T- 117^o38'T. Bontang boundaries with the surrounding areas is as follows:

North : District of Sangatta, East Kutai Regency

East : Makassar Strait
South : District of Marangkayu, Kutai Kartanegara regency.
West : District of Sangatta, East Kutai Regency.

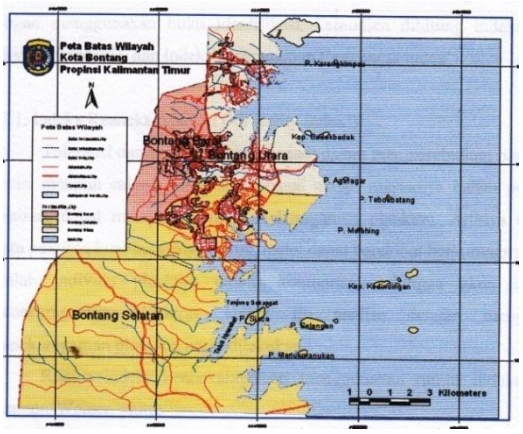


Fig.4.1. Bontang area map

4.2 . Research time

The study started from May to September . Secondary data search starts from the beginning of the study . Plankton sampling at the same time water quality data collection is done afterwards . After that held the identification of plankton and water analysis .

4.3 . Plankton

Plankton sampling was carried out during the day , using jerry cans of 10 liters capacity , and then inserted into the plankton net with a mesh size of phytoplankton (0.053 mm mesh) . Water sampling performed 3 times , so we get the volume of water that will be incorporated into the plankton net as much as 30 liters (3 x 10 liters) . Zooplankton and phytoplankton are netted through plankton net is inserted into the bottle and preservative formalin 4 % a few drops . Sampling stations for plankton samples can be seen in Figure 4.2 .

Water samples were taken to the laboratory to be identified with the type and amount of plankton using identification books , and then calculated diversity index (' diversity index') , and the uniformity index (' evenness index').

4.3.1 . Diversity index (' diversity index')

Tolerance and competitions that occur in getting the living space , oxygen , nutrients and sunlight , as the entry of pollutants into waters , may affect the diversity of plankton . This means that if in a marine water quality is bad, it can result in a reduction of plankton species and number of individuals in the community , so it will affect the diversity of plankton . For the analysis using plankton diversity index needs to be done.

Diversity index formula used Shannon diversity index formula - Weiner , namely :

$$H' = \Sigma Pi \ln Pi$$

Where $Pi = ni / N$

Description :
H ' = diversity index
Ni = total number of i-th individual
N = Total Number of Individuals throughout types.

Plankton diversity index values ranged from 0 to infinity . The larger the index value means the better the condition of the water environment . But conversely , if the index value close to 0 means that the poor condition of the water environment .

4.3.2 . Uniformity Index (Evenness Index).

If in an aquatic environment is bad , plankton can survive , then the plankton have a high tolerance . Such a type of

plankton is not much but if it is able to survive , it will be able to breed. Conversely, if the plankton have a low tolerance , then the type of plankton is not able to survive or the number of species found in the waters a bit . Such conditions lead to discrepancies or inconsistency between the number of individuals in a community types . It is necessary to determine the uniformity index calculated uniformity inidividu number for each species in the marine community Bontang . Uniformity index formula refer to the formula used Shannon - Weiner . The formula is :

$$E = H' / \ln S$$

Description :
E = Uniformity index
H ' = diversity index Shannon – Weiner
S = number of species

Plankton uniformity index values range from 0 to 1 , the uniformity index value close to 1 indicates that there is a tendency of the number of individuals among species of plankton that uniform . Meanwhile, if the value of the uniformity index of plankton close to 0 , meaning the number of individuals among species in a community is not uniform . In other words, there are several types of biota amount is too little or too much , when compared with other types of plankton.

4.4 . Water quality

Water quality parameters measured include temperature , brightness , pH (power of hydrogen) , DO (dissolved oxygen) , and BOD (biological oxygen demand) . Water quality sampling stations can be seen in Figure 4.2 .

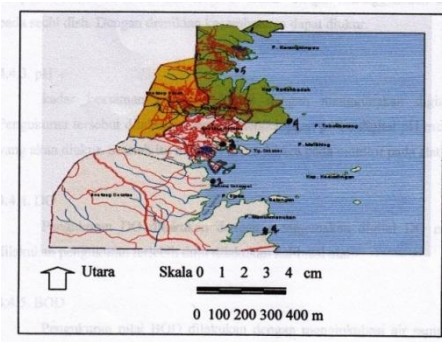


Fig.4.2. Sampling stations for plankton samples and water quality.

Description:
o 1 = Station 1
o 2 = Station 2
o3 = Station 3
o4 = Station 4
o5 = Station 5

4.4.1 . Temperature

To assess the temperature at the desired station used a thermometer .

4.4.2 . Brightness

Brightness parameters measured using Sechi dish . Sechi dish dipped in the cool waters at the point , until the object is not visible. Stelah that the depth is measured using a rope attached to the dish Sechi . Thus the brightness can be measured .

4.4.3 . pH

Water acidity was measured by using a digital pH meter . The measurement is done by dipping a digital pH meter probe on the media to be measured , After the pH value can be read on the monitor to the appliance .

4.4.4.DO

DO measurements performed using diiigital DO meter . Before the first measurement calibration tool.

4.4.5 . BOD

BOD value measurements performed by incubating water samples have been measured DO-0 for 5 days in an incubator at a temperature of 20^{o}C . After 5 days was measured using a DO -

5 DO meter . The result is then subtracted by the value of DO - o , then obtained its BOD value .

V : Result And Discussion

5.1 . Plankton in the sea conditions Bontang

After identification , the type and amount of plankton found in marine waters Bontang in August-September , as shown in Table 5.1 .

Table 5.1. Plankton in marine waters Bontang in August-September

No	Taksa	Station				
		1	2	3	4	5
	Phytoplankton					
1.	*Asterionella*	1	1	2	1	1
2.	*Bacteriostrum*	-	-	1	-	-
3.	*Biddulphia*	2	1	1	-	-
4.	*Centronella*	-	-	-	-	1
5.	*Ceratium*	31	9	1	2	6
6.	*Chaetoceros*	128	119	49	3	37
7.	*Closterium*	1	-	-	1	-
8.	*Coscinodiscus*	1	1	1	-	2
9.	*Cymbella*	1	-	-	-	-
10.	*Diatoma*	-	-	1	-	1
11.	*Dinophysis*	1	1	-	1	1
12.	*Goniodoma*	-	1	-	-	-
13.	*Gyrodinium*	-	-	1	-	-
14.	*Melosira*	5	4	5	1	2
15.	*Navicula*	1	1	-	1	1
16.	*Nitzchia*	-	1	-	1	-
17.	*Oscilatoria*	2	-	1	1	1
18.	*Pediastrum*	-	-	1	-	-
19.	*Peridinium*	4	3	4	8	3
20.	*Phormidium*	-	-	-	-	1
21.	*Pleurosigma*	1	1	-	-	-
22.	*Rhizosolenia*	26	21	10	4	10
23.	*Surirella*	1	1	-	2	-
24.	*Synedra*	-	1	-	2	-
25.	*Tabellaria*	1	1	1	1	1
26.	*Tintinnopsis*	1	1	-	2	1
27.	*Tintinidium*	6	1	-	1	8
28.	*Trichodesmium*	1	1	-	-	8
29.	*Vorticella*	1	-	-	-	1
30.	*Fragilaria*	1	-	-	-	-
	Zooplankton					
31.	*Diaptomus*	1	1	-	-	-
32.	*Macrocyclops*	1	1	-	2	2
	Meroplankton					
33.	*Naupilus*	7	4	1	2	1
34.	*Oikopleura*	1	1	1	1	-
	Abundance	**226**	**177**	**78**	**33**	**78**
	Number of spesies	**24**	**23**	**13**	**17**	**16**
	H Maximum	**3.18**	**3.14**	**2.56**	**2.83**	**2.77**
	Diversity index	**1.65**	**1.41**	**1.43**	**2.56**	**1.90**
	Uniformity index	**0.52**	**0.47**	**0.56**	**0.90**	**0.69**

From Table 5.1 above it was shown that phytoplankton were present evenly on each station is Asterionella , Cerratium , Melosira , Peridinum , Rhizosolenia , and Tabellaria . While Zooplankton found only 2 types of the total number of stations with very little . Trophic structure imbalance that happens this will affect the stability of ecosystems , which can cause changes in the pattern of trophic structure . This change may threaten the extinction of certain species of fish and reduced fish catches.

Predominant species is a species whose numbers reached 10 % or more of the total number of individuals of all species in the community. Understanding predominance only indicates the number of high and did not show the function held by the organism. According to the research results that the predominant species is Chaetoceros . Chaetoceros presence that dominates bias indicates a contamination in the water .

Species abundance at each station were minimal, if this is a feature on a fairly extensive marine waters . The number of species counted ranged from 16 to 24 different types of species .

While the diversity index can be seen in Figure 5.1 .

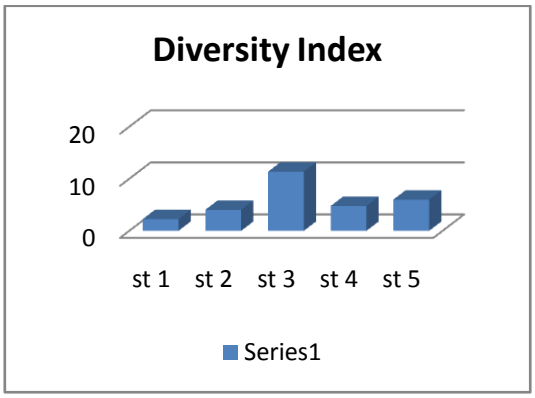


Fig 5.1. Plankton diversity index Bontang marine waters, in August - September.

Effect of pollution on communities is as a result of the interaction of organisms and their tolerance limits on competition . Polluted ecosystems , structurally will reduce the number of species in a community , which means it will lower species diversity , functional and will cause food webs and trophic structure simpler .

An index value of diversity in marine waters Bontang in a row starting from the smallest is located at station 2, the following stations 3,1,5 , and 4 the greatest value there distasiun . This is understandable because of the location of station 4 is the location where mangrove forests are located, so that the supply of oxygen , nutrients , and penetration is still in normal condition . While on station location 1 is the location which is close to the coal industry , location 2 location is a location that is close to the natural gas industry , location 3 is the location where the proliferation of residential areas around the coast , and location 5 is a location that is close to the fertilizer industry , it is not surprising that a low diversity index values .

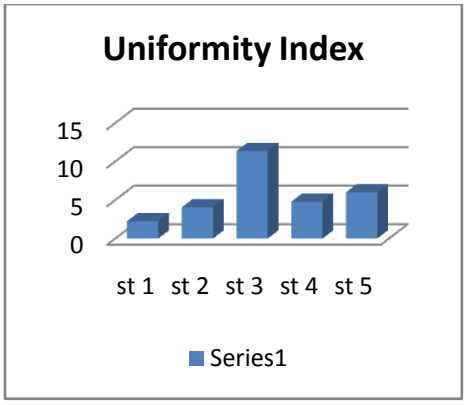


Fig. 5.2. Uniformity index of marine plankton in Bontang, Month of August-September.

Seen from the figure 5.2 . the uniformity index value at station 4 has the highest value . That is on location at station 4 for the number of individuals tend to be uniform between species in the community . It can be seen from the uneven uniformity index value at the station . While the smallest uniformity index values obtained by the station 2 . This value indicates that the location of station 2 there are several types of life are too little and instead there are too many types , when compared with other types of plankton in a community .

The results of the analysis of the value of diversity index and uniformity index shows that the two stations are both low index values . Station 2 is the locations where the natural gas industry . At this location need to be monitoring and special treatment so expect an increase in the value of diversity and uniformity index . The increase in value of the index will have an impact on ecosystem restoration industry changes with activation .

5.2 . Water quality in aquatic Bontang

The measurement results in this study showed some parameter values with the brightness , temperature , pH ,

DO , and BOD can be seen in Table 5.2 . following .

Table 5.2 . Measurement of water quality in marine waters Bontang , in August – September.

Parameter	Unit	St-1	St-2	St-3	St-4	St-5	QS
Brightnes	m	1,80	2,00	1,50	1,80	1,95	>3
Temperature	°C	38	44	35,5	29	37	Natural
pH	-	5,6	7,5	6,75	7,0	6,4	7 - 8,5
DO	Mg/L	3,14	5,40	12,88	6,7	7,7	6 - 7
BOD	Mg/L	2,25	4,04	11,36	4,77	6,00	20

Description:
St-1 = Station 1, near the location of the coal industry
St-2 = Station 2, near the location of the natural gas industry
St-3 = Station 3, near the location of the township / residential population around the coast.
St-4 = Station 4, the location of surrounding mangrove forest
St-5 = Station 5, near the location of the fertilizer industry
QS = Environment Quality Standards in accordance decree of The Minister of Environmental No. 51/ 2004.

5.2.1. Brightness

Penetration of sunlight that enters the marine waters Bontang ranged between 1.5 to 2.0 meters above sea level. This value is below the threshold limit value standards issued by the Decree of The Minister of Environment No. 51/2004, amounting to over 3 meters. It shows turbidity occurred at that location, especially at station 3 which is where the settlements. The lack of enlightenment seawater showed turbidity caused by the activity of residents in disposing of solid waste resulting in sedimentation around the site.

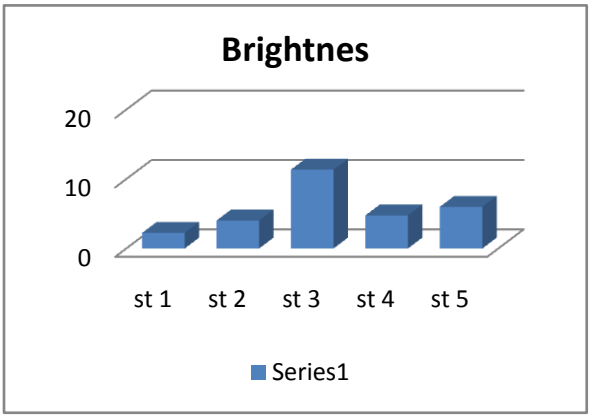


Fig. 5.3. Brightness parameters in marine waters Bontang, month of August-September

5.2.2. temperature

Temperature is one factor that important for marine life. Because temperature affects the metabolism and proliferation of marine life. The temperature in the sea varies according to the depth. For tropical regions, water surface temperatures range from 20-30° C. In the study, the temperature ranged from 29 to 44 ° C. This value indicates that the Bontang sea surface temperature hotter than the average temperature of the sea surface.

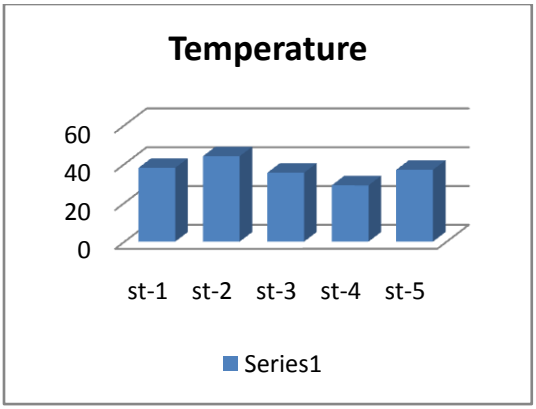


Fig.5.4. Temperature parameters in marine waters Bontang, month of August-September.

From the picture above shows that the hottest temperature is 44°C is near the location of the natural gas industry.

It is probable discharge of hot water around the site.

5.2.3. The degree of acidity

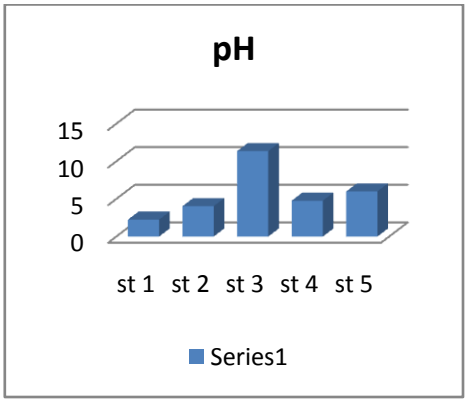


Fig.5.5. Parameters acidity in water Bontang Sea, August – September.

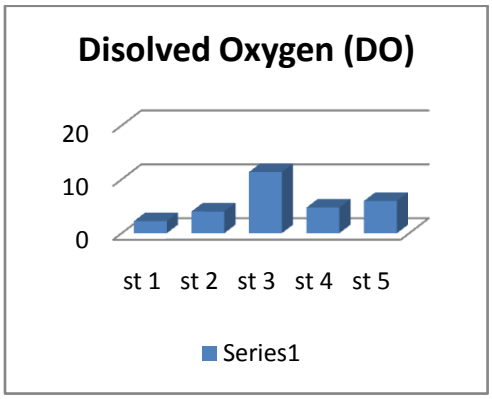
Value degrees of acidity or often called the pH measured in the field ranged from 5.6 to 7.5 . According to the quality standard acidity values are allowed around 7 to 8.5 , meaning there are several locations that are outside the range of pH values allowed . Monitoring and improvement effort for the pH value is absolutely necessary considering the influence of pH on the stability of an ecosystem . Seen in Figure 5.5 the lowest pH is owned by Station 1 which is the location close to the coal industry.

5.2.4 Dissolved Oxygen

Dissolved oxygen is a basic requirement for marine life . Minimum dissolved oxygen concentration for marine life should not be less than 6 mg/L. A polluted waters say if the oxygen concentration falls below the minimum required for microbial life.

According to the study , dissolved oxygen values ranged from 3.12 to 12.88 mg / L. The lowest value is in Station 1 , and the highest value there at 3 stations .

At station 1 the DO value is below its threshold value .



Gb. 5.6. Dissolved oxygen in the ocean waters Bontang, in August - Septamber.

5.2.6 . Biological Oxygen Demand

Indicates the amount of dissolved oxygen requirements of dissolved oxygen needed by living organisms to oxidize the waste material in the water . If high oxygen consumption , which is indicated by the small residual dissolved oxygen , the mean content of the waste materials that require oxygen , is also high . That is , if the value needs of high biological oxygen demand , means the organic matter content is also high . It shows the polluted waters of organic matter.

Almost pure water has a value of biological oxygen demand of approximately 1 mg/L. Water with biological needs 3 mg/L , considered quite pure. Water with a value of biological needs above 5 mg/L , the water is said to be pure again . If the water has a biological need between 1-3 mg/L can be said that these waters are not polluted , but if the value is between 4-7 mg/L said being contaminated , and if the value of oxygen demand above 7 mg/L , the heavily polluted.

The result of research showing any biological oxygen demand values ranged from 2.25 to 11m36 mg /L. If according

to the classification of a water contamination by biological oxygen demand value as above, then the research is done , one is said to be polluted stations , stations 2,4 , and 5 , are being polluted , while the heavily polluted station 3. But when compared with environmental quality standards , the BOD values in marine waters Bontang still in the permitted range .

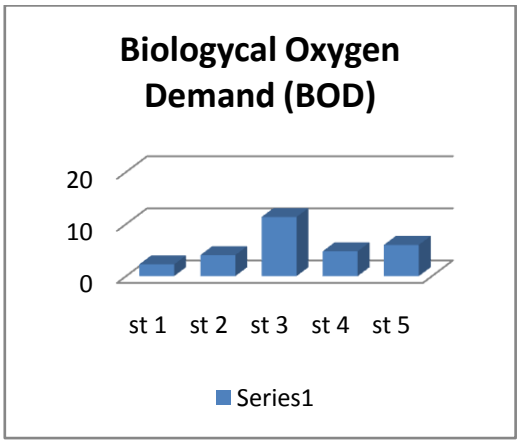


Fig. 5.7. Conditions of BOD in water Bontang, month of August-September.

5.3. Correlation between plankton with water quality in marine waters Bontang.

To facilitate inter-table observation in order to see the correlation between planktonic marine waters with water quality Bontang, then made the following table 5.3.

Table 5.3. Bontang sea condition data at each station.

STATION	PARAMETER						
	Diversity Index	Uniformity Index	Brightnes (m)	t ° C	pH	DO (mg/L)	BOD (mg/L)
1	1,65	0,52	1,8	38	5,6	3,14	2,25
2	1,41	0,47	2	44	7,5	5,4	4,04
3	1,43	0,56	1,5	35,5	6,75	12,88	11,36
4	2,56	0,9	1,8	29	7	6,7	4,77
5	1,9	0,69	1,95	37	6,4	7,7	6,00

Station 1 which has a high enough temperature, ie 38° C with acidic pH (5.6) with low DO of 3.14 mg/L and BOD of 2.25 mg/L. At this station diversity index of 1.65 and 0.52 uniformity index. The relationship between the value of the diversity index of water quality can be expressed in table 5.3.

Table 5.4. Water quality of the relationship between phytoplankton and zooplankton diversity index, according to Canter and Hill in (Dianthani, 2003).

Water quality	Diversity Index	
	Phytoplankton	Zooplankton
Very Good	>2,0	>2,0
Good	1,6 – 2,0	1,6 – 2,0
Moderate	1,0 – 1,6	1,4 – 1,6
Bad	0,7 – 1,0	1,0 – 1,4
Very Bad	<0,7	<1,0

When seen from Table 5.3, the first station is classified as an area with good water conditions with a diversity index of 1.65 . However, if viewed from the temperature , pH , DO and its value , then the station is categorized including polluted waters . This can be explained as follows , uniformity index of 0.52 indicates that the location of station 1 is only half the plankton species are the same . It shows the unfavorable conditions in these waters . Waters with a temperature of 38°C including waters with high temperatures and is above the average temperature of the tropical water temperature of around 29 -30 ° C. The increase in temperature of 1°C in the water will cause physical and chemical conditions of the water and the next will bring significant changes to the biological condition of the waters . The changes that occur can lead to changes in the magnitude of the impact of an aquatic ecosystem . The pH value of 5.6 is acidic enough to cause the death of a

number of species of living things and the waters that are chemically will bring change chemical processes that occur in these waters . DO values are quite low at 3.14 mg/L gives the sense that the dissolved oxygen in the water is only 3.14 mg/L and this value is below the normal value is 6 mg/L. With little dissolved oxygen then the oxygen is not enough to provide O_2 to the needs of living things that exist such waters . With the BOD value is below the treshold standard , that is equal to 2.25 mg/L , it can be said of these waters do not occur in organic pollution . But with other physical conditions need to be examined heavy metal content. .

Station 2 with a diversity index of 1.41 , 0.47 brightness uniformity index 2 m , temperature 44°C , pH 7.5 , DO 5.4 mg/L , and 4.04 mg BOD/L when compared with table 5 , 3 then this location has water quality that is being categorized . Categories of water quality at station 2 is worse than at station 1 .

Uniformity index of 0.47 implies a condition of the waters with the type and amount of plankton species are not spread evenly . This indicates that the physical and chemical conditions in these waters can not support the existence of a life for living organisms therein . The higher the value is close to 1 , the better the condition of the waters . Waters at station 2 has a temperature of 44°C , a high figure and is above the average daily temperature is found in tropical waters . The high temperature is very worrying , given the diversity index values and low uniformity index. DO value of 5.4 mg/L and BOD of 4.04 mg/L can be categorized as being polluted waters .

At station 3 the value of diversity index of 1.43 and 0.56 uniformity index values . The temperature at this location is 35.5 ° C with a brightness of 1.5 m , it had a pH of 6.75 , the value of DO 12.88 mg / L , and BOD values of 11.36 mg / L. If seen in Table 5.3 . the station has a water quality medium category . This category together with the station 2 . At this station thing that really stands out is the value of the DO is above the average value , which amounted to 12.88 mg / L. The high value implies DO pollution in these waters . BOD value of 12.88 mg / L included in the category of heavily polluted .

Station 4 which has a diversity index value of 2.56 and 0.9 uniformity index value is the station with the best water conditions among all stations . This can be seen by comparing the values in Table 5.3 . Station 4 classified waters with very good water quality . This is understandable because at this location there is a mangrove that has a fairly wide area . The temperature is measured at this station was 29°C normal classified . Ph value of 7 , the DO value of 6.7 mg/L is still in the normal range , while BOD was 4.77 mg/L were classified as polluted .

Station 5 has a diversity index value of 1.9 and the uniformity index value of 0.69 . If seen in Table 5.3 then it belongs to the category 5 station location with good water conditions. Brightness at a depth of 1.95 M means the water can still be penetrated by the light of the sun , over the depth of the sunlight can not penetrate. The temperature measured at this station is quite high at 37°C. At temperatures above the normal average temperature can affect the lives of living beings waters , monitoring and

evaluation should be carried out at this station , as well as at stations 1,2 , and 3. For the pH value at this station still is in normal condition , but DO value was above average , which was 7.7 mg/L is quite high . For normal DO values in marine waters is 6 mg/L is still below the threshold value in accordance The Minister of Environment Decree No. 51/2004 . But with that value can already be categorized as being polluted waters .

VI : ConclutionS and Advice

6.1 Conclusion

The results of the research that has been done can be summed up as follows , namely:

1. Broadly speaking stations 1,2,3 and 5 need a lot of attention because of the location it was found some indication of poor water quality and low diversity index values of plankton.
2. For station 4 state waters better compared with four other station locations . This is because there are still many mangrove forests at the station location .

6.2 . Advice

From the conclusions obtained are the input and advice to municipalities Bontang for :

1. Giving more attention to the site
2. To monitor and evaluate more intensive.
3. A persuasive approach to companies that are around each station sites 1,2 , and 5 , as well as in communities around loaksi station 3 , in order to avoid contamination of water in the sea city of Bontang .

REFERENCES

Afiati , N. , Susilo , Y. S. B. , Lumban Tobing , Y. , and Susiati , H. , 2007. Baseline Tread Water Plankton in NPP Mura . Abstract .

Agusnar , H. , 2007. Environmental Chemistry . USU Press . Field .

Akrimi and Subroto , G. , 2002. Observation Techniques Water Quality and Plankton . In Reservat Charcoal - Charcoal Lake Jambi.Buletin Agricultural engineering . 7 : 2-5 . www.pustaka - deptan.go.id/publikasi/abstract/bt72025. pdf

Barners , M. K. , Columbus , S. H. , Hulliday , N. C and Pingree , R. D. , 2007. Disribution of Plankton and Hydrography in Relation to Great Sole , Cockburn and Little Sole Banks . Journal of the Marine Biological Association of the United Kingdom . 89 : 11-18 .

Dahuri , R. , 2003. Marine Biodiversity . PT . Gramedia Pustaka Utama , Jakarta

_____ 2004. Natural Resources Management of Coastal Areas and Integrated Ocean . Revised Edition . Publisher PT Pradnya Paramita .

Dianthani , D. , 2003. Identify the type of Plankton in the waters of Muara Badak , East Kalimantan . Philosophy of Science Papers (PPs 702) Graduate Program / S3 Bogor Agricultural University.

Effendi , H. , 2003. Assessing Water Quality .Yogyakarta , KANISIUS.
.

Fahrul , M. F. , Haeruman , H. , and Sitepu , L. C. Phytoplankton Communities in 2005 as Bio - Indicators of Water Quality Jakarta Bay . National

Seminar on Mathematics , 2005, the University of Indonesia . Depok

Hayanto . S , Irawan . B and Soedarti . T. 2008. Theory and Practice of Ecology . Publisher Airlangga University Press.

Muksin . , I.K. , 2008. Plankton Species Diversity in Lake Bayan Buleleng, Bali . Udayana University , Abstract .

Nurdahlanti , L. , 2008. Community Structure . Faculty , University of Indonesia .

Purnomo , K. , Kantamiharja , E. S. and Sunarno , T. D. , 2004. Effect of Pollution Das Way Seputih in Central Lampung Against Fisheries Resources . Journal of Fishery Sciences and Aquaculture , 2 : 13-16 .

Sabo , E. , Roy . D. , Hamilton . P. B. , Hehanussa.P . E. , McNeely . R and Haffner.G.D . , 2008. The Plankton Community of Lake Matano : Factors regulating Plankton Composition and Relative Abundance in an Ancient , Tropical Lake of Indonesia . Hydrobiologia . 615 : 225-229.

Sanusi , H.2004 . Chemical Characteristics and Fertility Gulf waters Season Pelabuhan Ratu in West and East . Journal of Aquatic Sciences and Fisheries of Indonesia. Water Resources Department of the Faculty of Fisheries and Marine Science, IPB - Bogor .

Sari, Nilam . , 2003. Waste Management in the archipelago Brondong Pier fishing port , Lamongan East Java . Masters Thesis . Biologi.ITB .

Sari, Nilam. , 2006. Results of Treatment of Waste Management of Fisheries in the city of Bontang , East Kalimantan , Higher Colleges of Technology (STITEK) . Bontang . East Kalimantan .

Thoha , H. , 2003. Influence of season on Plankton in Riau Islands and surrounding waters . Research Centre for Oceanography , Indonesian Institute of Sciences , Jakarta , Indonesia . Makara Science . 7 : 59-61 .

_____2007 . Plankton abundance in the Gulf Gilimanuk Aquatic Ecosystems , National Parks , Bali West . Research Centre for Oceanography , Indonesian Institute of Sciences , Jakarta , Indonesia . Makara Science . 11 : 44-48 .