Mapping of Physical and Chemical Parameters of Seaweed Cultivation Area in Geranting Island Waters

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Abstract: Seaweed is a marine resource that has very high value. In addition, seaweed cultivation is easy because it takes a relatively short time, requires a small fee, and also the need for seaweed continues to increase. This study aims to determine the relationship between each parameter of both physical and chemical marine seaweed cultivations in the location and present it in the form of maps. The study was conducted in the waters of Geranting Island, Belakang Padang District, Batam City. in this study, parameters were measured directly in the field and using interpolation to determine the value of the surrounding parameters. The parameters in this study are temperature, dissolved oxygen (DO), pH, and Visibility. The final results of this study are maps of Physical and Chemical Parameters of the Sea between stations. The temperature obtained from stations 1-4 ranged from 28.1 - 29.7 0C, the results of the Visibility ranged from 1.5 - 2.5 m, the DO values ranged from 21.7 - 29 mg/L, and for pH values ranged between 4.8 - 4.9. According to the field data temperature parameters at all stations, and visibility parameters at stations 2, 3, 4 are suitability with seaweed cultivation area. Based on the field data visibility parameters at Station 1, pH, and DO parameters at all stations are not suitable with seaweed cultivation criteria. Information of the distribution of physical and chemical parameter values of the waters in the Geranting Island seaweed cultivation can be seen in the resulting maps.

1 INTRODUCTION

Batam City is one of the cities in Indonesia which has a larger sea area than the land area. Batam is one of the cities in Indonesia with large industrial, residential and commercial land needs (Gustin and Roziqin, 2019), it continues to grow rapidly according to previous studies (Gustin, Roziqin, & Fatulloh, 2018; Roziqin, Gustin, and Syari, 2018). Thus in the city of Batam, it has abundant marine natural resources. One of the marine natural resources in Batam is seaweed. Lately, seaweed has many advantages such as in the field of trade, which is very famous in the world. This seaweed cultivation can improve the economy of the people in Batam City because of the high demand and needs of the seaweed.

Water conditions are very important to consider by taking into account the state of the physical parameters of the sea including sea surface temperature, water brightness and dissolved oxygen available in the water (Antoni, et al., 2019; Lubis, et al., 2018). Some things to consider and excel are, among others, wide open export market opportunities, relatively stable prices, there are no trade restrictions or quotas for seaweed, the cultivation technology is simple so it is easy to master, the cultivation cycle is relatively short, capital requirements are relatively small, commodities which are irreplaceable because there is no synthetic product.

The seaweed cultivation business is classified as a labor-intensive business that can absorb labor (Rajagukguk, 2009). Therefore, further research can be done on the physical and chemical parameters of marine seaweed cultivation in Batam so that people in Batam know the importance of marine physical and chemical parameters for seaweed cultivation. In conducting this research, the physical parameters are temperature and visibility, while the chemical parameters of seawater are pH and Dissolved Oxygen (DO). in this study, parameters were measured directly in the field and using interpolation to determine the value of the surrounding parameters.

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A lot of industrial activities, dense settlement and sea transportation in the west coast of Batam Island, Riau Islands has the opportunity to make a major contribution to the heavy metal content in the region. Research on water conditions by looking at the condition of physical parameters is very useful to provide information for the future.

Table 1: Criteria fitness for seaweed cultivation (Ardiansyah et al., 2016).

No	Parameter	The Range	Appropriateness	Reference
1	Temperature (c)	28-31	25-30	Ditjenkanbud, 2005
2	Salinity ($^0/_{00}$)	30-33	28-33	Anggadiredja *et al.,* 2008
3	pH	8	6-9	Aslan, 1998
4	DO (ppm)	3.2-7.8	3-8	Ditjenkanbud, 2008
5	Visibility (m)	2.1-2.4	2-15	Anggadiredja *et al.,* 2008
6	Depth (m)	4.6-5.1	0.2-0.4	Poncomuyo *et al.,* 2006
7	Current strength (m/s)	0.1-0.2	0.2-0.4	Anggadiredja et al., 2008
8	Nitrate (mg/l)	0.05-0.06	0.02-0.04	Effendi, 2003
9	Phosphate (mg/l)	0.05-0.07	0.02-1.0	Sulistijo, 1996

Seaweed is one of the marine plants that are classified in benthic macro algae, which is more inherent in the seabed. Seaweed is algae that lives in the sea and belongs to the thallophyta division. Classification of seaweed-based on pigment content consists of 4 classes, namely green seaweed (Chlorophyta), red seaweed (Rhodophyta), brown seaweed (Phaeophyta) and blond seaweed (Chrysophyta). This seaweed is a group of marine plants that have indistinguishable properties between the roots, stems, and leaves. All parts of the plant are called a thallus, so seaweed is classified as a low-level plant (Dahuri, 2003).

2 RESEARCH METHODS

2.1 Research Sites

The research activity was carried out in Geranting Island Waters, Belakang Padang District. The location can be seen in Figure 1. The material used in this study is the primary data. The primary data in the form of sea surface temperature, water brightness, and dissolved oxygen distribution were measured in situ in 2017. The data processing was carried out at Politeknik Negeri Batam.

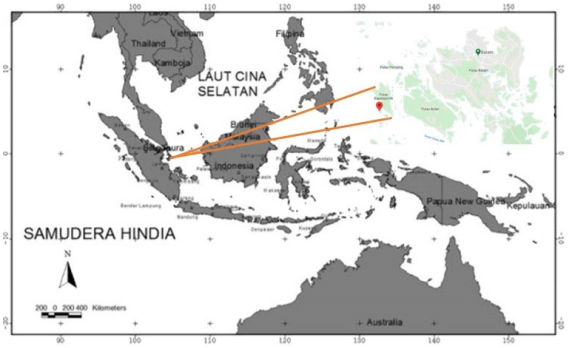

Figure 1: Research location.

2.2 Tools and Materials

The tools used are laptops, cellphone cameras, GPS Garmin GPSMap 78S, DO meters, pH meters, Secchi disks, Thermometers, stationery. The material used is the Batam City Administration Map.

2.3 Methods

The field survey was conducted to test the field validation by taking temperature, dissolved oxygen (DO), pH, and visibility parameters. Temperature parameters are taken using a thermometer, dissolved oxygen using a DO meter, the pH uses a pH meter, and the visibility is taken using a secchi disk with the formula (1), whereas the T value is the visible value and TT is the invisible value from the results of data retrieval with Secchi disk. The research flow can be seen on Figure 2.

$$Visibility = (T + TT) /2 \quad (1)$$

2.4 Research Procedure

Data collection and processing as in Figure 2 research flow diagram, the details are as follows:

- determine the suitable location for doing research,
- prepare survey tools,
- perform calibration on the survey tools,

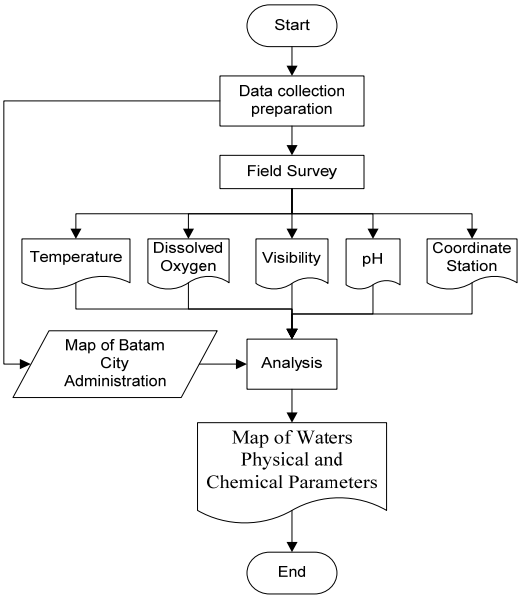

Figure 2: Research flow chart.

- next, start doing field measurements to get the coordinates, visibility, temperature, DO, and pH.
- display graphs on each parameter using Microsoft Excel software.
- make a contour map of the relationships between parameters using a Surfer.
- and make a map of each parameter using Arcmap.

3 RESULT AND DISCUSSION

3.1 The Results of Temperature Parameter Data

The results of Temperature Parameter Data come from a field survey at 4 stations. Station 1 has a value of 28.3 ^{0}C, station 2 has a value of 28.1 ^{0}C, station 3 has a value of 29.7 ^{0}C, and station 4 has a value of 29.5 ^{0}C. Seen from table 1 for its temperature, the four stations include the appropriate criteria because the temperature suitability values range from 25-30 ^{0}C. These results indicate that the temperature of the waters is relatively stable and can be interpreted as stable sunlight (intensity) in this region because the high and low temperature of the waters is very dependent on the intensity of sunlight. Vertical distribution of temperature can be seen on Figure 3. Figure 3 is the result of the vertical distribution between temperature and location. In the vertical distribution of temperature, there is a low value of 28.1 ^{0}C around the area of station 1, and the highest value is 29.7 ^{0}C around the station areas 2, 3, and 4.

Based on Figure 4, it can be seen that the temperature distribution value of the research location is in the range of 28.3-29.5^{0}C.

3.2 The Results of Visibility Parameter Data

The results of Visibility Parameter Data come from a field survey at 4 stations. Station 1 has a value of 1.5 m, station 2 has a value of 2 m, station 3 has a value of 2.5 m, and station 4 has a value of 2 m. Seen from Table 1, only stations 2, 3, and 4 could fulfil the criteria, while station 1 is not appropriate because the suitability value for visibility is in the range of 2-15 meters. From observations in the field, the obtained visibility value of 2-15 m. It shows that the value of the intensity of the sun entering the waters is quite high. This condition shows that waters have very low dissolved organic matter content. Vertical distribution of visibility can be seen in Figure 5.

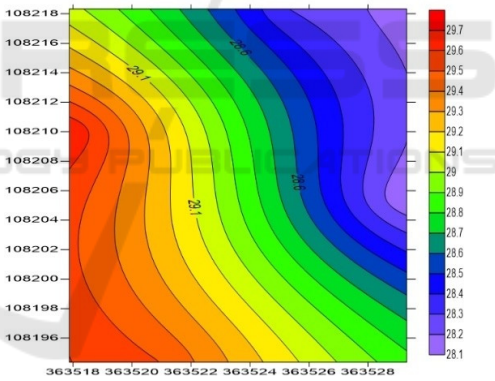

Figure 3: Temperature vertical distribution.

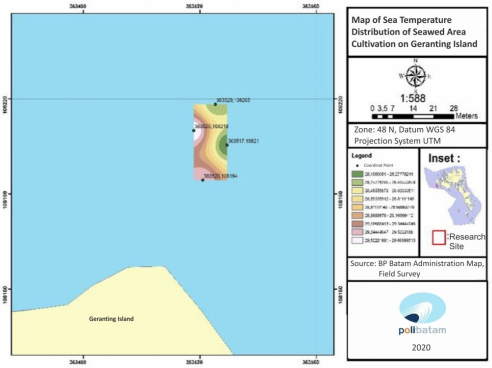

Figure 4: Map of sea temperature distribution.

Figure 5 is the result of the vertical distribution between visibility and location. In the vertical distribution of visibility, there is a low value of 1.5 m around the area of station 3, and the highest value is 2.5 m around the station areas 2.

Based on Figure 6, it can be seen that the visibility value of the research location is in the range of 1.5-2 meters.

3.3 The Results of Dissolved Oxygen (DO) Parameter Data

The results of the DO Parameter Data is from a field survey at 4 stations. Station 1 has a value of 29 mg/L, station 2 has a value of 22.9 mg/L, station 3 has a value of 23.9 mg/L, and station 4 has a value of 21.7 mg/L. Seen from Table 1, the four stations are included in the criteria that are less appropriate because the suitability value for DO is in the range of 3-8 mg / L.

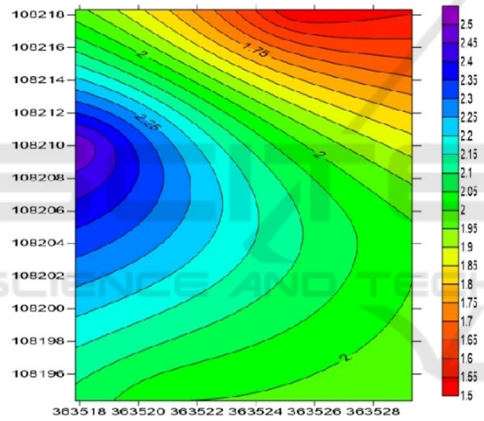

Figure 5: Visibility vertical distribution.

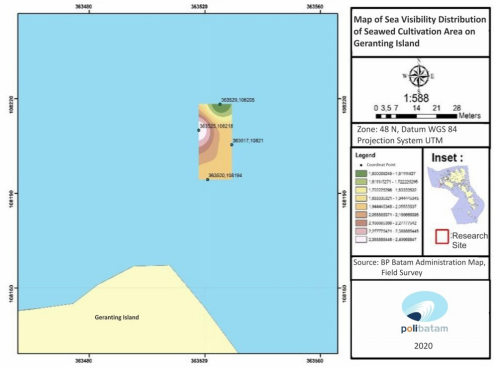

Figure 6: Map of sea visibility distribution.

Figure 7 is the result of the vertical distribution between DO and location. In the vertical distribution of DO, there is a low value of 21.5 mg/L around the area of station 4, and the highest value is 29 mg/L around the station areas 3. The value of dissolved oxygen in the waters of the isthmus produces a value that is between 21.5-21.9 mg/L. The condition of sunlight fluctuates between bright light and dim light. During the process of sunlight, the activity of photosynthesis is a major factor in the provision of some dissolved oxygen in the waters of the island of Genting. When the sun sets, diffusion of oxygen from the atmosphere is the biggest contributor to dissolved oxygen in addition to the movement of water mass (turbulence).

Based on Figure 8, it can be seen that the DO value of the research location is in the range of 21.7-29 mg/L.

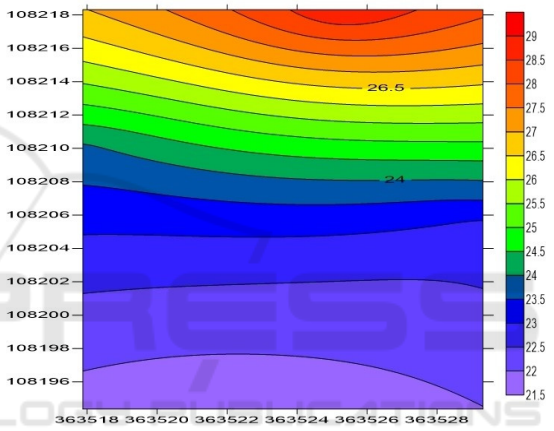

Figure 7: DO vertical distribution.

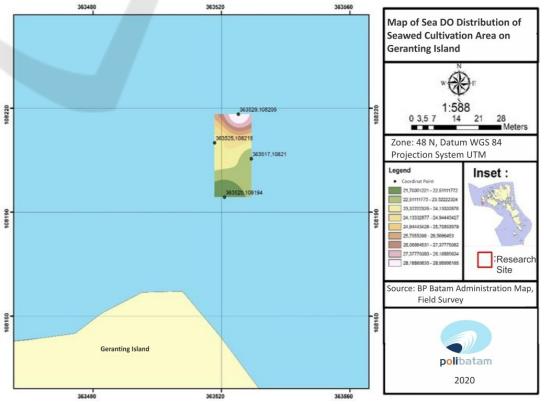

Figure 8: Map of sea DO distribution.

3.4 The Results of pH Parameter Data

The results of pH Parameter Data come from a field survey at four stations. Station 1 has a value of 4.9, station 2 has a value of 4.8, station 3 has a value of

4.9, and station 4 has a value of 4.8 mg/L. Seen from table 1, the four stations are included in the criteria that are less appropriate because the suitability value for pH is in the range of 6-9. The observations found that the waters are in the pH range from 4.8 to 4.9 and the salinity of around 33 ‰. These results show that these waters are quite stable and meet the criteria as the location of waters that have not been polluted, and these waters can be categorized as waters that are can be used as a place of cultivation.

Figure 9 is the result of the vertical distribution between pH and location. In the vertical distribution of pH, there is a low value of 4.8 around the area of station 2 and 4, while the highest value is 4.9 around the station areas 1 and 3. Based on Figure 10, it can be seen that the pH value of the research location is in the range of 4.8-4.9.

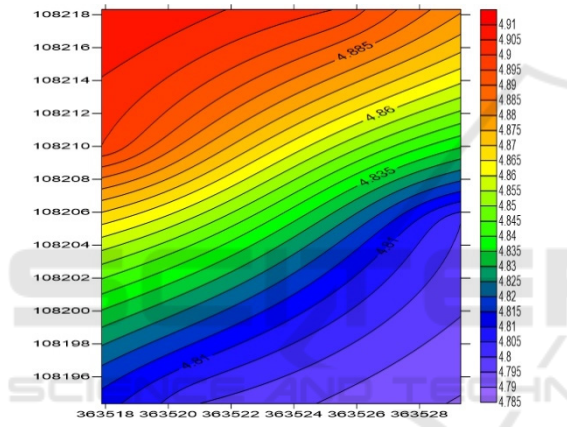

Figure 9: pH vertical distribution.

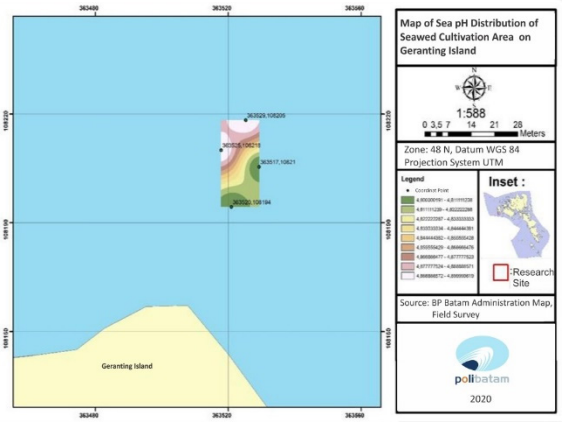

Figure 10: Map of sea pH distribution.

This shows that the waters of Lampung Bay are included in fertile waters (Anggoro, 1983), where it shows the results that suggest the distribution of the values of the distribution of brightness, distribution of dissolved oxygen and sea surface temperature which can be categorized as fertile waters. The saturated oxygen level will be reached if the dissolved oxygen content of the waters is theoretically the same as the dissolved oxygen level. Unsaturated oxygen levels occur if dissolved oxygen levels are lower than dissolved oxygen levels (Effendi, 2003).

4 CONCLUSIONS

Based on the objectives and results of the study, the conclusions of this study are:

- Field data temperature parameters at all stations and visibility parameters at stations 2, 3, 4 meet the suitability criteria for appropriate seaweed cultivation.
- According to the field data visibility parameters at Station 1, pH and DO parameters at all stations are not following the suitability criteria for appropriate seaweed cultivation.
- The resulting maps show the location and also the distribution of physical and chemical parameter values that exist in the seaweed cultivation in Geranting Island waters.

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