A Distribution of pH and Temperatures in Palopo Coastal Water, South Sulawesi

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Abstract. The construction work in coastal and marine zones has an impact of environmental quality degradation. It causes an environmental pollution which has brought changes in the physical, chemical and biological characteristics of the water environment. Temperature and pH as physical parameters can directly affect marine ecosystem conditions. This research aims to study the pH and temperature conditions and to simulate distributions of these components in Palopo seawater. Direct pH and temperature measurements are provided in eleven stations and implemented on December, 2017. Also, Geographic Information System (GIS) and Surfer 13 software are applied to analyze all obtained data. The results of pH and surface temperature measurements in the Palopo's coastal waters, it showed that surface pH values range from 6 to 6.5. This value is below the quality standards for sea water pH to marine biota around at pH7-8,5, while the surface temperature value is at around 31,5 - 33,3°C. This value has passed the sea water quality standard for marine biota at 28-30°C. A simulation mapping result indicates that the distribution of pH and surface temperature is affected by increased community activity in coastal waters.

Keywords: coastal water; pH; temperatures

1 Introduction

Palopo is one of the cities in South Sulawesi, which has a coastal area. Geographically, it is located in 2.53'15 "- 3.04'08"latitude and 120.03'10 "- 120.14'34"longitude, and covers an administrative area approximately at 247,52 km^2. More over, it consists in large part of a lowland and around 62,85 per cent of total area is a coastal area, while plateauis about 24,76% .

The growth of Palopo's population increased significantly, having a growth rate of 1.20% per year until 2015. The majority of them focuses on coastal area. Then, the Palopo's land division is used for agricultural land, settlements, public and social facilities, a fish auction and a harbour.

Coastal and marine waters are a very strategic water territory. The development of activities and an enhancement of area utilization in coastal and marine areas have an impact on environmental degradation. These impacts are pollution and excessive use of coastal resources [1]. Coastal and marine pollution source from effluents in land and sea, which causes contamination both physically and chemically [2]

Pollution originates from industrial activities, settlements, agriculture, fisheries and transportation [3,4]. Pollution leads to changes in physical, chemical and biological characteristics of the environment [5]. Physical, chemical and biological parameters of waters include turbidity, temperature, TSS, DO, pH, salinity, heavy metals and coliform bacteria [5,6,7].

Temperature and pH are the key parameters to determine environmental quality. The range of values of sea surface temperature in Indonesia is around 27-30°C and then there is a difference in the annual mean of sea surface temperature between one aquatic and the others [8]. The distribution of sea surface temperature is influenced by oceanographic factors such as currents, tides, meteorological factors and topography [9]

The degree of acidity (pH) of the waters is affected by natural factors (carbonate minerals) and anthropogenic act (waste disposal) [10]. The pH value of sea water tends to be constant over time [8]. How ever, by the end of the century, sea level pH is expected to decline to 0.3-0.4 unit saccompanied by an increase in sea surface temperature of 2-4°C [11,12].

The increasing settlement activity and harbour existence in the Palopo's coastal area are triggering pollution. The availability of very limited infrastructure, lack of understanding and public awareness of environmental management will have an impact on the deterioration of environmental quality. Therefore, it is

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very important to supervise the quality of waters including pH distribution and water temperature. As an effort to support sustainable development with environmental insight and low carbon.

2 Method

This research was conducted in the Palopo's coastal waters, South Sulawesi. The pH and sea surface temperature measurements were performed at 11 stations in December of 2017. Determination of the station by purposive random sampling utilized Global Positioning System (GPS) tools. Station coordinate points can be seen in Table 1 as follows:

Table 1. The pH and Sea Surface Temperature Stations

Stations	Coordinat Point	
	Latitude	Longitude
St1	02°58.8966'S	120°11.8727'E
St2	02°59.0008'S	120°12.0271'E
St3	02°59.0444'S	120°12.1125'E
St4	02°59.1275'S	120°12.1956'E
St5	02°59.1599'S	120°12.2125'E
St6	02°58.9725'S	120°12.6285'E
St7	02°59.0332'S	120°12.6346'E
St8	02°59.0784'S	120°12.5506'E
St9	02°59.2603'S	120°12.2753'E
St10	02°59.3166'S	120°12.3063'E
St11	02°59.2540'S	120°12.0185'E

The pH and sea surface temperature measurements are carried out by direct measurement using pH meters and thermometers. To simulate the surface distribution of pH and temperature were performed using the *Geographic Information System (GIS)* and *software surfer* 13.

3 Results And Discussions

The degree of acidity (pH) and temperature are physical and chemical parameters that can affect marine ecosystems [13, 14]. The pH and sea surface temperature measurement data for each station can be seen on Table 2 as follows:

Table 2. pH and Sea Surface Temperature values in eleven stations

Stations	Parameters	
	pH	Temperatures (°C)
St1	6	32,3
St2	6	32,1
St3	6	31,7
St4	6,5	31,5
St5	6	32,3
St6	6,5	32,3
St7	6	32,3
St8	6	33,3
St9	6	32,6
St10	6,5	32,5
St11	6	31,5

Table 1 and the map of surface pH distribution in the Palopo's coastal waters in Figure 1 high light that the surface pH value at 11 stations ranges between 6 and 6,5. It exists below the quality standards of pH to marine biota, reaching at pH 7-8,5 [15].

The pH measurements at eleven stations have relatively similar values due to the distance between adjacent stations. Station 4, 6, and 10 are noted for pH 6,5, while the pH value at station 1,2,3,5,7,8,9 and 11 slightly is pH 6 which is lower than three stations before. This is caused by these stations which are located near the settlement and the harbour dock.

The low pH value in the Palopo's coastal waters is influenced by the increasing community activities in coastal areas. People who are living in coastal areas tend to dispose of waste directly into the waters. In addition, the effluent also comes from port activities [16]. The facilities of processing sewage installation at Palopo port are not available so that the ship waste is discharged directly into the waters.

The quality of sea water isimpacted by the concentration of chemical dissolved in water. The higher pollutant containing proportion is in the water, the greater oxygen is needed by microorganisms. The sewage contains some organic materials in terms of particles, oils and fats, nitrogen, phosphorus, potassium, and organic carbon. The organic carbon content dissolved in water is one of the factors that affect the decrease of sea water pH [17,18]. Sea surface pH changes have badly effects on biota life both directly and indirectly. The direct impact will bring in the death of the biota while indirect influence will cause the toxicity of substances in the water.

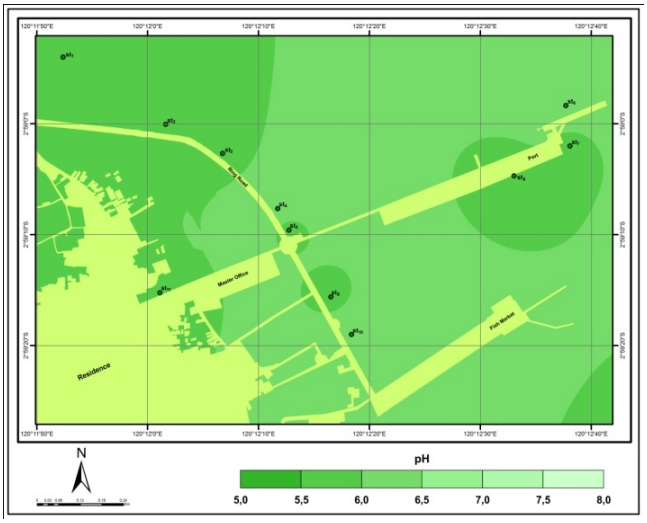

Fig. 1. Distribution Maps of pH in Palopo Coastal Water

The performance measurement data of surface temperature value in Table 1 and its distribution maps in Palopo's marine coastal waters in Figure 2 depict that the sea surface temperature range at 11 stations is 31,5 –

33,3ºC. This value has passed through the sea water quality standard for marine biota which is 28-30ºC [15] .

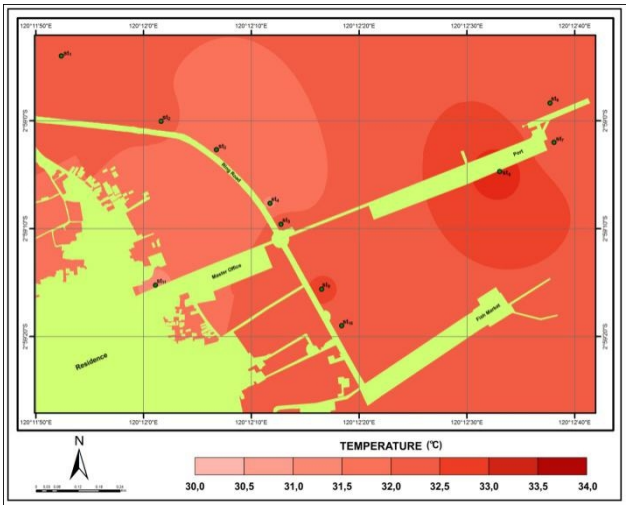

Fig. 2. Distribution Maps of Sea Surface Temperature in Palopo Coastal Water

The value range of sea surface temperature at eleven stations is not far different from each others. The lowestof temperature is station 3,4, and 11 at 31,5-31,7ºC, and then the temperature at stations 1,2,5,6,9 and 10 slightly increases temperature at 32,3-32,6ºC inhabitated by nearly the residential area. Then, the highest temperature found at station 8 placed in the harbour dock area with surface temperature 33,3ºC. The increase of surface temperature in Palopo's coastal waters is also caused by the influence of waste disposal activity from settlements and harbour.

Temperature plays an important role in the process of biochemical reaction rates in waters [18]. The high temperatures will encourage the microorganism activities to reduce organic matter from waste, resulting a dissolved oxygen decrease in water [19]. The dissolved oxygen in water is needed by the biota for respiration [20]. Therefore, temperature changes will impact marine life and aquatic ecosystems [8,10].

4 Conclusions

Based on the results of pH and surface temperature measurements in the Palopo's coastal waters, it showed that surface pH values range from 6 to 6.5. This value is below the quality standards for sea water pH to marine biota around at pH 7-8,5, while the surface temperature value is at around 31,5 - 33,3ºC. This value has passed the sea water quality standard for marine biota at 28-30ºC. A simulation mapping result indicates that the distribution of pH and surface temperature is affected by increased community activity in coastal waters. The availability of infrastructure and increasing public awareness need to be improved to support environmentally sound and low carbon development.

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