The Study on Physical and Chemical Water Quality Parameters at Pasir Putih, Situbondo

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Keywords: Water Quality, Pasir Putih Situbondo, Temperature, Turbidity, pH, DO.

Abstract: Indonesian coastal and marine biodiversity has important role for both economical and developmental state aspects. This field offer environmental services such as marine tourism. Considering its coastal area potentials, Situbondo develops their marine tourism, such as Pasir Putih Beach. The present of white sand beach and coral reef ecosystems in Pasir Putih attract tourist and researcher intention to explore. Water quality is very influential on the biodiversity of aquatic biota, coral reef ecosystem indeed. Therefore, study on the physical and chemical parameters of water quality needed as monitoring effort of the Pasir Putih's water quality. Data of temperature, turbidity, pH, and DO, TSS and salinity compared to the standards of water quality under The Decree of the Minister of Environment No.51/2004. Result of turbidity, temperature, pH, and DO parameters show that they are in safe criteria, but TSS and salinity parameters ranges are exceed the water quality standards under The Decree of the Minister of Environment No.51/2004.

1 INTRODUCTION

Indonesia marine and coastal biodiversity is present in the form of coral reef ecosystems, mangroves, sea grass beds, estuaries, beaches, open sea, and deep seas (Dahuri, 2003). This marine and coastal biodiversity has high economic natural resources potential. Furthermore, this area are able to offer environmental services for public developmental purposes. The scope of marine and coastal environmental services are education and research aspects, defence and security aspects, climate control, marine tourism, maritime transportation and communications, source of energy, conservation and preservation, and also living-system supports (Dahuri, 2003). Tourism as one of environmental services gives obvious contributing for both local and national economic development. It is contribute to the country's foreign exchange and increase local income.

Situbondo's coastline is 131.575 km along (Sukandar, 2016) and marine tourism become its main tourism. One of its marine tourism is Pasir Putih beach that located in Bungatan sub-district. This beach is accessible and passed by Pantura road. Pasir Putih beach offers beauty of its white sand and underwater sceneries to the tourist. They can swimming, canoeing, snorkelling, or diving. The diversity of its marine biota such as coral reefs, nektons, and benthic species attract both tourists and researchers to explore this area. The local government's efforts to promote and conserve Pasir Putih environment are organizing the national water sport, diving and culture event placed in Pasir Putih Beach, publishing Situbondo's Regent Regulation No.19/2012 about Pasir Putih Coral Reef Conservation (Peraturan Bupati Situbondo, 2012), and building and renewing the infrastructures. Seeing the potentials, it is possible for increasing the developments of Pasir Putih underwater tourism in future years.

The condition of Pasir Putih marine biota can not be separated with its water quality. Water as substance that surrounding marine biota and medium for chemical reaction occurs, both inside and outside of organism body (Nybakken, 1988). The optimum development and growth of marine biota reach if waters environment in balance ecosystem condition. The presence of disturbing factors cause the break of one or more food chain in its web food (Wibisono, 2011). The waters physical-chemical parameters influence the living of marine biota around. Biodiversity that exists in an ecosystem is reflection

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of its physical-chemical parameters characteristics (Dahuri, 2003). The study of physical and chemical water quality is necessary for water quality indicator and comparison data on environmental monitoring assessment (Tatangindatu, et.al, 2013). Therefore, the research on physical and chemical parameters at Pasir Putih waters needs to be carried out as monitoring of water quality that is closely related to the condition of its marine biota.

2 MATERIAL AND METHODS

2.1 Study Area

Pasir Putih beach located at Pasir Putih village, Bungatan subdistrict, Situbondo regency, East Java. It is about 25 km from the downtown area. The beach is passed by Pantura road and make it accessible. Fig. 1 shown the location of the study area.

Figure 1: Study Area.

2.2 Sampling and Data Analysis

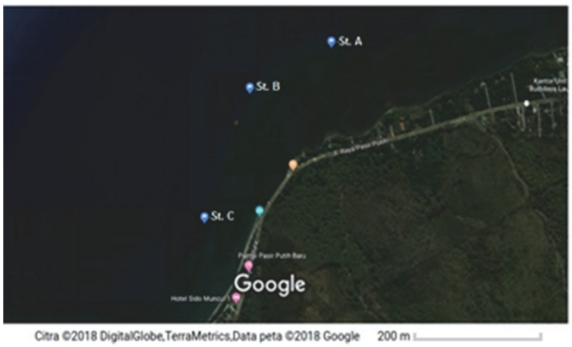

Figure 2: Sampling Location.

The measurement of water quality data have been conducted for three stations (see Fig. 2). The coordinate point each sampling's site are A site (S 7°41'4.8" E 113°49'56.1"), B site (S 7°41'10.8" E 113°49'45"), C site (S 7°41'27.7" E 113°49'38.8"). Sampling of water quality takes 2 kind of depth, (1) 0.5 m under water surface and (2) 0.5 m above the sea bed. Van Dorn Sampler horizontal type is used for collect sea water sample.

The sampling of turbidity, temperature, DO, pH parameters using in-situ methods. Meanwhile, TSS and salinity parameters deriving from laboratory analysis. Sampling of seawater sample for laboratory analysis packed in dark bottle and should be storage at cooler box. The sample should not more than 24 h picked up to the laboratory for maintaining its stability and quality.

Kinds of water quality parameters, sampling methods, and methods specification shown in Table 1. The available data are analyzed descriptively using graphics and tables then compared with the water quality standard under The Decree of the Minister of Environment No.51/2004.

Table 1: Parameters, sampling methods and methods specification.

Parameters	Sampling Methods	Methods Specification
Sampling's coordinate	Insitu	GPS
Depth	Insitu	Gauge stone
Physical Parameters		
Turbidity	Insitu	Turbidimeter
Temperature	Insitu	Digital Termometer
TSS	Laboratory	SNI 06-6989.3 - 2004
Chemical Parameters		
Salinity	Laboratory	Refractometer
pH	Insitu	pH meter
DO	Insitu	DO meter

3 RESULT AND DISCUSSION

Since the publishing of Situbondo's Regent Regulation No.19/2012, Pasir Putih has already became not only marine tourism but also coral reef's conservation area. The water environmental condition as limiting factor influence the living of marine biota around. The physical and chemical water quality monitoring at Pasir Putih waters was conducting on October 2018 at dry season in ebb condition. At dry season, the minimum input of freshwater can minimize the effect of rain diluting

the salts in the ocean. The water depth each sampling site shown in Table 2.

Table 2: Water Depth (Ebb Condition).

Location	Coordinate	Depth
Station A	S 7°41'4.8" E 113°49'56.1"	4 meter
Station B	S 7°41'10.8" E 113°49'45"	5.5 meter
Station C	S 7°41'27.7" E 113°49'38.8"	5 meter

Comparison between physical-chemical parameters measurement data and water quality standard for marine biota and marine tourism under Ministerial Decree of Environment Number 51/2004 given at Table 3.

Table 3: Comparison of measurement data and Government's Quality Standard.

Parameters	Water quality standard (biota)	Water quality (tourism)	Unit	The results					
				Station A		Station B		Station C	
				A1	A2	B1	B2	C1	C2
Physical Parameters									
Turbidity	< 5	< 5	NTU	0.85	1.78	0.31	2.82	0.41	6.41
Temperature	28 – 30	Natural	°C	30.1	29.1	29.2	28.9	29.3	29.3
TSS	20	20	mg/l	26	27	27	29	21	27
Chemical Parameters									
Salinity	33 – 34	Natural	‰	35.1	35.1	35.2	35.3	34.8	35.3
pH	7 – 8.5	7 – 8.5	-	8.08	7.64	7.66	7.89	7.69	7.85
DO	> 5	> 5	mg/l	11.13	7.74	8.9	8.11	8.14	7.88

3.1 Physical Parameters

3.1.1 Turbidity

The turbidity measurement data (Fig. 3) at three sampling sites taken from surface (0.5 m under water surface) and bottom (0.5 m above the seabed). The turbidity value at 3 sampling site are within safe criteria, for marine biota and marine tourism.

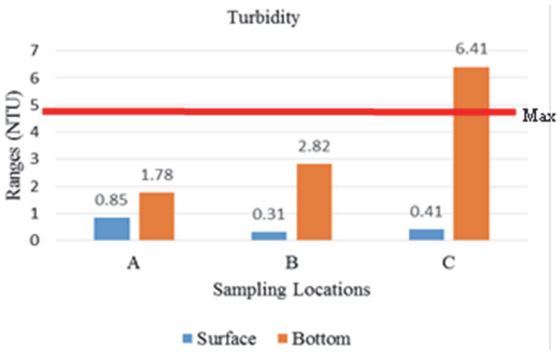

Figure 3: Turbidity measurement data.

The standard quality of turbidity range for marine biota and marine tourism under The Decree of the Minister of Environment No.51/2004 is less than 5 NTU (red line as maximal standard quality criteria).

The turbidity mean range at Station A is 1.315 NTU, not exceed the standard quality. At Station B, mean range of turbidity is 1.56 NTU are also not exceed the quality standard. Mean range of turbidity at Station C is 3.41 NTU. Seeing its mean range, turbidity is still in safe condition, because it is not exceed the quality standard. At Station C, the range in bottom site exceed the water quality standard. Turbidity caused by dissolved suspended organic or anorganic particles in water body which make it turbid (Wibawa and Luthfi, 2017). The high range of turbidity bottom side at station C probably caused by substrate stirred by marine organism such as nekton or by water current in sampling moment.

3.1.2 Temperature

The mean temperature at all sampling station are within normal condition because it is not exceed the maximal range of water quality standard for marine biota and marine tourism. The mean temperature in Station A is 29.6 °C, Station B is 29.5 °C, and Station C is 29.3 °C. The surface water as first receptor of direct sunlight accept more heat than the underwater layer. The consequent is temperature at surface always higher than other underwater columns. This is illustrate at Fig. 4, which the surface temperature in the sampling station higher than bottom temperature. The temperature at the surface and bottom site is not much different, because the water depth consider as shallow water, so it cannot form temperature stratification. Temperature Station A at surface part is 30.1 °C, little higher than maximal range of water quality standard, 30°C. The increase of this temperature is temporary as effect from boat machine heat through the line occasionally. Water temperature parameter

should be considered since the increasing of water surface temperature caused coral bleaching and present coral diseases (Wibawa and Luthfi, 2017). The illustration of water temperature condition in Pasir Putih beach shown in Fig. 4.

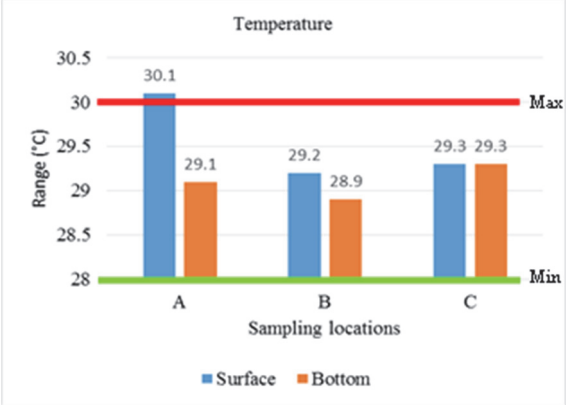

Figure 4: Temperature measurement data.

3.1.3 TSS (Total Suspended Solids)

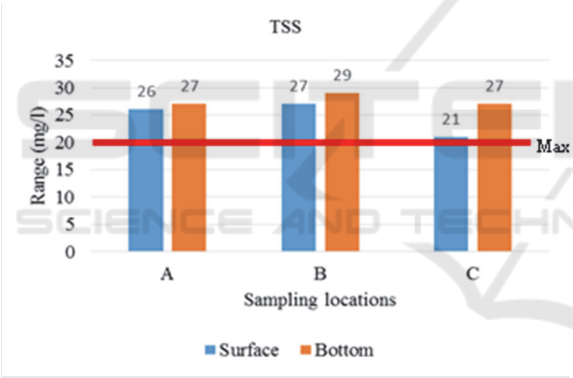

Figure 5: TSS measurement data.

Fig. 5 shows the range of TSS in all sampling stations exceed water quality standard allowed. The mean TSS range at A station is 26.5 mg/l. The mean range of TSS at B station is 28 mg/l. The mean range of TSS at station C is 24 mg/l. TSS is suspended materials (diameter > 1µm) which detained on milipore filter with pore diameter 0.45 µm. TSS consist of mud and fine sand and microorganism, as the result of land erosion flush to the water body (Effendi, 2013). The monitoring of TSS used for knowing the water quality, because highly TSS range indicate the high risk pollution and inhibit the sun light penetration to water body (Maulana, et.al, 2015). Generally, the content of suspended solid affects the level of water turbidity and temperature (Edward, 2003). Despite of its high TSS value, it is not driven the turbidity and temperature exceed the water quality standard yet. Highly TSS range at sampling station probably caused by highly nutrient content due to floating net cages near sampling location. Further research needed to investigate the impact of floating net cages to the water quality at Pasir Putih waters.

3.2 Chemical Parameters

3.2.1 Salinity

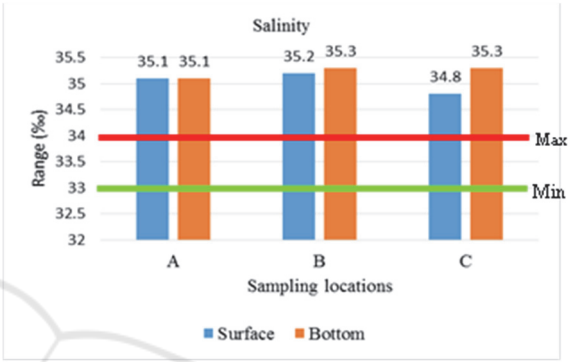

Figure 6: Salinity measurement data.

Fig. 6 shows the range of salinity in the surface is not much differ from salinity range in bottom site. This is indicate that overall there are homogeneous salinity distribution at each depth. Mean range of salinity at Station A is 35.1 ‰, station B is 35.25 ‰, station C is 35.05 ‰. The salinity range exceed water quality standard allowed for marine biota. The range salinity for the marine tourism water quality standard is natural, depend on normal condition and varied at time (noon, night, season). Salinity range in this area is still appropriate to the marine water salinity range, 30 – 40 ‰ (Effendi, 2013). The present salinity range are differ from research data in 2013, which Pasir Putih water salinity range 30 - 31 ‰ (Aunurohim, 2013). The present salinity range close to the salinity range of the floating net cage research in 2017 (Anrosana, 2017). This probably caused by the fact that salinity is measured under laboratory process, not insitu measurement. On the real condition, salinity is influenced by several factors such as evaporation, rainfall, current circulation pattern, fresh water flush and anthropogenic activities (Nontji, 1987). The sampling stations are also located near ponds.

3.2.2 PH

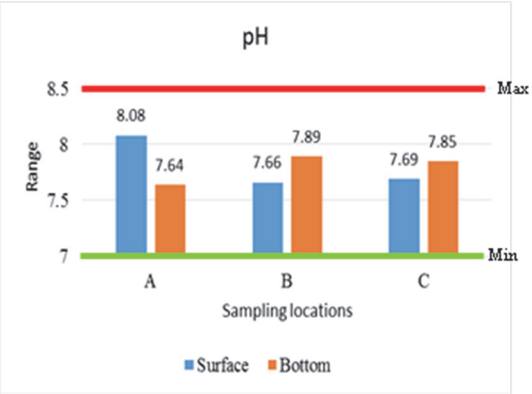

Figure 7: PH measurement data.

According to water standard quality for marine biota and marine tourism, the range salinity of pH is 7 – 8.5. Mean pH range at Station A, B, C are 7.86, 7.78, and 7.77. Fig. 7 show that pH range at three sampling sites appropriate with the government's water standard quality for marine biota and marine tourism. The pH content is hydrogen ion concentration unit in solution, usually for defining acidity or base of solution (Wibawa and Luthfi, 2017). Change in pH affect the marine biota chemical and biological process. The pH affect the toxicity of water chemical compound. The pH's range is very influential for water biochemical process as nitrification will end in lower pH range (Tarsim and Wardiyanto, 2004).

3.2.3 DO

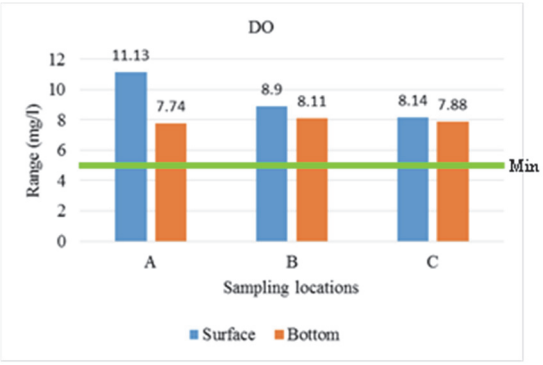

Figure 8: DO measurement data.

Fig. 8 shows the measurement of DO's range. The range of DO quality standard for marine biota and marine tourism is more than 5 mg/l. The mean range of DO at Station A, B, C are 9.44 mg/l, 8.51 mg/l, and 8.01 mg/l. The three mean range more than 5 mg/l, which show that DO range is within safe criteria, not exceed the range of water quality standard under The Decree of the Minister of Environment No.51/2004. Dissolved oxygen are needed for respiration process of living organism. The lower DO content at bottom-side show the presence of respiration process by coral or other marine biota (Wibawa and Luthfi, 2017).

4 SUMMARY

The condition of physical and chemical parameters include turbidity, temperature, pH, DO are still within water quality standard allowed. TSS and salinity parameters are exceed the water quality standard allowed. It is needed the further research about highly range of TSS content in Pasir Putih water and salinity measurement should be done on location.

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