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Analysis of Water Suitability for Ecotourism Development on Several Beaches in Morella Village, Central Maluku Regency, Maluku Province

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Abstract

Maluku is an archipelago whose territory is coastal and marine which is suitable for tourism. The tourism value and attractiveness of coastal areas should be developed through marine tourism. This study aims to analyze current speed, water depth, pH, DO, temperature, salinity, sigma-t, chlorophyll-a, and turbidity-m as physical, chemical, and biological indicators in the Lubang Buaya and Moki Beach ecotourism areas. Water sampling was carried out using Kemmerer bottles at different depths, namely at the surface and at a depth of 20 meters.Water samples are used to analyze chemical elements both horizontally and vertically. Sample analysis was carried out at the Oceanology Laboratory and Basic Biology Laboratory of Pattimura University.The test parameters in this study were water depth, temperature, salinity, sigma-t, chlorophyll-a, turbidity-m using conductivity, temperature, and depth (CTD), current speed using a current meter, pH using a pH meter, and dissolved oxygen (DO) using a DO meter. The waters of Lubang Buaya Beach and Moki Beach, Morella Village, Central Maluku Regency, Maluku Province have water conditions, namely pH, temperature, salinity, sigma-t, chlorophyll-a, turbidity-m, and brightness with appropriate categories, while DO with an inappropriate category based on water assessment standards. The assessment results show the waters' suitability for ecotourism development at a surface depth of 0 meters and a bottom depth of 3 to 25 meters. The minimum current speed of 0.003 m/s and the maximum current speed of 0.36 m/s are suitable for boating, banana boating and jet skiing activities.

Keywords: Chemical Analysis, Water Suitability, Ecotourism, Morella Village

1. Introduction

Ecotourism is a combination of tourism markets and the application of environmentally friendly practices to develop sustainable natural resources (Ouattara et al., 2016). The development of the tourism sector is one of the leading sectors in the national economy that always needs to be developed and improved. If viewed from the socio-economic aspect, it can increase community income, expand employment opportunities, increase government income, increase foreign exchange earnings, increase national entrepreneurship and can help encourage development in the region (Maulana and Aprianto, 2018).

Lubang Buaya Beach was widely known in 2012, this 2.5 hectare beach is located in the middle of the Morella Village area and is visited by people because of the uniqueness of its natural beaches. The structure of the beach is in the form of curved coral and sandy substrates, turquoise sea water, cliff areas and vegetation that are not dense. The length of the beach, which is almost 2 km, has a unique view in the water formed by the slopes of cliffs with curved coral walls as a home for various small fish. The natural beauty of the surrounding area is still maintained because this area is not a residential area with very minimal levels of population activity around it (Nur and Tupan, 2017).

This uniqueness makes Lubang Buaya Beach very popular and a favorite tourist destination for tourists. The increasing number of visits from day to day is used by local people to trade. Until now, there have been many food stalls and tents offering food and various other tourism services. In addition, boats that were previously only used as vehicles for fishing, have now also been used as a means of recreation for tourists if they want to go around the

ocean (Launuru and Assagaf, 2023). In addition, one of the areas that has the potential for ecotourism in Maluku is Moki Beach which is located in Morella Village which is approximately 109 km from the capital of Central Maluku Regency and 35 km from the capital of Maluku Province, the beach is very supportive for marine tourism locations because it has exotic beaches and seas that contain a lot of biodiversity.

The beauty of a tourist spot is determined by its cleanliness, naturalness, and ecological diversity. Environmental cleanliness is a necessity for everyone, especially in tourist spots that are targeted for visits to enjoy its beauty. It is undeniable that tourist spots are places for community activities so that the environmental quality in the area must be maintained. Ecotourism must be implemented properly to minimize the negative impacts of tourists on local habitats. These impacts can be physical, including increased shoreline erosion, noise and pollution, or social, including the exclusion of local tour operators and communities. We need to understand these impacts, and how. (Hakim et al., 2017). Analysis of the chemical characteristics of essential nutrients in the waters of Lubang Buaya Beach and Moki Beach will provide an overview of the fertility of the waters. Indirectly related to the productivity and carrying capacity of the waters concerned, which are tourist areas in Maluku Province.

In the general development of tourism, the term "sustainable tourism" has also emerged. Sustainable tourism is seen as a step towards managing all resources that can be socially and economically fulfilled while maintaining cultural integrity, fundamental ecological processes, biodiversity, and other life-supporting elements. In the general development of tourism, the term "sustainable tourism" has also emerged. Sustainable tourism is seen as a step towards managing all resources that can be socially and economically fulfilled while maintaining cultural integrity, fundamental ecological processes, biodiversity, and other life-supporting elements (Sukarnoto, 2020).

Phosphate and nitrate are essential nutrients for phytoplankton growth and metabolism. However, if these two substances are present in high concentrations in waters and exceed threshold levels, eutrophication (nutrient overload) occurs, characterized by phytoplankton blooms that cause the death of various marine biota. Insufficient nutrients, such as phosphate and nitrate, are primarily sourced from the waters themselves, through the decomposition processes of plants and dead organisms. Furthermore, the influx of industrial waste containing organic compounds from land influences nutrient concentrations. This decomposition process, which results in inorganic compounds entering the water, requires significant oxygen (Simanjuntak, 2012). Data collection on water depth, current speed, pH, DO, temperature, salinity, sigma-t, chlorophyll-a, turbidity-m was conducted to support the study of the suitability of waters as an ecotourism area based on water quality at Lubang Buaya Beach and Moki Beach, Morella Village, Central Maluku Regency, Maluku Province.

2. Materials and Methods

2.1. Research Location

In determining the location of the study, a check was carried out on the tidal schedule of the waters, there are 20 stations, namely 10 stations at Lubang Buaya Beach and 10 stations at Moki Beach (**Figure 1**) (Primary Research, 2025). The stations at the location were selected using the purposive sampling method, namely determination based on known characteristics.

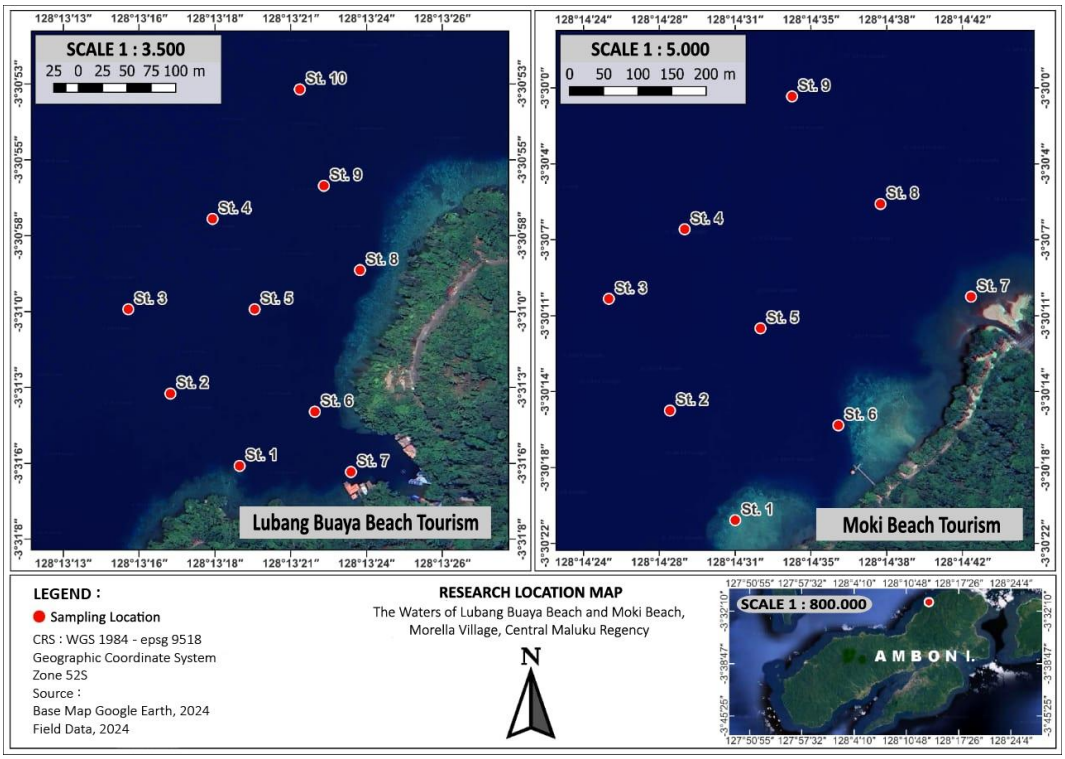

Figure 1. Research Location Map at Lubang Buaya Beach and Moki Beach (Primary Research, 2025).

2.2 Data Collection

2.2.1. Water Samples

Water sampling using Kemmerer water sampler bottles, each carried out at different depth layers, namely on the surface and a depth of 20 m, at high tide. The water samples were used to study the distribution of chemical elements both horizontally and vertically. Data was taken at each station with 3 (three) repetitions.

2.2.2. Sample Analysis

Sample analysis (chemical and biological) was conducted at the Oceanology Laboratory of FPIK Pattimura University and the Basic Biology Laboratory of Biology Education FKIP Pattimura University. The test parameters in this study were water depth, temperature, salinity, sigma-t, chlorophyll-a, turbidity-m using conductivity, temperature, and depth (CTD), current speed using a current meter, pH using a pH meter, and dissolved oxygen (DO) using a DO meter.

3. Results and Discussion

3.1. Results of The Analysis of The Characteristics of The Tourist Waters of Lubang Buaya Beach and Moki Beach

Analysis of in-situ measurement data and laboratory analysis of water quality parameters was conducted descriptively, by comparing the results with seawater quality standards for marine biota based on Decree of the Minister of Decree of the Minister of Environment No. 51/2004 concerning Seawater Quality Standards. Dissolved oxygen (DO) is the total amount of oxygen present (dissolved) in water. DO is required by all living organisms for respiration, metabolism, and the exchange of substances, which then generate energy for growth and reproduction. In addition, oxygen is also needed for the oxidation of organic and inorganic materials in aerobic processes. The need for dissolved oxygen varies depending on the species, stage, and activity (Gemilang et al., 2017).

The results of DO measurements at observation stations vary quite a bit namely the DO value on the surface is an average of 4.25 and in bottom waters an average of 4.37. At each data collection station, the DO values obtained indicate that the waters are in very good condition and still meet the seawater quality standards set out in the Decree of the Minister of State for the Environment No. 51 of 2004 for marine life with a DO value of >5 mg/l. Therefore, the DO concentrations at Lubang Buaya and Moki Beach are. The results of the analysis of the characteristics of the tourist waters of Lubang Buaya Beach and Moki Beach can be seen in **Table 1** and **Table 2.**

Table 1. Results of measurements and analysis of the physical and chemical quality of sea water at Lubang Buaya Beach

	pH		DO		Temperature		Salinity		Sigma-T		Chl-A		Turb-M		Brightness	
St.	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	Seen	No
1	7,3	7,7	6,4	6,9	29,96	29,86	27,62	27,85	16,22	16,42	2,51	2,23	2,39	2,03	10	11
St.	0 m	10 m	0 m	10 m	0 m	10 m	0 m	10 m	0 m	10 m	0 m	10 m	0 m	10 m	Seen	No
2	7,2	7,4	1,4	1,4	30,20	29,87	27,42	28,19	15,99	16,67	1,82	2,48	2,97	2,49	13	14
St.	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	Seen	No
3	7,3	7,4	5,9	5	27,38	27,19	33,91	33,89	21,77	21,82	1,78	0,49	3,65	0,48	13	14
St.	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	Seen	No
4	7,3	7,1	1,4	6,9	27,25	27,22	33,81	33,87	21,74	21,80	1,86	0,38	2,84	0,24	13	14
St.	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	Seen	No
5	7,3	7,2	7,1	2,7	27,33	27,32	33,83	33,81	21,73	21,72	3,96	0,16	3,57	0,51	13	14
St.	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	Seen	No
6	7,3	7,4	6,5	5,2	27,37	27,33	33,86	26,76	21,73	16,44	2,61	1,21	1,46	0,88	11	12
St.	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	Seen	No
7	7,2	7,3	2,5	3,4	27,25	27,3	33,86	33,83	21,78	21,74	1,61	0,41	2,22	0,71	13	14
St.	0 m	16 m	0 m	16 m	0 m	16 m	0 m	16 m	0 m	16 m	0 m	16 m	0 m	16 m	Seen	No
8	7,2	7,3	3,3	2,9	27,11	27,24	28,18	33,84	17,57	21,77	2,72	2,58	2,42	2,23	13	14
St.	0 m	19 m	0 m	19 m	0 m	19 m	0 m	19 m	0 m	19 m	0 m	19 m	0 m	19 m	Seen	No
9	7,3	7,4	3	2,2	27,51	27,31	33,57	33,71	21,47	21,65	3,58	3,13	3,49	6,11	12	13
St.	0 m	18 m	0 m	18 m	0 m	18 m	0 m	18 m	0 m	18 m	0 m	18 m	0 m	18 m	Seen	No
10	7,4	7,5	5	7,1	27,33	27,34	33,83	30,9	21,73	19,53	1,13	2,06	1,79	3,46	10	11

The Lubang Buaya Beach tourist location at stations 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 shows that the pH value on the surface is an average of 7.28 and in the bottom waters an average of 7.37, the DO value on the surface is an average of 4.25 and in the bottom waters an average of 4.37, the temperature value on the surface is an average of 27.86 and in the bottom waters an average of 27.79, the salinity value on the surface is an average of 31.98 and in the bottom waters an average of 31.66, the sigma-t value on the surface is an average of 20.17 and in the bottom waters an average of 19.95, the chl-a value on the surface is an average of 2.35 and in the bottom waters an average of 1.51, the turb-m value on the surface is an average of 2.68 and in the bottom waters an average of 1.91, and the visible brightness value is an average of 1.91. 12.1 meters and the invisible average 13.1 meters. The distribution map of pH, DO, temperature, salinity, sigma-t, chl-a, turb-m, and brightness parameters at stations 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 can be seen in **Figure 2 - Figure 9.**

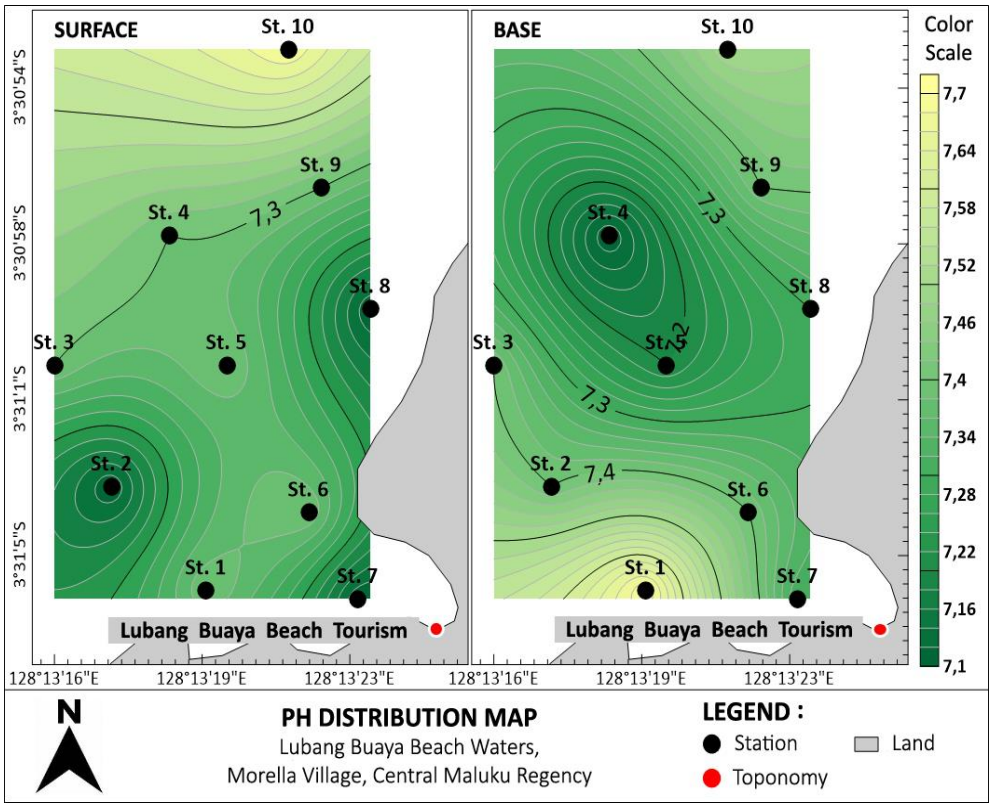

Figure 2. pH Distribution of Lubang Buaya Beach Tourism.

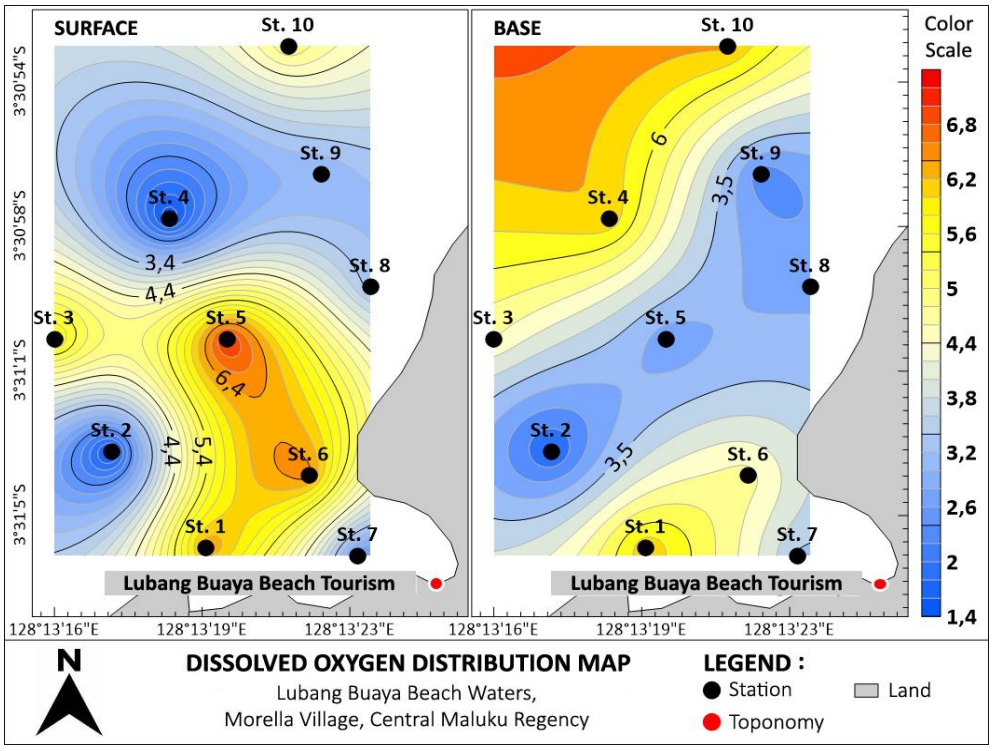

Figure 3. DO Distribution of Lubang Buaya Beach Tourism.

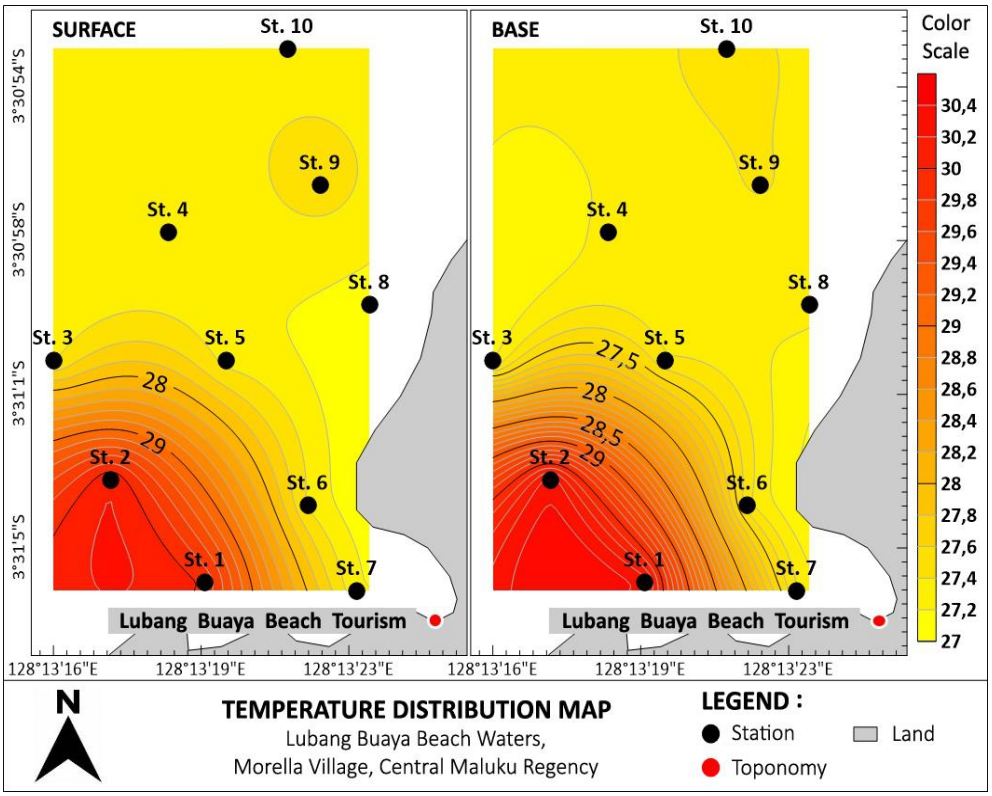

Figure 4. Temperature Distribution of Lubang Buaya Beach Tourism.

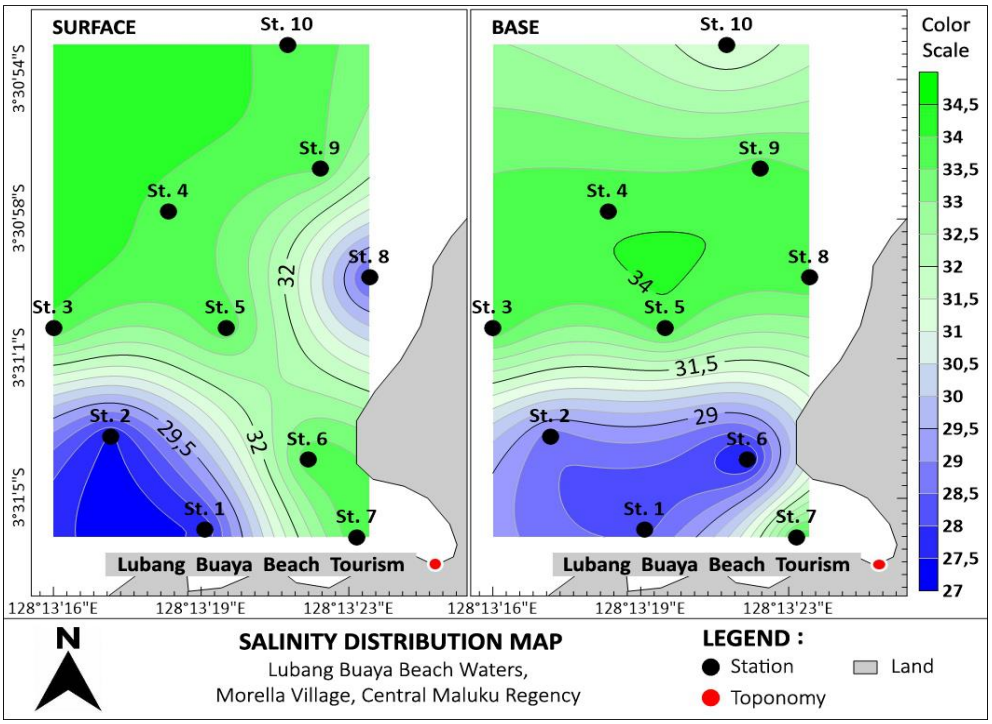

Figure 5. Salinity Distribution of Lubang Buaya Beach Tourism.

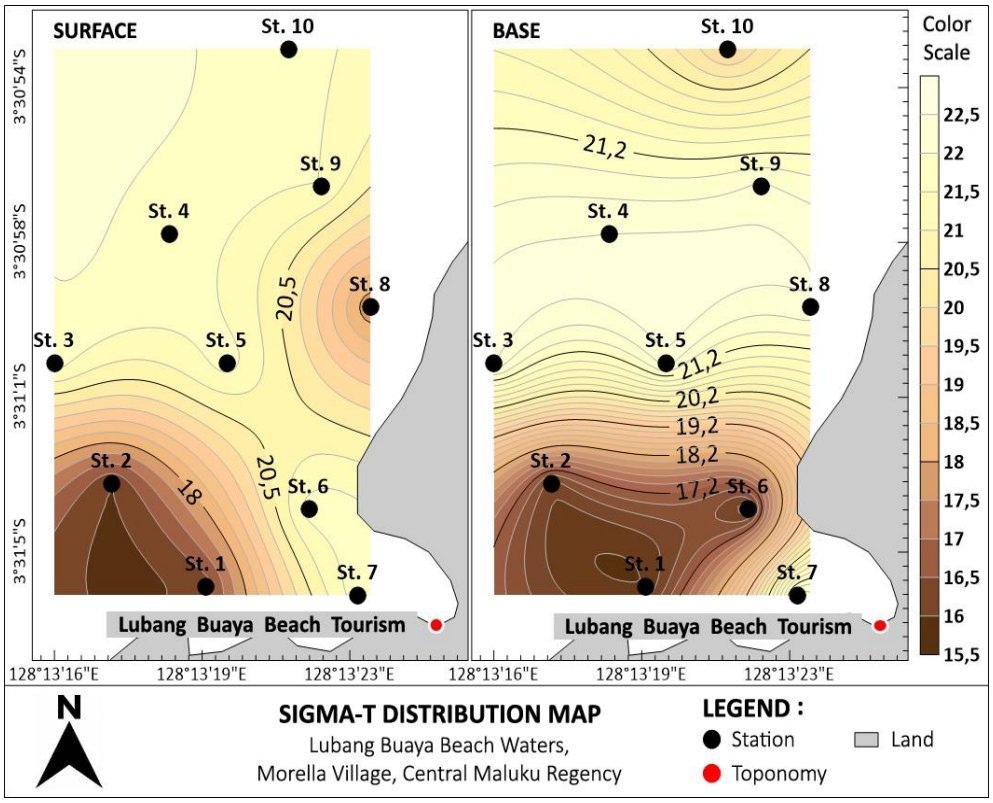

Figure 6. Sigma-T Distribution of Lubang Buaya Beach Tourism.

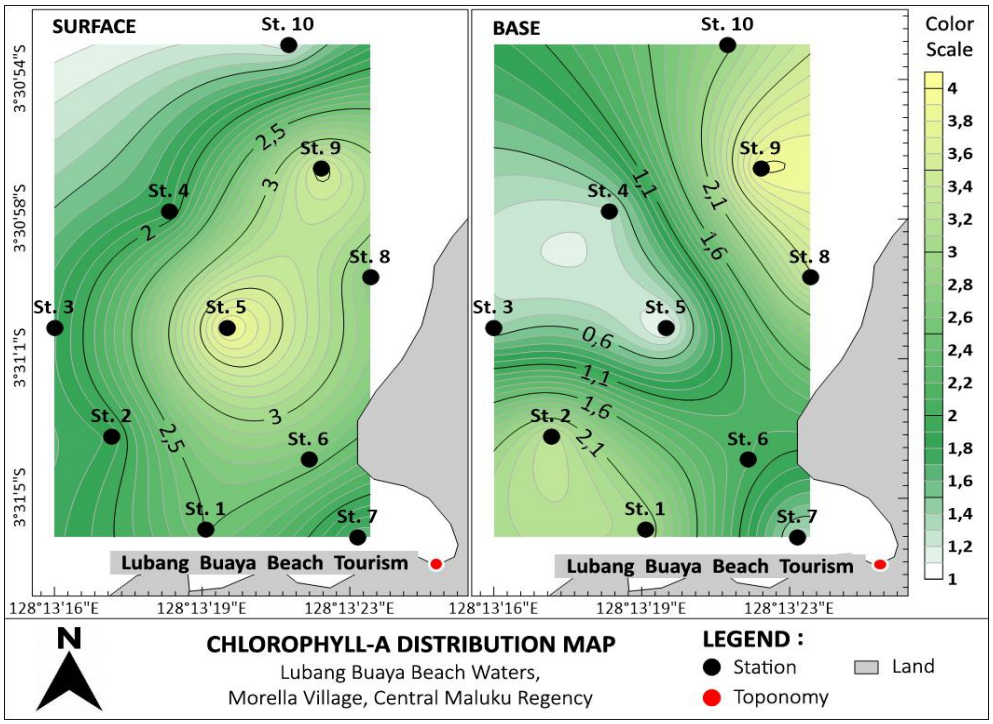

Figure 7. Chlorophyll-A Distribution of Lubang Buaya Beach Tourism.

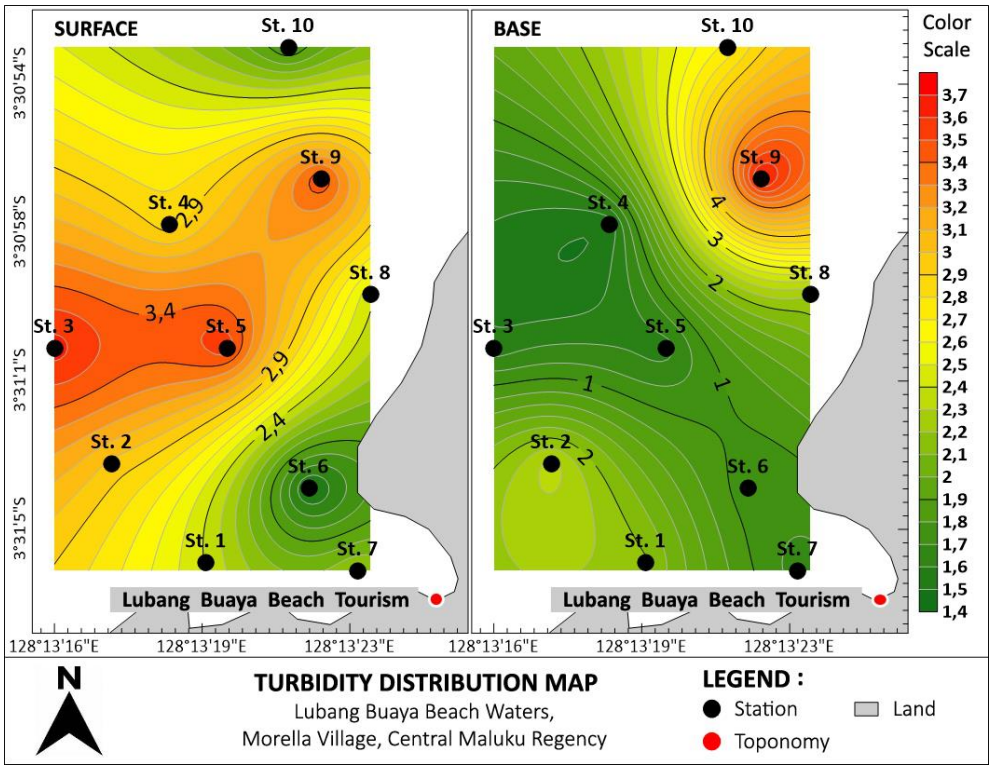

Figure 8. Turbidity Distribution of Lubang Buaya Beach Tourism.

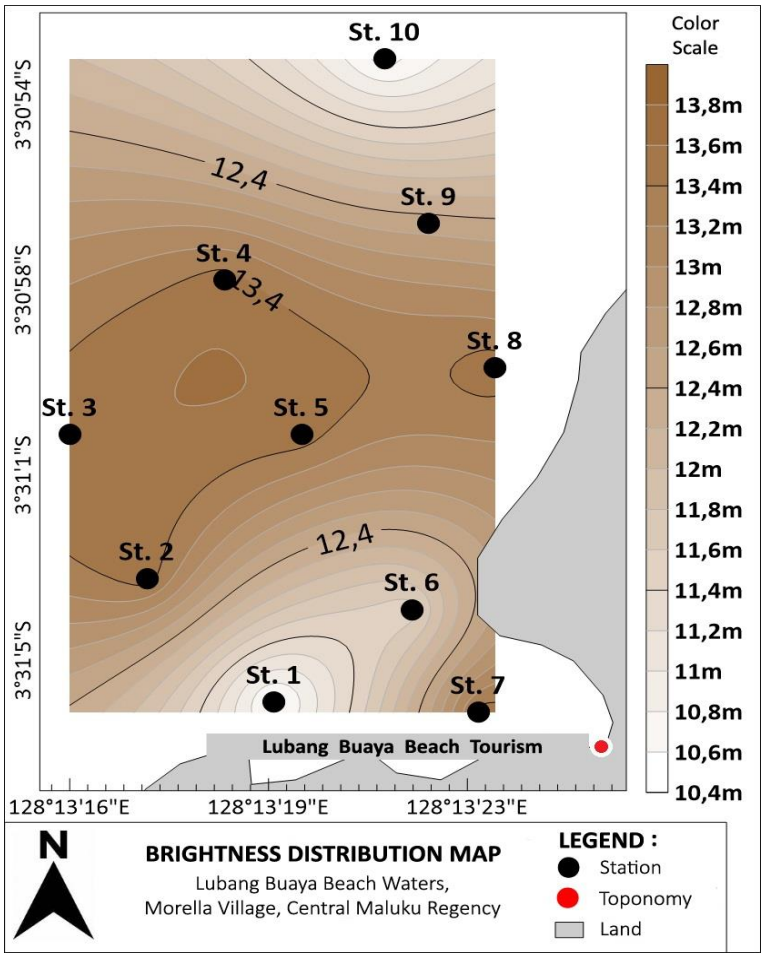

Figure 9. Brightness Distribution of Lubang Buaya Beach Tourism.

Table 2. Results of measurements and analysis of the physical and chemical quality of sea water at Moki Beach.

	pH		DO		Temperature		Salinity		Sigma-T		Chl-A		Turb-M		Brightness	
St.	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m	0 m	3 m		
1	7,7	7,5	5,3	5,3	27,52	27,52	33,77	32,3	21,63	20,52	0,42	0,55	1,22	1,03	2 m	
St.	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	Seen	No
2	7,3	7,4	6,9	6,8	27,79	27,66	33,69	32,57	21,47	20,68	1,31	1,10	1,80	1,73	14	15
St.	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	Seen	No
3	7,3	7,6	7.2	6,9	27,89	27,9	33,68	33,72	21,43	21,46	1,82	3,26	2,37	2,34	16	17
St.	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	0 m	24 m	Seen	No
4	7,3	7,4	4,9	6,6	28,00	28,09	33,72	33,66	21,43	21,36	1,17	3,04	1,42	1,91	15	16
St.	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	0 m	21 m	Seen	No
5	7,2	7,4	5	1,6	27,73	27,63	33,72	25,46	21,52	15,37	2,03	3,44	2,36	2,61	16	17
St.	0 m	4 m	0 m	4 m	0 m	4 m	0 m	4 m	0 m	4 m	0 m	4 m	0 m	4 m		
6	7,2	7,5	5,3	0,6	28,07	27,76	33,61	33,71	21,32	21,50	0,58	0,26	1,26	0,31	3 m	
St.	0 m	6 m	0 m	6 m	0 m	6 m	0 m	6 m	0 m	6 m	0 m	6 m	0 m	6 m		
7	7,6	7,5	4,4	2,6	27,72	27,7	33,12	33,22	21,07	21,15	1,52	0,97	0,72	0,76	3 m	
St.	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	0 m	23 m	Seen	No
8	7,4	7,2	6,1	1,4	28,14	28,08	33,68	33,69	21,35	21,38	1,74	2,21	2,27	4,27	12	13
St.	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	0 m	25 m	Seen	No
9	7,3	7,4	0,9	3,9	28,5	27,38	33,7	33,83	21,25	21,72	3,21	0,39	9,37	0,39	16	17

The location of Moki Beach tourism at stations 1, 2, 3, 4, 5, 6, 7, 8, and 9 shows that the pH value on the surface is an average of 7.36 and in the bottom waters an average of 7.43, the DO value on the surface is an average of 4.85 and in the bottom waters an average of 3.96, the temperature value on the surface is an average of 27.92 and in the bottom waters an average of 27.74, the salinity value on the surface is an average of 33.63 and in the bottom waters an average of 32.46, the sigma-t value on the surface is an average of 21.38 and in the bottom waters an average of 20.57, the chl-a value on the surface is an average of 1.53 and in the bottom waters an average of 1.69, the turb-m value on the surface is an average of 2.53 and in the bottom waters an average of 1.70, and the visible brightness value is an average of 10.77 meters. and the invisible average is 11.44 meters. The distribution map of pH, DO, temperature, salinity, sigma-t, chl-a, turb-m, and brightness parameters at stations 1, 2, 3, 4, 5, 6, 7, 8, and 9 can be seen in **Figure 10-17.**

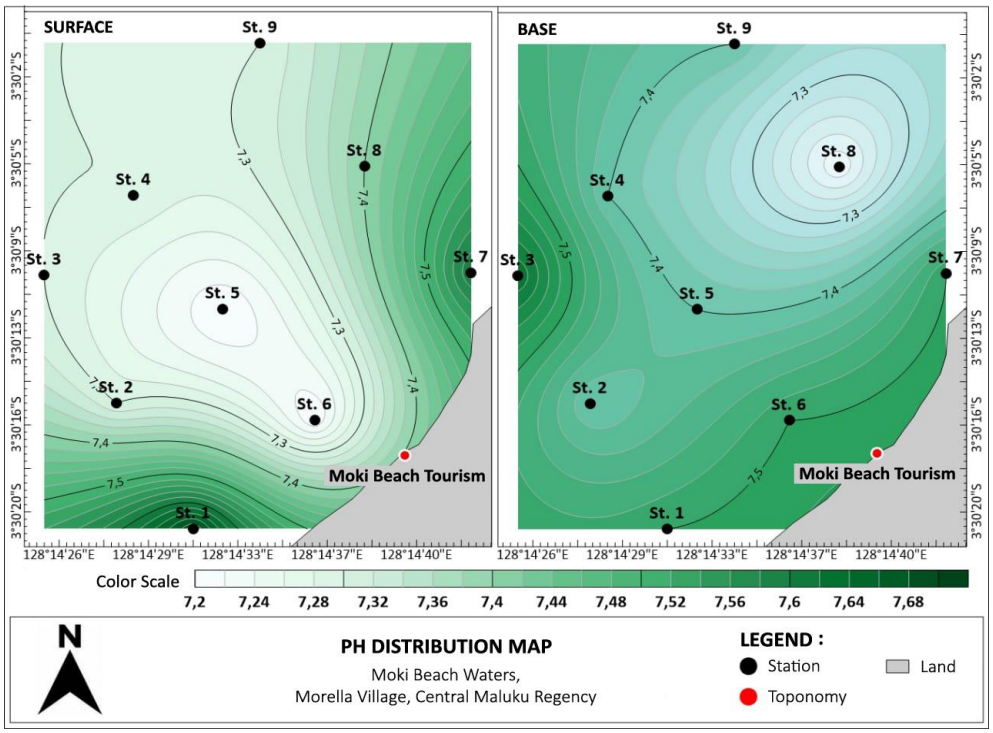

Figure 10. pH Distribution of Moki Beach Tourism.

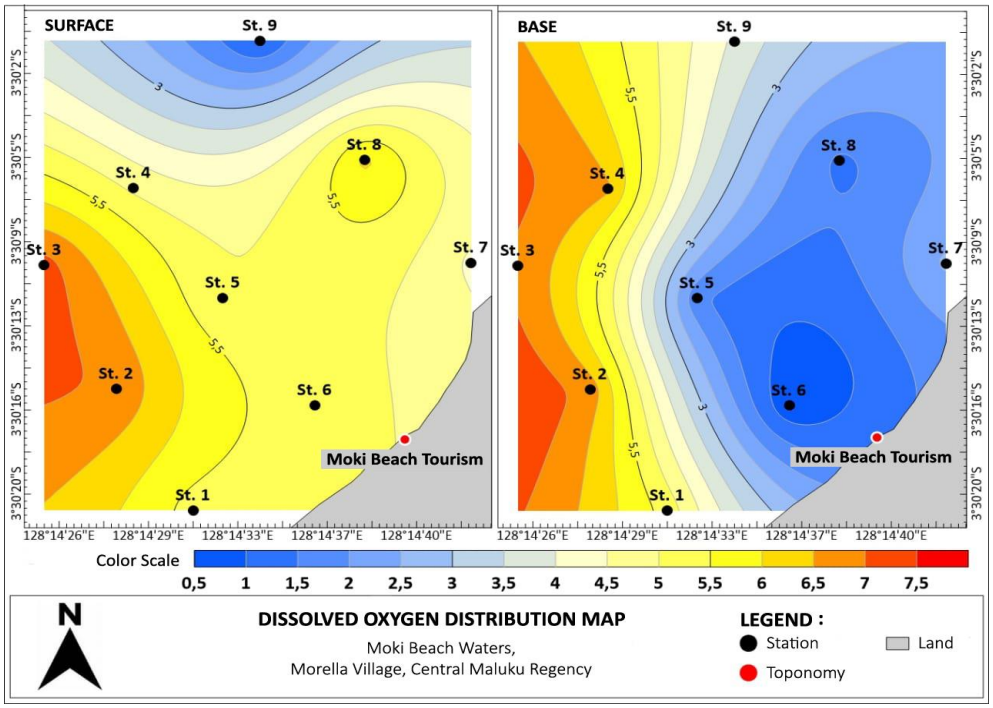

Figure 11. DO Distribution of Moki Beach Tourism.

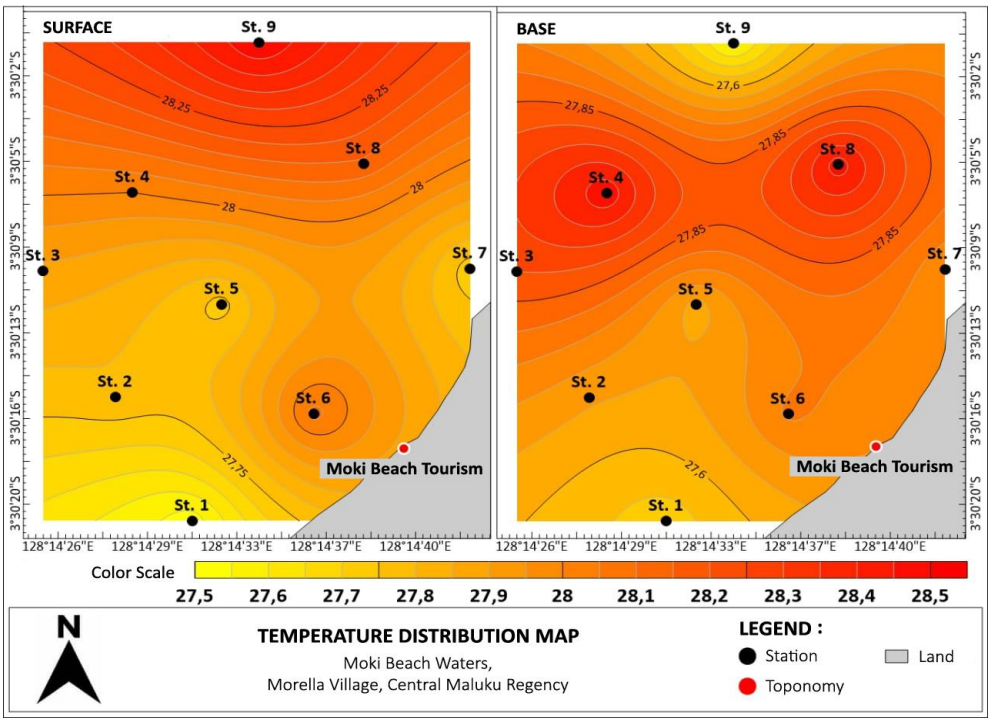

Figure 12. Temperature Distribution of Moki Beach Tourism.

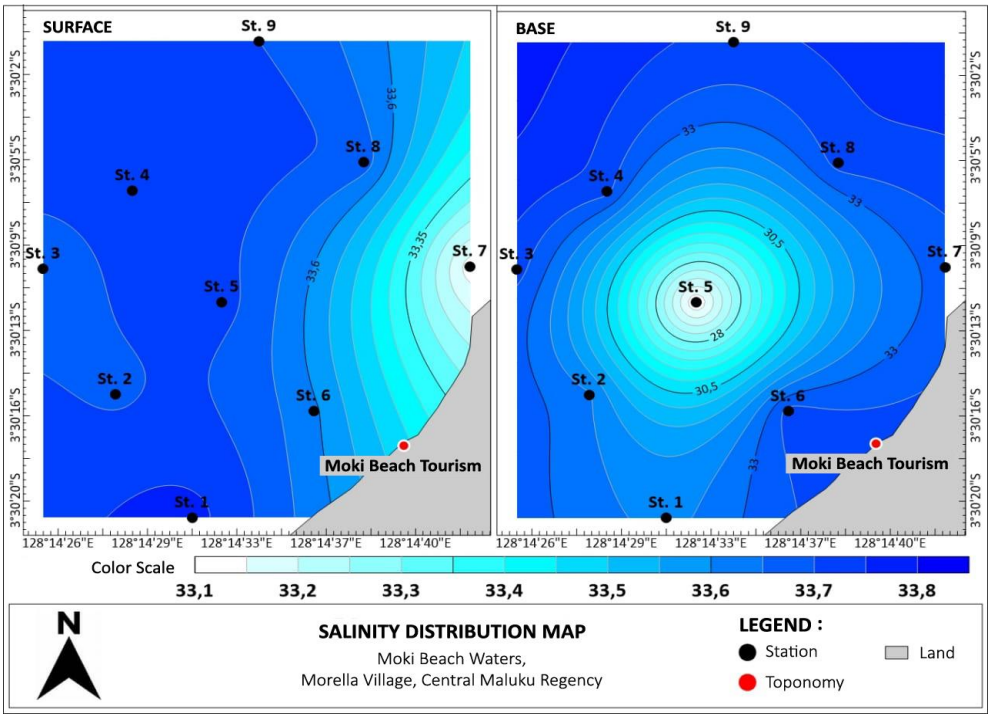

Figure 13. Salinity Distribution of Moki Beach Tourism.

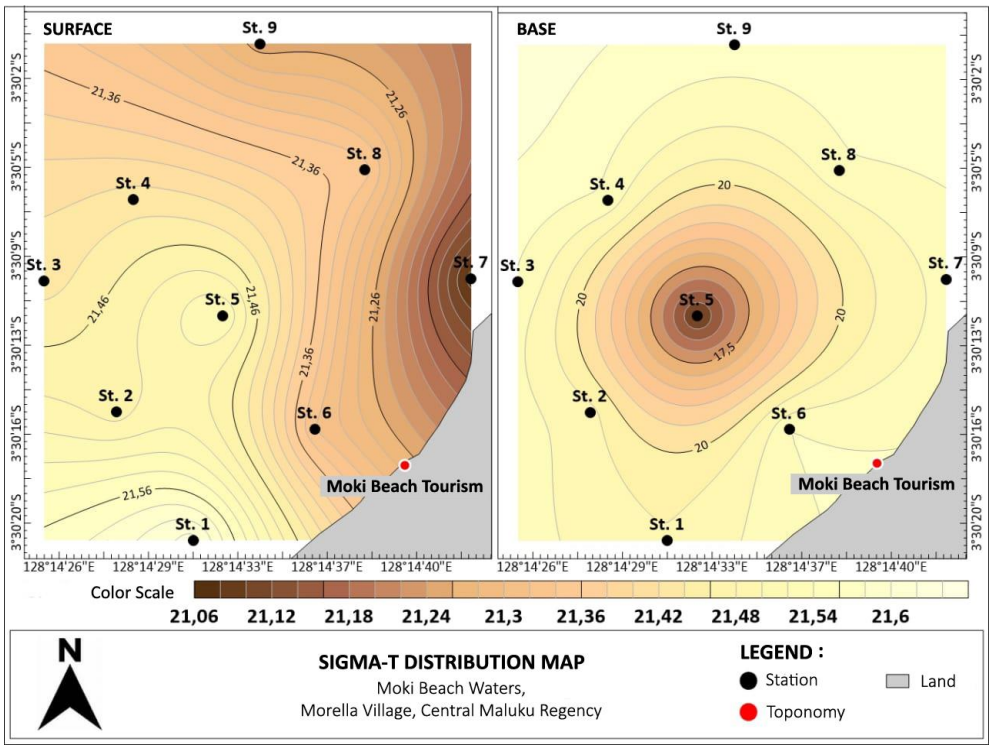

Figure 14. Sigma-T Distribution of Moki Beach Tourism.

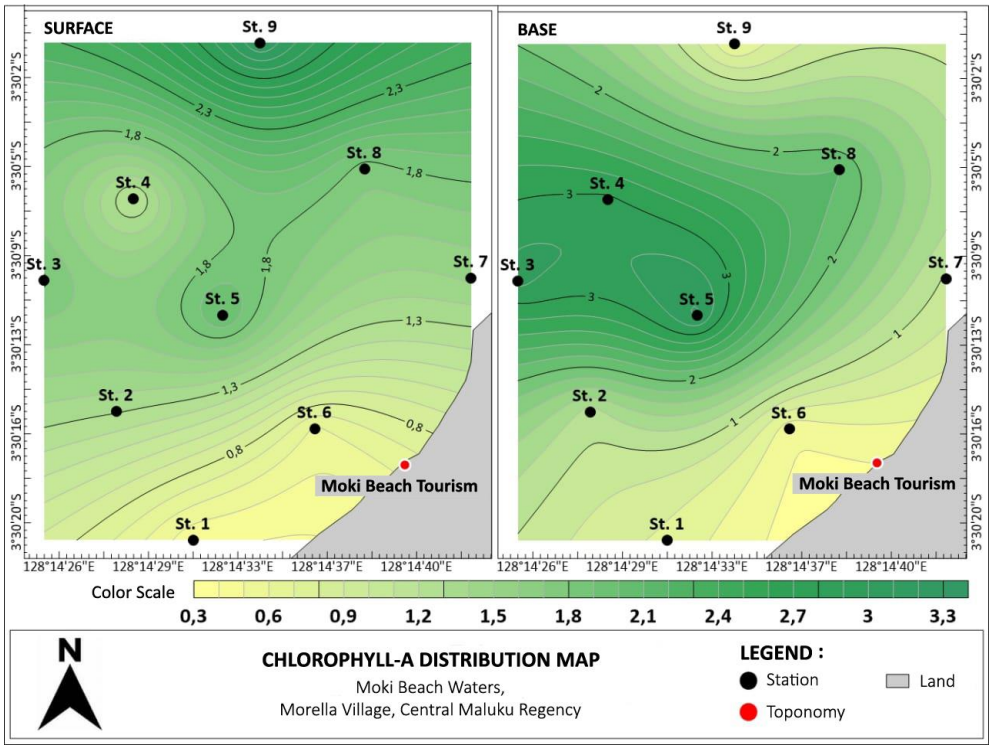

Figure 15. Chlorophyll-A Distribution of Moki Beach Tourism.

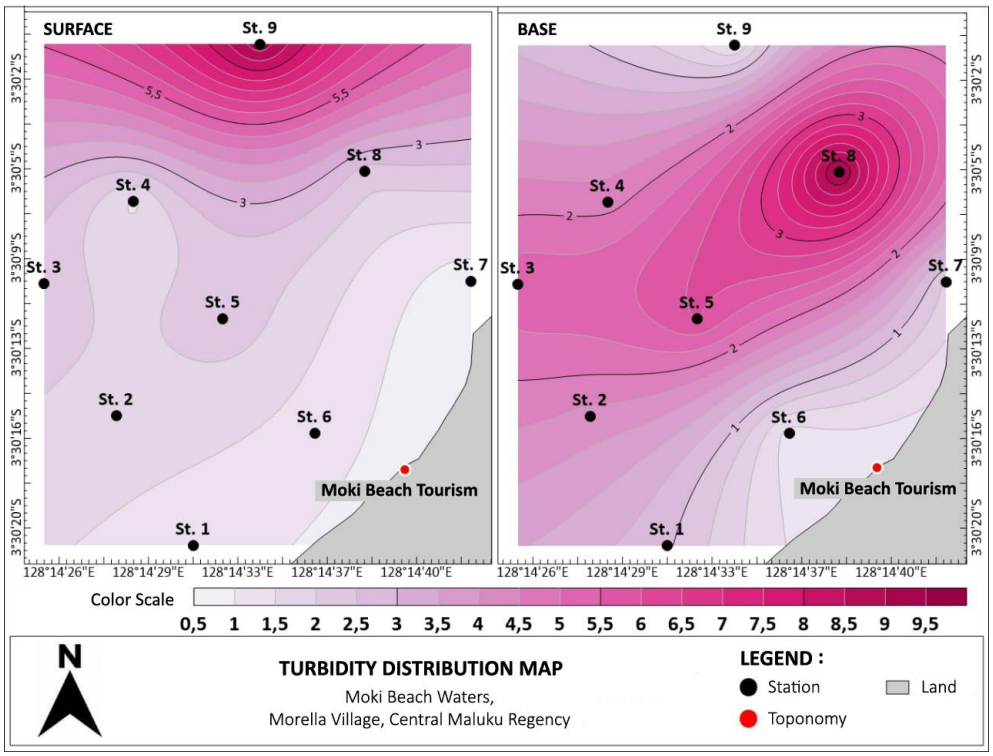

Figure 16. Turbidity Distribution of Moki Beach Tourism.

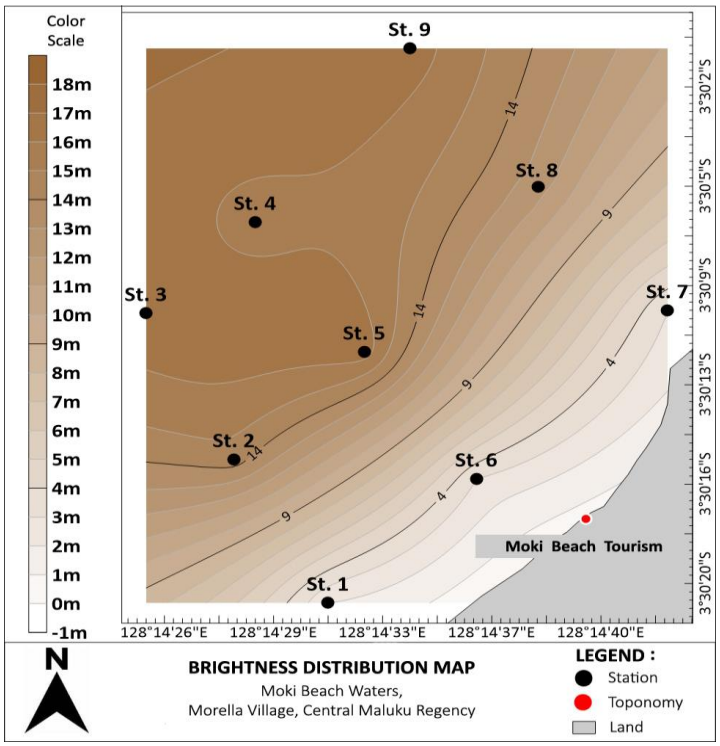

Figure 17. Brightness Distribution of Moki Beach Tourism.

Table 3. Depth and current speed parameters in waters.

Criteria	Weight	Suitability Class (Score)		
		3	2	1
Water Depth (m)	5	> 8	4-8	< 4
Current Velocity (m/sec)	3	0-0.15	0.15-0.40	> 0.40

The current speed of the waters of Lubang Buaya Beach and Moki Beach in the form of a stick plot can be seen in **Figure 18-19.**

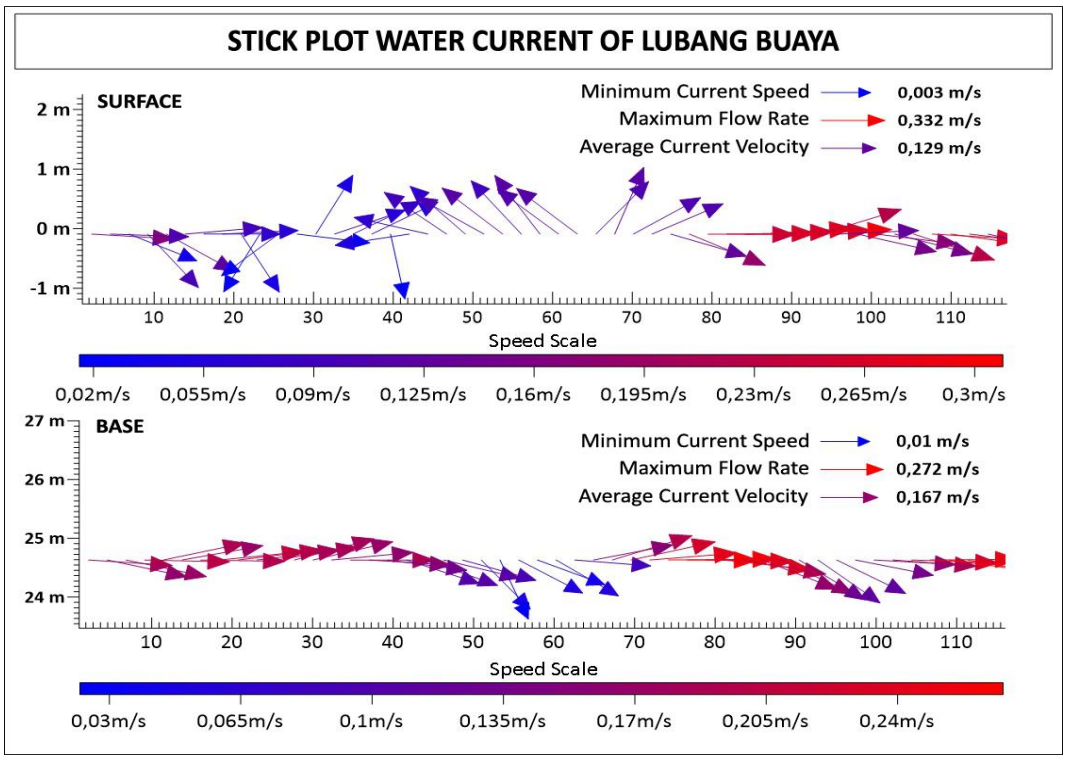

Figure 18. Stick Plot Water Current of Lubang Buaya Coastal.

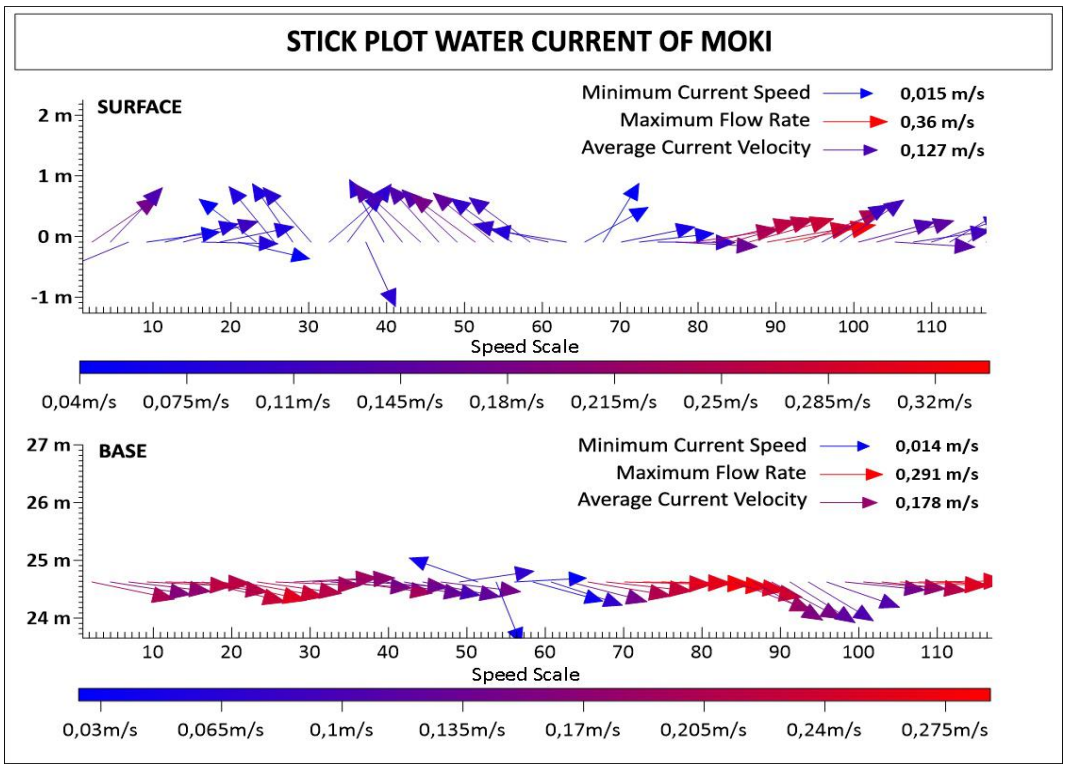

Figure 19. Stik Plot Water Current of Moki Coastal.

The results of current data processing in the waters of Lubang Buaya Beach have a varied current pattern, but the dominant current moves to the northwest and east, the maximum

speed of this current reaches 0.332 m/s, while the minimum current speed reaches 0.003 m /s, the surface current moves with an average speed of 0.129 m/s. While the current pattern in the bottom waters predominantly moves towards the east with a maximum speed of 0.272 m/s, the minimum current speed reaches 0.010 m/s and the average current speed reaches 0.167 m/s, while the current pattern in the waters of Moki Beach which is displayed in the form of a stick plot, namely the current pattern in surface waters shows that the current moves predominantly to the east and northwest, this current moves with a maximum speed of 0.360 m/s, a minimum of 0.015 m/s, and an average current speed of 0.178. Meanwhile, the current pattern that occurs in the bottom waters experiences differences in pattern and speed where the current pattern that occurs in the bottom waters predominantly moves towards the east but often changes direction towards the southeast, this current moves at a maximum speed of 0.291 m/s, a minimum speed of 0.014 and an average speed of 0.178 m/s.

3.2. Discussion

The measured pH value in the waters of Lubang Buaya Beach and Moki Beach is generally greater than 7. At pH < 6 the nitrification process will stop. The optimum pH value for nitrification is 8-9 (KMNLH, 2004). Variations in water pH significantly affect the biota in a body of water. Furthermore, high pH values significantly determine the dominance of phytoplankton, which influences the level of primary productivity in a body of water. The presence of phytoplankton is supported by the availability of nutrients in marine waters (Megawati et al., 2014). The pH value in a body of water is an indication of disturbance of the body of water. A decrease in the pH value in a body of water is indicated by an increase in organic compounds in the body of water. The pH value in the waters of Lubang Buaya Beach at 10 stations is between 7.1-7.7, on the surface an average of 7.28 and on the bottom waters an average of 7.37, the pH value in the waters of Moki Beach at 9 stations is between 7.2-7.7, on the surface an average of 7.36 and on the bottom waters an average of 7.43, still good because it still meets the criteria of the Threshold Limit Value (NAB) of the Ministry of Environment, namely 7-8.5 (KMNLH, 2004), so these waters are suitable for tourism activities.

The DO content of Lubang Buaya Beach waters (10 research stations) on the surface averaged 4.25 and in the bottom waters an average of 4.37, while the DO content of Moki Beach waters (9 research stations) on the surface averaged 4.85 and in the bottom waters an average of 3.96, referring to the Threshold Limit Value (NAB) of the Ministry of Environment Quality Standard for dissolved oxygen levels in waters, namely > 5 mg / l (KMNLH, 2004), then these waters are infertile waters. In general, DO on the surface is relatively higher than in the bottom waters at the 2 research locations. DO is required by all living organisms for respiration, metabolism, and the exchange of substances, which then generate energy for growth and reproduction. In addition, oxygen is also needed for the oxidation of organic and inorganic materials in aerobic processes. The need for dissolved oxygen varies depending on the species, stage, and activity (Gemilang et al., 2017).

In the waters of Lubang Buaya Beach (10 research stations) the average surface temperature value is 27.86°C and the average bottom waters are 27.79°C, while in the waters of Moki Beach (9 research stations) the average surface temperature value is 27.92°C and the average bottom waters are 27.74°C. Temperature is one of the important parameters in tourism development. The natural temperature according to the quality standards for marine tourism activities ranges from 28-30^{o}C with the dominant temperature ranging between 27-29°C (Hamuna et al, 2015). For optimal development, the average temperature is in the range of 23-35^{o}C with a tolerance limit ranging from 36-40^{o}C. The range of temperature values found in the 2 research locations is still feasible for ecotourism development.

The salinity of the Lubang Buaya Beach waters (10 research stations) on the surface averaged 31.98‰ and on the bottom waters averaged 31.66‰, while the salinity of the Moki Beach waters (9 research stations) on the surface averaged 33.63‰ and on the bottom waters averaged 32.46‰. Salinity plays a very important role in supporting the life of aquatic biota. In marine tourism, the existence of coral reefs in good condition is an

attraction for snorkeling and diving. The salinity value found in the 2 research locations is in accordance with the coral reef salinity quality standard, namely 33-34‰. In addition, salinity is influenced by physical factors such as temperature. Differences in water salinity can occur due to differences in evaporation and precipitation (Hamuna et al, 2018). The range of salinity values is suitable for coral reef life.

The distribution of sigma-t in the waters of Lubang Buaya Beach (10 research stations) on the surface averaged 20.17 and in the bottom waters an average of 19.95, while the distribution of sigma-t in the waters of Moki Beach (9 research stations) on the surface averaged 21.38 and in the bottom waters an average of 20.57. Density (sigma-t) increases with increasing salinity and decreasing temperature, except at temperatures below the maximum density. The density of seawater is in the range of 1,025 kg/m-^{3} while in fresh water it is 1,000 kg/m-^{3} (Ramdhan, 2015).

The chlorophyll-a content of the Lubang Buaya Beach waters (10 research stations) on the surface averaged 2.35 mg/l and in the bottom waters an average of 1.51 mg/l, while the chlorophyll-a content of the Moki Beach waters (9 research stations) on the surface averaged 1.53 mg/l and in the bottom waters an average of 1.69 mg/l which are classified as oligotrophic and mesotrophic waters. Organisms' requirements for dissolved oxygen vary depending on their species, stage, and activity (Gemilang et al., 2017). Nitrate (NO_3-N) is the primary form of nitrogen in natural waters. Nitrate is an essential nutrient for protein synthesis in animals and plants. High nitrate concentrations in water can stimulate the growth and development of aquatic organisms in a region, supported by nutrient availability (Hamuna et al., 2018). Turbidity (Turb-M) or turbidity in the waters of Lubang Buaya Beach (10 research stations) on the surface averaged 2.68 NTU and turbidity in the bottom waters averaged 1.91 NTU, while in the waters of Moki Beach (9 research stations) on the surface averaged 2.53 NTU and in the bottom waters averaged 1.70 NTU. The turbidity value characterizes the level of water clarity. This value is very suitable for beach tourism activities. The turbidity standard for marine tourism in the Decree of the Minister of State for the Environment Number 51 of 2004 is 5 NTU (KMNLH, 2004). The turbidity of seawater is influenced by the presence of currents, waves and tides (Indrayana et al., 2014).

The brightness value in the waters of Lubang Buaya Beach (10 research stations) ranges from 10-13 meters, while the brightness value in the waters of Moki Beach (9 research stations) ranges from 2-16 meters. Most of the observation results are still above the seawater quality standards for marine biota in the Decree of the Minister of State for the Environment No. 51 of 2004, except at station 1 with a brightness level of only 2 meters, station 6 and station 7 with a brightness level of only 3 meters in the waters of Moki Beach. The water clarity level at Lubang Buaya Beach and Moki Beach is categorized as good for bathing and swimming (Yulisa et al., 2016).

Parameters of depth and current speed in waters compared with tourism suitability index for boating, banana boat and jet ski categories. Tourism suitability matrix for boating, banana boat and jet ski categories according to Tambunan et al. (2013) can be seen in Table 3.

Based on the measurement of biophysical parameters, it shows that for boating tourism activities, banana boats and jet skis in the waters of Lubang Buaya Beach and Moki Beach are included in the very suitable and appropriate categories. The relationship between water depth and current speed that can be utilized for marine tourism boats, banana boats, and jet skis is the type of slow and medium currents and locations with depths above 5 meters (Tambunan et al., 2013).

4. Conclusions

Based on the results of research on the Lubang Buaya and Moki Beach tourist beaches, Central Maluku Regency, Maluku Province, the water conditions, namely pH, temperature, salinity, sigma-t, chlorophyll-a, turbidity-m, and frequency are in the appropriate category, while DO is in the inappropriate category based on water assessment standards so that it can cause oxygen deficiency for aquatic organisms and damage so that it is necessary to carry out a training process for the community in the ecotourism area regarding household management needed to improve air quality. The results of the environmental atmosphere

assessment for ecotourism development at a surface depth (0 meters) and the bottom of the waters of 3-25 meters and a minimum current speed of 0.003 m / s and a maximum current speed of 0.36 m / s are included in the appropriate category and are very suitable for boating, banana boating, and jet skiing tourism activities.

Conflicts of interest

There are no conflicts to declare.

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