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Pore Water Nutrient Profile in the First and Second Transitional Season in Teluk Ciletuh, Sukabumi District, West Java

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ABSTRACT

The purpose of this research conducted between October 2018 and April 2019 was to determine the effect of the first and second transitional season on the nutrient profile in Ciletuh Bay. The data used in this research and directly taken from the research site were seawater quality parameters, analysis of granulometry sample and analysis of nutrient profile, while all data processing was conducted in a laboratory. The method used in this study was purposive sampling. The results of this research indicated that the nutrient profile in the first transitional season is higher than the second transition season. This is due to the introduction of organic matter into the waters. From this research it can be concluded that the first transitional season affects the concentration of nutrient in Ciletuh Bay.

Keywords: Nutrients, Transitional Season, Water Quality Parameters, Ciletuh Bay

1. INTRODUCTION

Nutrients are utilized by marine organisms found on the surface and at depths that can be reached by sunlight (the euphotic zone) where the photosynthesis process takes place [1]

The types of primary nutrients needed in the sea include nitrate, nitrite, ammonia, phosphate and chlorophyll - a. One area that has a high nutrient content is in the Ciletuh Bay

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area. Geomorphologically, Ciletuh Bay has a unique landscape shape such as an open amphitheater facing Ciletuh Bay, and is bordered by a white sandy coastline with the Indian Ocean - Australia. Ciletuh Bay has abundant nutrient components. One of the factors affecting nutrient content in Indonesian waters is the transitional season [2]. Indonesia is influenced by the monsoon wind system, which consists of a west monsoon and an east monsoon. This monsoon usually lasts between three months, between the east and west monsoons there is a change of wind direction before completely changing to the west and east monsoons, this season is called the transitional season. The first transitional season occurs in the period March to May, while the second transitional season occurs in the period of September. In addition, many activities carried out by residents have made the waters of Ciletuh Bay have abundant nutrient components. One of the factors affecting nutrient content in Indonesian waters is the transitional season [2].

2. METHODS

2. 1. Research Area

The research area is located at Ciletuh Bay in Sukabumi district of West Java, Indonesia (geographical location – Figure 1, location coordinates - Table 1).

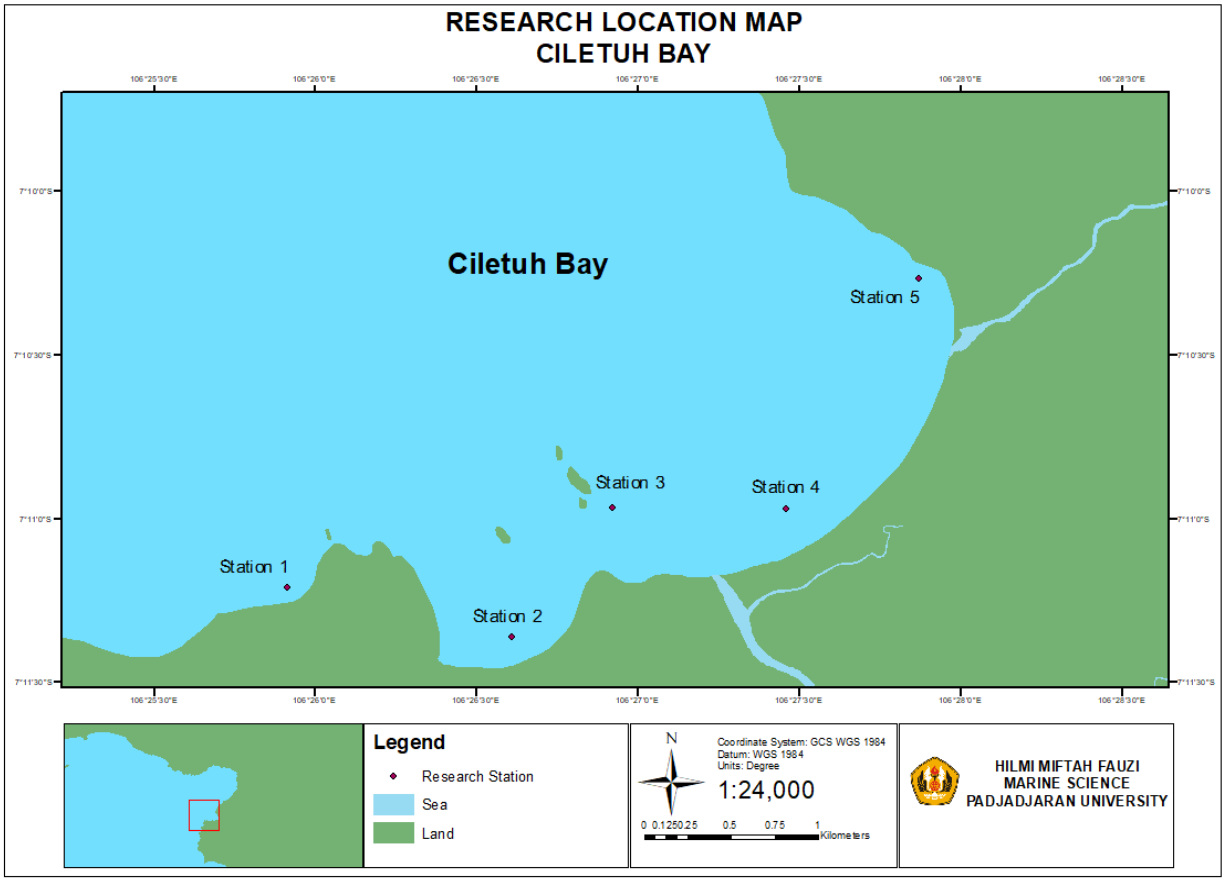

Figure 1. Research Study Area

Table 1. Coordinates of Research Station.

Station	Latitude	Longitude
1	-7.186861°	106.431861°
2	-7.189389°	106.443500°
3	-7.182806°	106.448667°
4	-7.182845°	106.457651°
5	-7.171157°	106.464503°

2. 2. Data and Method

The data used in this study are water quality (temperature, water transparency, salinity, DO, pH and current velocity) and sample sediment. The data were collected using a purposive sampling method and were taken in October 2018 (Second Transitional Season) and April 2019 (First Transitional Season). The samples of water quality were measured using the tools of each parameter and repeated three times with the results averaged.

Sediment samples were processed to see the comparison with nutrient data taken from granulometric analysis. Nutrients identification was conducted in the University Ecological Laboratory of Padjajaran, while the processing of sedimentary samples was by way of utilizing Sieve shaker tools and was carried out at the Hydro-Oceanography Laboratory and Laboratory Marine Conservation Faculty of Fisheries and Marine Science.

3. RESULTS AND DISCUSSION

3. 1. Research Location Condition

The table shows that the first and second transitional seasons have varying values of physical and chemical parameters (Table 2). It can be seen that the whole second transitional season has a fairly good value compared to the first transitional season in accordance with the seawater quality standards according to KEPMEN LH No.51 of 2004 [3]. In the first transitional season the parameter that has a low value is salinity with a value of 14 ‰, This low value is due to the influence of increased rainfall intensity. Meanwhile, in second transitional season, the brightness level in second transitional season ranges from 37.40 -100% and a salinity value of 30-35‰.

The results of water quality data collection in Ciletuh Bay during the first and second transitional season can be seen in Table 2. The water temperature in first transitional season ranges from 26 - 30.5 °C, while in the second transitional season ranges from 27 - 30 °C. The difference in water temperature in the two seasons was caused by the difference in time at each seawater temperature sampling, because the intensity of sunlight affects water temperature [4].

The value of the water transparency in first transitional season ranged from 7 - 27.77%, while in the second transitional season the value of the water brightness was different between 37.4 - 100%. The value of water transparency in the second transitional season shows that the water quality is good according to KEPMEN LH No.51 of 2004 [3], where the good water transparency value for sea water is> 3 m or above 10%. The low value of sea water transparency

in the first transitional season is caused by the intensity of rainfall and particle runoff into the river which brings it to the bay [5] However, it can still be classified as 'good'.

Table 2. Result of Water Quality Parameters.

Station	Water Quality Paremeters						
	Seasons	Sea Temperature (°C)	Water Transparancy (%)	Salinity (‰)	DO (mgl/L)	pH	Current (m/s)
1	First Transitional	26	21,42	19	8,5	8,1	4,3
	Second Transitional	29,5	100	35	7,2	7,9	2,9
2	First Transitional	30	27,77	16	8,3	8	5
	Second Transitional	30	53,83	34	7,2	7,8	3,4
3	First Transitional	28	17,5	14	5,6	8	4
	Second Transitional	28	60,89	34	6,4	7,7	2,3
4	First Transitional	27	13,33	20	5,6	8	3,8
	Second Transitional	28	40,89	32	5,9	7,3	1,2
5	First Transitional	30,5	7	18,3	8,15	8,1	2,4
	Second Transitional	27	37,4	30	5,9	7,55	0,8

In the first transitional season, the salinity value ranges from 14 - 20 ‰, while in the second transitional season it ranges from 30 - 35 ‰. The difference in salinity values occurs due to the entry of fresh water due to rainfall either directly or from river flows. DO levels in the first transitional season ranged from 5.6 - 8.5 mg / L, while in the second transitional season ranged from 5.9 - 7.5 mg / L. DO levels in Ciletuh Bay waters are acceptable because they have values above the DO quality in seawater (> 5 mg / L).

The pH value of seawater in first transitional season ranges from 8 - 8.1 while in second transitional season ranges from 7.3 - 7.97. Based on the quality of seawater according to KEPMEN LH No.51 of 2004 [3], the acceptable pH value for water is above 5, so that a good pH value will affect the nutrient content.

The average current velocity in the first transitional season is 4.5 m / s, and in the second transitional season is 2.12 m / s. . The current condition of Ciletuh Bay in both months is classified as very fast (> 1 m / s). This is caused by tidal phenomena where the main driver of water mass in closed waters such as bays is tides.

3. 2. Sediment Type Classifications

An analysis results of sediment samples at each station was made utilizing the software package KUMMOD SEL to assess and to classify the largest sediment sizes obtained during sampling (Table 3).

Table 3. Sediment Clasification

Station	Seasons	Sediment Type
1	First Transitional	Gray mud
	Second Transitional	Slightly Mud
2	First Transitional	Slightly Gnarled Sand Mud
	Second Transitional	Sand Mud
3	First Transitional	Silt
	Second Transitional	Slightly Gnarled Sand Mud
4	First Transitional	Silt
	Second Transitional	Slightly Gnarled Mud
5	First Transitional	Silt
	Second Transitional	Sandy silt

The type of sediment in the first transitional season shows that the sediment texture in Ciletuh Bay is dominated by silt. On the other hand, during second transitional season, the sediment fraction in Ciletuh Bay is dominated by mud. The different types of sediments in each month are caused by the size of the particles carried by the current and also the runoff. The spread of the sediment fraction is influenced by slower ocean currents (Table 2).

The difference in sediment types in each season in the waters is due to the size of the particles and skeletal remains determined by the physical characteristics of each sampling location and will affect the nutrient content [6].

3. 3. Pore Water Nutrient Concentrations

Nutrient concentrations can be seen in Table 4. The nutrient concentration in the first transitional season had an average of 17.267 mg / L, while in the second transitional season it was 5.76 mg / L. The two seasons have significant differences, where the concentration in the first transitional season is higher than that of the second transitional season. However, the nitrite concentration in the second transitional season was higher, namely 3.702 mg / L, and in the first transitional season had a concentration value of 0.535 mg / L.

Table 4. Nutrient Concentrations in Ciletuh Bay Waters

Unit mg/L	Station									
	1		2		3		4		5	
	TS I	TS II	TS I	TS II	TS I	TS II	TS I	TS II	TS I	TS II
Nitrate	3,778	1,05	3,147	1,22	3,838	0,94	3,966	1,39	2,538	1,16
Nitrite	0,071	0,195	0,21	0,137	0,176	2,58	0,054	0,631	0,024	0,159
Ammonia	0,009	0,0179	0,077	0,0367	0,02	0,0392	0,014	0,0233	0,214	0,0286
Phosphate	0,158	0,009	0,153	0,055	0,174	0,058	0,21	0,008	0,184	0,071
Chlorophyll -a	3,1	1,48	2,24	2,47	2,01	4,45	3,72	6,43	7,09	2,97

3. 3. 1. Nitrate

Nitrate concentrations in transitional season I ranged from 2,538-3,966 mg / L and had a difference during second transitional season which ranged from 0.94 to 1.39 mg / L (Fig.2) The high concentration of nitrate in first transitional season was due to high intensity. High rainfall and causes runoff from river flows that are collected at various stations and affects the Nitrate concentration. Source of nutrient elements comes from river input [7,8].

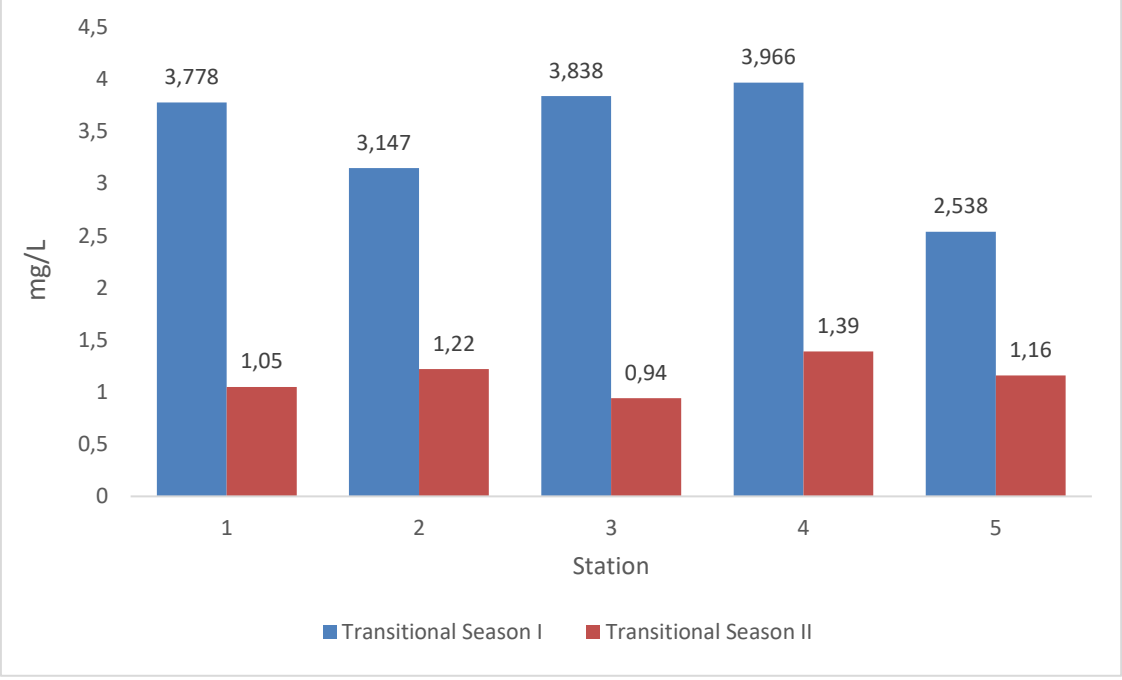

Figure 2. Nitrate of Concentration

The increase in nitrate concentration is due to a decrease from upstream to downstream and dilution of coastal water and nutrient deposition in the estuary. The transformation of nitrogen contained in the sediment is regulated based on the type of sediment, dissolved oxygen, benthic organisms and hydrodynamic processes [9,10]. Based on KEPMEN LH No.51 Year 2004 [3], the sea water quality standard at the nitrate concentration is 0.008 mg / L, so that in both seasons it has a fairly high concentration.

3. 3. 2. Nitrite

Nitrite concentrations in the first transitional season ranged from 0.024 - 0.210 mg / L, while in the second transitional season ranged from 0.137 - 2.58 mg / L. The differences that occur in nitrite concentrations can be influenced by water conditions at the research location itself (Fig.3). The high levels of nitrite at station 3 can be caused by the influence of activities from lift net there is a supply from the mainland of Mandra Island that enters the water, besides that, the concentration of nutrients in the sediment is controlled by transportation (exchange of sediment water.), the release of nutrients (by fauna, bacteria and dissolution) and absorbed (by plants, bacteria and adsorption) [11].

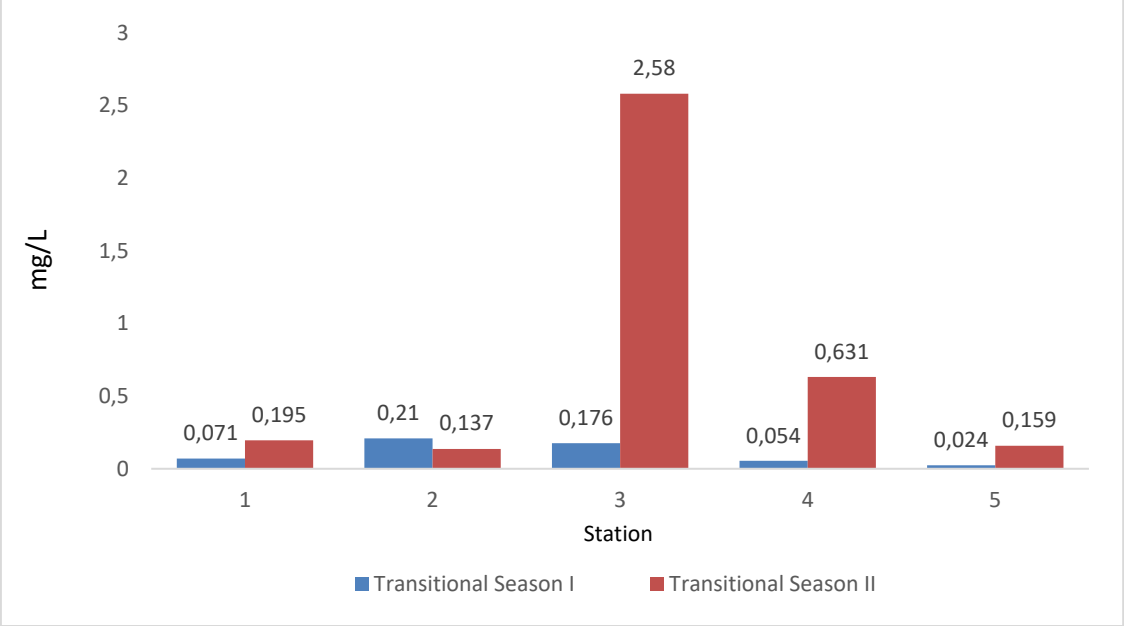

Figure 3. Nitrite of Concentration

A significant increase occurred at station 3 during second transitional season, this happened because the area at this station was affected by the interaction of river flow and tides. In addition, there is a spatially changing material displacement which causes differences in the concentration of pore water nutrients. A significant increase can be caused by the denitrification process, where the resulting reduced N2 gas is not involved in the sediment redox process, so it has a direct effect on oxygen demand [12] Based on KEPMEN LH No.51 of 2004 [3], concerning sea water quality standards against the maximum limit of nitrite levels in the waters of 0.06 mg / L.

3. 3. 3. Ammonia

Based on the test results, the concentration of ammonia has various values, during the first transitional season ammonia concentration is in the range of 0.009 - 0.214 mg / L, while in the second transitional season ranges from 0.0179 - 0.0392 mg / L (Fig. 4) . The increase occurred at station 5, where the research location at that station was an estuary area. Based on KEPMEN LH No.51 of 2004 [3], the seawater quality standard for ammonia concentration is 0.3 mg / L.

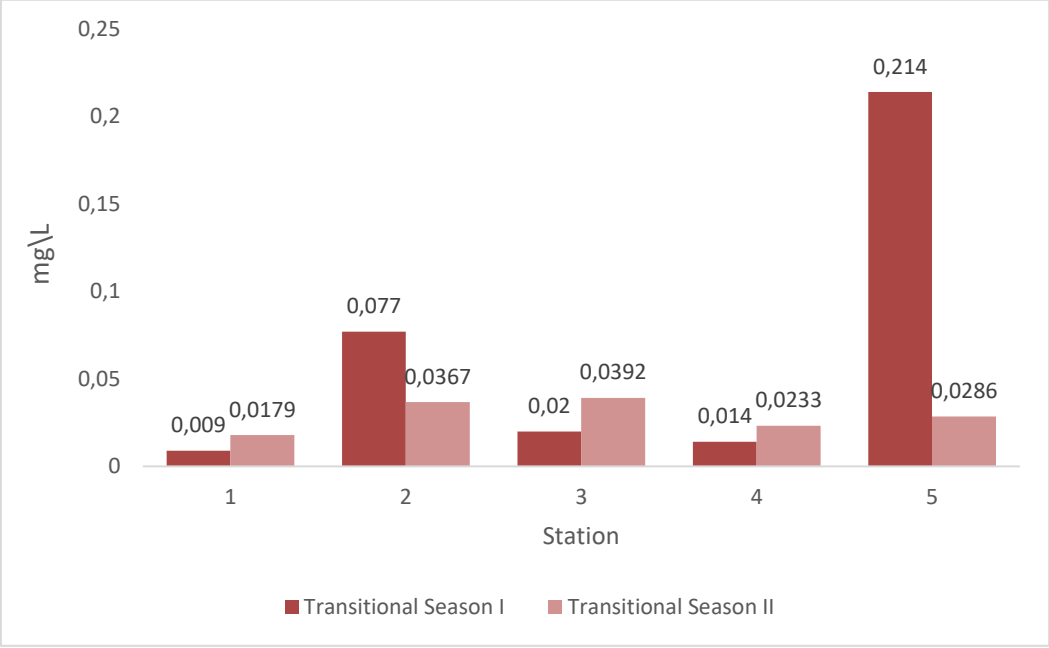

Figure 4. Ammonia of Concentration

3. 3. 4. Phospate

The phosphate concentration in the waters of Ciletuh Bay, in the first transitional season ranged from 0.153 - 0.075 mg / L and had a higher average than the second transitional season with a range of 0.008 - 0.071 mg / L. Based on KEPMEN LH No.51 of 2004 [3], the limit for the value of the quality standard on the phosphate parameter in a waters is 0.015 mg / L.

Pore water phosphate concentration changed between seasons in the upper reach of the estuary, suggesting that phosphate was strongly influenced by runoff inputs. Phospate concentrations were the high because the high water temperature elevated the activities of microorganisms, and thus stimulated the degradation of organic matter by microbiological agents, which enhanced the further release of phosphate [13,14].

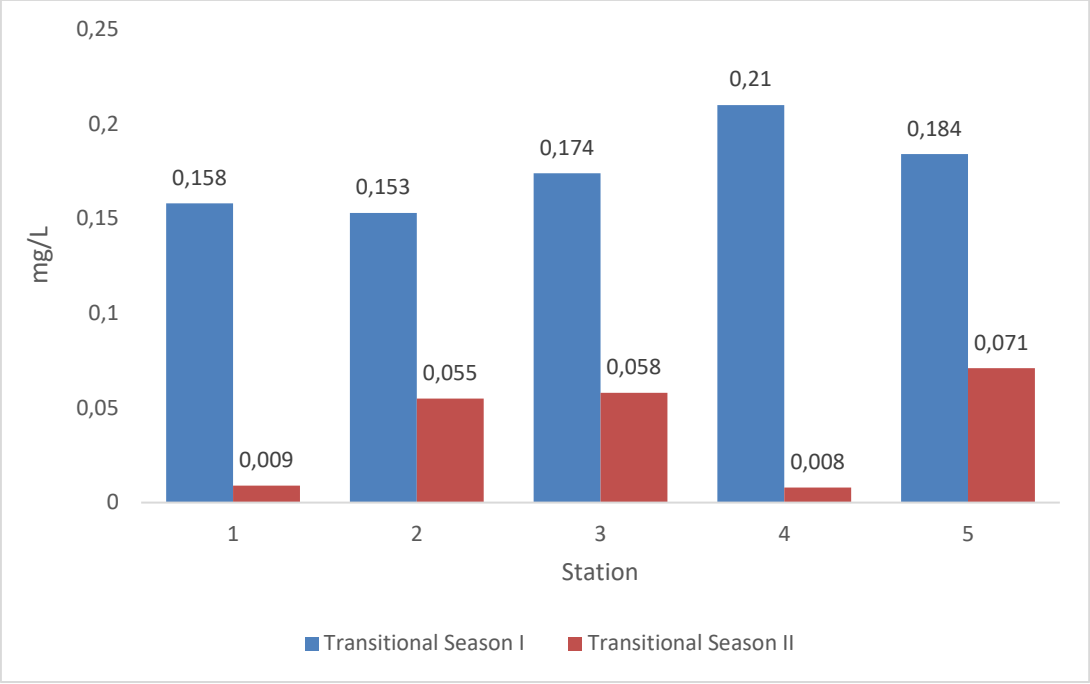

Figure 5. Phosphate of Concentration

3. 3. 5. Chlorophyll-a

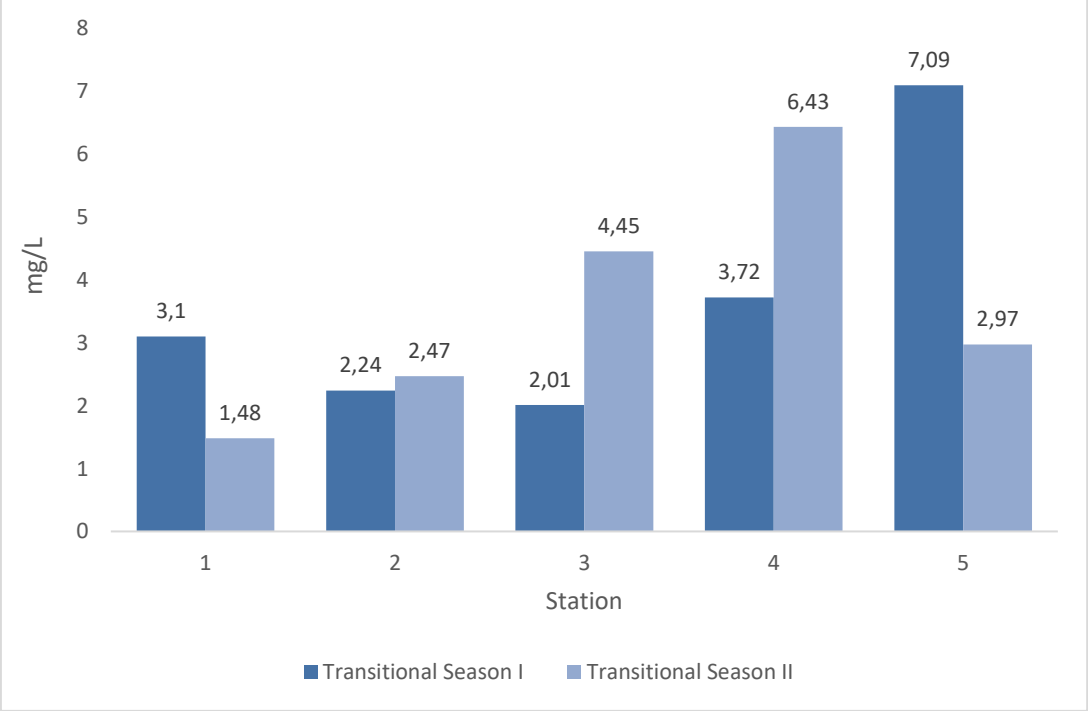

Figure 6. Chlorophyll-a of Concentration

The concentration of chlorophyll-a in Ciletuh Bay in the first transitional season ranged from 2.01 - 7.09 mg / L, while in the second transitional season ranged from 1.48 - 6.43 mg / L (Fig. 6). Based on KEPMEN LH No.51 of 2004 [3], the limit of the quality standard value for chlorophyll-a parameters in a waters is 0.2 mg / L. The concentration of chlorophyll-a in the surface area shows that there is approximately 30% of primary productivity in the sea and the distribution of the concentration of chlorophyll-a is higher in coastal waters compared to the high seas, because coastal waters get a supply of nutrients from land [15].

The chlorophyll-a concentration at stations 4 and 5 is influenced by the high organic matter present at these stations. The large concentration of organic matter can trigger the growth of phytoplankton so that the chlorophyll-a concentration at the station is high [16,17] The increase in nutrients leads to an increase in the phytoplankton population, and vice versa [18] States that the abundance of phytoplankton species is related to the increase in nutrients that enter coastal waters from river estuaries.

4. CONCLUSION

The first transitional season affects the condition of nutrient profile in Ciletuh Bay which causes the increasing of the concentration of nitrate, phosphate, ammonia, and chlorophyll- a (2,3 mg/L, 0,13 mg/L, 0,03 mg/L, 0,07 mg/L, respectively). The second transitional season affects the condition of the nutrient profile in Ciletuh Bay which causes the increasing of the concentration of nitrite (0.633 mg L).

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