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Spatial Distribution Of Nutrient In The Waters Of Haruku Strait, Central Maluku Regency, Maluku Province

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ABSTRACT

Strait waters are influenced by tides, water masses and surrounding land. This study aims to analyze the spatial distribution of nutrients in the waters of the Haruku Strait, Central Maluku Regency, Maluku Province. The research method used is purposive sampling method by taking water samples. Water samples were taken from 17 observation stations spread across the Haruku Strait at depths of 1 meter, 25 meters and 50 meters using the Niskin Bottle Water Sampler. Nitrate concentration analysis using the OPTIZEN Alfa equipment (Spectrophotometer UV-Vis) and the Brucine Sulfate method (SNI: 06-2480-1991) and phosphate concentration analysis using the Ammonium Molybdate method (APHA 10th ed. 5400-PD, 1998). The time of observation took place on July 23, 2022. The results showed that the average concentration of nitrate at a depth of 1 m was 1.146 ± 0.647 mg/L, a depth of 25 m was 1.148 ± 0.709 mg/L and a depth of 50 m was 1.136 ± 0.701 mg/L while the average concentration of phosphate at a depth of 1m was 0.051 ± 0.028 mg/L, a depth of 25 m was 0.053 ± 0.029 mg/L and at a depth of 50 m was 0.049 ± 0.020 mg/L. The waters of the Banda Sea, the Seram Strait and contributions from the rivers on the coast of Ambon Island play a role in the distribution of nutrients in the waters of the Haruku Strait.

***Kata Kunci*:**
Fosfat; Nitrat; Selat Haruku; Sebaran Spasial

ABSTRAK

Perairan selat merupakan perairan dinamis karena dipengaruhi oleh pasang surut, massa air perairan dan daratan di sekitarnya. Penelitian ini bertujuan untuk menganalisis distribusi nutrien secara spasial di perairan Selat Haruku, Kabupaten Maluku Tengah, Provinsi Maluku. Metode penelitian yang digunakan adalah metode purposive sampling dengan cara pengambilan contoh air. Contoh air diambil dari 17 Stasiun pengamatan yang tersebar di Selat Haruku pada kedalaman 1 meter, 25 meter dan 50 meter dengan menggunakan Niksin Bottle Water Sampler. Analisis konsentrasi nitrat menggunakan peralatan OPTIZEN Alfa (Spectrophotometer UV-Vis) dan metode Brucine Sulfat (SNI: 06-2480-1991) dan analisis konsentrasi konsentrasi fosfat menggunakan metode Amonium Molibdat (APHA ed. 10th 5400-PD, *1998). Waktu pengamatan berlangsung pada 23 Juli 2022. Hasil penelitian menunjukkan bahwa rata-rata konsentrasi nitrat pada kedalaman 1 m sebesar 1,146±0,647 mg/L, kedalaman 25 m sebesar 1,148±0,709 mg/L dan kedalaman 50 m sebesar 1,136±0,701mg/L sedangkan rata-rata konsentrasi fosfat pada kedalaman 1m sebesar 0,051±0,028 mg/L, kedalaman 25 m sebesar 0,053±0,029 mg/L dan pada kedalaman 50 m sebesar 0,049±0,020 mg/L. Perairan Laut Banda, Selat Seram dan kontribusi dari sungai di pesisir Pulau Ambon berperan dalam distribusi nutrien di perairan Selat Haruku.*

INTRODUCTION

Haruku Strait is located in the Central Maluku Regency, Maluku Province. The strait is flanked by Ambon Island in the west, Seram Strait in the north, Haruku Island in the east and Banda Sea in the south. The Haruku Strait is a potential fishing area for pelagic and demersal fish such as tuna (*Euthynus affinis*), skipjack (*Katsumonus pelamis*), mackerel (*Rastreliiger kanarguta*), selar (*Selaroides* sp), (*Decapterus macrosoma*), bubara (*Caranx* sp), sikuda (*Lethrinus* sp), snapper (*Lutjanus* sp), grouper (*Epinephulus* sp) (Lestaluhu, 2023), lalosi (*Pterocaesio* tile) (Tuapetel, et al., 2022), red snapper subfamily Etelinae (Matrutty, 2016).

The waters of the Haruku Strait are influenced by the circulation of Banda Sea water mass, and Seram Strait water mass as well as freshwater mass input through rivers that end up on the coast of Waai and Tulehu Village, Ambon Island and Haruku and Rohomini Village, Haruku Island. Freshwater mass input through rivers on the coastal of Ambon Island and Haruku Island can play a role in depositing nutrient concentrations in the coastal waters of the Haruku Strait.

The Banda Sea water mass has seasonal variations in characteristics. During the eastern season (June-August) upwelling occurs in the Banda Sea due to monsoon winds. Upwelling causes nutrient enrichment in the surface layer. The high level of nutrients triggers phytoplankton growth and has an impact on water productivity (Tubalawony et al., 2016). According to Weber and Deutsch (2010), nitrate and phosphate are the main nutrients in the sea and have a correlation with plankton biomass.

The water mass of the Seram Strait is influenced by the mainland of Seram Island and the Banda Sea water mass. Banda Sea water masses enter through the Saparua Strait and the strait waters between Saparua Island and Seram Island (Tubalawony et al. 2023). The meeting of these water masses and the influence of freshwater masses that flow into these waters are thought to affect the spatial distribution of nutrients, both nitrate and phosphate waters.

Research in Haruku waters has been conducted by Tubalawony et al. (2023) on the distribution of temperature and salinity in Haruku Strait waters, Matrutty (2016) related to the profile of oceanographic conditions of red snapper fishing grounds in Lease Islands waters including Haruku Strait waters, Regubregt et al. (2019), analyzed water quality and phytoplankton in Haruku waters, Sangadji and

Sofyan (2019) on reproductive biology of white momar fish (*Decapterus macrosoma*), Tuapetel et al. (2022) on reproduction of lalosi fish in Tulehu waters and Lestaluhu (2023) on fishing gear and catches in Haruku Strait waters.

Based on this, research related to the spatial distribution of nutrients, both nitrate and phosphate, in the Haruku Strait waters needs to be conducted. This study aims to assess the spatial distribution of nutrients in the Haruku Strait waters.

LITERATURE REVIEW

Nitrate and phosphate are the main nutrients for phytoplankton growth in the sea (Miller and Wheeler, 2012). Nitrate is a fundamental constituent of proteins, nucleic acids, enzyme cofactors and plays a role in the process of marine carbohydrates and chitin. Phosphorus, available in the ocean as phosphate ($PO4^{3-}$), is incorporated in many biological molecules, for example, nucleic acids, and adenosine di and triphosphates (ADP and ATP).

In pelagic ecosystems, the supply of inorganic nutrients to the euphotic layer occurs due to vertical mixing and advection of water masses and fluxes to the bottom of the euphotic layer due to the sinking power of organic material both dissolved organic material and organic particulates (Miller and Wheeler, 2012). Levingston (2015) said that the high concentration of nutrients in coastal waters, including bay and strait waters, is due to the supply of nutrients through river flow. Nutrient concentrations vary and depend on the magnitude of river flow and anthropogenic sources. According to Miller and Wheeler (2012), the vertical distribution characteristics of nutrients differ between waters with low to undetectable concentrations at the water surface, and concentrations increase with depth. However, the depth position of the nutricline is highly dependent on the depth and rate of remineralization processes.

Nitrate and Phosphate concentrations in the ocean also depend on the processes of water mass dynamics, water mass circulation and local transformations such as chemical and biological processes and radioactive decay Heinze et al., 2013). Denman et al. (2007) said that ocean circulation and physical control of climate, combined with the carbon cycle and related biogeochemical cycles play a major role in nutrient concentrations in marine waters.

METHOD

Time and Location of Research

This research took place in July 2022 in the waters of Haruku Strait (**Figure 1**). Water sampling was conducted on July 23, 2022, and then analyzed at the Marine Science Laboratory, Faculty of Fisheries and Marine Science, Pattimura University.

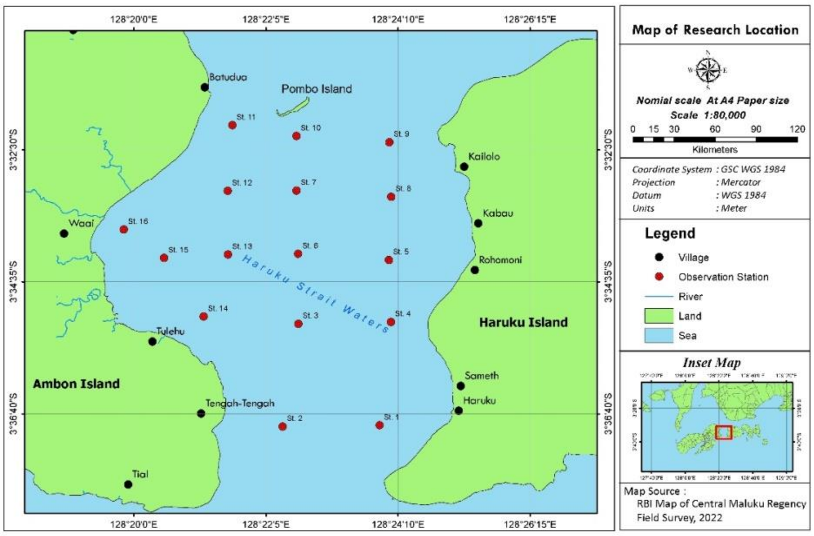


Figure 1. Map of Research Locations

Tools and Materials

The tools used in this research are Niskin Bottle Water Sampler, Global Positioning System (GPS) 60 Garmin, purse seine boat, coolbox, and UV-Vis Spectrophotometer. The materials used in this study are Aquabides, Cadmium, Phosphoric Acid, NH4Cl, Glass wool, Sulphanilamide, N-1-Napthtylene iarmin, dihydrocloride, Cupric Sulfate ($CuSO_4$), H_2SO_4, Ascorbic Acid (AA), Potassium Antimonyl Tartrate (KAT), Ammonium Molybdate (AM).

Data Collection Method

Nutrient data including nitrate (NO3) and phosphate (PO4) concentrations of Haruku Strait waters were observed using purposive sampling method by taking water samples at a depth of 1 meter, 25 meters, and 50 meters at 17 observation stations using Niksin Bottle Water Sampler. The water samples obtained were then analyzed for nitrate and phosphate concentrations at the Marine Science Laboratory, Faculty of Fisheries and Marine Science, Pattimura University. Analysis of nitrate concentration was carried out using the Brucine Sulfate method approach (SNI: 06-2480-1991) using OPTIZEN Alfa (UV-Vis Spectrophotometer), while analysis of phosphate concentration using the Ammonium Molybdate method approach (APHA 10th ed. 4500-PD, 1998) using OPTIZEN Alfa (UV-Vis Spectrophotometer).

Data Analysis Method

The nitrate (NO_3) and phosphate (PO_4) data were then analyzed for horizontal distribution patterns at depths of 1 meter, 25 meters and 50 meters with the help of Surfer 12 and Microsoft Excel software. The results of the analysis are displayed in the form of images of nitrate and phosphate distribution. Based on the image, the spatial distribution pattern of nitrate and phosphate and the phenomena that may occur are analyzed descriptively.

RESULT AND DISCUSSION

Description of Research Location

The Haruku Strait is flanked by Ambon Island in the west and Haruku Island in the east, which is an administrative area of Maluku Province. Haruku Strait is directly connected to Seram Strait in the north, and Banda Sea in the south. There is a Nature/Marine Tourism Park area in the northern part of Haruku Strait, namely Pombo Island. Pombo Island was designated as a Tourism Park area by the Minister of Forestry Decree Number 392/Kpts-VI/1996 which has an area of 998 ha. Coral reefs and algae dominate the waters of Pombo Island (Matrutty, 2016).

The circulation of water masses from the Banda Sea and Seram Strait waters greatly influences the characteristics of the water masses in the Haruku Strait waters. In addition, monsoon winds also affect the movement of water masses and the process of vertical mixing of water masses. This has an impact on changes in the characteristics of the water masses in the Haruku Strait. The range of temperature and salinity in the Haruku Strait ranges from 24.68-29.43^{o}C and 33.12-34.38 PSU at a depth of 0 to 100 m (Tubalawony, et al., 2023).

The stratification of water masses in the Haruku Strait shows that the thickness of the mixed surface layer ranges from 50-70m. Thus, in the Haruku Strait waters, the upper part of the thermocline layer is at a depth of 50-70 m (Tubalawony et al., 2023). In the thermocline layer, there is a significant gradient of temperature, salinity and density changes with increasing depth.

Distribution of Nitrate Concentration

The distribution of nitrate concentration in the surface layer (1 m depth) of Haruku Strait waters ranged from 0.303-2.330 mg/L with a mean of 1.146 ± 0.647 mg/L. The results obtained show higher nitrate concentrations when compared to the results of Rugebregt, et al. (2019) in Haruku Waters. Rugebregt et al. (2019) obtained nitrate concentrations in the eastern season in the surface layer ranging from 0.032-0.058 mg/L. The difference in nitrate concentration between the results of the study and Regebregt, et al. (2019) was due to differences in location area and research time. The research conducted has a wider location area, namely the waters of the Haruku Strait as a whole and was carried out in July while Rugebregt, et al. (2019) only in the coastal waters of Haruku State from July to December. However, the high nitrate concentration of the results of the study was due to the influence of the Banda Sea upwelling water mass and the Seram Strait water mass, which tends to have high concentrations. In addition, it is also due to inputs from land that are carried directly into marine waters or through river flow that empties into the Haruku Strait.

Horizontally, the distribution pattern of nutrient concentrations in the surface layer shows that nitrate concentrations tend to be high in the middle part of the Haruku Strait waters, namely between Tulehu Village and Pombo Island (Stations 10, 12, 13, and 14) with a concentration range of 1,712-2,330 mg/L. The highest concentration at stations 13 and 14. This part of the water is a sea transport route so that the high nitrate concentration is thought to be due to the mixing of water masses which causes the uplift of the inner water mass which has a higher nitrate concentration, besides that the area is a meeting place for water masses from the Banda Sea and coastal water masses or Waai Bay which is influenced by the input of water masses from rivers that drain into these waters.

The horizontal distribution of nitrate in the surface waters indicates the entry of Banda Sea water mass into the Haruku Strait waters. This can be seen through the isonitro lines of 0.6 mg/L, 0.8 mg/L and 1.0 mg/L which tend to point towards the strait waters. The Banda Sea water mass characteristics have nitrate concentrations ranging from 0.303-0.594 mg/L (Stations 1, 2, 3, and 6) (**Figure 2**). In general, the nitrate concentration is quite high, but when compared to the nitrate concentration in the middle of the strait waters, the Banda Seawater mass has a lower concentration. The low nitrate concentration may be due to the fact that nitrate has been utilized by phytoplankton for photosynthesis. Water mass input with lower concentrations was also found in the northeastern part of the waters, namely the waters between Kailola and Pombo Islands (Station 9). The water mass is the Seram Strait water mass that moves into the Haruku Strait waters. The nitrate concentration in this part of the water was around 0.311 /L (**Figure 2**). Water masses with nitrate concentrations ranging from 0.693-0.951 mg/L were also found in Waai Bay waters (Stations 15-17). These waters are influenced by the input of water masses from Wai Rutung, Wai Atua, Wai Tosoi and Wai Nusa Rivers. Thus, the distribution of nitrate in the surface waters of the Haruku Strait varies spatially. Ulqodry, et al. (2010), nitrate and phosphate concentrations in waters are influenced by inputs from land, plankton and marine biota activities, and water mass movements. Ikhsani, et al. (2016) said that the high concentration of nitrate and phosphate in the bay waters is caused by the overflow of nutrients from the mainland that enter through the river.

At 25 m depth, the distribution of nitrate concentration in Haruku Strait ranged from 0.200-2.471 mg/L with an average of 1.148±0.709 mg/L. The distribution pattern of nitrate concentrations showed high concentrations in the middle part of the strait waters, namely the waters between Tulehu and Pombo Island (Stations 10, 12, 13, and 14) with nitrate concentrations ranging from 1.997-2.471 mg/L (**Figure 3**). In the mid-strait waters, the nitrate concentration at 25 m depth was higher than the nitrate concentration at the surface (1 m). The nitrate distribution pattern also shows the widespread movement of the Banda Seawater mass into the Haruku Strait waters in the southern part of the waters with a concentration of 0.430-1.080 mg/L (Stations 1, 2, 3, 4, 6). The pattern of concentration distribution in the southern part of the waters shows similarities with the pattern of distribution of nitrate concentrations in surface waters. In the western part of the waters, namely the waters around Waai Bay to the coastal waters of Batudua Hamlet, there is a movement of water masses to the middle of the strait waters (**Figure 3**) with nitrate concentrations ranging from 0.200-0.880 mg/L (Stations 11, 15, 16, 17).

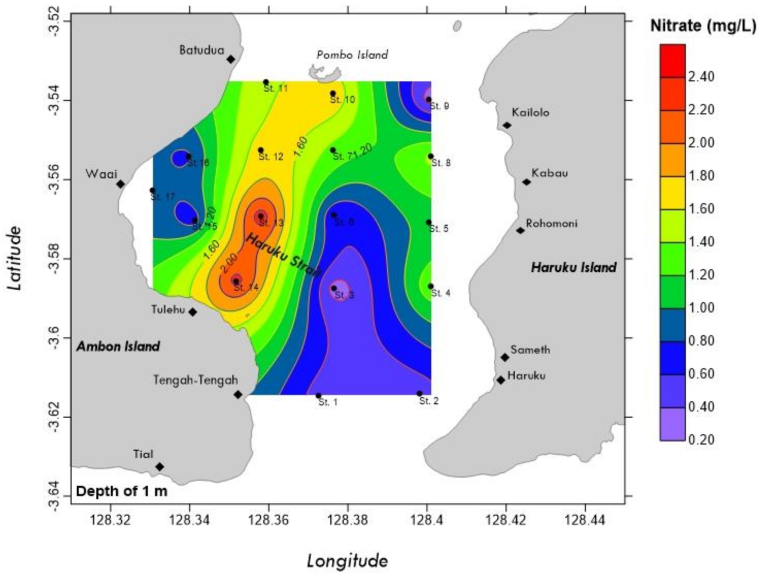


Figure 2. Horizontal distribution of nitrate concentration in surface waters (1m) of Haruku Strait

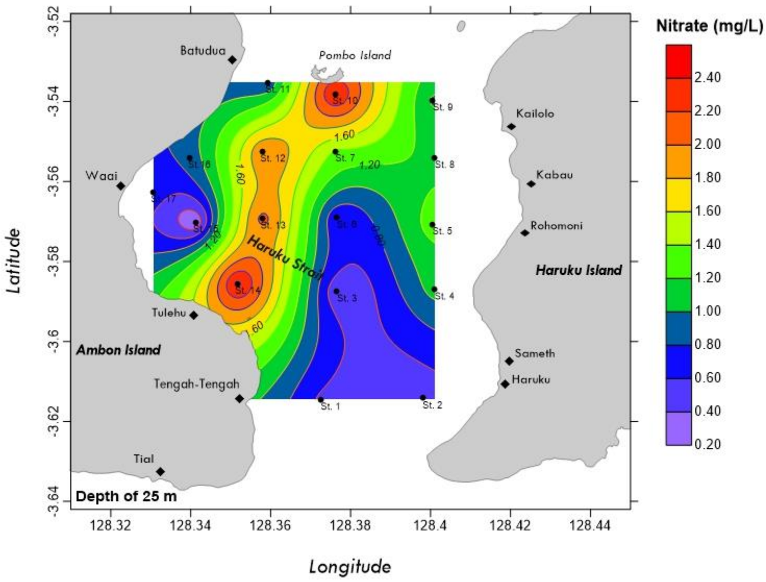


Figure 3. Horizontal distribution of nitrate concentration at a depth of 25 m in the waters of the Haruku Strait

The distribution of nitrate concentration at 50 m depth in Haruku Strait waters ranged from 0.273-2.314 mg/L with an average of 1.136±0.701 mg/L. The distribution pattern of nitrate concentration at 50 m depth showed similarity with the distribution pattern of nitrate at 25 m depth (**Figure 4**). The distribution of nitrate concentrations also shows the expansion of water masses with lower nitrate concentrations in the western part of the waters, namely the bay and coastal waters of Waai to Batudua Hamlet (Stations 11, 15, 16, and 17). The water mass is seen moving towards the middle of the strait waters. This was also seen in the southern part of the waters (Stations 1, 2, 3, 4, and 6) which showed the movement of the Banda Sea water masses towards the waters of the Haruku Strait. Nitrate concentrations in the southern part of the strait ranged from 0.273-1.149 mg/L. Similar to the distribution of concentrations at surface waters and 25 m depth, at 50 m depth the distribution of nitrate also showed high concentrations in the middle part of the strait waters, namely at Stations 10, 12, 13, and 14 with concentrations ranging from 1.977-2.314 mg/L.

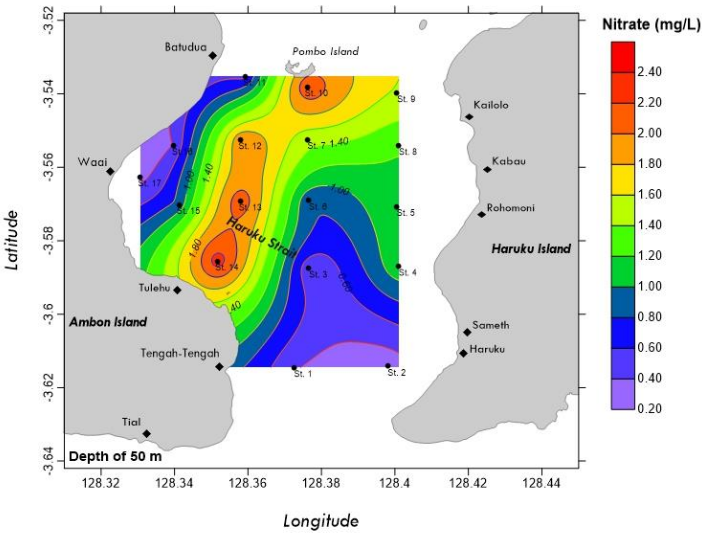
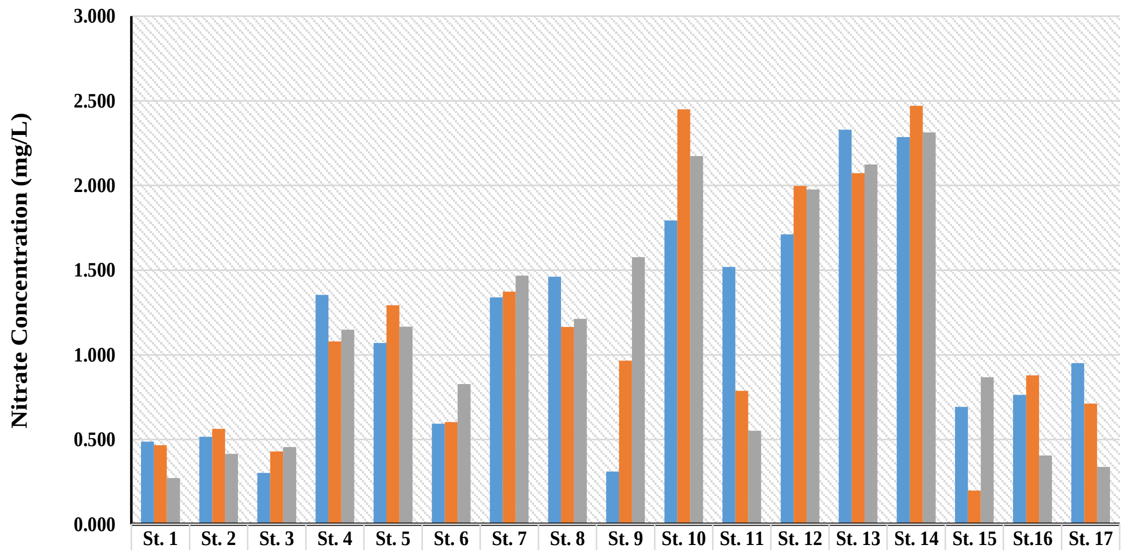


Figure 4. Horizontal distribution of nitrate concentration at a depth of 50 m in the waters of the Haruku Strait

The vertical distribution of nitrate concentrations for each observation station shows that stations located in the western side of the waters, namely in the coastal waters of Waai Bay to Batudua Hamlet (Stations 11 and 17) and the eastern side of the waters, namely around the coast of Haruku Island (Stations 1, 4 and 8) show high nitrate concentrations in surface waters when compared to 25 m and 50 m depths (**Figure 5**). This is likely due to the influence of freshwater inputs containing nitrate in the western side of the waters while in the eastern side of the waters as a result of the influence of upwelling water masses from the Banda Sea.

The distribution pattern of nitrate concentration in Haruku Strait waters showed an increase in concentration with increasing depth. A significant increase in concentration with increasing depth was observed at Stations 10, 12 and 14 (**Figure 5**). At Station 10, the nitrate concentration increased from 1.793 mg/L in surface waters to 2.449 mg/L at 25 m depth. In station 12, the nitrate concentration increased from 1.712 mg/L in surface waters to 1.997 mg/L at a depth of 25 m and 1.977 mg/L at a depth of 50 m, while at Station 14 the nitrate concentration in surface waters was 2.286 mg/L and increased to 2.471 mg/L at 25 m depth. Hamzah et al. (2015) and Meirinawati et al. (2021) state that nutrient concentrations are low in the surface layer and increase with increasing depth. The difference in nutrient concentrations in each layer is due to differences in nutrient utilization, remineralization and regeneration, Hamzah et al. (2015).



	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7	St. 8	St. 9	St. 10	St. 11	St. 12	St. 13	St. 14	St. 15	St.16	St. 17
Depth 1 m	0.487	0.516	0.303	1.355	1.070	0.594	1.340	1.462	0.311	1.793	1.519	1.712	2.330	2.286	0.693	0.764	0.951
Depth 25 m	0.467	0.563	0.430	1.080	1.293	0.603	1.373	1.164	0.966	2.449	0.788	1.997	2.073	2.471	0.200	0.880	0.713
Depth 50 m	0.273	0.416	0.456	1.149	1.167	0.828	1.468	1.214	1.577	2.174	0.552	1.977	2.124	2.314	0.869	0.406	0.339

Station

Figure 5. Distribution of nitrate concentrations at surface waters (1m), depths of 25 and 50 m for each observation station in the waters of the Haruku Strait

Based on the distribution of nitrate concentrations both horizontally and vertically, it shows that Haruku Fiber waters have a nitrate concentration range of 0.273-2.479 mg/L with an average of 1.143 ± 0.672 mg/L which is categorized as mesotrophic waters. Effendi (2023) said that the level of water fertility based on nitrate is categorized as follows: oligotrophic (0-1 mg/L), mesotrophic (1-5 mg/L), and eutrophic (5-50 mg/L). The fertility of a water body can be described by the high and low concentration of nutrients. Eutrophication in a water body is caused by high concentrations of phosphate and nitrate and as a result can trigger an explosion in the algae population (Davidson et al. 2014).

Distribution of Phosphate Concentration

The phosphate concentration in Haruku Strait in surface waters (1 m depth) ranged from 0.014-0.106 mg/L with a mean of 0.051±0.028 mg/L. The distribution of phosphate concentration shows a higher value when compared to the research results from Rugebregt (2019) which obtained phosphate concentrations in the waters around Haruku Island ranging from 0.013-0.026 mg/L. Spatially, the pattern of phosphate concentration distribution in the surface waters of the Haruku Strait shows high concentrations in the western part of the waters, namely the coastal waters of Waai to Batudua Hamlet (Stations 11, 12, 15, 16 and 17). In this part of the water, the phosphate concentration ranged from 0.046-0.093 mg/L (**Figure 6**). The high concentration of phosphate is also found at Station 1, which is directly bordered by the Banda Sea at 0.106 mg/L. In the eastern part of the strait waters, namely the waters near Haruku Island, the concentration distribution tends to be low, ranging from 0.021-0.042 mg/L.

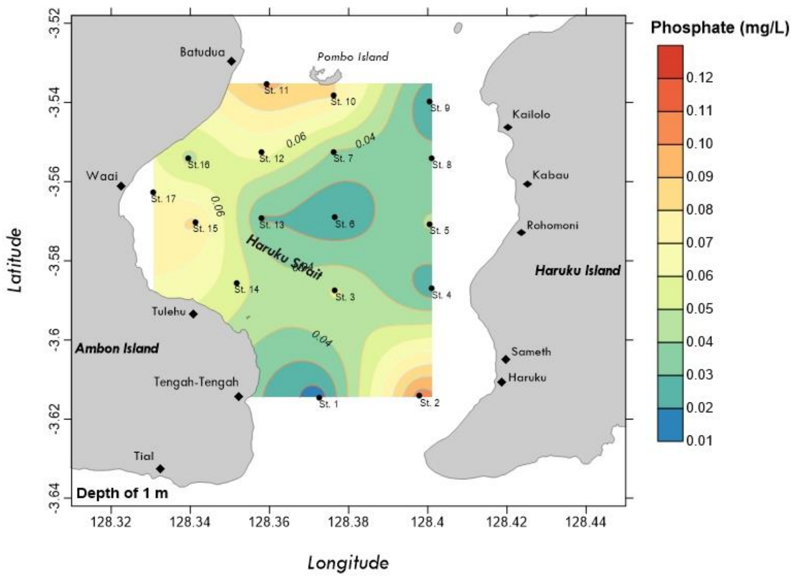


Figure 6. Horizontal distribution of phosphate concentration in surface waters (1m) of Haruku Strait

The high phosphate concentration in the western part of the waters is due to nutrient input from rivers that empty into the coastal waters of Waai, but also due to the process of lifting water masses influenced by tides due to changes in the topography of coastal waters. Rahayu, et al. (2018), the distribution of phosphate concentrations tends to be higher in waters around river mouths.

The decomposition process in aquatic sediments has an impact on increasing phosphate concentrations and can reach the surface of the water if there is a lifting of the water mass (Vahtera et al., 2007). In the southern part of the strait waters, the high phosphate concentration (Station 1) is due to the influence of the Banda Sea water mass that experiences upwelling. Ikhsani et al. (2016) based on the results of research in the inner Ambon Bay said that the Banda Sea water mass entering the bay in the East Season is rich in nutrients. Thus, the phosphate concentration of Haruku Strait waters is strongly influenced by the water mass of Banda Sea.

The distribution of phosphate concentrations in surface waters also shows high concentrations in the waters around Pombo Island. This pattern shows the influence of the Seram Strait water mass that carries water masses with high concentrations. At 25 m depth (**Figure 7**), the distribution of phosphate concentration in Haruku Strait ranged from 0.005-0.117 mg/L with an average of 0.053±0.029 mg/L. The distribution pattern shows higher concentrations in the southern part of the waters influenced by the water mass of Banda Sea and coastal waters between Waai Bay and Batudua Hamlet. In coastal waters between Waai Bay and Batudua Hamlet, phosphate concentrations ranged from 0.044-0.117 mg/L. The high concentration in this area is likely due to the input of freshwater carrying nutrients and also due to the uplift of the bottom water mass influenced by tidal currents. In the southern part of the waters, water masses with phosphate concentrations ranging from 0.065-0.089 mg/L were found (Stations 2, 3, and 4) which were thought to come from the Banda Sea upwelling water mass. From the distribution of phosphate at a depth of 25 m, a low phosphate concentration center was also found in the waters around Stations 7 and 6. The low concentration is probably because phosphate has been utilized by phytoplankton for photosynthesis.

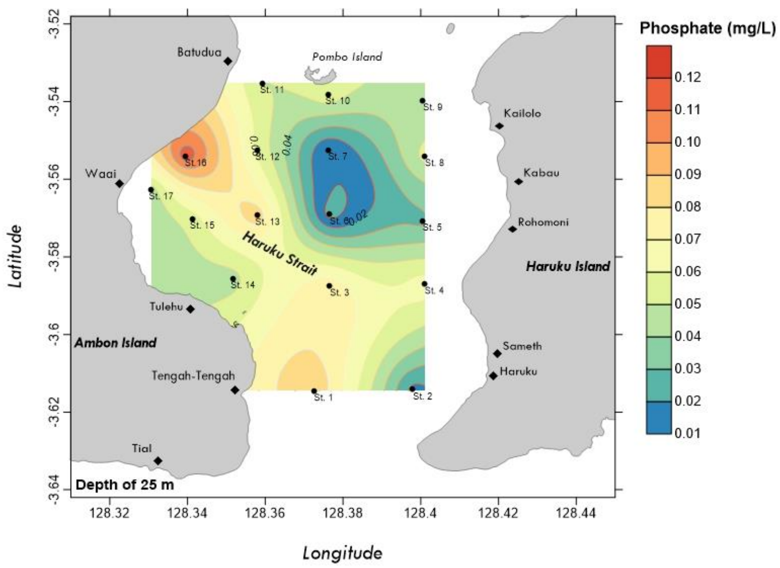


Figure 7. Horizontal distribution of phosphate concentration at a depth of 25 m in the waters of the Haruku Strait

At 50 m depth, the distribution of phosphate concentration in Haruku Strait waters ranged from 0.011-0.089 mg/L with an average of 0.046±0.020 mg/L

(**Figure 8**). The distribution of phosphate at 50 m depth shows a different pattern from the distribution of phosphate at 25 m depth and surface waters. However, the distribution at a depth of 50 m still shows the influence of the Banda Seawater mass and the Seram Strait water mass and coastal dynamics between Waai Bay and Batudua Hamlet on the increase in water phosphate concentration. The influence of different water masses is indicated through the character of nutrients including phosphate and the pattern of water mass movement. Harms et al., (2019), the distribution of water masses can be used to determine the distribution of nutrients in a body of water.

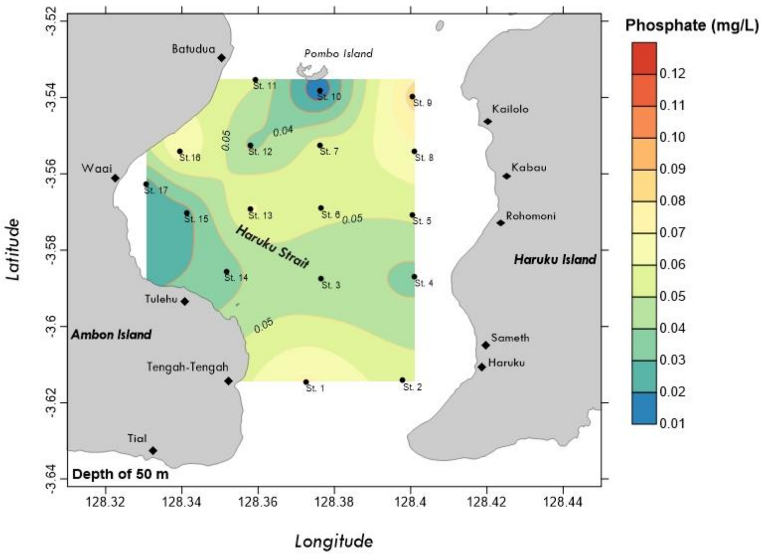


Figure 8. Horizontal distribution of phosphate concentration at a depth of 50 m in the waters of the Haruku Strait

Vertically, the distribution of phosphate concentration in Haruku Strait showed different patterns between observation stations (**Figure 9**). Patty (2015) stated that the average phosphate concentration is higher near the bottom of the water compared to the surface layer, however, the results showed a difference in the high concentration at different depths at each observation station. Of the 17 observation stations, seven stations (Stations 1, 10, 11, 12, 14, 15, and 17) showed high phosphate concentrations in surface waters when compared to other depths, and five stations each showed high concentrations at depths of 25 m (Stations 2, 3, 4, 13 and 16) and 50 m (Stations 5, 6, 7, 8, and 9).

Vertically, stations located in the western part of the waters, namely the waters of Waai Bay and the coastal waters of Waai Village to Batudua Hamlet, have higher phosphate concentrations in surface waters. The high concentration of nutrients or phosphate in surface waters is generally due to the supply of nutrients through rivers that empty into these waters. In this part of the waters, there are a number of rivers that are thought to supply phosphate to the waters.

At a depth of 25 m, high concentrations of phosphate at a depth of 25 m compared to a depth of 50 m and the surface are generally found at stations that collide directly with the Banda Sea. Thus, the high concentration of phosphate at this depth is determined more by the influence of the the water mass of Banda Sea. Parts of the waters that show higher phosphate concentrations at a depth of 50 m or phosphate concentrations increasing with increasing depth are seen in the waters around the northeast, namely the waters around Kailolo Country, Rohomoni, Kabau on Haruku Island. This pattern shows the influence of water mass from the Seram Sea entering between Pombo Island and Haruku Island in the northern part of the strait waters.

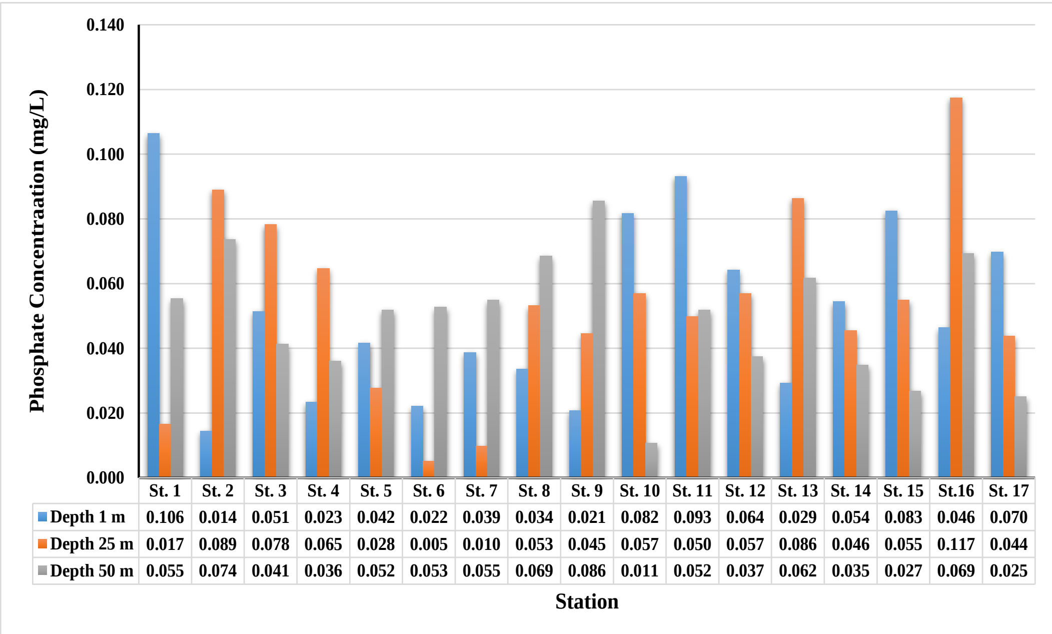


Figure 9. Distribution of phosphate concentrations at surface waters (1m), depths of 25 and 50 m for each observation station in the waters of the Haruku Strait

Based on the distribution of phosphate concentrations both horizontally and vertically, it shows that the Haruku Strait waters have a nitrate concentration range of 0.005-0.117 mg/L with an average of 0.051±0.025 mg/L which is categorized as eutrophic waters. Effendi (2023) said that the fertility level of waters based on phosphate concentration is categorized as follows: oligotrophic (0.003-0.01 mg/L), mesotrophic (0.011-0.03 mg/L), and eutrophic (0.031-0.10 mg/L).

CONCLUSSION

Spatially, the distribution of nutrients in the waters of the Haruku Strait during the east season shows low nitrate concentrations and high phosphate concentrations in the western and southern parts of the waters, while the middle parts of the waters have high nitrate concentrations and low phosphate concentrations. The vertical distribution of nitrate concentrations shows that stations located on the west and east sides of the Haruku Strait waters have high nitrate concentrations at the surface of the waters when compared to depths of 25 m and 50 m. Phosphate has a higher concentration in surface waters found in the western part of the waters, at a depth of 25 m in the southern part of the waters and at a depth of 50 m in the waters around Kailolo Haruku Island. The fertility level of Haruku Strait waters is categorized as mesotropic waters based on nitrate concentration and eutrophic based on phosphate concentration

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