Phytoplankton of Inner Ambon bay during east monsoon

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Abstract. The Inner Ambon Bay has a potency for fisheries resources, especially the anchovy of the genus Stolephorus. This species is depended on the abundance of plankton organisms as their food sources. The research was carried out on east monsoon and was aimed to analyze the species composition, abundance, diversity, similarity and spatial distribution of phytoplankton in Inner Ambon Bay. Sampling was done by towing the Kitahara plankton net vertically from the depth of 5 meters to surface water at 10 stations. Sixty-four species of phytoplankton was found during the sampling periods. The phytoplankton abundance varied between $5.4 \times 10^4$ cells/m$^3$ and $7.7 \times 10^5$ cells/m$^3$. The average values of species diversity index ($H'$), evenness index ($J'$) and dominance index ($D$) were 1.31, 0.37 and 0.63, respectively. Similarity between stations ranged from 53.4% to 85.5% and can be grouped into three clusters. Spatial distribution showed that station 5, station 6 and station 8 were more abundant compare to other stations.

1. Introduction
Ambon bay waters has various fisheries resources especially anchovies, small pelagic fishes of the genus Stelophorus. These species are depended on the abundance of plankton organisms as their food sources. Currently, increasing development in Ambon city affected quality of the waters in Ambon bay. Utilization of upland for settlement cause pressure for this bay especially in at east monsoon when frequency of rain is high [1].

Eutrofication is one of the main factors that cause deterioration of aquatic environment [2]. This factor is caused by overloaded of nutrient such as nitrate and phosphate [3]. Changing in quality of the waters can cause succession among phytoplankton [4] followed by changing in their composition in Ambon bay. Diatom is one of the important primary organisms in the sea [5]. Dwiono and Rahayu (1984) [6] found that genus Chaetoceros (Diatom) is dominant in Ambon bay. Meanwhile, Pello and Huliselan (2007) [7] as well as Pello et al (2014) [8] stated that genus Trichodesmium (Cyanobacteria) has the highest density among 35 genera found in Inner Ambon bay during east monsoon.

This research was conducted to analyze species composition, abundance, diversity, similarity and spatial distribution of phytoplankton during east monsoon in Inner Ambon bay.

2. Material and Methods
This research was carried out in Inner Ambon bay, Ambon Island, Maluku Province. Sampling of phytoplankton was conducted at 10 stations (Figure 1) during east monsoon on June 2016. Position of each station was determined by using GPS-Garmin, Model 76CSx.
Figure 1. Map of sampling station

Oceanography parameters temperature, salinity and pH were taken by using Nansen bottle while clarity was measured using secchi disc (30 cm in diameter). As many as 250 ml sea water was taken to determine concentration of NH$_3$-N, NO$_3$-N, NO$_2$-N, PO$_4$-P and SiO$_2$-Si. Concentration of those parameters was determined based on standard method recommended by Parson et al (1984) [9] by using spectrophotometer at Chemistry Laboratory of LIPI Ambon.

Samples of phytoplankton was taken vertically at the depth of 5 m to surface by using 1m Kitahara plankton net with an opening diameter of 30 cm and 60 µm mesh. Phytoplankton samples were stored in the bottle contain 4% formalin solution. Phytoplankton was identified to the species level based on Yamaji (1984) [10], Newell and Newell (1977) [11] and Tomas (1996) [12].

Abundance of phytoplankton was determined based on Perry (2003)[5] which was modified by Huliselan et al (2007) [13] as follows:

\[
D = \frac{n_f \times v_p}{V}
\]

where:  
- $D$ = phytoplankton abundance (ind./ m$^3$)
- $n_f$ = number of individu per 1 ml
- $v_p$ = counting volume
- $V$ = filtered water volume (m$^3$)

Volume of filtered water was determined by using formula proposed by Newell and Newell (1977)[11]:

\[
V = \pi \times r^2 \times l
\]

where:  
- $\pi$ = constant, 3.14
- $r$ = radius of opening plankton net
- $l$ = distance between plankton net and surface, 5m

Similarity index of the phytoplankton between stations in Inner Ambon Bay was calculated using similarity index according to Michael (1984) in Hutauruk (2009) [14] as followed:

\[
IS = \frac{2C}{A+B} \times 100\%
\]

where :  
- $A$ = total numbers of species at station A.
- $B$ = total numbers of species at station B
- $C$ = total numbers of the similar species at station A and B

The criteria used are:
- IS = 75 – 100% : very similar
- IS = 50 – ≤ 75% : similar
- IS = 25 – ≤ 50% : dissimilar
- IS = ≤ 25% : different

Calculation of ecological indexes such as diversity index, dominance index, evenness index and similarity index was done by using the PRIMER-5 program.
3. Results and Discussion

3.1. Hydrology parameters

Data on water quality parameters on June 2016 at 10 stations in Inner Ambon bay is shown in Table 1. Temperature, salinity and pH show small variation. Except for pH, temperature and salinity in Inner Ambon bay are optimal for growth of plankton. Plankton can tolerate wide range of temperature, but they grow best at temperature of 20 - 30°C [15]. The pH is one of the main factors that inhibit growth of phytoplankton and they grow well at pH 7.0 - 8.5.

Clarity in Inner Ambon bay ranged from 4 - 7.5m with the average 6.5m. The lowest clarity occurred at station 4 due to flow of suspended particle through the river from upper land which is cleared up for housing. In addition, this station is also closed to mangrove for forest, so sedimentation in this station is very high.

| Station | Temperature (°C) | Salinity (%) | pH | Clarity (m) | DO (mg/l) | PO₄ (mg/l) | NO₃ (mg/l) | NO₂ (mg/l) | NH₃ (mg/l) | SiO₂ (mg/l) |
|---------|------------------|-------------|----|-------------|----------|-----------|-----------|-----------|-----------|-------------|
| 1       | 28               | 35          | 6  | 7.5         | 7.1      | 0.0001    | 0.0108    | 0.0003    | 0.0029    | 0.1246      |
| 2       | 28               | 35          | 6  | 7.5         | 7.2      | 0.0001    | 0.0044    | 0.0074    | 0.0017    | 0.1854      |
| 3       | 28               | 35          | 6  | 7.0         | 6.9      | 0.0081    | 0.0019    | 0.0003    | 0.0065    | 0.2614      |
| 4       | 28               | 35          | 6  | 6.5         | 6.7      | 0.0001    | 0.0163    | 0.0054    | 0.0029    | 0.1854      |
| 5       | 27               | 35          | 6  | 4.0         | 6.2      | 0.0368    | 0.0158    | 0.0023    | 0.0005    | 0.2310      |
| 6       | 27               | 33          | 6  | 6.0         | 6.3      | 0.0033    | 0.0118    | 0.0013    | 0.0113    | 0.6869      |
| 7       | 28               | 35          | 6  | 6.5         | 7.3      | 0.0001    | 0.0218    | 0.0033    | 0.0053    | 0.1702      |
| 8       | 27               | 34          | 6  | 7.0         | 7.0      | 0.0033    | 0.0153    | 0.0003    | 0.0005    | 0.2918      |
| 9       | 27               | 35          | 6  | 7.0         | 7.1      | 0.0129    | 0.0001    | 0.0013    | 0.0005    | 0.4438      |
| 10      | 27               | 34          | 6  | 6.5         | 6.8      | 0.0033    | 0.0143    | 0.0013    | 0.0101    | 0.2614      |

Dissolved oxygen in Inner Ambon bay ranged from 6.2 – 7.3 mg/l with the average 6.86 mg/l. Variation of dissolved oxygen found is quite large. The lowest of dissolved oxygen value at station 5 (6.2 mg/l), while the highest at station 7 (7.3 mg/l). Phosphate concentration ranged from 0.0001- 0.0368 mgPO₄-P/l, with the average 0.0065 mg PO₄-P/l, while nitrate concentration ranged from 0.0001- 0.0218 mg NO₃-N/l with the average 0.0120 mg NO₃-N/l and silicate concentration ranged from 0.1246 – 0.6869 mg SiO₂/l. According to Mackentum (1969) cited in Yuliana (2006)[16], to achieve optimal growth, phytoplankton requires nitrate concentration in the  ranged from 0.9 – 3.5 mg/l and phosphate concentration from 0.09 – 1.80 mg/l. It was further stated that if the phosphate concentration was less than 0.02 mg/l, it will become a limiting factor. Based on that statement it seems that the concentration of nitrate and phosphate in Inner Ambon bay waters does not support optimal growth of phytoplankton.

3.2. Species composition of phytoplankton

Totally, there were 64 species of phytoplankton which belong to 4 classes, 7 ordo, 22 families and 45 genera found during the study at 10 stations in Inner Ambon bay (Table 2). Bacillariophyceae (Diatom) has the highest species (31 species, 68.89%) followed by Dinophyceae with 12 species (26.67%), while Cyanobacteria and Silicoflagellata only have 1 species each. In marine waters, Diatom and dinoflagellata are common and abundant especially in the coastal waters [17, 18]. Table 2 also shows that station 3 has more species (44 species) compare to others, followed by station 7 with 43 species, while station 8 and station 10 have less species i.e. 27 species each.

As many as 17 species were found in all stations namely Coscinodiscus centralis, Chaetoceros diversus, Dinophysis caudata, D. miles, Ceratium furca, C. lunula, C. trichoceros, C. macroceros, C. tripos, C. pulchelum, Gonyaulax spinifera, Pyrocystis lunula, P. noctiluca, P. stenii, Protoperidinium depressum and Trichodesmium erythrocluem. Those species have wide distribution and capable to adapt to environment where they live. On the contrary, some species of phytoplankton show
narrow distribution and only found in certain station such as Skeletonema costatum, Thalassiosira gravida, Gossleriella tropica, Bacteriastrum furcatum, Chaetoceros lorenzianus, Pleurosiga directum, Prorocentrum compressum, Ornithocercus splendidus, Alexandrium affine, Gonyaulax polygramma, sista Gonyaulax and Dictyocha fubula.

3.3. Abudance of phytoplankton
Abundance of phytoplankton in Inner Ambon bay ranging from $5.4 \times 10^4$ cells/m$^3$ to $7.7 \times 10^5$ cell/m$^3$ with an average of $2.5 \times 10^5$ cell/m$^3$. The highest abundance was found at station 8 while the lowest abundance at station 10 (Figure 2). High abundance of phytoplankton in Inner Ambon bay during the research is caused by abundant of two species namely D. miles (mean 13.61%) and T. erytracheum (mean 66.16%) (Table 2).

High abundance of T. erytracheum is caused by blooming of this species during the research in east monsoon. Rogier and Borne (2010)[19] stated that Trichodesmium is blooming at the temperature ranging from 24.2 - 28.6 °C. This species is filamentous Cyanobacteria which is commonly found in calm shallow waters in tropical and sub-tropical area (20-34°C) with poor nutrient (oligotrophic) [20]. The high abundance of T. erytracheum is in line with the result of Pello et al (2014) [8] in Inner Ambon bay during east monsoon.

The result of this study also shows diatom has high number of species but it has low abundance compare to cyanobacteria (T. erytracheum) and dinoflagellata (Figure 2). On the contrary, Pello et al (2015) [21] found high abundance and dominancy of diatom during west monsoon in Inner Ambon bay.

Table 2. Species composition and relative abundance (%) of phytoplankton in Inner Ambon bay

| No. | Species                        | St 1 | St 2 | St 3 | St 4 | St 5 | St 6 | St 7 | St 8 | St 9 | St 10 |
|-----|--------------------------------|------|------|------|------|------|------|------|------|------|-------|
| 1   | Planktoniella sol               | 0.18 | 0.04 | 0.01 |      |      |      |      |      |      |       |
| 2   | Skeletonema costatum            | 0.12 |      |      |      |      |      |      |      |      |       |
| 3   | Thalassiosira gravida           | 0.12 |      |      |      |      |      |      |      |      |       |
| 4   | Melosira nummuloides            |      | 0.10 | 0.19 | 0.03 | 0.07 | 0.03 |      |      |      |       |
| 5   | Coscinodiscus radiatus          | 0.16 | 0.15 | 0.80 | 0.14 | 0.33 | 0.52 | 0.41 | 1.24 |      |       |
| 6   | Coscinodiscus centralis         | 0.11 | 0.10 | 0.19 | 0.26 | 0.14 | 0.18 | 0.34 | 0.21 | 1.09 | 0.26  |
| 7   | Gosleriella tropica             |      |      |      |      |      |      |      |      |      | 0.02  |
| 8   | Pseudoguinardia recta           | 0.10 | 0.15 | 0.11 | 0.07 | 0.03 |      |      |      |      |       |
| 9   | Asteromphalus flabellatus       | 0.02 | 0.02 | 0.03 |      |      |      |      |      |      | 0.01  |
| 10  | Rhizosolenia formosa            | 0.02 | 0.03 |      | 0.06 | 0.01 | 0.01 | 0.16 |      |      |       |
| 11  | Rhizosolenia imbricata          | 0.02 | 0.06 | 0.05 | 0.02 | 0.05 | 0.19 | 0.03 | 0.02 | 0.39 |      |
| 12  | Rhizosolenia decipiens          | 0.07 | 0.06 | 0.05 | 0.24 | 0.19 | 0.12 | 0.19 | 0.04 |      |       |
| 13  | Rhizosolenia robusta            | 0.04 | 0.19 | 0.10 | 0.04 | 0.01 | 0.03 |      |      |      |       |
| 14  | Rhizosolenia setigera           |      | 0.13 |      | 0.03 |      |      |      |      |      |       |
| 15  | Eucampia cornuta                | 0.38 | 0.19 | 0.04 | 0.17 | 0.46 | 2.72 | 0.88 |      |      |       |
| 16  | Hemiaulus haekii                | 0.04 | 0.10 | 0.02 | 0.03 | 0.03 | 0.01 | 0.16 |      |      |       |
| 17  | Bacteriastrum hyalinum          |      |      |      |      | 0.04 |      |      |      |      |       |
| 18  | Bacteriastrum furcatum          |      |      |      |      | 0.04 |      |      |      |      |       |
| 19  | Chaetoceros aequatoralis        | 3.27 | 0.79 | 1.38 | 0.74 | 0.45 | 2.72 | 2.37 |      |      |       |
| 20  | Chaetoceros affinis             | 0.09 | 0.17 | 0.32 | 0.13 | 0.14 | 0.22 | 0.78 | 1.16 | 0.44 |       |
| 21  | Chaetoceros compressum          | 0.13 |      | 0.15 |      |      |      |      |      |      |       |
| 22  | Chaeto. coarctatus              | 0.09 |      |      |      |      |      |      | 0.06 | 0.54 |       |
| 23  | Chaeto. decipiens               | 0.11 | 0.16 |      |      |      |      |      |      |      | 0.13  |
| 24  | Chaetocros diversus             | 0.27 | 0.13 | 0.22 | 0.09 | 0.05 | 0.18 | 0.10 | 0.04 | 0.39 | 0.09  |
Continued

| No. | Genus                  | Species                | Relative Abundance |
|-----|------------------------|------------------------|--------------------|
| 25  | Chaetoceros            | lorenzianus            | 0.17               |
| 26  | Odontella              | mobilensis             | 0.07 0.04 0.04     | 0.18               |
| 27  | Biddulphia             | sinensis               | 0.04 0.01 0.01 0.08 | 0.09               |
| 28  | Asterionelopsis        | gracialis              | 0.18 0.53 0.10     | 0.11 0.08 0.09     |
| 29  | Thalassionema          | nitzschoides           | 0.25 0.48 0.32 0.22| 0.22 0.46 0.32 0.12|
| 30  | Phaeodactylum          | tricornutum            | 0.07               |
| 31  | Pleurosigma            | directum               | 0.02               |
| 32  | Pleurosigma            | normanii               | 0.03 0.02          | 0.07               |
| 33  | Navicula               | sp                     | 0.22 0.41 0.22     | 0.24 0.17 0.07     | 0.44               |
| 34  | Amphora                 | sp                     | 0.02               | 0.07               |
| 35  | Nitzschia              | longisima              | 0.10 0.07 0.06     | 0.04 0.01 0.26     |
| 36  | Nitzschia              | sp                     | 0.48               | 0.18               |
|     | **DINOFLAGELLATA**     |                        |                    |
| 37  | Prorocentrum           | compressum             | 0.22               |
| 38  | Prorocentrum           | micans                 | 0.07 0.05 0.05     | 0.04 0.07 0.16     |
| 39  | Dinophysis             | acuminata              | 0.01               | 0.23 0.18          |
| 40  | Dinophysis             | caudata                | 0.20 2.20 2.43     | 0.24 0.22 0.28     | 0.31 0.48 2.87     | 19.14               |
| 41  | Dinophysis             | miles                  | 19.40 20.67 11.04  | 10.16 16.71 10.38  | 4.37 12.11 23.74   | 7.55                |
| 42  | Ornithocercus          | thumii                 | 0.06               | 0.10               | 0.07 0.01 0.23     | 1.49                |
| 43  | Ornithocercus          | stenii                 | 0.06               | 0.07               | 0.03               | 0.18                |
| 44  | Ornithocercus          | splendidus             | 0.16               |
| 45  | Noctiluca              | scintilans             | 0.18 0.10 0.11     | 0.03 0.06 0.01     |
| 46  | Ceratium               | furca                  | 0.13 0.67 0.85     | 0.22 0.09 0.36     | 0.13 0.07 2.48     | 3.69                |
| 47  | Ceratium               | fucus                  | 0.74 1.62 0.95     | 0.34 0.18 0.47     | 0.37 0.12 1.40     | 0.44                |
| 48  | Ceratium               | lunula                 | 0.11               | 0.41 0.12          | 0.11 0.22 0.11     | 0.29 0.14 1.16     | 0.18                |
| 49  | Ceratium               | macroceros             | 4.58 4.30 2.60     | 2.80 2.16 1.49     | 1.30 1.82 8.15     | 1.14                |
| 50  | Ceratium               | tripus                 | 0.54 0.99 0.83     | 0.60 0.43 0.36     | 0.27 0.40 2.25     | 1.32                |
| 51  | Ceratium               | trichoceros            | 0.40               | 1.11 1.31 0.65     | 0.36 0.97 0.25     | 0.45 4.27 0.44     |
| 52  | Ceratium               | pulchellum             | 0.34 0.70 0.32     | 0.13 0.03 0.18     | 0.19 0.15 1.47     | 0.88                |
| 53  | Alexandrium            | tamarense              | 0.02 0.09 0.03     | 0.03 0.04          | 0.08               |
| 54  | Alexandrium            | affine                 | 0.03               |
| 55  | Gonyaulax              | spinifera              | 1.23 3.92 3.40     | 0.84 0.18 0.30     | 0.53 0.15 2.48     | 2.02                |
| 56  | Gonyaulax              | polygramma             | 0.01               |
| 57  | Pyrocystis             | lunula                 | 0.31 0.38 0.22     | 0.13 0.17 0.14     | 0.32 0.09 0.93     |
| 58  | Pyrocystis             | noctiluca              | 0.18 0.35 0.24     | 0.24 0.08 0.32     | 0.27 0.10 0.93     | 0.26                |
| 59  | Phyroplaca             | stenii                 | 2.20               | 3.34 3.40 1.94     | 2.50 2.24 2.24     | 0.87 7.45 3.42     |
| 60  | Podolamps              | palmides               | 0.10 0.07 0.04     |
| 61  | Proteroperidinium      | depressum              | 0.56 0.51 0.90     | 0.24 0.12 0.36     | 0.37 0.17 1.71     | 1.32                |
| 62  | Cysta Gonyaulax        |                        | 0.10               |
|     | **CYANOBACTERIA**      |                        |                    |
| 63  | Trichodesmium          | erythraceum            | 66.79 55.70 67.96  | 74.78 74.02 77.97  | 84.90 80.75 27.31  | 51.27               |
| 64  | Dacytcolyla            | fibula                 | 0.02               |

| Total species | 33 | 34 | 44 | 39 | 38 | 40 | 43 | 27 | 31 | 27 |
Diversity of phytoplankton in Inner Ambon bay during east monsoon as described by Shannon’s diversity index ($H'$), evenness index ($J'$) and Simpson’s dominancy index ($D$) is shown in Figure 3. Shannon diversity index varied, ranging from 0.8 to 2.3 (mean $H'$=1.31). This index illustrates that as a whole, diversity of phytoplankton during the research in Inner Ambon bay can be categorized as moderate. Based on Shannon index, diversity can be grouped into 3 categories namely low ($H'<1.0$), moderate ($1.0<H'<3.0$) and high ($H \geq 3.0$) [22]. The lowest $H'$ was found at station 8 while the highest $H'$ was found at station 9.

The values of evenness index ($J'$) during the research ranging from 0.22 - 0.71 with the lowest value was found at station 7 whilst the highest value belonged to station 9. The values of evenness index ranging from 0 - 1 and if this value close to 1 means that there is equal number of cell among species in community of phytoplankton and vice versa. Odum (1975)[22] stated that if $J \geq 0.6$ then the community is in stable/steady condition. Average value of $J'$ during the research was 0.37 which means that phytoplankton community in Inner Ambon bay is not in stable condition. Low value of this index also indicates that the number of cell among species is not equal or there are some species which have high number of cell and dominate the community of phytoplankton during the research.

Simpson’s index ($D$) to measure dominance of phytoplankton during the research ranged from 0.29 to 0.78. The $D$ value is ranging from 0 - 1 and if this value is closed to 1 means that there are some species dominate the community with high number of cells [23]. Furthermore, to measure dominance, D index can be grouped into 3 categories i.e. low ($D < 0.4$), moderate ($0.4 < D < 0.6$) and high ($D > 0.6$) [24]. Average value of $D$ for phytoplankton community in Ambon Inner bay during east monsoon was 0.63 which means that there is high dominance of some species. It can be seen in Table 2 that there are two species namely $D. miles$ (13.61%) and $T. erytracheum$ (66.16%) dominate phytoplankton community with average contribution of their cells as high as 79.77% to total cells of phytoplankton found in Inner Ambon bay.
3.5. Similarity and spatial distribution of phytoplankton

Species similarity index of phytoplankton between stations is presented in Table 3. It can be seen in Table 3 that those indexes ranging from 53.4% to 85.5%. The lowest similarity of phytoplankton is found between station 8 and station 9 while the highest index occurred between station 5 and station 8. Based on criterion of Hutauruk (2009)[14], similarity of phytoplankton between station in Inner Ambon bay can be categorized as similar (50 - 75%) to very similar (75 - 100%).

Table 3. Species similarity index (%) of phytoplankton between stations in Inner Ambon Bay

|       | Sl1 | Sl2 | Sl3 | Sl4 | Sl5 | Sl6 | Sl7 | Sl8 | Sl9 | Sl10 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| St.1  |     |     |     |     |     |     |     |     |     |      |
| St.2  | 79.71 |     |     |     |     |     |     |     |     |      |
| St.3  | 79.56 | 85.32 |     |     |     |     |     |     |     |      |
| St.4  | 79.78 | 69.78 | 74.82 |     |     |     |     |     |     |      |
| St.5  | 82.30 | 69.66 | 73.20 | 81.98 |     |     |     |     |     |      |
| St.6  | 78.91 | 71.73 | 77.16 | 85.42 | 84.6 |     |     |     |     |      |
| St.7  | 75.04 | 67.54 | 70.58 | 70.10 | 80.31 | 83.47 |     |     |     |      |
| St.8  | 78.18 | 64.47 | 89.64 | 80.20 | 85.51 | 81.73 | 78.90 |     |     |      |
| St.9  | 60.91 | 69.39 | 67.16 | 59.94 | 54.51 | 58.70 | 55.44 | 53.56 |     |      |
| St.10 | 62.25 | 69.88 | 72.37 | 66.13 | 61.82 | 65.85 | 63.85 | 60.27 | 69.36 |      |
Result in section 3.2 shows that some species of phytoplankton occurred in all stations but others only found in a certain stations. This result indicates that phytoplankton is not evenly distributed in Inner Ambon bay ([25] and thus their distribution pattern tends to aggregated or patchy [17]. In addition, phytoplankton has limited ability to move and their movement is depended on current [26].

The result of cluster analysis which is based on Bray-Curtis similarity index shows that phytoplankton in Inner Ambon bay during east monsoon can be grouped into three clusters (Figure 4).

- Cluster 1 represented stations 7, 5, 8, 4 and station 6. This cluster is characterized by high number of species as well as high number of cells and has similarity up to 80.46%. Phytoplankton in this cluster is dominated by *D. miles* and *T. erytracheum*.

![Figure 4. Dendogram for cluster of phytoplankton in Inner Ambon bay](image)

- Cluster 2 is a cluster among station 1, station 2 and station 3 with similarity 79.64%. This cluster has relatively low abundance but has high number of species. Cluster 2 is dominated by *D. miles, D. caudata, C. macroceros, G. spinifera, P. stenii* and *T. erytracheum*.

- Cluster 3 is formed by station 9 and station 10 with similarity 69.37%. This cluster has low number of species and low abundance. Cluster 3 is dominated by *T. erytracheum, D. miles, D. caudata, P. stenii, C. macroceros, C. furca* and *G. spinifera*.

Spatial distribution of phytoplankton during the research showed that the highest abundance were found at station 5, station 6 and station 8 in the eastern Inner Ambon bay while the lowest abundance belonged to station 9 and station 10 (Figure 5).

![Figure 5. Spatial distribution of phytoplankton in Inner Ambon bay](image)
4. Conclusion

There are 64 species of phytoplankton which belong to 4 classes, 7 orders, 22 families and 45 genera found during the study at 10 stations in Inner Ambon bay with the abundance ranging from $5.4 \times 10^4$ to $7.7 \times 10^5$ cell/m$^3$. Phytoplankton during east monsoon is dominated by *T. erythraeum* and *D. miles*. In general, diversity of phytoplankton during the research can be categorized as moderate with low evenness and high dominance. Similarity of phytoplankton between stations in Inner Ambon bay can be categorized as similar to very similar and they are grouped into three clusters.

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