# SPECIES COMPOSITION, ABUNDANCE AND DISTRIBUTION OF PHYTOPLANKTON IN THE ELPHINSTONE ISLAND, MYEIK COASTAL WATERS

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## Abstract

Phytoplankton composition, abundance and distribution were evaluated on June 2013 to January 2014 from Elphinstone Island of Myeik Coastal Waters. Altogether 81 species of phytoplankton; 60 species in 37 genera which belong to 16 families of diatoms and 21 species in 9 genera which include to families of dinoflagellates were identified. The highest species composition (49 species) was found at Grants Island and Zalat Aw Gyi in November and the lowest number (22 species) was also found at Grants Island in August. The abundance of diatom species was found more than that of dinoflagellate species. The highest diversity index (*H'*) and the lowest species richness value (*R'*) were found at Espace Bay. The value of evenness index (*J'*) was not significantly differed by stations.

**Keywords:** Phytoplankton, Elphinstone Island, Species Composition, Abundance, Distribution.

## Introduction

In the phytoplankton, Diatoms (class: Bacillariophyceae) and Dinoflagellates (phylum : dinoglagellata) commonly predominate. Individuals of these two orders are unicellular plants with a size range of about 15 - 400 µm in maximum dimension, but dinoflagellates contain a larger proportion among very small forms.

Diatoms are remarkedly distinguishable into two orders, the Centrales and the Pennales. The Centrales, or centric diatoms, have a radial symmetry and are successful as plankton in marine waters. Their frustules, or shells, can also be triangular or quadrate. The centric diatoms are mostly planktonic and non-motile.

The Pennales, pennate diatoms, occupy and dominate the freshwater, soil, and epiphytic environments. Although they also thrive in marine habitats,

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their typical environmental niche is in fresh water. The Pennales have bilateral symmetry. Most marine diatoms tolerate a wide range of temperatures typically ranging from 19º C to 30.5º C.

Marine dinoflagellates are unicellular, eukaryotic algae. Dinoflagellates are the second most abundant form of autotrophic life in the marine ecosystem. Majority of dinoflagellates are autotrophic and a few are holozoic, saprophytic orphagotrophic. In the autotrophic dinoflagellates, the products of the photosynthesis are starch and lipids (Hunter 2007).

Myeik Archipelago extends from Mali Island to Similand Island and comprises about 800 islands covering on area of about 34,340 squares kilometer in is lying up to 30 km offshore. Elphinstone Island (Thayawthadangyi kyun) is one of the largest outer islands of Myeik Coastal Waters. Around this island, there are some populated fishing villages and culture farms (pearl oyster farm and old seaweed farms).

The study areas; Escape Bay and Grants Island are developed with pearl oyster (*Pinctada maxima*) farms and Mway Kyun station was also developed with seaweed (*Kappaphcus alverazii*) farms. The objectives of the present study are: (1) to identified what kinds of phytoplankton species and (2) to analyze the community structures of phytoplankton species.

## Materials and Methods

Phytoplankton samples were collected from five sampling stations; Station (1) Escape Bay (Lat 12° 16' N and Long 98° 00' E), Station (2) Myaw Island (Lat 12° 22' N and Long 98° 06' E), Station (3) Grants Island (Lat 12° 23' N and Long 98° 06' E), Station (4) Zalat Aw Nge (Lat 12° 18' N and Long 98° 01' E) and Station (5) Zalat Aw Gyi (Lat 12° 18' N and Long 98° 02' E),in the waters off Elphinstone Island, MyeikArchipelago, Taninthayi Region (Figure 1).

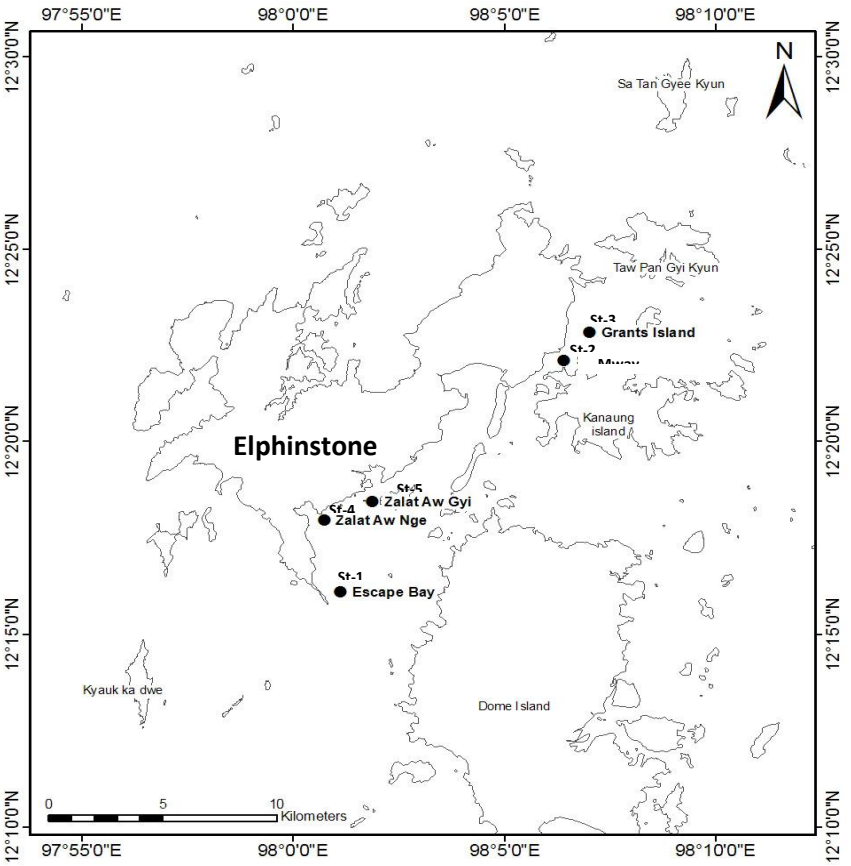


**Figure 1.** Map showing the study areas of Elphinstone Island

At all study stations, monthly collection of phytoplankton was carried out during June 2013 to February 2014. Phytoplankton net (60cm in length, 25cm in width (diameter) and 25 µm mesh size) was towed horizontally at every station. The collected samples were kept in clean small size plastic bottles and preserved in 2% formaldehyde immediately. The specimens were identified up to species level with the following references; Newell and Newell (1963), Allen and Cupp (1930), Hendey (1964), Yamaji (1971), Tomas (1997), Wood (1968) and Al-Kandari, *et al*. (2009).

Species diversity indices for each sample were calculated by using the formula of Shannon and Weaver (1963), Pielou (1966) and Margalef (1958). $H'=-\sum$ Pi*lnPi, $J'=H'/$lnS, $R'=S-1/$ln N; where, $H'$ is the index of species diversity, Pi is the population abundance of $i^{th}$ species calculated by ni/N, ni is the number of individual of the $i^{th}$ species, N is the total number of individuals in a station, $J'$ is the index of species eveness, S is the total number of species and $R'$ is the index of species richness.

The dominancy index (D) was calculated by the Simpson's index formula; D= n (n-1)/N (N-1), N is the total number of species of phytoplankton and n is the total number of organisms of a particular phytoplankton species. Similarity index was determined by using Sorenson's index as follows: S=C/A+B, where C is the number of species the two communities have in common, A is the total number of species found in community A and B is the total number of species found in community B (as cited in Huliselan, Tuapattinaja and Pattimura, 2017)

## Results

A total of 81 species of phytoplankton were identified during the study period from Elpninstone Island. In 81species of phytoplankton of which, 60 species of diatoms, 21species of dinoflagellates were recorded respectively (Table 6). The highest number of species (49) was found in November at both stations 3 and 5 followed by number of species (47) in also November at stations 2 and 4 and the lowest number was occurred in October at stations 1, 4 and 5 (Table 1 and Figure 2). During the study period, diatoms species were more dominant than dinofagellates at all stations in every month.

**Table 1.** Distribution and occurrence of phytoplankton in Elphinstone Island in Myeik Coastal Waters

| Stations | Months | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan | Total |
| Escape Bay | 37 | 39 | 31 | 44 | 24 | 44 | 41 | 30 | 290 |
| Myaw Island | 39 | 41 | 36 | 26 | 43 | 47 | 33 | 35 | 300 |
| Grants Island | 30 | 41 | 22 | 36 | 39 | 49 | 38 | 43 | 298 |
| Zalat Aw Nge | 47 | 35 | 26 | 41 | 24 | 47 | 43 | 27 | 290 |
| Zalat Aw Gyi | 41 | 41 | 27 | 41 | 24 | 49 | 33 | 28 | 284 |
| Total | 194 | 197 | 142 | 188 | 154 | 236 | 188 | 163 | **1462** |

**Table 2.** Dominancy index (D) of phytoplankton communities at all stations during study period.

| Stations | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Escape Bay | 0.292 | 0.325 | 0.204 | 0.415 | 0.121 | 0.415 | 0.360 | 0.191 |
| Myaw Island | 0.282 | 0.312 | 0.240 | 0.124 | 0.344 | 0.411 | 0.201 | 0.226 |
| | | | | | | | | |
| Grants Island | 0.170 | 0.321 | 0.090 | 0.246 | 0.290 | 0.460 | 0.275 | 0.353 |
| Zalat Aw Nge | 0.400 | 0.220 | 0.120 | 0.304 | 0.102 | 0.400 | 0.334 | 0.130 |
| Zalat Aw Gyi | 0.340 | 0.340 | 0.145 | 0.340 | 0.114 | 0.487 | 0.219 | 0.157 |

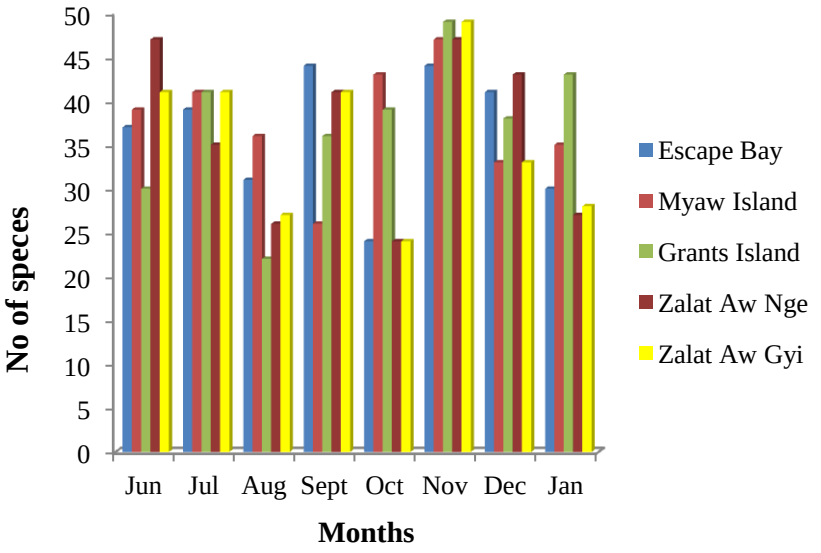


**Figure 2.** Distribution and occurrence of phytoplankton in Elphinstone Island in Myeik Coastal Waters

During study period, the dominance index varied from 0.090 to 0.487. The maximum (0.487) was recorded at Zalat Aw Gyi in November and the minimum (0.090) was at Grants Island in Auguest (Table 2). The similarities index of phytoplankton at all stations showed that the percentage of similarity ranged from 90% to 95.24%. The value revealed that phytoplankton communities between stations from Elphinstone Island in space were similar. This condition was supported by the value of Dominancy index which was low (Table 3).

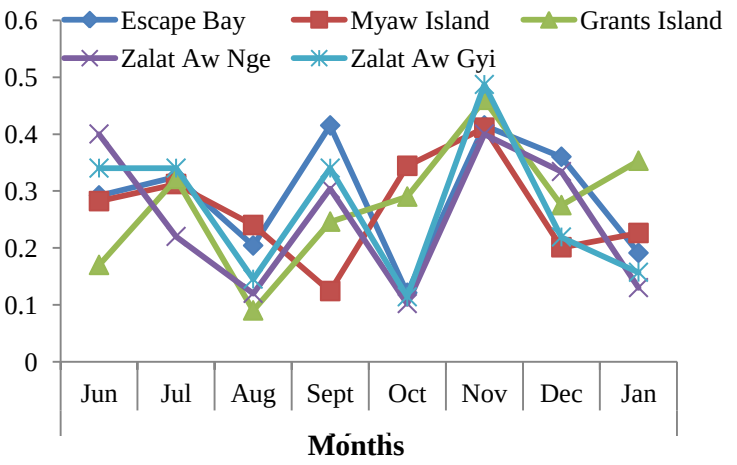


**Figure 3.** Dominancy index (D) of phytoplankton communities at all stations during study period

**Table 3.** Similarity (S) of phytoplankton communities at all stations during study period.

| Dimension | Object | Similarity (S) | Percentage |
|---|---|---|---|
| Spatial | Stations 1 and 2 | 0.9503 | 95.03% |
| | Stations 1 and 3 | 0.9000 | 90.00% |
| | Stations 1 and 4 | 0.9296 | 92.96% |
| | Stations 1 and 5 | 0.9275 | 92.75% |
| | Stations 2 and 3 | 0.9517 | 95.17% |
| | Stations 2 and 4 | 0.9524 | 95.24% |
| | Stations 2 and 5 | 0.9371 | 93.71% |
| | Stations 3 and 4 | 0.9315 | 93.15% |
| | Stations 3 and 5 | 0.9014 | 90.14% |
| | Stations 4 and 5 | 0.9028 | 90.28% |

**Table 4.** The abundance (cells $L^{-1}$) of phytoplankton communities at all stations from Elphinstone Island.

**Table 4.1.** The abundance (cells $L^{-1}$) of phytoplankton communities at Escape Bay station during study period.

| Family | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Biddulphiales | 34586 | 257790 | 125831 | 23334 | 178256 | 24414 | 176441 | 120031 |
| Bacillarineae | 1635 | 96820 | 449 | 277103 | 144 | 1205 | 5577 | 589 |
| Prorocentrales | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dinophysiales | 160 | 154 | 64 | 128 | 577 | 128 | 385 | 52 |
| Gonyaulacales | 577 | 256 | 64 | 2225 | 0 | 386 | 371 | 103 |
| Dictyochales | 0 | 0 | 0 | 0 | 0 | 0 | 38 | 0 |

**Table 4.2.** The abundance (cells $L^{-1}$) of phytoplankton communities at Myaw Island station during study period.

| Family | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Biddulphiales | 64135 | 229318 | 82790 | 3749 | 565153 | 23885 | 7242 | 857932 |
| Bacillarineae | 5077 | 232825 | 3298 | 4135 | 124474 | 5240 | 7659 | 3076 |
| Prorocentrales | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dinophysiales | 177 | 67 | 135 | 352 | 180 | 400 | 1026 | 240 |
| Gonyaulacales | 317 | 3904 | 539 | 689 | 1705 | 1344 | 849 | 913 |
| Dictyochales | 0 | 0 | 0 | 0 | 90 | 0 | 0 | 0 |

**Table 4.3.** The abundance (cells $L^{-1}$) of phytoplankton communities at Grants Island station during study period.

| Family | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Biddulphiales | 10174 | 83158 | 59487 | 12435 | 338143 | 65790 | 14873 | 102820 |
| Bacillarineae | 577 | 6922 | 7629 | 15385 | 15751 | 5205 | 5769 | 3429 |
| Prorocentrales | 16 | 0 | 0 | 0 | 0 | 0 | 51 | 0 |
| Dinophysiales | 64 | 128 | 128 | 609 | 174 | 872 | 385 | 962 |
| Gonyaulacales | 112 | 3012 | 192 | 1473 | 1735 | 3005 | 921 | 2787 |
| Dictyochales | 0 | 0 | 0 | 0 | 87 | 0 | 0 | 64 |

**Table 4.4.**The abundance (cells $L^{-1}$) of phytoplankton communities at Zalat Aw Nge station during study period.

| Family | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Biddulphiales | 11246 | 363801 | 158095 | 15460 | 567036 | 16598 | 15084 | 53443 |
| Bacillarineae | 499 | 25667 | 1499 | 16880 | 11751 | 820 | 12307 | 353 |
| Prorocentrales | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 |
| Dinophysiales | 192 | 167 | 83 | 160 | 603 | 282 | 288 | 0 |
| Gonyaulacales | 1269 | 1333 | 83 | 384 | 151 | 975 | 272 | 0 |
| Dictyochales | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 |

**Table 4.5.**The abundance (cells $L^{-1}$) of phytoplankton communities at Zalat Aw Gyi stations during study period.

| Family | Months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan |
| Biddulphiales | 15209 | 444203 | 74310 | 8637 | 158011 | 16133 | 11366 | 140923 |
| Bacillarineae | 558 | 48692 | 2846 | 18814 | 6904 | 4422 | 4974 | 1205 |
| Prorocentrales | 19 | 19 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dinophysiales | 173 | 231 | 308 | 80 | 285 | 1106 | 359 | 26 |
| Gonyaulacales | 1038 | 3763 | 616 | 240 | 336 | 1923 | 77 | 0 |
| Dictyochales | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

During the study, the abundance of phytoplankton at Escape Bay ranged between 52 cells $L^{-1}$and 257790 cells $L^{-1}$. The minimum (52 cells $L^{-1}$) was found during the post-monsoon season in January and the maximum (257790 cells $L^{-1}$) was during monsoon season in July (Table 4.1). At Myaw Island, the abundance varied from 67 cells $L^{-1}$ to 857932 cells $L^{-1}$. The smallest value (67 cells $L^{-1}$) was recorded during monsoon seasonin July and the largest value (857932 cells $L^{-1}$) was during the post-monsoon season in January (Table 4.2). From Grants Island, the range of phytoplankton abundance was 16 cells $L^{-1}$-338143 cells $L^{-1}$. The lowest value (16 cells $L^{-1}$) was occurred during monsoon season in June and the highest value 338143 cells $L^{-1}$ during the post-monsoon season in October (Table 4.3). In Zalat Aw Nge station, the abundance of phytoplankton ranged between 16 cells $L^{-1}$ and 567036 cells $L^{-1}$. Minimum value (16 cells $L^{-1}$) was reported during the post-monsoon season in December and maximum (567036 cells $L^{-1}$) was during the post-monsoon season in October (Table 4.4). At station Zalat Aw Gyi, the phytoplankton abundance varied from 19 cells $L^{-1}$ to 444203 cells $L^{-1}$. The smallest value (19

cells $L^{-1}$) was recorded during monsoon season in June and July and the largest value (444203cells $L^{-1}$) was during the monsoon season in July (Table 4.5).

**Table 5.** Species diversity index, richness index, evenness at study areas during study period.

| | Stations | | | | |
|---|---|---|---|---|---|
| | Escape Bay | Myaw Island | Grants Island | Zalat Aw Nge | Zalat Aw Gyi |
| Diversity index (*H'*) | 2.4 | 1.8 | 2.4 | 2.1 | 2.2 |
| Richness index (*J'*) | 5.7 | 5.5 | 5.9 | 5.7 | 5.8 |
| Evenness (*R'*) | 0.6 | 0.4 | 0.6 | 0.5 | 0.5 |

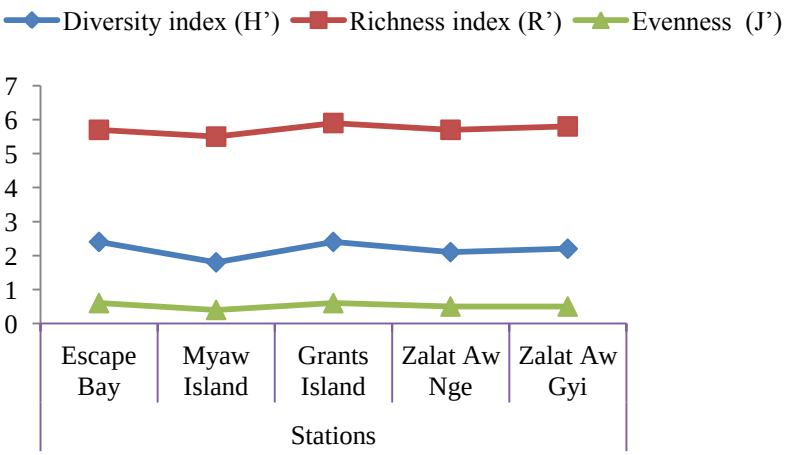


**Figure 4.** Species diversity index, richness index, evenness at study areas during study period

**Table 6.** Composition of phytoplankton communities at all stations from Elphinstone Island.

| Sir No. | Species Name | Station-1 | Satation-2 | Station-3 | Station-4 | Station-5 |
|---|---|---|---|---|---|---|
| | *Cyclotella striata* | + | + | + | + | + |
| | *Lauderia annulata* | + | + | + | + | + |
| | *Skeletonema costatum* | + | + | + | + | + |
| | *Planktoniella sol* | + | + | + | + | _ |
| | *Thalassiosira eccentrica* | + | + | _ | + | + |
| | *Paralia sulcata* | + | + | + | + | + |
| | *Corethron criophilum* | + | + | + | + | + |
| | *Coscinodiscus occulus-irridis* | + | + | + | + | + |
| | *Coscinodiscus centralis* | + | + | + | + | + |
| | *Coscinodiscus granii* | + | + | + | + | + |
| | *Coscinodiscus radiatus* | + | + | + | + | + |
| | *Hemidiscus cuneiformis* | + | + | + | + | + |
| | *Rhizosolenia imbricata* | + | + | + | + | + |
| | *Rhizosolenia setigera* | + | + | + | + | + |
| | *Rhizosoleniarobusta* | + | + | + | + | + |
| | *Rhizosoleniacalcar-avis* | + | + | + | + | + |
| | *Rhizosolenia bergonii* | + | + | + | + | + |
| | *Proboscia alata* | + | + | + | + | + |
| | *Guinardia flaccida* | + | + | + | + | + |
| | *Guinardia striata* | + | + | + | + | _ |
| | *Eucampia zodiacus* | + | + | + | + | + |
| | *Eucampia cornuta* | + | + | + | + | + |
| | *Cerataulina pelagica* | + | + | + | + | + |

| Sir No. | Species Name | Station-1 | Satation-2 | Station-3 | Station-4 | Station-5 |
|---|---|---|---|---|---|---|
| | *Hemiaulus sinensis* | + | + | + | + | + |
| | *Climacodium biconcavum* | _ | + | + | _ | + |
| | *Bacteriastrum hyalium* | + | + | + | + | + |
| | *Chaetoceros decipiens* | + | + | + | + | + |
| | *Chaetoceros curvisetum* | + | + | + | + | + |
| | *Chaetoceros diversus* | + | + | + | + | + |
| | *Chaetoceros denticulatus* | + | + | + | + | _ |
| | *Chaetoceros coastatus* | + | + | + | + | _ |
| | *Chaetoceros pervianum* | + | + | + | + | + |
| | *Chaetoceros compressus* | + | _ | _ | _ | _ |
| | *Bellerochea horologicalis* | + | + | + | + | + |
| | *Ditylum sol* | + | + | + | + | + |
| | *Helicotheca tamensis* | + | + | + | + | + |
| | *Odontella sinensis* | + | + | + | + | + |
| | *Odontella mobiliensis* | + | + | + | + | + |
| | *Odontella aurita* | + | + | _ | + | + |
| | *Odontella obtusa* | _ | _ | _ | + | _ |
| | *Triceratium favus* | + | + | + | + | + |
| | *Lamprisus shadboltianum* | + | + | + | + | + |
| | *Astrionellopsis glacialis* | + | + | _ | _ | + |
| | *Isthmia nervosa* | _ | _ | _ | _ | + |
| | *Thalassionema nitzschioides* | + | + | + | + | + |
| | *Thalassionemafrauenfeldii* | + | + | + | + | + |
| | *Licmophora flabellata* | _ | _ | + | _ | + |
| | *Navicula lyra* | _ | + | + | + | + |

| Sir No. | Species Name | Station-1 | Satation-2 | Station-3 | Station-4 | Station-5 |
|---|---|---|---|---|---|---|
| | *Pleurosigma normanii* | + | + | + | + | + |
| | *Pleurosigma angulatum* | + | + | + | + | + |
| | *Pleurosigma elongatum* | + | + | + | + | + |
| | *Amphiprora alata* | + | + | + | + | + |
| | *Deplonies crabro* | _ | _ | _ | + | _ |
| | *Bacillaria paxillifera* | + | + | + | + | + |
| | *Nitzschia longissigma* | + | + | + | + | + |
| | *Nitzschia lorenzian* | + | + | + | + | + |
| | *Nitzschia sp.* | + | + | + | + | + |
| | *Pseudo-nitzschia seriata* | + | + | + | + | + |
| | *Surirella ovalis* | + | + | + | + | + |
| | *Tabellaria fenestratea* | + | + | + | + | + |
| | *Prorocentrum micans* | _ | _ | _ | + | + |
| | *Triposolenia truncata* | _ | _ | + | _ | _ |
| | *Dinophysis caudata* | + | + | + | + | + |
| | *Ornithocercus magnificus* | + | + | + | + | + |
| | *Phalacroma circumsutum* | _ | + | + | + | _ |
| | *Ceratium fusus* | + | + | + | + | + |
| | *Ceratium fucar* | + | + | + | + | + |
| | *Ceratium macroceros* | + | + | + | + | + |
| | *Ceratium massiliense* | _ | + | + | + | _ |
| | *Ceratium tripos* | + | + | + | + | + |
| | *Ceratium breve* | + | + | + | + | + |
| | *Ceratium flacatum* | _ | _ | + | + | _ |

| Sir No. | Species Name | Station-1 | Satation-2 | Station-3 | Station-4 | Station-5 |
|---|---|---|---|---|---|---|
| | *Pyrophacus horologium* | + | + | + | + | + |
| | *Protoperidinium depressum* | + | + | + | + | + |
| | *Protoperidinium conicum* | + | + | + | + | + |
| | *Protoperidinium pentagonum* | + | + | + | + | + |
| | *Protoperidinium oceanicum* | + | + | + | + | + |
| | *Protoperidinium oblongum* | + | + | + | + | + |
| | *Protoperidinium grande* | _ | + | + | _ | + |
| | *Protoperidinium pellucidum* | _ | + | + | + | + |
| | *Dictyocha fibula* | + | + | _ | + | + |

+ =present, - =absent

## Discussion

From the observation of phytoplankton in the waters off Elphinstone Island, 81species of diatoms and dinoflagellates were recorded. In comparison, the diatoms were more abundant than dinofagellates during the present study period. In Myeik, Si Thu Hein (2010), Khin Yu Nwe (2011) and Lett Wai Nwe (2011) observed that diatoms are more dominant than dinoflagellates. Moreover, Zin Mar Aye (2012) and Tin Tin Kyu (2012) reported that diatoms were higher than dinoflagellates in Palaw Waters. However, Zin Lin Khine and Htay Aung (2009) described dinoflagellates occurred to be more abundant than diatoms in the waters off Ayeyarwaddy and Taninthayi coast.

During the whole study period, the highest number of phytoplankton species was found at all stations in November. In this month, the common diatom genera were *Coscinodiscus, Hemidiscus, Rhizosolenia, Proboscia,*

*Guinardia, Eucampia, Ditylum, Odontella, Thalassionema* and the common dinoflagellates genera were *Amphiprora, Nitzschia, Pseudo-nitzschia, Dinophysis, Ornithocercus* and *Protoperidineum.* However, minimum species numbers were found at all stations in August that was rainy season. Similarly, this result was reported by Caric *et al*., (2011), Zin Mar Aye (2012) and Tin Tin Kyu (2012).

The genera of *Chaetoceros* and *Thalassionema* were observed as dominant in the present study period. Boonyapiwat (1997a) reported these above genera as dominant genera in the Gulf of Thailand and the East Coast of Peninsular Malaysia. Boonyapitwat (1997b) recorded that *Oscillatoria erythrae, Proboscia alata, Rhizosolenia calcar-avis* and *Thalassionema frauenfeldii* were dominant species in Vietnamese. Zin Lin Khin and Htay Aung (2009) also recorded that *Osciallatoria* was dominant species in lower part of Taninthayi Waters. Moreover, Boonyapitwat, *et al.,* (2008) reported *Oscillatoria erythrae* and *Proboscia alata* were the dominance species in north, west and east of the Bay of Bengal. However, the genus *Oscillatoria (Trichodesmiun)* was not found but *T. frauenfeldii* and *P. alata* were found moderately in the present study.

During the study period, the abundance of phytoplankton at all stations varied from 16 cells $L^{-1}$ to 857932 cells $L^{-1}$ by families. The lowest value (16 cells $L^{-1}$) was occurred during monsoon (June) and post-monsoon season (December) and the highest value (857932 cells $L^{-1}$) was found during the post-monsoon season (January). The phytoplankton population density varied from 12000 to 92625 cells $L^{-1}$. The minimum value (12000 cells $L^{-1}$) was occurred during monsoon (November) and the maximum value (92625 cells $L^{-1}$) was found during pre-monsoon season (May) (Ananthan, et.al, 2008). The highest cell density (133790 cells $L^{-1}$) was observed in the Bay of Bengal (Boonyapiwat, *et al.,* 2008).

In present study, the range of dominance index was 0.090-0.487. In the islands of Burung and Buntal, the dominancy index varied from 0.125 to 0.462 (Huliselan, Tuapattinaja and Pattimura, 2017). However, the dominancy index ranged between 8.99 and 53.7was recorded from Ariyankuppam estuary and Verampattinam coast (Ananthan, et.al, 2008). The similarities index of phytoplankton at all stations showed that the percentage of similarities index of phytoplankton at all stations showed from 90% to 95.24%. Phytoplankton communities were similar significantly as well as species by station. Similarity, in Burung and Buntal, that the percentage of similarities index of phytoplankton (73%-96%) was similar significantly between stationand time (Huliselan, Tuapattinaja and Pattimura, 2017)

During the present study, variation of species diversity index values (*H')* ranged from 1.8 to 2.4; the evenness values (*J'*) from 0.4 to 0.6; Species richness index value (*R'*) ranged between 5.5 and 5.9 by stations. Shannon-Wiener diversity index ranged from 0.44 to 3.47, the evenness ranged from 0.13 to 0.86 and species richness index value ranged between 2.45 and 6.8 was observed in South Adaman (Begum *et al.*, 2012). The diversity value at all station of Burung and Buntal Islands ranged from 1.524 to 2.872 and the degree of evenness index of phytoplankton varived from 0.538 to 0.875 (Huliselan, Tuapattinaja and Pattimura, 2017). From Ariyankuppam estuary and Verampattinam coast, diversity index (3.11-5.38) species evenness (1.13-3.91) and species richness index (0.77-0.99) were reported by Ananthan, et.al, 2008.

## Conclusion

In the present study, diatoms were more dominated than dinoflagellates. Then, *Chaetoceros curvisetum, Thalassionema nitzschioides* were common at all stations in October. The maximum species composition of phytoplankton was found at all stations during post-monsoon season (October). The high abundance and composition of phytoplankton species were found in all study areas. The community structure of phytoplankton

reflecting by diversity is showed that the community was in a fair state because the Shannon-Wiener diversity indice is fair value ($2< H'<3$). It can be concluded that the study areas were high productive area for phytoplankton. Therefore, the health of water condition had favorable to growth phytoplankton and to success pearl oysters culture.

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