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SPECIES COMPOSITION AND ABUNDANCE OF HYTOPLANKTON IN DAWEI COASTAL WATERS

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Abstract

Species composition and abundance of phytoplankton were studied bimonthly at Dawei coastal waters in Myanmar during the period from June 2019 to January 2020. Samples were collected at the four stations, namely, Maungmagan (station 1), Kampani (station 2), Nyawpyin (station 3), and Kyaukmatak (station 4). A total of 148 species in which 6 classes are of 36 orders, 48 families, and 65 genera was recorded in the present study. Centric diatoms contributed a maximum percentage composition (80% in total) followed by the pennate diatoms (18%), whereas dinoflagellates comprised a minimum percentage composition, with an average of 2 %. Silicoflagellates were rarely observed. Among the four stations, the highest cell abundance (3139 cells/mL) was observed at station 1, with a 43% in total, which was followed by station 3 (1667 cells/mL) and station 2 (1573 cells/mL), with a percentage of 23% and 22% in total, respectively. The least cell abundance (889 cells/mL) was found in station 4 with a percentage of 12% in total. Phytoplankton abundance was high in the post-monsoon period but the low cell abundance in the monsoon season. *Skeletonema costatum, Leptocylindrus danicus, Proboscia alata, Bacteriastrum delicatulum, Chaetoceros compressus, Thalassionema frauenfeldii, Chaetoceros lorenzianus, Thalassionema nitzschioides* were dominant species along Dawei coastal waters.

Keywords: Abundance, centric, Dawei, dinoflagellates, pennate, species composition

Introduction

Phytoplankton, also known as microalgae, are similar to terrestrial plants in that they contain chlorophyll and require sunlight to live and grow. Most phytoplankton are buoyant and float in the upper part of the ocean, where sunlight penetrates the water. There are two main classes of phytoplankton which are known as diatoms and dinoflagellates. (NOAA) About 90% of the total production in the marine ecosystem is contributed by plankton (Achary *et al.* 2010).

Phytoplankton is very important because they form the base of the aquatic food web (Reynolds, 1984). Phytoplankton is the pioneer of an aquatic food chain. Biological production can be used as an index of trophic status and fisheries resource potential in any aquatic body (Jhingran, 1992).

Because of its importance in the marine ecosystem, many previous studies from various aspects of ecological approaches have been reported by several researchers related to its primary production, species composition, and abundance (Guo *et al*. 2014; Simo-Matchim *et al*. 2016). In this study, I have conducted species composition and abundance of phytoplankton in the four study areas of Dawei coastal waters. The main objective of the study is to know the species composition and abundance of phytoplankton in Dawei coastal areas.

Materials and Methods

Phytoplankton samples were collected at the four stations of Dawei coastal areas such as Maungmagan (Lat 14° 14′ N long 98° 02′ E), Kampani (Lat. 14° 04′ N, Long.98° 04′ E), Nyawpyin (Lat. 13° 38′ N, Long 98° 08′ E) and Kyaukmatak (Lat 13° 38′ N, Long 98° 08′ E), from July 2019 to January 2020.

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Phytoplankton samples were collected using a standard plankton net. A known volume of 50 L surface water was scooped with the bucket for quantitative sampling, then sieved to the final volume of 200 mL. After that samples were fixed with formalin (final concentration 1%) and also preserved with Lugol's neutralized iodine solution. Then sampling bottles were transported to the laboratory at the Department of Marine Science, Mawlamyine University. The sampled bottles were settled for 24 hours to the final volume of 50 mL for phytoplankton cell counting and identification. Species identification was mainly based on Cupp 1943, Hasle *et al.* 1997, Tomas 1997, Taylor *et al.* (2007), Al-Kandari *et al.* (2009), and Al-Yamani and Saburova (2019). Cell count and identification were made by using a light microscope (Nikon Eclipse E200) and Sedgewick-Rafter counting chamber, followed the methods reported by LeGresly and McDermott (2010). The counting unit of phytoplankton is expressed as cells/mL.

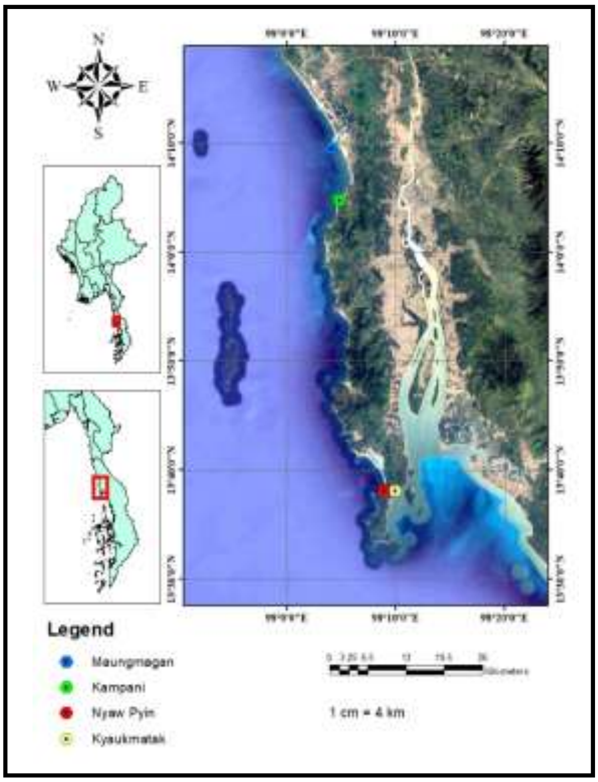

Figure 1 Map showing the sample collection sites in Dawei coastal waters

Results and Discussion

Phytoplankton species composition and abundance

A total of 148 species in which 28 species are of 8 orders, 11 families, 15 genera of Class: Coscinodiscophyceae, 50 species, 8 orders, 10 families, 15 genera of Class: Mediophyceae, 7 species, 4 orders, 4 families, 6 genera of Class: Fragillariophyceae, 33 species of 8 orders, 11 families, 16 genera of Class: Bacillariophyceae, 29 species, 7 orders, 11 families, 12 genera of Class: Dinophyceae, and 1 species, 1 orders, 1 family, 1 genus of Class: Dictyochophyceae was noted in this study.

Regarding the species occurrence of phytoplankton in Dawei coastal area, station 1 has the highest species occurrence (91 species) followed by station 4 (87 species), station 3 (80 species), and station 2 (78 species), respectively. Concerning the percentage composition of the different phytoplankton groups, centric diatoms 83%, pennate diatoms 15%, and dinoflagellates 2% were recorded in station 1. In station 2, centric diatoms 74%, pennate diatoms 22%, dinoflagellates 4%

and centric diatoms 83%, pennate diatoms 16%, dinoflagellates 1% were observed as station 3. Besides centric diatoms, 71%, pennate diatoms 26%, dinoflagellates 3% were found in station 4. The phytoplankton abundance ranged from 558-947 cells/mL in station 1, 184-630 cells/mL in station 2, 114-890 cells/mL in station 3, and 63-624 cells/mL in station 4.

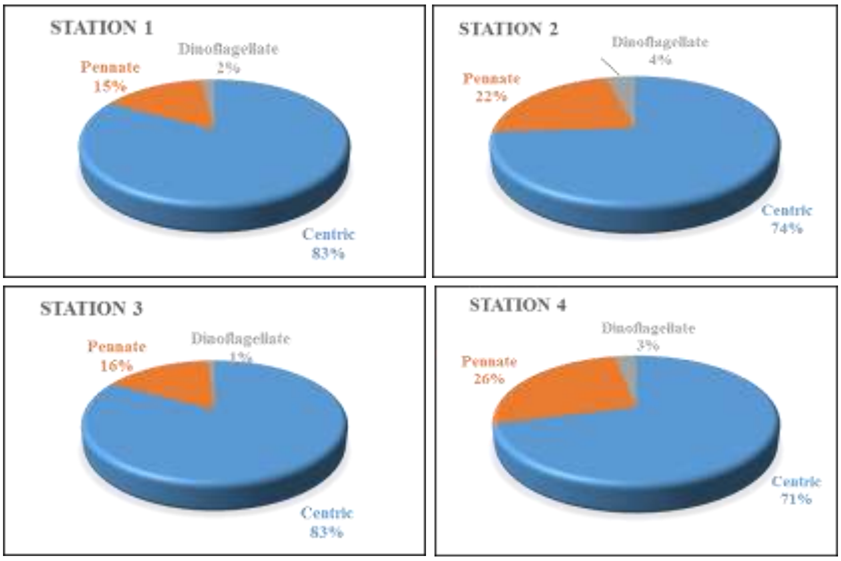

Figure 2 Species composition of phytoplankton in four study areas.

Species composition and occurrence of phytoplankton in four study areas

Centric diatoms	**St 1**	**St 2**	**St 3**	**St 4**
Hyalodiscus subtalis	+	+	_	+
Thalassiosira hyalina	+	_	+	+
Thalassiosira rotula	+	_	_	_
Thalassiosira subtilis	+	+	+	+
Thalassiosira osterupii	_	_	+	_
Planktonilla sol	_	+	+	+
Cyclotella striata	+	+	+	+
Lauderia annulata	+	+	+	+
Skeletonema costatum	+	+	+	+
Coscnodiscus centralis	_	_	+	+
Coscinodiscus granii	+	_	_	+
Coscinodiscus marginatus	+	+	_	+
Coscinodiscus oculus	+	_	_	+
Coscinodiscus radiatus	+	+	+	+
Coscinodiscus wailesii	_	_	+	+
Palmeria hardmaniana	_	+	_	_
Paralia sulcata	+	+	+	+
Asteromphalus cleveanus	+	_	_	_
Asterompjalus flabellatus	_	+	+	_
Bddulphia alternans	+	_	_	_
Bddulphia buddulphiana	_	+	_	_
Bddulphiia rhombus	_	+	+	_

Centric diatoms	**St 1**	**St 2**	**St 3**	**St 4**
Odontella granulata	+	_	_	_
Trieres mobiliensis	+	_	+	+
Trieres sinensis	_	+	+	+
Triceratium favus	_	+	+	_
Teiceratium reticulum	_	_	+	_
Stephanopyxis nipponica	_	_	_	+
Eucamppia zoodiacus	+	_	_	+
Eucamppia cornuta	+	+	+	+
Hemiaulus hauckii	+	+	+	_
Hemiaulus membranceus	+	_	_	+
Hemiaulus sinensis	+	+	+	+
Climacodium biconcavum	+	+	+	+
Climacodium frauenfeldianum	_	_	_	+
Bellerochae horologicalis	_	_	_	+
Helicotheca tamesis	_	_	_	+
Streptotheca indica	+	_	_	+
Ditylum brightwellii	+	+	+	+
Ditylum sol	+	+	+	+
Leptocylindrus danicus	+	+	+	+
Leptocylindrus mediterranius	+	_	_	_
Dactyliosolen fragillissimus	_	_	+	_
Rhizosolenia bergonii	+	+	+	_
Rhizosolenia cochlea	_	+	_	+
Rhizosolenia hyalina	+	_	+	+
Rhizosolenia imbricata	+	+	+	+
Rhizosolenia robusta	_	_	_	+
Rhizosolenia setigera	+	+	+	+
Rhizosolenia shrubsolei	_	+	_	+
Proboscia alata	+	+	+	+
Proboscia indica	+	_	_	+
Guinardia cylindrus	+	_	_	_
Guinardia flaccida	+	+	+	+
Guinardia striata	+	+	+	+
Bacteriastrum comosum	+	+	+	+
Bacteriastrum curvetum	_	+	_	_
Bacteriastrum delicatulum	+	+	+	+
Bacteriastrum furcatum	+	_	+	_
Bacteriastrum hyalinum	+	+	+	+
Bacteriastrum varians	_	+	+	_
Chaetoceros affinis	+	+	+	+
Chaetoceros coarctatus	+	_	+	_
Chaetoceros compressus	+	+	+	+
Chaetoceros constrictus	+	+	+	_

Centric diatoms	**St 1**	**St 2**	**St 3**	**St 4**
Chaetoceros costatus	–	–	+	–
Chaetoceros curvisetus	+	+	+	+
Chaetoceros danicus	+	+	+	+
Chaetoceros decipiens	+	–	+	–
Chaetoceros denticulatus	+	+	+	–
Chaetoceros diversus	+	+	+	+
Chaetoceros didymus	–	–	+	+
Chaetoceros laciniosus	+	+	+	–
Chaetoceros lorenzianus	+	+	+	+
Chaetoceros laevis	+	+	+	–
Chaetoceros messanensis	+	+	+	+
Chaetoceros peruvianus	–	+	+	+
Corethrom criophilum	+	+	–	–
Pennate Diatoms				
Asterionellopsis glacialis	+	–	+	–
Fragilaria capucina	+	+	+	+
Centronella reichelti	–	–	+	+
Thalassionema frauenfeldii	+	+	+	+
Thalassionema nitzschioides	+	+	+	+
Tabellaria fenestrata	–	+	–	–
Climacosphenia moniligera	+	–	–	–
Grammatophora marina	–	–	+	–
Lyrella lyra	–	–	+	–
Achnanthes fimbriata	–	–	+	–
Cocconeis guttata	+	–	+	+
Pinnularia trevelyana	–	+	–	–
Diploneis chersonensis	+	–	–	–
Diploneis smithii	+	+	+	+
Diploneis splendica	–	–	+	–
Diploneis nitescens	–	–	+	–
Diploneis finnica	–	–	+	–
Diplonies weissflogii	–	–	+	–
Meuniera membranacea	–	+	–	–
Navicula deliculata	+	+	+	+
Navicula granii	+	+	+	+
Haslea trompii	–	–	+	–
Pleurosigma aestuarii	+	+	–	+
Pleurosigma angulatum	–	–	–	+
Pleurosigma elongatum	–	+	–	–
Pleurosigma pelagicum	–	–	–	–
Pleurosigma normanii	+	+	–	+
Amphora angusta	+	–	–	–
Amphora linceolata	+	+	–	–

Centric diatoms	**St 1**	**St 2**	**St 3**	**St 4**
Bacillaria paxillifera	+	_	_	+
Cylindrotheca closterium	+	+	_	+
Nitzschia longissima	+	+	_	+
Nitzschia lorenziana	_	_	_	+
Nitzschia frigida	_	_	+	_
Nitzschia seriata	+	+	+	+
Nitzschia sigma	_	+	_	_
Nitzschia panduriformis	_	_	_	+
Tryblionella coarctata	_	+	+	_
Surirella gemma	_	+	_	_
Surirella ovalis	+	_	_	+
Dinoflagellates				
Prorocentrum micans	+	+	+	+
Prorocentrum rhathymum	+	_	_	+
Prorocentrum sigmoides	+	_	+	+
Dinophysis caudata	+	+	+	+
Dinophysis parvula	_	+	_	_
Dinophysis miles	+	_	_	+
Ornithocercus magnificus	_	_	_	+
Ornithocercus steinii	_	+	_	_
Akashiwo snaguinea	_	+	_	+
Ceratium furca	+	+	+	+
Ceratium fusus	+	+	+	+
Ceratium furocoides	_	_	_	+
Ceratium gibberum	_	+	_	_
Ceratium macroceros	+	_	+	+
Ceratium trichochoceros	+	_	_	_
Ceratium breve	_	_	_	+
Pyrocystis lunula	_	_	+	+
Cladopyxis hemibranchiata	+	_	_	_
Gonyaulax spinifera	+	_	_	_
Pyrophacus horologicum	+	_	_	_
Pyrophacus steinii	+	_	_	_
Diplopsalis lenticula	+	_	_	+
Protoperidinium compressum	+	+	_	_
Protoperidinium divergens	+	_	_	_
Protoperidinium oblongum	_	+	_	+
Protoperidinium oceanicum	_	+	_	+
Protoperidinium pentagonum	_	_	_	+
Protoperidinium venustum	+	_	_	_
Noctiluca scintillans	+	_	_	+
Silicoflagellates				
Dictyocha fibula	+	+	+	+
Total	**91**	**78**	**80**	**87**

Present = +, Absent = -

In the present study, six major classes were composed in the phytoplankton community such as Coscinodiscophyceae, Mediophyceae, Fragilariophyceae, Bacillariophyceae, Dinophyceae, and Dictyocho-phyceae. In a total of 148 species, Coscinodiscophyceae 19%, Medio-phyceae 34%, Fragilariophyceae 5%, Bacillariophyceae 22%, Dinophyceae 19%, and Dictyochophyceae 1% were observed.

Regarding the different phytoplankton groups in four study areas were observed centric diatoms are the most contributive and followed by pennate diatoms, dinoflagellates, and silicoflagellates. In our study, centric and pennate diatoms showed an overall coverage of 80 %. A similar condition was also reported in the Bay of Bangle where diatoms accounted for more than 95% of the phytoplankton population (Shenoy et al., 2006).

Skeletonema costatum, Leptocylindrus danicus, Proboscia alata, Bacteriastrum delicatulum, Chaetoceros compressus, Thalassionema frauenfeldii, Chaetoceros lorenzianus, Thalassionema nitzschioides were common during the present study which agrees well with the findings of Sarojini and Sarma (2001) who reported *Nitzschia*, *Chaetoceros* and *Rhizosolenia* were dominant in the Bay of Bengal. Moreover, a similar finding was noted in Raji et al. (2012) who stated the above phytoplankton species were common in the coastal water of Port Blair, South Andaman Island.

Concerning the abundance of phytoplankton, monthly variations were observed at Dawei coastal waters which were probably related to the seasonal environmental variables. The highest cell abundance was recorded in January 2020 (post-monsoon period) whereas the lowest was observed in July 2019 (monsoon period) (Fig.3). According to the literature (Muraleedharan et al. 2010, Badsi et al. 2012), high light intensity, and nutrient concentrations during pre-and post-monsoon periods promoting the increase of phytoplankton abundance. In contrast, heavy rainfall and river discharge loaded heavy tons of sediments in the monsoon months may reduce the water clarity, then, in turn, influenced the low cell density of phytoplankton.

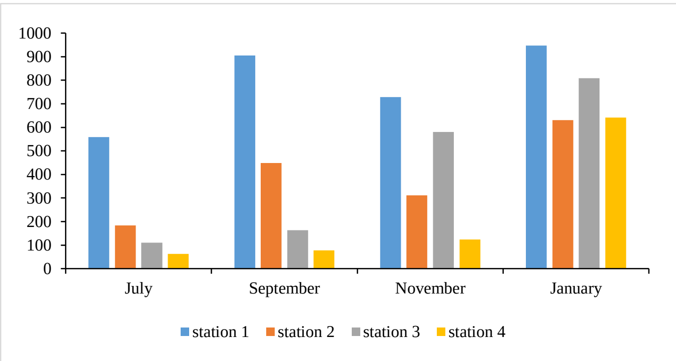

Figure 3 Phytoplankton abundance from July 2019 to January 2020.

The cluster analysis for the phytoplankton abundance among the four study months identified November and January had the high phytoplankton abundance, with over 90% similarity level.

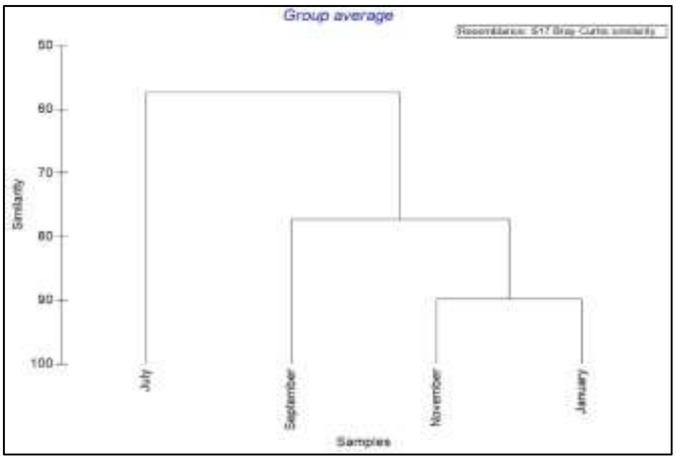

Figure 4 Dendrogram produced by clustering the abundance of different phytoplankton groups during the four study months.

Conclusion

Concerning the species composition of phytoplankton, centric diatom contributed the maximum percentage composition in Dawei coastal waters. During the study period, phytoplankton composition and abundance showed noticeable variations at the four stations. The resulted differences are likely due to the local forcing environmental parameters such as water temperature, salinity, and nutrient concentration, etc. Therefore, further study needs to be continued for the understanding of environmental forcing on the phytoplankton community.

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