COMPOSITION AND DIVERSITY OF PHYTOPLANKTON SPECIES FROM ANDIN COASTAL WATER, YE TOWNSHIP, MON STATE

May Sabai Htay[1], Thida Nyunt[2]

Abstract

Phytoplankton species were studied from Andin coastal water from December 2019 to August 2020. A total of 74 species of phytoplankton were identified and comprised 36 species of centric diatoms, 29 species of pennate diatoms and 9 species of dinoflagellates. The percentage composition of centric diatoms ranges from 63% to 68%, pennate diatoms range from 30% to 35% and dinoflagellates with 2% were observed. Species composition and abundance were found to be highest at Station III (2597 no/m³) and lowest at Station II (2191 no/m³). The index values encountered from Andin coastal water ranged between 3.73 and 3.76 for the species diversity index (*H'*), between 0.85 and 0.87 for evenness index (*E'*), and between 9.28 and 9.49 for species richness index (*D'*). The maximum salinity value of 30‰ was found in February and the minimum value of 24‰ was found in August. The highest water temperature of 31°C was found in February and the lowest water temperature value of 28°C and was found in August. This paper represents part of the ongoing effects to revise and document the phytoplankton of Andin coastal water.

Keywords Phytoplankton, Andin coastal water, composition, diversity, diatoms, dinoflagellates.

Introduction

Phytoplankton is mostly microscopic drifting organisms, solitary or colonial and unicellular algae. They live near the surface of the sea because, like all plants, they require light for photosynthesis. They are single-celled organisms, primary producers that serve as the base of the marine food chain. Diatoms are the most important group of phytoplankton. Dinoflagellates are the second most abundant phytoplankton.

Kyi Win (1972) identified 341 species of phytoplankton along the Myanmar coastal region. Zar Ni Ko Ko (2014) reported 60 species of diatoms and 21 species of dinoflagellates widely distributed in the Elphinstone Island waters, Myeik Archipelago. Nyunt Sandar Aung (2011) studied the littoral diatoms and dinoflagellates of Setse coastal area. Zaw Moe Aung (2011) studied the primary productivity of marine phytoplankton in Setse waters. Zin Mar Phyo (2012) examined the phytoplankton of Setse and Kyaikkhami coastal waters. In addition, Thida Nyunt (2013) classified the 112 species of phytoplankton collected Mon coastal waters. Aung Kyaw Lwin (2018) studied 48 species of phytoplankton from Ahlyat coastal water. Wai Yan Tun (2019) observed 50 species belonging to 20 families and 27 genera of diatoms and dinoflagellates from Ankhae coastal water. Recently, Thu Thu Myat Noe Kyaw (2021) observed 66 species belonging to 23 orders, 30 families and 37 genera of diatoms and dinoflagellates from Hnyigarok tidal creek, Ye Township, Mon State.

The purposes of this study are to know the diversity of phytoplankton and to realize the species composition and abundance of phytoplankton from Andin coastal water.

Materials and Methods

Phytoplankton samples were collected monthly from Station I (Lat 15°19'16.78"N and Long 97°42'16.77"E), Station II (Lat 15°18'7.07"N and Long 97°43'29.37"E), and Station III (Lat 15°16'27.69"N and Long 97°42'33.15"E) in Andin coastal water from December 2019 to August 2020 (Fig. 1). The samples were collected from the surface water by towing the

[1] Department of Marine Science, Mawlamyine University
[2] Department of Marine Science, Sittway University

phytoplankton net horizontally, during the neap tide in the day time. Phytoplankton net (length of 50 cm, mouth diameter with 24 cm, mesh size 28 µm was towed for 5 minutes one time in the study area. All samples were retained in polythene bottles and preserved in 2% formaldehyde buffer with seawater immediately. Then, the specimens were carried to the Department of Marine Science, Mawlamyine University. The water temperature was determined by an ordinary mercury thermometer and the salinity of seawater was measured by using a refractometer. The specimens were identified by light microscope Olympus (H20BIMF 200) and are measured by using an ocular micrometer. This study has followed by the classification system used by Allen and Cupp (1930), Davis (1955), Newell and Newell (1963), Hendey (1964), Shirota (1966), Weber (1966), Sourina (1968), Yamaji (1962, 1969, 1971), Guiry (2016), Al-Kandari *et al.* (2009) and Al-Yamani and Saburova (2019).

The diversity indices of phytoplankton for each sample, species diversity (*H´*), evenness (*E´*) and richness (*D´*) were calculated, using the formula of Shannon and Wiener (1963) and Pielou (1975).

$$H' = -\sum Pi * \mathrm{Log}_e Pi$$
$$E' = H'/\ln S$$
$$D' = S\text{-}1/\ln N$$

Where, *H'* is the index of species diversity,
E' = the index of species evenness
S is the total number of species,
D' is the index of species richness,
Pi is the proportional abundance of i^{th} species (ni/N),
ni is the total number of individuals of i^{th} species and
N is the total number of individuals in a station and the total number of species.

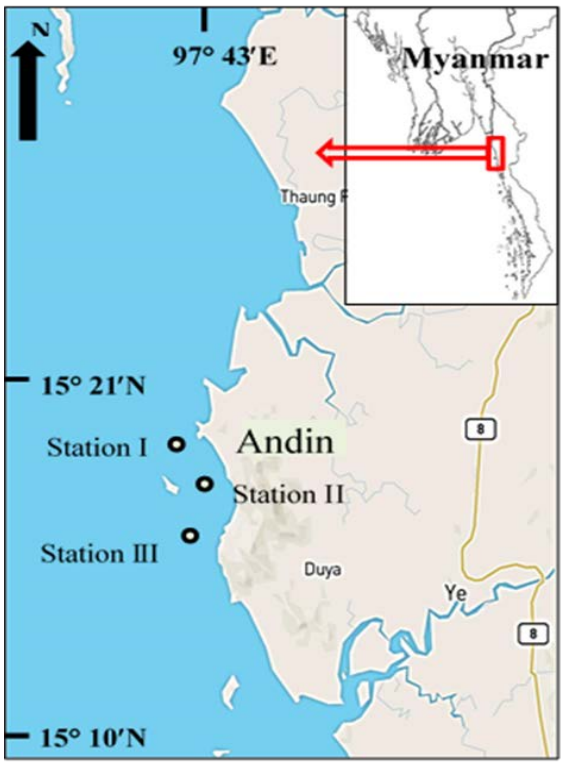

Figure 1 Collection site of phytoplankton from Andin coastal water, Ye Township, Mon State.

Results

Composition

A total of 74 species comprising 36 families and 44 genera were recorded and identified. Among them, the phytoplankton community of Andin coastal water was composed of 65 diatoms species representing 29 families and 9 species of dinoflagellates representing 7 families. Distribution of diatom species at Andin coastal water as shown in Table 1. Distribution of dinoflagellate species at Andin coastal water as shown in Table 2. Percentage composition of phytoplankton group as in Figure 2.

Table 1 Distribution of diatom species at Andin coastal water

Family	Species Name	St I	St II	St III
Diatom				
Hyalodiscaceae	1. *Hylodiscus subtilis*	+	+	+
Paraliaceae	2. *Paralia sulcata*	+	+	+
Coscinodiscusceae	3. *Coscinodiscus asteromphalus*	+	+	+
	4. *C. excentricus*	+	+	+
	5. *C. gigas*	+	+	+
	6. *C. nitidus*	+	+	+
	7. *C. marginatus*	+	+	+
	8. *C. radiatus*	+	+	+
Rhizosoleniaceae	9. *Rhizosolania alata*	+	+	+
	10. *R. bergonii*	+	+	+
	11. *R. calcar-avis*	+	+	+
	12. *R. imbricata*	+	+	+
	13. *R. setigera*	+	+	+
	14. *R. styliformis*	+	+	+
	15. *R. stolterfothii*	-	+	-
	16. *Guinardia striata*	-	+	+
Asterolampraceae	17. *Asteromphalus cleveanus*	+	+	+
Triceratiaceae	18. *Triceratium reticulum*	+	+	+
Lauderiaceae	19. *Lauderia annulata*	+	+	+
Skeletonemataceae	20. *Skeletonelma costatum*	+	+	+
Thalassiosiraceae	21. *Thalassiosira decipiens*	+	+	+
	22. *Planktoniella sol*	-	+	+
Stephanodiscaceae	23. *Cyclotella striata*	+	+	+
Hemianulaceae	24. *Hemiauulus hauckii*	+	+	+
	25. *H. sinensis*	+	+	+
Eupodiscaceae	26. *Odontella sinensis*	+	+	+
	27. *O. mobilliensis*	+	+	+
Lithodesmiaceae	28. *Lithodesmium undulatum*	+	+	+
	29. *Ditylum sol*	+	+	+
Bellerocheaceae	30. *Bellerochea horologicalis*	+	+	+
Streptothecacecae	31. *Streptotheca indica*	+	+	+
	32. *S. temesis*	+	+	-
Chaetocerotaceae	33. *Chaetoceros curvisetus*	+	-	-
	34. *C. lorenzianus*	+	+	+
	35. *C. peruvianus*	+	+	+
Leptocylindraceae	36. *Leptocylindrus danicus*	+	+	+
Surirellaceae	37. *Surirella ovalis*	+	+	+
Entomoneidaceae	38. *Entomoneis alata*	+	+	+
Thalassionemataceae	39. *Thalassionema nitzshoides*	+	+	+

	40. *Thalassionema frauenfeldii*	+	+	+
	41. *Thalassiothrix longissima*	+	+	+
Tabellariaceae	42. *Asterionella japonica*	+	+	+
Naviculaceae	43. *Navicula distans*	+	+	+
	44. *N. elegan*	-	-	+
	45. *N. pusilla*	-	+	+
	46. *Gyrosigma tenuissimum*	+	+	+
Diploneidaceae	47. *Diploneis chersonensis*	+	+	+
Pleurosigmataceae	48. *Pleurosigma angulatum*	+	+	+
	49. *P. elongatum*	+	+	+
	50. *P. normanii*	+	-	+
	51. *P. marium*	+	+	+
Catenulaceae	52. *Amphora spectibilis*	-	+	-
Bacillariaceae	53. *Vibrio paxillifer*	+	+	+
	54. *Nitzschia angularis*	+	+	+
	55. *N. clausii*	+	+	+
	56. *N. seriata*	+	+	+
	57. *N. lanceolata*	+	+	+
	58. *N. linearis*	+	+	+
	59. *N. longissima*	+	+	+
Plagiotropidaceae	60. *Plagioltropis tayrecta*	+	+	+
Achnanthidaceae	61. *Planothidium delicatulum*	+	+	+
Fragilariaceae	62. *Fragilaria crotonensis*	+	+	-
	63. *F. islandica*	+	+	+
	64. *Synedra ulna*	+	+	+
	65. *Centranella reicheltii*	+	+	-

Table 2 Distribution of dinoflagellate species at Andin coastal water

Dinoflagellate				
Prorocentraceae	66. *Prorocentrum mican*	+	-	-
Dinophysaceae	67. *Dinophysis caudata*	+	-	-
Gonyaulaceae	68. *Gonyaulax grindleyi*	+	+	+
Diplopsalis	69. *Diplopsalis lenticula*	+	+	-
Protoperidiniaceae	70. *Protoperidinium pentagonum*	+	+	+
Podolampadaceae	71. *Podolampas palmipes*	-	+	-
Ceratiaceae	72. *Tripos furca*	+	+	+
	73. *T. muelleri*	+	+	+
	74. *T. fusus*	+	+	+
	Total of species	67	69	64

Symbol: + = present.

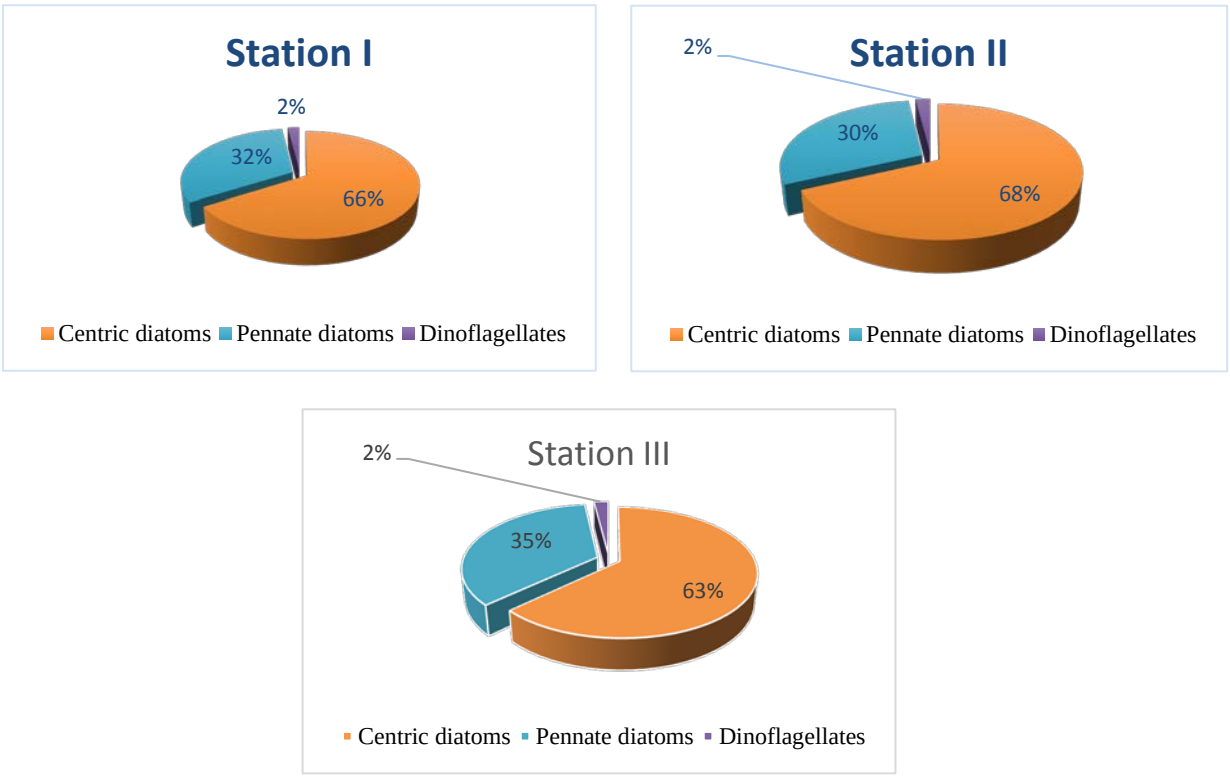

Figure 2 Percentage composition of phytoplankton group at Andin coastal water

Diversity and Density

Phytoplankton species diversity was calculated by the formula of Shannon and Wiener (1963) and Pielou (1975), and the result indicated that the diversity index (*H'*) was in Station I (3.73), followed by Station II (3.76), Station III (3.74). The evenness (*E'*) values of phytoplankton species were found in Station I (0.85) followed by Station II (0.87), Station III (0.86). Species richness (*D'*) values were found in Station I (9.43), Station II (9.49), Station III (9.28). The highest Shannon index was found in Station II and the lowest index was found in Station I. The high density of phytoplankton was found in Station III and phytoplankton density was found to be low in Station II. Phytoplankton species diversity indices and density were presented in Figures (3, 4). The highest temperature 31˚C was measured in February and the lowest temperature 28˚C was found in August during the study period. During the study period, the maximum salinity value of 30‰ was found in February and the minimum value of 24‰ was found in August.

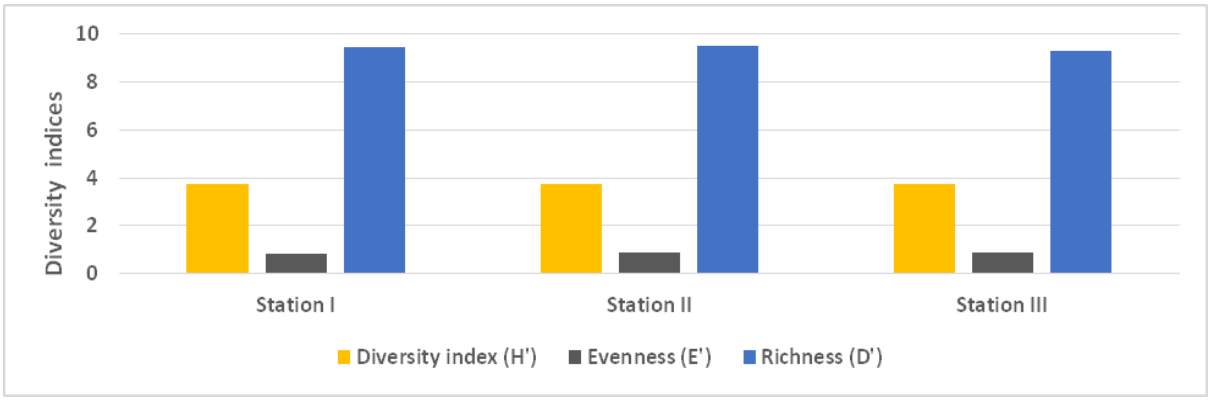

Figure 3 Phytoplankton species diversity indices at Andin coastal waters

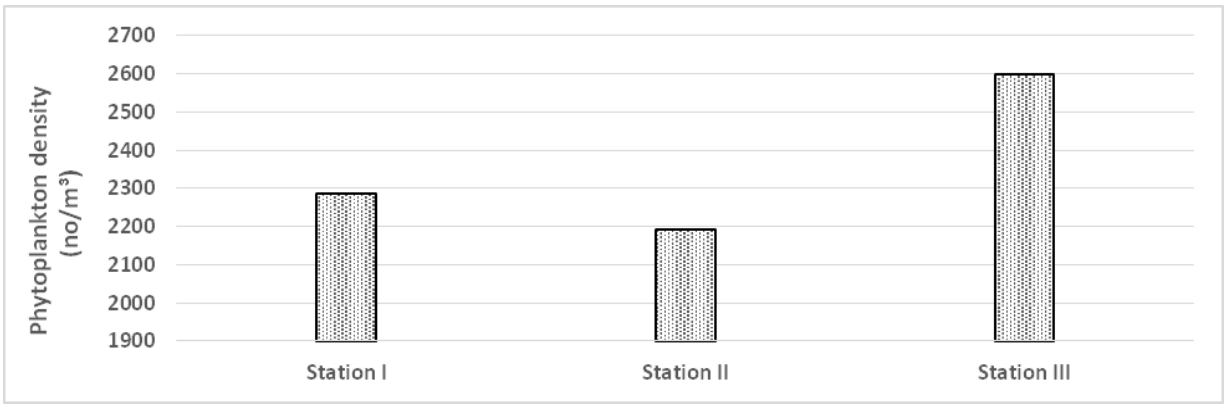

Figure 4 Phytoplankton density at Andin coastal water (no/m³)

Discussion

In the present study, a total of 74 species were identified. 65 species belonged to diatoms, 9 species to dinoflagellates. Among them, diatoms species were most abundannt as compared to dinoflagellates. The environmental parameters such as salinity and temperature are very important for growth and dispersal of phytoplankton on which zooplankton and some higher consumers depend for their existence. Thu Myat Noe Kyaw (2021) described, maximum temperature was observed in February (2021) 31°C and minimum temperature was observed in August (2021) 26°C. In the present study the highest water temperature (31°C) was observed in February and the lowest water temperature (28°C) was observed in August. Thu Myat Noe Kyaw (2021) described, the higher salinity values in dry months (February-April) are related to the high rate of evaporation from water bodies; however, salinity values were very low in the rainy season. In the present study salinity values were gradually increased to the highest value of 30‰ in February but the salinity was lowered to 24‰ in August because of heavy raining.

Phytoplankton community structure was reported by three different terms diversity index, Shannon's species diversity index (*H'*), evenness index (*E'*) and species richness index (*D'*). During study period the highest diversity value (*H'*) 3.76 whereas the lowest one, 3.73 was found in the Andin coastal water. Thida Nyunt (2013) mentioned that the diversity index values 2.05-3.2 was recorded from Mon coastal waters.

In the present study the highest value of evenness index (*E'*) 0.87 whereas the lowest 0.85 was found in the Andin coastal water. Thida Nyunt (2013) described the highest values of evenness index (*E'*) as 0.95 and the lowest 0.54 was found from Mon coastal waters.

The maximum richness index value (*D'*) 9.49 however the minimum 9.28 was found in the Andin coastal water. Thida Nyunt (2013) described the maximum richness index value as 5.17 and the minimum value 2 was found from Mon coastal waters.

Phytoplankton species composition richness, population density, and primary productivity will vary from coast to coast and sea to sea depending upon the varying hydrobiological features. The abundance of phytoplankton can directly or indirectly contribute to the development of fishery in a certain area, such as Andin coastal water.

Conclusion

Bacillariophyceae is the most diverse and high abundance class because it possesses a wide range of the environmental variables. The most abundant species of *Coscinodiscus asteromaphalus, C. gigas, C. nitidus, C. excentricus, C. marginatus, Rhizosolenia calcar-avis, Asteromphalus cleveanus, Hemiaulus hauckii, Lithodesmium undulatum, Lauderia annulata* and *Diploneis chersonensis* were observed in the Andin coastal water. Density during this period indicated that Station III had the richness of phytoplankton species when compared to the two stations. In the present study was observed increase of water temperature and salinity cause increasing of phytoplankton abundance and diversity. The diversity and density of phytoplankton communities are essentially reflecting the resource supply in the ecosystem. Phytoplankton of Andin coastal water was composed of seventy-four phytoplankton species in which diatoms numerically dominated in the community. Regarding species richness, density, and diversity of phytoplankton, it could be concluded Andin coastal water is a protective water area. This study on the status of phytoplankton will provide information for resource conservation and fisheries management on local and regional scales. Moreover, a sea without phytoplankton could not support the zooplankton and the other larger animals. Further studies of the distribution and abundance of phytoplankton in the Andin coastal water should be continued long term.

Acknowledgements

I would like to express my gratitude to Dr. Aung Myat Kyaw Sein, Rector of Mawlamyine University; Dr. Khaing Khaing San, Dr. Myint Thida, and Dr. Malar Aung, Pro-rectors of Mawlamyine University for their permission to undertake this research work. I give my greatest thanks to Dr. Nyo Nyo Tun, Professor, and Head of the Department of Marine Science, Mawlamyine University, for her kind permission to present this paper. I wish to express my special thanks to Dr. Naung Naung Oo, Lecturer, Department of Marine Science, Mawlamyine University, for sharing his ideas and knowledge with me. I would like to thank Professor Dr. Thida Nyunt, Department of Marine Science, Sittway University, for her valuable suggestions, encouragement, and providing references. Special thanks to Dr. Nyo Nyo San, Lecturer, Department of Marine Science, Sittway University, for her assistance in the field study. My special thanks go to our parents, for their kindness and financial support throughout the study period. Thanks also to all respected teachers and colleagues of the Department of Marine Science, Mawlamyine University for their help and encouragement during this research work.

References

Allen, W. E. and Cupp, E. E. (1930) “Plankton diatom of Java seas.” *The scripps Institution of Oceanography of the University of California*, pp.102-120.

Al-Kandari, M. Al-Yamani, F. Y. and Al-Rifaie, K. (2009) *Marine Phytoplankton Atlas of Kuwait’s Waters.* Kuwait Institute for Scientific Research. Lucky Printing Press, Kuwait.

Al-Yamani, F. Y and Saburova, M. A. (2019) *Marine phytoplankton of Kuwait’s waters Volume I. Cyanobacteria, Dinoflagellates, Flagellates.* Kuwait Institute for Scientific Research. Waves Printing Press, Kuwait.

Al-Yamani, F. Y and Saburova, M. A. (2019) *Marine phytoplankton of Kuwait's waters Volume II. Diatoms.* Kuwait Institute for Scientific Research. Waves Printing Press, Kuwait.

Aung Kyaw Lwin (2018) *Study on the phytoplankton from Ahlyat coastal water*. M.Sc. Thesis Marine Science Department, Mawlamyine University (Unpublished).

Davis, C. C. (1955) *The marine and fresh-water plankton*. The Michigan State University Press.

Guiry, M. D. (2016) *AlgaeBase version*. World-wide electronic publication, National University of Ireland, Galway [http: // www. algaebase.org.]

Hendey, N. I. (1964) *Bacillariophyta* (*Diatoms*). *In: An introductory account of the smaller algae of the British Coastal waters.* Landon: Her Majesty's Stationary Office.

Kyi Win. (1972) "A classified list of Marine Plankton of Burma." *Burma Research Congress*, pp.1-20.

Newell, G. E. and Newell, R. C. (1963) *Marine Plankton a practical guide*. Hutchinson, London.

Nyunt Sandar Aung (2011) *Study on the littoral diatom and dinoflagellate of Setse coastal area, Mon State*. M.Res. Thesis Marine Science Department, Mawlamyine University (Unpublished).

Pielou, E. C. (1975) *Ecological diversity*. John Wiley & Sons, INC, New York.

Shannon, C. E. and Wiener, W. (1963) *The mathematical theory of communication.* University of Illinois. Urban press, Illinois, USA.

Shirota, A. (1966) "The plankton of South Vietnam, fresh water and marine plankton." *Overseas Technical Cooperation Agency, Japan*, pp.288-345.

Sourina, A. (1968) *Diamotiees Planetoniques au Canal De Mozambique Et De He He L´ile Maurice*. ORSTOM, Parise.

Thida Nyunt (2013) *Phytoplankton communities in Mon coastal waters*. PhD. Dissertation Marine Science Department, Mawlamyine University (Unpublished).

Thu Thu Myat Noe Kyaw (2021) *Study on the species composition and abundance of phytoplankton from Hnyigarok tidal creek, Ye Township, Mon State*. M.Sc. Thesis Marine Science Department, Mawlamyine University (Unpublished).

Wai Yan Tun (2019) *Study on the phytoplankton from Ankhae coastal water*. M.Sc. Thesis Marine Science Department, Mawlamyine University (Unpublished).

Weber, C. I. (1966) *A Guide to the Common Diatoms at Water Pollution Surveillance System Station*. United States Department of the Interior.

Yamaji. (1962) *The plankton of Japanese coastal waters.* Hoikusha Publishing Co.ltd.

Yamaji. (1969) *The plankton of Japanese Coastal Waters*. Hoikusha Publishing Co.ltd.

Yamaji. (1971) *The plankton of Japanese Coastal Waters*. Hoikusha Publishing Co.ltd.

Zar Ni Ko Ko (2014) *Study on the phytoplankton in the Elphinstone Island waters, Myeik Archipelago*. M.Res. Thesis Marine Science Department, Myeik University (Unpublished).

Zaw Moe Aung (2011) *Studies on the primary productivity of marine phytoplankton in Setse waters*. M.Res. Thesis Marine Science Department, Mawlamyine University (Unpublished).

Zin Mar Phyo (2012) *Study on the phytoplankton of Setse and Kyaikkhami coastal waters.* M.Sc. Thesis Marine Science Department, Mawlamyine University (Unpublished).