

Species composition and distribution of some phytoplankton in Myeik Archipelago, Southern Myanmar

Abstract

The species composition and distribution of some phytoplankton, the primary producer in the food chain of fish and shrimp, was studied from water samples that collected at surface layer of 20 stations in the Myeik Archipelago, Southern Myanmar from 2010 to 2018. A total of 144 species comprised of 123 species of diatoms and 21 species of dinoflagellate were recorded in the Myeik Archipelago. Among them, the most number 93 species of phytoplankton was recorded in Done Pale Aw Station however the lowest 26 species found in Le' Al' Thal Tan Station. The common representative species were ten diatoms species such as *Chaetoceros curvisetus*, *Ditylum sol*, *Lauderia annulata*, *Nitzschia longissima*, *Odotella sinensis*, *Pleurosigma normanii*, *Pseudo Nitzschia seriata*, *Rhizosolenia setigera*, *Thalassionema nitzschioides* and *T. frauenfeldii* and then one of dinoflagellate, *Ceratium furca*. Moreover, the percentage of diatom (87%) was higher than the dinoflagellate (13%) during the study period. The temperature 25-30°C and salinity 4-34‰ was found in the Myeik Archipelago during the study period.

Keywords: composition, distribution, phytoplankton, species, temperature

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Yin Yin Htay, Tin Tin Kyu, Moe Lwin Lwin
Marine Science Department, Myeik University, Myanmar

Correspondence: Yin Yin Htay, Marine Science Department, Myeik University, Myanmar, Email seagrass772018@gmail.com

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Introduction

The Myeik coastal waters are located in the southern part of Myanmar and Myeik Archipelago which covers an area of 34,340sqkm and consist of over 800 islands. This coastal area is remarkably rich in terrestrial nutrients supplied by numerous rivers and extensive mangrove forests. For this reason, Myeik coastal areas are especially noteworthy for high production of marine resources. Phytoplankton consists of diatom and dinoflagellate. Phytoplankton plays an important role as the basis of trophic chain and served as the most important biological community in any aquatic system.

The seasonal variations of temperature and salinity are great importance for distribution of phytoplankton in the marine environment. This factor has a pronounced impact on the general distribution of relative abundance of marine organisms.

The objectives of this study are: 1. to know the number of phytoplankton species; 2. to record the species composition; 3. to recognize the distribution range of phytoplankton in Myeik coastal waters as compared with that of the tropical and subtropical regions in the world.

Materials and methods

The phytoplankton was collected from Kywe Ku bridge station located at Lat. 12°30' N and Long. 98°45' E to Sin Kyun situated at Lat. 11°1' and Long. 98°18' from 2010 to 2018 (Figure 1). These samples were collected with a 10 µm mesh size standard plankton net (2 feet in long and 8 inches in wide) through 10 m in length from a boat for 3 minutes to obtain a sufficient amount of sample for making the species identification. The sample was preserved in 2 % formalin/sea water mixture and stored at the Department of Marine Science, Myeik University. Moreover the temperature and salinity were measured.

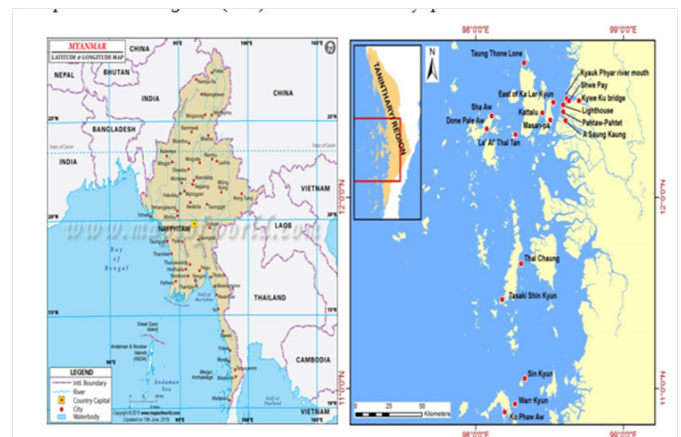


Figure 1 Map showing the location of sample collection sites, Myeik Archipelago, southern Myanmar.

Results

A total 144 species of phytoplankton consisted of four classes, namely, Coscinodiscophyceae (19%), Bacillariophyceae (66%), Dictyochophyceae (1%) and Dinophyceae (14%) were occurred in the present study. The diatom (86%) and the dinoflagellate (14%) were observed during the study period. At Station 1: Seventy two species were recorded. There were 61 species of diatom (85%) and 11 species of dinoflagellate (15%). At Station 2: Seventy eight species were observed. Seventy species of diatom (90%) and eight species of dinoflagellate (10%) were recorded. At Station 3: Seventy five species were found. There were sixty seven species of diatom (89%) and eight species of dinoflagellate (11%). At Station 4: Eighty nine species were

recorded. There were 74 species of diatoms (83%) and 15 species of dinoflagellate (17%) (Figure 2).

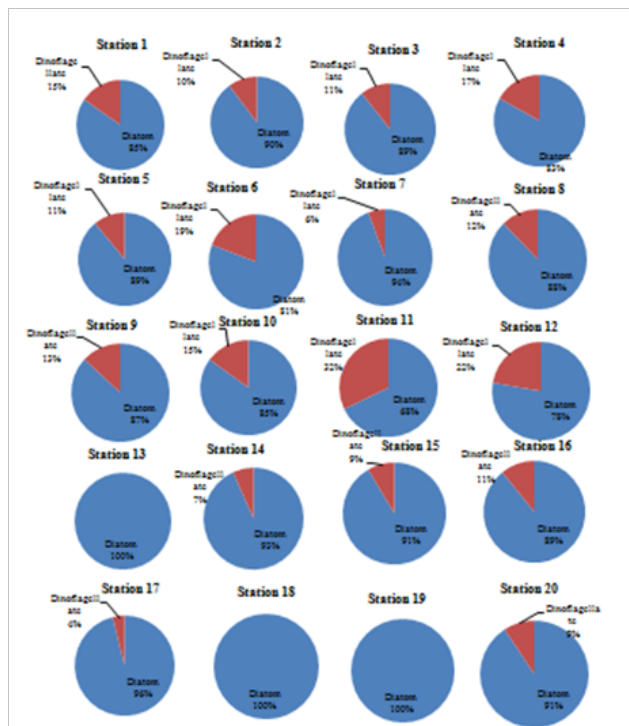


Figure 2 The composition of diatom and dinoflagellate from Station 1 to 20 during 2010 to 2018.

At Station 5: Eighty two species were recorded. Seventy three species of diatom (89%) and nine species of dinoflagellate (11 %) were observed. At Station 6: Seventy three species were observed. There were 59 species of diatom (81%) and 14 species of dinoflagellate (19%). At Station 7: Seventy species were observed. There were 58 species of diatom (83%) and 12 species of dinoflagellate (17%). At Station 8: Sixty six species were recorded. There were fifty eight species of diatom (88%) and eight species of dinoflagellate (12%). At Station 9: Eighty four species were found. There were 73 species of diatom (87%) and 11 species of dinoflagellate (13%). At Station 10: Ninety three species were found. There were 79 species of diatom (85%) and 14 species of dinoflagellate (15%).

At Station 11: The total of 28 species was observed. There were 19 species of diatom (68%) and 9 species of dinoflagellate (32%). At Station 12: There was 27 species were found; 21 species of diatom (78%) and 6 species of dinoflagellate (22%). At Station 13: There were 29 species of phytoplankton and only diatom (100%). At Station 14: The total of 30 species were presented, among them, 28 species of diatom (93%) and 2 dinoflagellate (7%). At Station 15: The total of 35 species: 32 species of diatom (91%) and 3 species of dinoflagellate (9%) were observed.

At Station 16: The total of 55 species, among them, 49 species of diatom (89%) and 6 species of dinoflagellate (11%) were distributed. At Station 17: Fifty one species, There were 49 species of diatom (96%) and 2 species of dinoflagellate (4%). At Station 18: The total of 26 species was only diatom (100%). At Station 19: Also the total of 33 species was only diatom (100%). At Station 20: The total of 33 species, among them, 29 species of diatom (91%) and 3 species of dinoflagellate (9%) were distributed. The temperature variation was

recorded 25-30°C. The seasonal and local variation of salinity 4-34‰ was found in the Myeik Archipelago during the study period.

Discussion

Two classes (Coscinodiscophyceae and Bacillariophyceae) of diatom 123 species and two classes (Dictyochophyceae and Dinophyceae) of dinoflagellate 21 species among 144 species of phytoplankton were observed in the 20 stations of Myeik Archipelago, Southern Myanmar (Table 1). Bacillariophyceae (66%) was the largest class however the lowest one was found in the Dictyochophyceae (1%).

In the present study, the most diatom species (79 species) was observed at Station 10. Over 70 species were found in the four stations (St. 2, St. 4, St. 5 and St. 9) (Figure 2). Moreover the species composition was few in the St. 13, St. 18 and St. 19 than other stations but all species were diatoms. The most dinoflagellate 15 species was occurred in Station 4 among other stations. Over ten species of dinoflagellate were observed in the four stations (St. 1, St. 4, St. 6 and St. 9) (Table 1).

In the present study, the most dinoflagellate composition 32 % was found in St. 11 however the lowest one 0 % was observed in St. 13, St. 18 and St. 19. In addition, 87 % of diatom and 13 % of dinoflagellate were recorded in Myeik Archipelago (Figure 2). In the study period, 22 species of diatom namely, *Chaetoceros peruvianus*, *C. curvisetus*, *C. lorenzianum*, *Coscinodiscus radiatus*, *Cyclotella striata*, *Ditylum sol*, *Eucampia cornuta*, *E. zodiacus*, *Hemidiscus cuneiformis*, *Lauderia annulata*, *Leptocylindrus danicus*, *Melosira nummuloides*, *Nitzschia longissima*, *Odotella mobiliensis*, *O. sinensis*, *Pleurosigma normanii*, *P. elongatum*, *Pseudo Nitzschia seriata*, *Proboscia alata*, *Rhizosolenia setigera*, *Thalassionema frauenfeldii*, *T. nitzschiioides* and 2 species of dinoflagellate namely, *Ceratium furca*, *Dinophysis caudata* were widely distributed in Myeik Archipelago (Table 1).

The largest species of genus, *Chaetoceros* 18 species were observed in the present study. Yin Yin Htay¹ described genus *Chaetoceros* was widely distributed in Myeik Archipelago. This result was similar to the present study. Moreover there were 61 species of *Chaetoceros* from British coastal waters by Hendey² 22 species from Myanmar by Han Shein and Kyi Win³ 47 species from Florida by Hasle and Syvertsen.⁴ Yin Yin Htay⁵ described 35 species of phytoplankton distributed from Tasaki Shin Kyun,⁶ Southern part of Domel Island and 30 species in Thal Chaung, Eastern part of Domel Island, Myeik Archipelago. These results were similar to the present study. Omura et al.⁷ described the dinoflagellate were more than diatom from Western Pacific region but more diatom in present study. Yin Yin Htay⁸ described that a total of 135 species of marine phytoplankton consisted of 116 species of diatoms and 19 species of dinoflagellates from Myeik coastal waters. Su Myat⁹ described 64 species of diatoms and 100 species of dinoflagellates from the Southern part of Myanmar however 21 species of dinoflagellate was observed in present study. Zami Ko Ko¹⁰ reported 60 species of diatoms and 21 species of dinoflagellates widely distributed in the Elphinstone Island waters, Myeik Archipelago. His observation was similar to the number of dinoflagellates in the present study.

Boonyapiwat et al.¹¹ described 78 species of diatoms, 53 species of dinoflagellates in the Bay of Bengal and this result was less diatoms and more dinoflagellates than the present study. Ajuonu et al.¹² described that 2172 species of phytoplankton in the Bonny estuary, Nigeria and more than the present study. Medupin¹³

described the most representative class in terms of species richness was Dinophyceae and dominated by *Ceratium hirudinella* however *C. furca* was dominant in the present study. Paulette et al.¹⁴ reported Bacillariophyta (23.97%) in a small African tropical reservoir however it was 87% in the present study. Amarnath et al.¹⁶ described Bacillariophyceae is 97-91% in Bhavanapadu Creek, Srikakulam District, South India and this result was a little more than the present study. Maung-Saw-Htoo-Thaw et al.¹⁷ described the end of the dry

season the phytoplankton population was dominated by high densities of the diatoms *Bellerochea horologicalis* and *Chaetoceros curvisetus*. This result was similar to the present study.

Thu Theingi Thin et al.¹⁸ described 55 species of diatom and 8 species of dinoflagellate distributed in A SaungKaung Station, Lighthouse Station and Shwe Pay Station. Their observation was nearly the same to the present study.

Table 1 The presence-absence index of phytoplankton species by twenty stations in Myeik Archipelago from June (2010) to March (2018).

Sr. No.	Species	Stations																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	<i>Amphora lineolata</i>	+	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
2	<i>A. comutata</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
3	<i>A. spectabilis</i>	-	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+
4	<i>Aulacoseira epidendron</i>	+	+	+	+	+	+	+	-	+	+	-	-	-	-	+	+	-	+	-	-
5	<i>Asterionellopsis glacialis</i>	+	+	+	-	+	-	+	+	+	+	-	-	-	+	-	+	+	-	+	-
6	<i>Asteromphalus heptactis</i>	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
7	<i>A. cleveanus</i>	-	+	-	-	-	+	-	+	+	+	-	-	-	-	+	+	-	-	-	-
8	<i>Azpeitia nodulifera</i>	+	+	-	+	-	-	+	+	+	+	-	-	-	-	+	+	+	+	-	+
9	<i>Aulacodiscus argus</i>	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	+	+	-	+
10	<i>Bacteriastrum elongatum</i>	+	+	-	+	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-
11	<i>B. hyalinum</i>	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	-	-	+	+	-
12	<i>B. varians</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	-	-	+	-	+
13	<i>Bacteriastrum sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
14	<i>Bacillaria paradoxa</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	+	+	-	-
15	<i>Biddulphia rhombus</i>	+	-	+	+	+	-	-	-	+	-	-	-	-	-	-	+	+	-	-	-
16	<i>B. reticulata</i>	+	-	+	+	+	+	-	-	+	-	-	-	-	-	-	-	-	-	+	-
17	<i>B. sp.</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	<i>Bellerochea horologicalis</i>	-	-	-	-	-	-	-	-	-	+	-	+	-	-	+	+	-	-	-	-
19	<i>Campylodiscus hibernicus</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	<i>Cerataulina bergonii</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+
21	<i>Chaetoceros decipiens</i>	-	-	-	-	+	-	-	+	+	+	-	-	-	-	-	-	-	+	+	-
22	<i>C. denticulatum</i>	+	+	+	+	+	-	+	+	+	+	+	-	-	-	-	+	-	-	-	-
23	<i>C. peruvianus</i>	+	+	-	+	+	+	+	+	+	+	-	-	-	+	+	+	+	-	-	-
24	<i>C. curvisetus</i>	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	-	-
25	<i>C. constrictus</i>	-	-	-	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-
26	<i>C. brevis</i>	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
27	<i>C. affine</i>	-	-	-	+	-	+	+	+	+	+	-	-	-	+	-	-	-	+	-	-
28	<i>C. diversus</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	+	+
29	<i>C. lorenzianum</i>	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	-	+	+
30	<i>C. van heurckii</i>	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
31	<i>C. atlanticus</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-
32	<i>C. subtilis</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	-	-	-
33	<i>C. pseudocrinitus</i>	+	+	+	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-
34	<i>C. coarctatus</i>	-	-	-	+	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-
35	<i>C. lauderi</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-

Table Continues...

36	<i>C. didymus</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	<i>C. costatum</i>	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-
38	<i>C. dichaeus</i>	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
39	<i>Climacosphenia moniligera</i>	-	-	+	-	-	+	-	+	-	-	+	+	+	-	+	-	-	-
40	<i>Coscinodiscus radiatus</i>	-	+	+	+	+	-	+	-	+	+	-	-	+	-	+	+	+	+
41	<i>C. granii</i>	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-
42	<i>C. asteromphalus</i>	+	-	-	+	+	+	+	-	-	+	-	-	-	-	-	-	-	-
43	<i>C. gigas</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	-
44	<i>C. marginatus</i>	+	+	+	+	+	+	-	+	+	+	-	-	-	-	-	+	-	-
45	<i>Climacodium frauenfeldianum</i>	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-
46	<i>Ceratium fusus</i>	+	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-
47	<i>C. macroceros</i>	-	-	+	-	+	+	-	-	+	-	+	-	-	-	+	-	-	-
48	<i>C. furca</i>	+	+	-	+	+	+	+	+	+	+	-	-	-	+	+	+	+	-
49	<i>Corethroncriophiluminflatum</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	<i>Cyclotella striata</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+
51	<i>Cylindrotheca clostenum</i>	-	+	-	-	+	-	-	+	+	+	-	-	-	-	+	-	-	-
52	<i>Dactyliosolen antarcticus</i>	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
53	<i>Detonula confervacea</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-
54	<i>Dinophysis caudata</i>	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-
55	<i>D. mile</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
56	<i>Ditylum sol</i>	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+
57	<i>Dictyocha fibula</i>	+	+	+	+	+	+	-	-	+	+	-	-	-	-	+	+	-	-
58	<i>Diploneis interrupta</i>	-	+	+	-	+	-	+	-	-	+	-	-	-	-	-	-	-	+
59	<i>D. bombus</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	<i>D. vetula</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
61	<i>D. chersonen</i>	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
62	<i>D. fusca</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
63	<i>Entomoneis alata</i>	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	+
64	<i>Eucampia cornuta</i>	+	+	+	-	+	-	+	-	+	-	+	-	-	-	+	+	+	-
65	<i>E. zodiacus</i>	+	+	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-
66	<i>Fragilaria crotonensis</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	<i>Guinardia flaccida</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-
68	<i>Gyrosigma balticum var. californicum</i>	-	+	+	+	+	+	-	+	-	+	-	-	-	-	-	-	-	-
69	<i>G. scalproides</i>	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
70	<i>G. fasciola</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	<i>G. strigilis</i>	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-
72	<i>Gymnodinium spp.</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
73	<i>Helicotheca tamensis</i>	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-	-	+
74	<i>Hemiaulus sinensis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+
75	<i>H. indicus</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+
76	<i>H. hauckii</i>	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-
77	<i>Hemidiscus cuneiformis</i>	+	+	+	+	+	-	+	+	+	+	-	+	+	+	-	-	-	+

Table Continues...

78	<i>Lauderia annulata</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
79	<i>Leptocylindrus danicus</i>	+	+	-	+	+	+	+	+	+	-	-	-	+	+	+	+	-	-	-
80	<i>Lyrellalaya</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	
81	<i>Melosira nummuloides</i>	-	+	+	+	+	-	+	+	+	-	-	-	-	-	+	+	+	+	
82	<i>Meuniera membranacea</i>	+	+	-	+	-	-	+	+	+	-	+	-	-	-	-	-	-	-	
83	<i>Minidiscus trioculatus</i>	+	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	
84	<i>Neoceratium tripos</i>	+	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-	-	
85	<i>N. breve</i>	-	-	-	+	-	+	-	-	+	-	-	-	-	-	+	+	-	-	
86	<i>N. falcatiforme</i>	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	
87	<i>Nitzschia longissima</i>	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	
88	<i>N. sigma</i>	+	+	+	+	+	+	+	+	+	-	-	-	+	-	-	-	-	-	
89	<i>N. angularis</i>	+	-	+	+	+	+	+	+	+	-	-	-	-	-	-	-	+	-	
90	<i>N. filiformis</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	
91	<i>N. angustata</i>	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	
92	<i>N. frigida?</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	+	+	-	
93	<i>Navicula advena</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
94	<i>N. aspera</i>	+	+	+	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	
95	<i>N. notabilis</i>	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	
96	<i>N. sp.</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
97	<i>Odotella mobiliensis</i>	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+	+	
98	<i>O. sinensis</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
99	<i>O. granulata</i>	+	+	+	+	+	+	-	-	+	-	-	-	-	-	+	+	-	-	
100	<i>Ornithocercus magnificus</i>	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	+	
101	<i>Palaria sulcata</i>	+	+	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-	-	
102	<i>Peridinium quinquecorne</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	
103	<i>Podolampaspalmipes</i>	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	
104	<i>Protoperidinium pentagonum</i>	+	+	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	
105	<i>P. oceanicum</i>	+	-	+	+	-	+	-	+	+	+	+	-	-	+	-	-	-	-	
106	<i>P. ceracus</i>	+	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	-	
107	<i>P. conicum</i>	+	+	+	+	+	-	+	+	+	-	-	-	-	-	-	-	-	-	
108	<i>P. latissimum</i>	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
109	<i>Pleurosigma normanii</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
110	<i>P. angulatum</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	+	-	-	-	-	
111	<i>P. elongatum</i>	+	+	+	+	+	+	+	+	-	+	-	-	+	+	+	+	+	-	
112	<i>P. pelagicum</i>	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
113	<i>Plantiella sol</i>	+	+	+	+	+	+	-	-	+	-	-	-	-	-	+	+	+	+	
114	<i>P. blanda</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
115	<i>Pseudo Nitzschia lineola</i>	-	+	+	+	-	+	+	+	+	-	+	-	+	-	+	+	-	-	
116	<i>P. seriata</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	
117	<i>Prorocentrum micans</i>	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	-	-	
118	<i>Proboscia alata</i>	+	+	+	+	+	+	-	+	+	+	+	+	+	-	+	-	-	+	
119	<i>Pyrophac usholorogium</i>	+	+	-	+	-	+	-	+	+	-	+	-	-	-	-	-	-	-	
120	<i>Pyrocystis notiluca</i>	-	+	+	+	-	+	+	+	+	-	-	-	-	-	-	-	-	+	
121	<i>Rhizosolenia calcar. avis</i>	-	+	+	+	+	+	+	+	+	-	-	+	-	-	-	-	-	+	

Table Continues...

122	<i>R. setigera</i>	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	-	+	+
123	<i>R. imbricata</i>	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	-	-	-	-	-
124	<i>R. robusta</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	-	-	+
125	<i>R. stouterfothii</i>	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-
126	<i>Schroderella delicatula</i>	-	-	+	+	+	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-
127	<i>Skeletonema costatum</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-
128	<i>Stephanopyxis palmarina</i>	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
129	<i>Surirellao valis</i>	+	+	+	+	+	-	+	+	+	+	-	-	-	-	-	-	-	+	-	+
130	<i>S. linearis</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
131	<i>S. gemma</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	<i>S. robustavar. splendida</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
133	<i>Surirella sp.</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
134	<i>Stephanopyxis palmariana</i>	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
135	<i>Synedra crystallina</i>	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	-
136	<i>Syringidium americanum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
137	<i>Tabellaria fenestrata</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	-	-	-	+	-
138	<i>Thalassionema frauenfeldii</i>	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	+	+	+
139	<i>T. nitzschioides</i>	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	-	-	+
140	<i>Thalassiosira excentrica</i>	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	+
141	<i>T. leptopus</i>	-	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	-	-	-
142	<i>T. punctigera</i>	-	+	+	+	-	-	-	-	+	+	-	-	+	+	+	+	+	+	+	+
143	<i>Triceratium faves</i>	-	-	-	+	+	+	+	-	+	+	-	-	-	-	+	+	+	+	+	+
144	<i>Ulnaria ulna</i>	-	+	+	+	-	-	+	-	+	+	-	-	-	-	+	+	-	+	+	+
	No. of species	72	78	75	89	82	73	70	66	84	93	28	27	29	30	35	55	51	26	33	33

Conclusions

The variation of species composition and distribution of phytoplankton were observed in the different 20 stations during the study period. The diatoms were more than the dinoflagellate in the study areas. The occurrence of high diversities of phytoplankton species in Myeik coastal waters seems to be related by highly enriched organic and inorganic nutrients from various marine environments such as mangrove forests and the runoff of numerous rivers along the coastlines. Therefore it was the more productive area for the sustainable development of fishery.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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