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SEASONAL SUCCESSION OF CERTAIN SPECIES OF PHYTOPLANKTON FROM ST. MARGARET'S BAY, N.S.

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Abstract

Seasonal succession of 18 species of phytoplankton from St. Margaret's Bay is described. Species of *Chaetoceros* and *Thalassiosira* occurred abundantly at times when nutrient values were high and temperatures were low, whereas *Ceratium* spp. preferred nutrient poor warm waters. Seasonal associations of species of phytoplankton which characterized one or more than one seasons were noted.

Introduction

Most studies on the seasonal succession of phytoplankton from the eastern board of Canada were restricted only to the areas of Bay of Fundy and Gulf of Maine (Bailey, 1915, 1917, Bailey & Mackay, 1921; Bigelow *et al.* 1940; Davidson, 1934; Fritz, 1921; Lillick, 1940, Mackay, 1907). The eastern coast of Nova Scotia, however, remained neglected for a long time. Up in the north, Burnel (1962) and Holmes (1956) studied phytoplankton from Baie des Chaleurs and Labrador Sea, respectively. Brunel took into account only the species composition and neglected the estimation of their actual abundance. Gran (1919) reported phytoplankton collected from Gulf of St. Lawrence during three short cruises and his methods ot estimation of abundance were outdated. The present study in St. Margaret's Bay thus fills an important gap between Labrador sea and Gulf of Maine.

Material and Methods

St. Margaret's Bay is situated on the eastern coast of Nova Scotia, Canada (Lat. 44°32' 54.96" N, long. 63°58' 37.35" W). A single station 'A' (Saifullah, 1971) a mile away from the shore in 58 M deep water, was occupied on 36 occasions from 1st April to 22nd December 1967. Water samples were collected by Van Dorn bottles from 1, 10, 15, 25 and 40 M. Phytoplankton, alive and fixed in 3% neutral formalin, were studied by phase contrast microscopy and diatoms were cleaned employing Hendey's (1964) method before examination. Utermohl's inverted microscope was used for estimation of abundance. Simultaneous observations on physical and chemical properties of seawater were made by Platt & Irwin (1968).

Observations and Discussion

The general regime of water temperatures and salinity in 1967 at Station 'A' is given elsewhere (Platt & Irwin, 1968). Salinity values varied only a little (from 30.96‰ to 31.67‰) for the whole water column but variation was great at surface (from 28.226‰ to 31.260‰); lowest values being recorded in July and August due to high rainfall. A bimodal annual distribution of nutrients with a large peak in spring and relatively smaller one in autumn was noted (Platt & Irwin, 1968). Of a total of 98 species of phytoplankton from St. Margaret's Bay (Saifullah, 1969), the seasonal succession of

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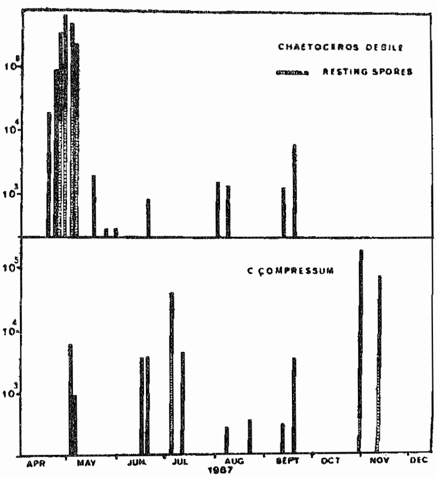

Fig. 1. Seasonal succession of *Chaetoceros debile* and *C. compressum*. Numbers integrated from 0 to 40 m and expressed in cells per litre.

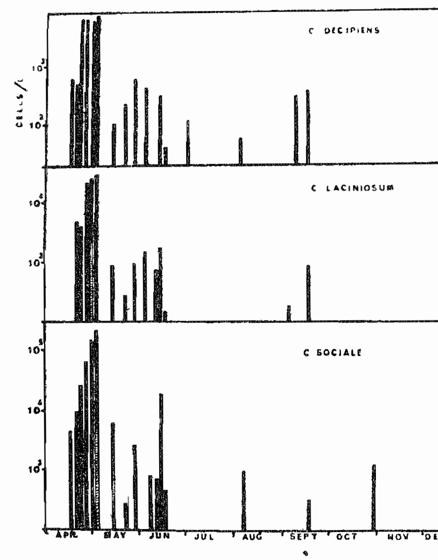

Fig. 2. Seasonal succession of *C. decipiens*, *C. laciniosum* and *C. sociale*. Numbers integrated from 0 to 40 m.

18 species which were relatively more abundant than the rest are shown in Fig. 1 to 4. Among the Bacillariophyceae, *Chaetoceros debile*, *C. decipiens*, *C. laciniosum*, *C. sociale*, and *Rhizosolenia fragilissima* occured more abundantly during spring than any other season; *C. debile* being the dominant over the rest. The dominant species were *Chaetoceros debile* and *Thalassiosira nordenskioldii* in Passamaquoddy region (Davidson, 1934) and they were *Chaetoceros sociale* and *Thalassiosira nordenskioldii* in Gulf of Maine (Gran & Braarud, 1935).

Some very interesting behaviour of chromatophore movement was noted in *C.decipiens*. Cells collected from a depth of 35 to 40 m showed chromatophores aggregated in the centre (Fig. 5). Sometimes the aggregation was so complete that there appeared one large axile chromatophore. Cells collected from 5 m. however, showed scattered chromatophores (Fig. 6). The light intensity values (Platt & Irwin, 1968) were 57% at 5 m. and 6% at 25 m in the first week of September, 1967 when the chromatophore movements were obvious. To test the hypothesis, if light was the factor affecting the movement of chromatophores in *C. decipiens*, cells were brought alive in a thermos flask in laboratory. Upon illumination from a microscope lamp the chromatophores scattered all over the surface of the cell whereas they remained aggregated in the centre in very week light.

Coscinosira polychorda, *Thalassiosira gravida* and *T. nordenskioldii* (Fig. 3) were recorded only during the spring season and were not found at temperatures above 4.5°C which shows their cold stenothermal nature (Brunel, 1962; Bursa, 1961 a, Pratt, 1959; Riley & Conover, 1967) and a preference for nutrient rich waters. Resting spore formation were noted in *Chaetoceros compressum*, *C. debile* (Fig. 1), *C. laciniosum* and *C. sociale* (Fig. 2) during the favourable period of growth. *Rhizosolenia alata* formed auxospores in the middle of September.

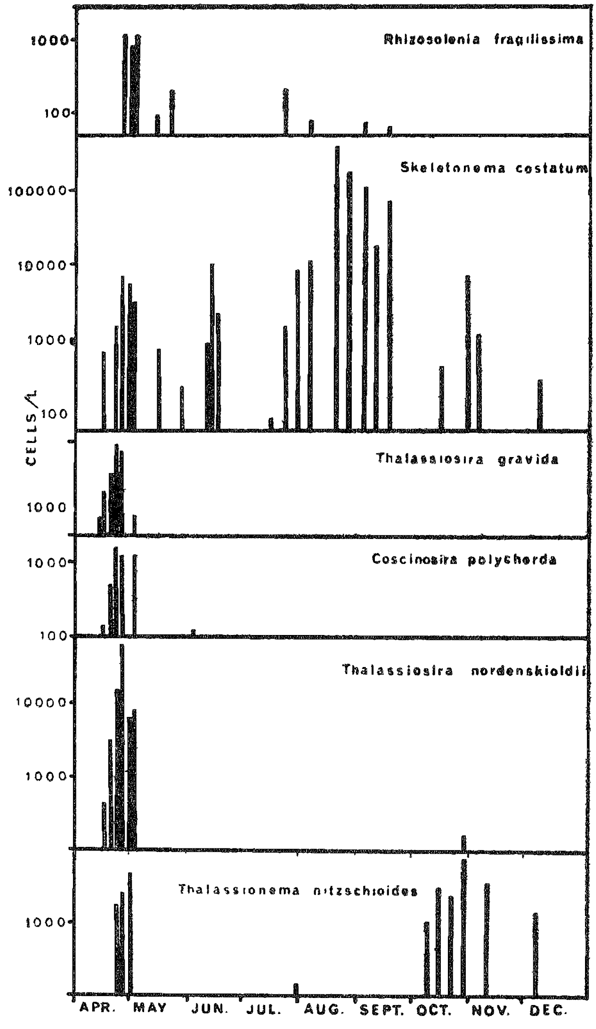

Fig. 3. Seasonal succession of 6 species of Bacillariophyceae. Numbers integrated from 0 to 40 m.

Skeletonema costatum which is a cosmopolitan species and prefers coastal occurence (Curl & McLeod, 1961) occurred profusely throughout the period of study, however more abundantly during late summer (Fig. 3). Its peak occurrence coincided with the lowest salinity value recorded during the period of study. The maximum occurrence of *Skeletonema costatum* occurred during spring in Narragansett Bay (Pratt, 1959), Long Island Sound (Riley & Conover, 1967) and Clyde Sea area (Marshall & Orr, 1927). The temperatures during spring in these localities were comparable to those in St. Margaret's Bay during summer which suggested that temperature was an important factor determining the abundance of *Skeletonema costatum*.

TABLE 1. Seasonal assoications of phytoplankton in St. Margaret's Bay.

Spring association

Chaetoceros concavicorne
C. breve
Coscinosira polychorda
Eucampia zodiacus
Fragilaria sp.
Thalassiosira gravida
T. nordenskioldii

Spring-summer association

Chaetoceros debile
C. decipiens
C. laciniosum
C. septentrionale
C. sociale
Cocconeis sp.
Nitzschia seriata
Rhizosolenia fragilissima

Summer association

Ceratium arcticum
Dinobryon sp.
Leptocylindrus minimum
Peridinium depressum
C. longipes
C. tripos
Chaetoceros affine
C. atlanticum
Dinophysis norvegica
Rhizosolenia alata

Autumn association

Ceratium macroceros
C. becephalum
Chaetoceros boreale
Phalachroma rotundatum
Rhizosolenia setigera
R. shrubsolei

Spring-autumn association

Chaetoceros convolutum
Coscinodiscus centralis
C. concinnus
Euglenophyceae

Spring-summer-autumn association

Chaetoceros compressum
Distephanus speculum
Gyrodinium spirale
Licmophora sp.

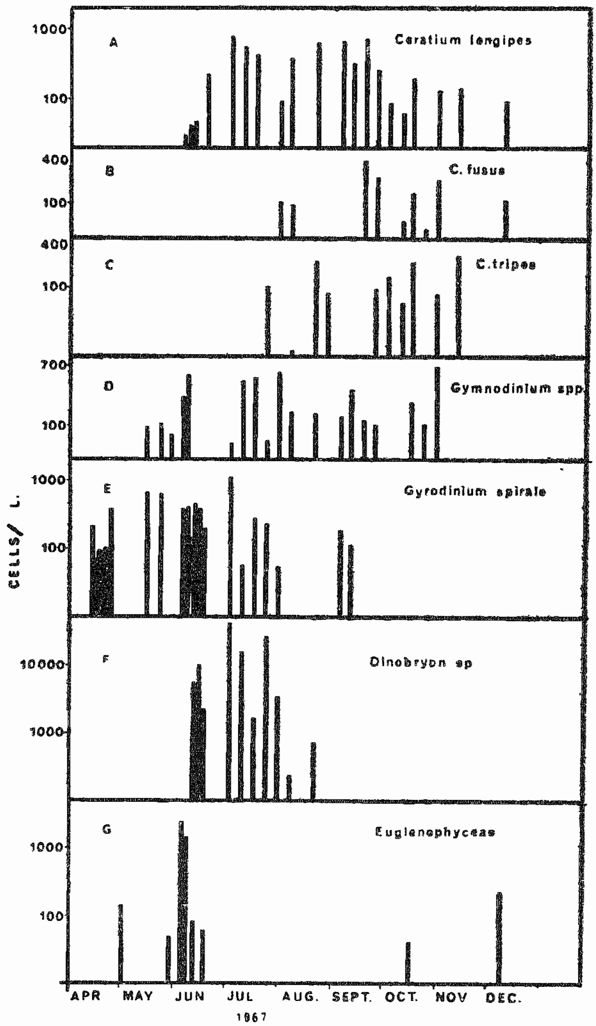

Fig. 4. Seasonal succession of species of Dinophyceae, Euglenophyceae and *Dinobryon*. Numbers integrated from 0 to 40 m.

Chaetoceros compressum (Fig. 1) was very abundant during autumn but it was so during winter in Chesapeake Bay (Patten *et. al*. 1963). The optimum temperature for the growth of *Chaetoceros compressum*, *C. debile* and *Thalassiosira nordenskioldii* in Gulf of Maine given by Gran & Braarud (1935) were also similar in St. Margaret's Bay

Ceratium fusus, *C. longipes* and *C. tripos* (Fig. 4ABC) grew relatively better during summer and were always restricted in their distribution to upper 15m. This showed their preference for nutrient deficient warm and less saline waters (Gran & Braarud, 1935).

Fig. 5. *Chaetoceros decipiens* from a depth of 35 m.

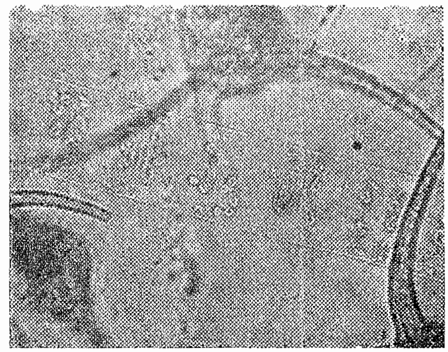

Fig. 6. *C. decipiens* from a depth of 5 m.

Dinobryon and Euglenophyceae (Fig. 4FG) occurred only during summer and were found only in the upper 15 m. at the time of decline of species of Bacillariophyceae that were dominant during spring. Bursa (1961) recorded great abundance of *Dinobryon* in Hudson Bay.

Following the practice of Ostenfeld (1913) it was possible to describe associations of species that characterized one or more than one seasons (Table 1). Species of Bacillariophyceae formed a significant part of all the associations except the summer and the summer-autumn associations when Dinophyceae became prominent. Species that occurred during all seasons were eurythermal and of wide geographic distribution (Burnel, 1962; Curl, 1959). The spring autumn association indicated that nutrients and not temperature were responsible for their active growth as temperatures were different and there was a rise in nutrient levels during the two seasons.

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