Seasonal distribution of diatoms and dinoflagellates (> 65 μm) off the coast of Israel

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Distribution saisonnière des diatomées et des dinoflagellés (> 65 μm) devant la cote d'Israël

Resume

Les abondances des populations de diatomées et de dinoflagellés ont été suivies de mars 1983 à février 1984 en deux stations (A = néritique et B = océanique), situées devant la côte israelienne en Meditérranée orientale.

Des differences sont observées dans les abondances relatives des deux groupes de phytoplancton de la fin du printemps à la fin de l'été entre les deux stations. Les dominances de plusieurs genres sont cycliques mais n'apparaissent pas simultanément aux deux points et il est difficile de préciser si les développements des espèces trouvent leur origine dans les eaux côtières ou dans les eaux du large.

Abstract

Bi-weekly monitoring of the diatom and dinoflagellate populations off the coast of Israel was carried out from March 1983 to February 1984 at two stations: A (inshore) and B (offshore).

Differences at the two stations in the relative abundances of the two groups were limited to the period from late spring to late summer. The seasonal pattern in the distribution of leading genera at the two stations was established. However, in view of the fact that the dominance of various genera within the two groups was cyclic, but out of phase, at the two locations, it was difficult to establish whether the respective seasonal peaks originated in the inshore or the offshore waters.

Monitoring of surface net phytoplankton populations at two reference stations in the coastal waters of Israel off Shikmona, near Haifa, was oriented towards an estimation of the relative abundance of the two major phytoplankton groups, the diatoms and dinoflagellates. Special attention was given to the occurrence of the dominant species or multispecies genera of the two groups as to their time of blooming at two sampling stations, one in nearshore waters and the other further offshore.

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Station A (inshore) was located 2 km west of Shikmona, in shelf waters 30 m deep and Station B (offshore) was located 10 km west of Shikmona, beyond the continental shelf, in waters over 250 m deep.

The two stations were occupied approximately every two weeks for a one-year period, beginning in March 1983 except when sampling operations could not be carried out for technical reasons.

At each station the secchi depth was measured as a rough indication of the clarity of the water and an even rougher indication of seston load including the amount of chlorophyll and thus plant biomass present (Figs. 1 and 2).

The horizontal surface hauls were carried out for about 5 minutes with a 1-m long 65 μm mesh plankton net of 40-cm mouth diameter fitted with a General Oceanics digital flow-meter. The samples preserved in 0.4% buffered formaldehyde were made up to 100 ml and after randomization subsamples were used for microscopic examination in 2-ml Zeiss counting cells by the inverted microscope technique. Five transects were counted for the presence of diatoms and dinoflagellates and the relative abundance of the two groups was computed on a percentage basis.

At the offshore Station B, diatoms and dinoflagellates alternated periodically in dominance (Fig. 1). Diatoms were dominant with a peak in relative abundance in March 1983 during a simultaneous increase in the presence of *Asterionella japonica, Rhizosolenia calcar avis, Chaetoceros* spp. and *Coscinodiscus granii*. In April, dinoflagellates became dominant until June with *Ceratium furca* as the prominent species accompanied by *C. candelabrum, C. pulchellum* and *Peridinium* spp. Beginning in June until the end of September, the diatoms again became dominant with an extended bloom of *Rhizosolenia calcar avis* accompanied by shorter blooms of *Bacillaria paradoxa* and *Chaetoceros* spp. In October the dinoflagellates returned to dominance with many species of *Ceratium* becoming abundant. This alternation of dominance of the two phytoplankton groups continued in November when pennate diatoms increased in numerical abundance and were gradually replaced by centric diatoms, especially *Coscinodiscus granii* towards the end of the month. By mid-December, diatoms and dinoflagellates were almost equally abundant with many species of both groups present and no species dominant. The increase in diatom abundance observed in spring 1983 was again observed in 1984 at the end of January and the beginning of February. The species composition of the early spring diatom bloom was similar in the two years.

At the inshore Station A, diatoms were consistently more abundant than dinoflagellates except during April 1983. The dominant dinoflagellate species during that month was *Ceratium furca* among additional species of the same genus. During May and July diatoms and dinoflagellates were equally abundant.

During the early spring season until April the two stations were similar in terms of species composition and ratio of diatoms to dinoflagellates although total surface phytoplankton biomass expressed as chlorophyll *a*/m^3 was considerably higher at the inshore station (0.19 - 0.63 mg/m^3 at the inshore station and 0.08 - 0.38 mg/m^3 at the offshore station; Fig. 2). During this period, differences in community structure between the two stations do not persist, apparently because of high rates of mixing and advection caused by

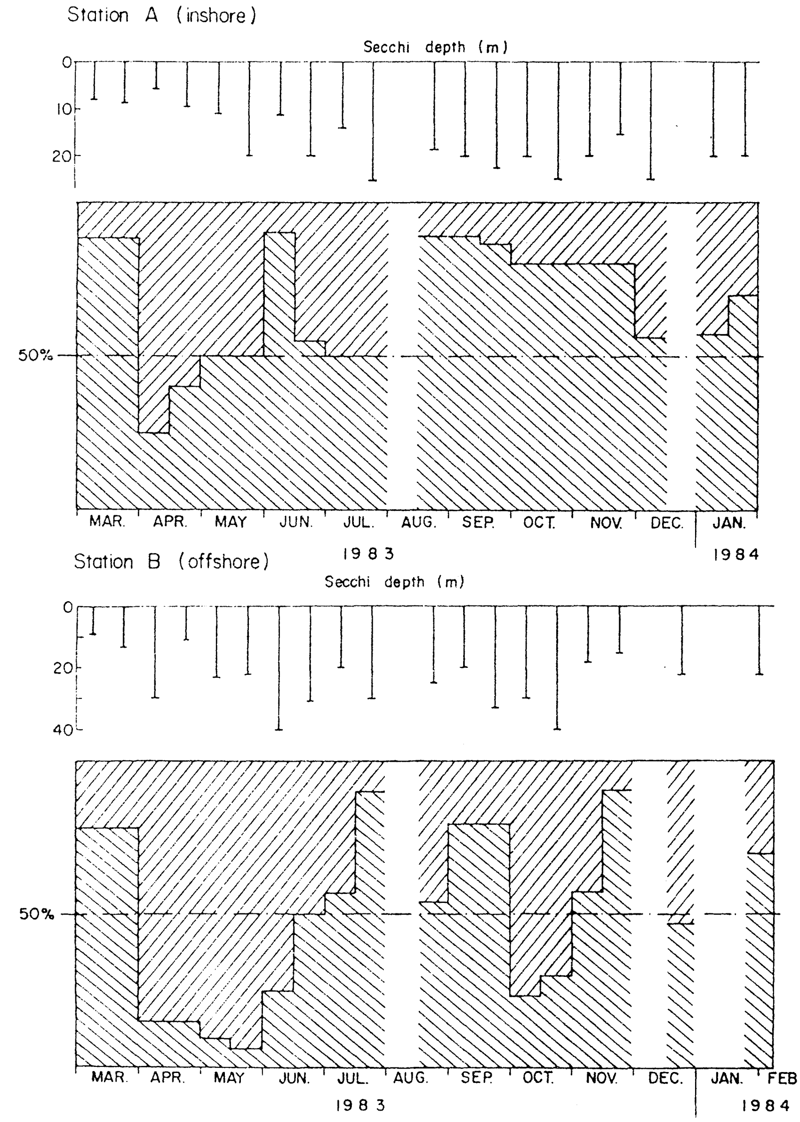


Fig. 1:

Diatoms / Dinoflagellates Ratio and secchi - disc depth, at stations A and B Mar. 1983 - Feb. 1984

Diatoms

Dinoflagellates

relatively stormy conditions and reduced water column stability. These processes may effectively extend the neritic zone into waters considered oceanic, i.e., beyond the shelf break and beyond Station B. During the rest of the year, greater differences were observed between the stations in regard to species composition and ratio of diatoms to dinoflagellates (Fig. 1), differences perhaps related to the depth of the water at the two stations.

Fig. 2 :

Chlorophyll a and Secchi depth in March April 1983 and January February 1984 at stations A and B.

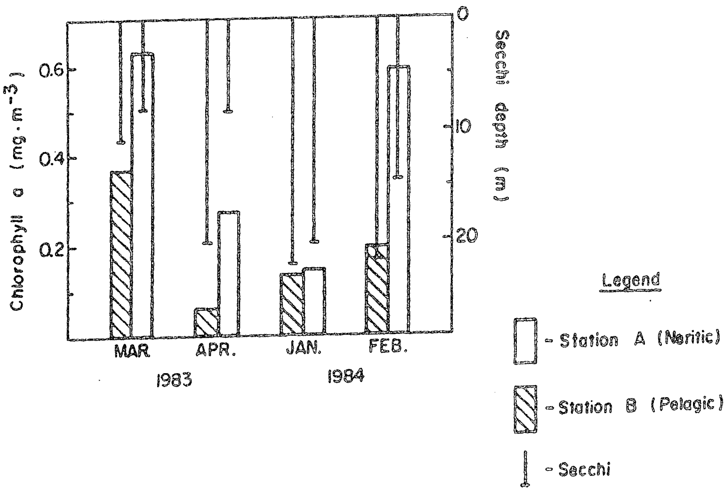
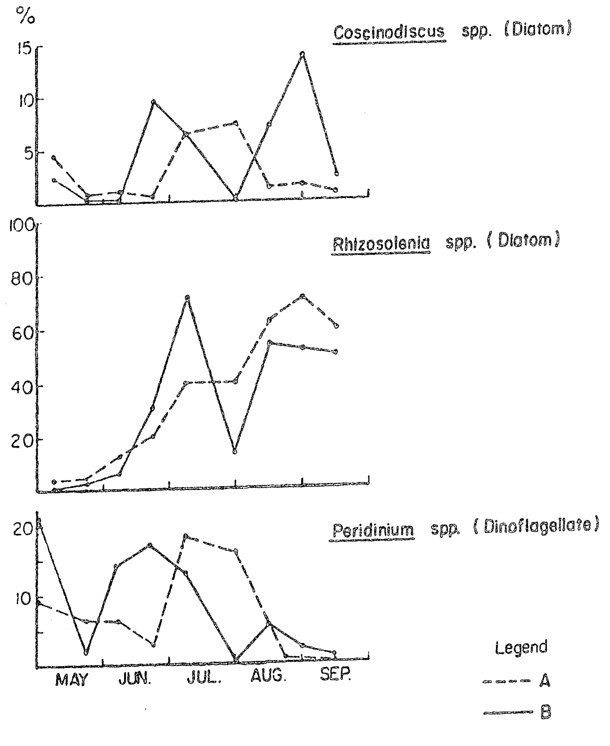


Fig. 3 :

Fluctuation and relative abundance of Coscinodiscus spp. Rhizosolenia spp. and Peridinium spp. at stations A and B.



Finally, an examination of the timing of the peak formation for some of the leading species of Coscinodiscus, Rhizosolenia and Peridinium during the late spring and summer revealed an intriguing pattern (Fig. 3). In all three genera, blooms were sequential with a difference of 1-3 weeks between the stations. Whether the blooms occurred first in inshore or offshore waters is not clear from these observations, but the possibility that the blooms occur first at the offshore station rather than at the inshore one, contrary to accepted concepts, is not ruled out.

Acknowledgements

The authors wish to express their thanks and appreciation to Dr. John R. Beers for his critical reading of the manuscript and to Oren Nativ for technical assistance.