

Bedford Basin Plankton Monitoring Program

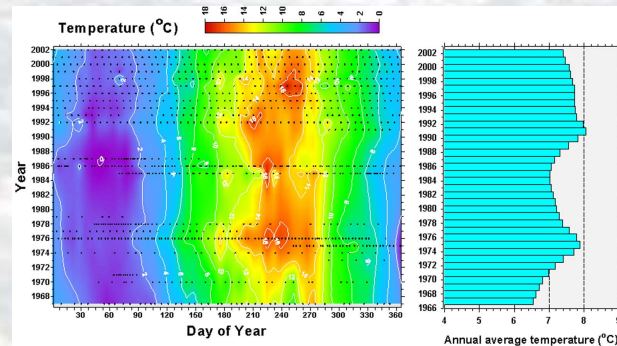
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Introduction

The Bedford Basin Plankton Monitoring Program was initiated in late 1991 to make weekly observations of biological, physical and chemical properties at the Compass Buoy site, which is the deepest location in the Basin. This time series records prevailing conditions to evaluate changes in the planktonic environment of the harbour. The temporal resolution and duration of the measurements permit a consideration of environmental variability at the weekly, monthly, seasonal and annual scales. Here we combine this 11 year time series with earlier data recorded at interrupted intervals to examine secular trends revealed by annual changes in the upper 10 meters of the water column.

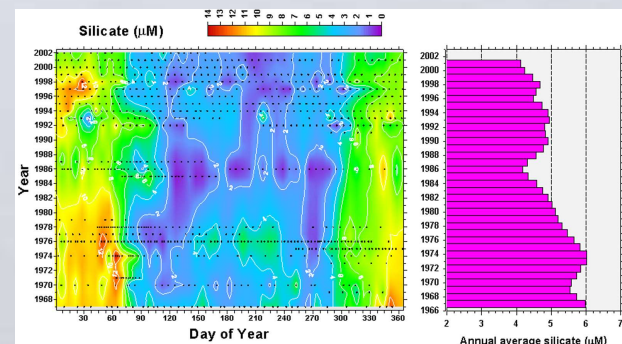
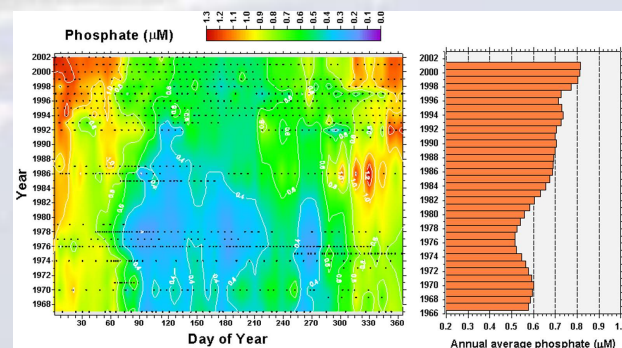
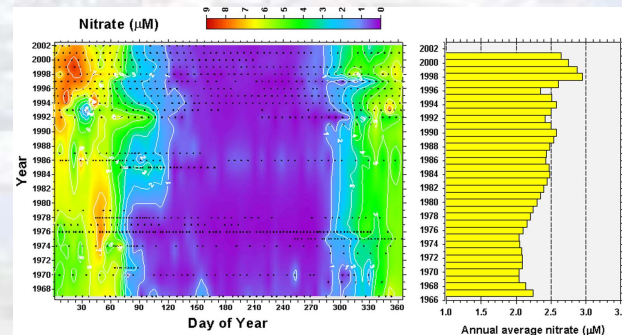
Water Temperature

The annual average temperature was 6.5°C in 1967 and 7.4°C in 2002 (Fig. 1). In recent years, the duration of winter appears to have shortened, as judged by the width of the 20°C isopleths. However, the existence of a long-term increase in annual average temperature is uncertain because of the interrupted nature of the record prior to 1992.



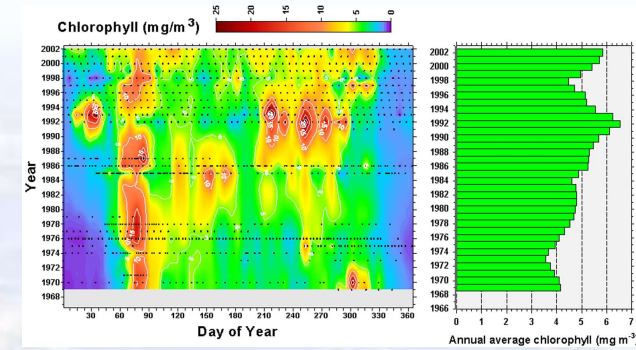
Inorganic Nutrients

In 2001, the annual average concentration of nitrate was 18% higher than in 1967 (Fig. 2); phosphate was 41% higher than in 1967 (Fig. 3); but silicate was 31% lower than in 1967 (Fig. 4). Higher concentrations of nitrate and phosphate in the winter have been particularly evident in recent years. Conversely, winter silicate concentrations have decreased.



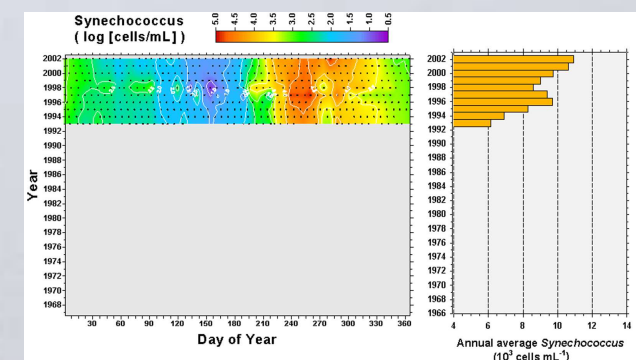
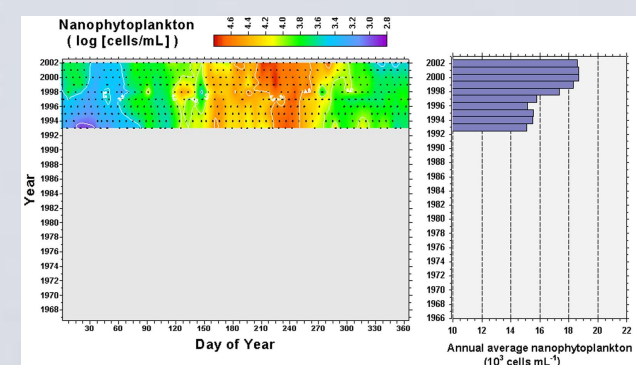
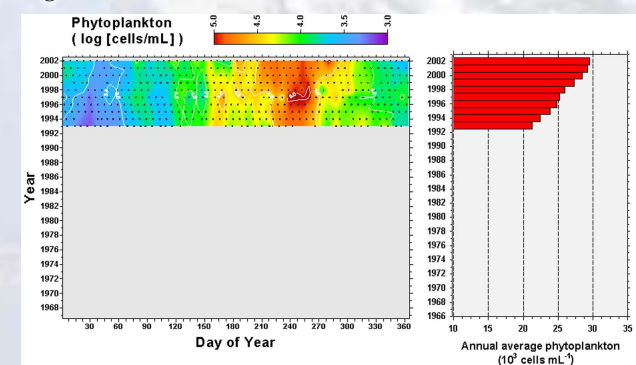
Phytoplankton Biomass

The total annual average biomass of phytoplankton, measured as chlorophyll concentration, was 41% higher in 2002 than in 1969 (Fig. 5). The strong seasonality of chlorophyll evident in the 1960s has become less marked in recent years; instead, a significant concentration of chlorophyll appears to be distributed throughout most of the year.



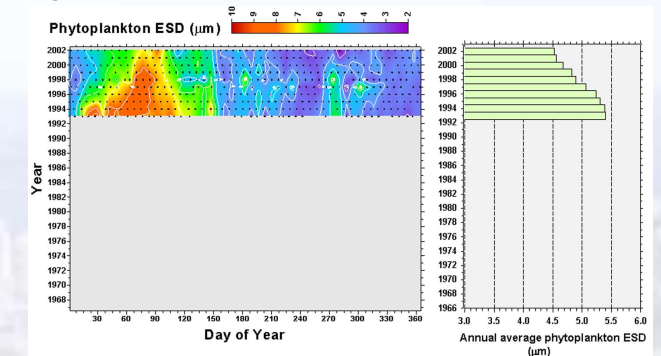
Phytoplankton Abundance

The systematic enumeration of phytoplankton in Bedford Basin only began in 1993 with the use of flow cytometry. In this period of 10 years, there has been a significant increase in annual average cell concentration of the total assemblage (Fig. 6), and its constituent size fractions of nanophytoplankters (Fig. 7) and picophytoplankters (Fig. 8).



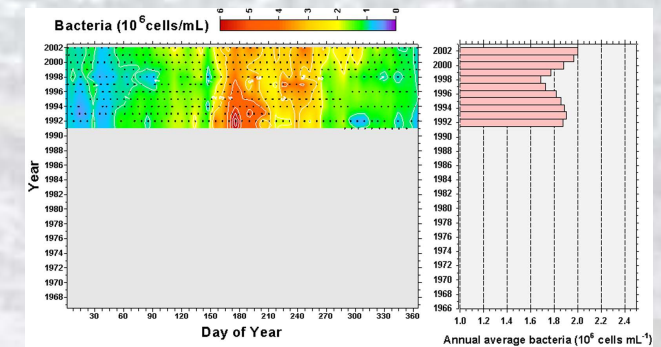
Phytoplankton Cell Size

The continued increase of picoplankton and nanoplankton in the phytoplankton is manifest as a reduction in the average cell size of the assemblage, expressed as equivalent spherical diameter, ESD (Fig. 9).



Bacterioplankton Abundance

The annual average concentration of bacterioplankton varies around a mean value of 1.9 million cells per milliliter (Fig. 10). This value is in accord with expectations based on a published global comparative analysis, indicating that Bedford Basin currently supports a standing stock of bacterioplankton that is not considerably different than other coastal environments of similar temperature.



Conclusions

In Bedford Basin, the nutrient regime appears to be undergoing a secular change with higher concentrations of nitrate and phosphate, but lower concentrations of silicate. Contemporaneously, there is an increase in the smaller components of the phytoplankton. These components are represented by the size groups of nanoplankton and picoplankton. By and large, these smaller phytoplankton do not use silicate as a macro-nutrient. The secular trends in phytoplankton composition may therefore be an indication of the nutrient trends. Bacterioplankton abundance has remained essentially invariant at a level to be expected given the prevailing temperatures.

Acknowledgements

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