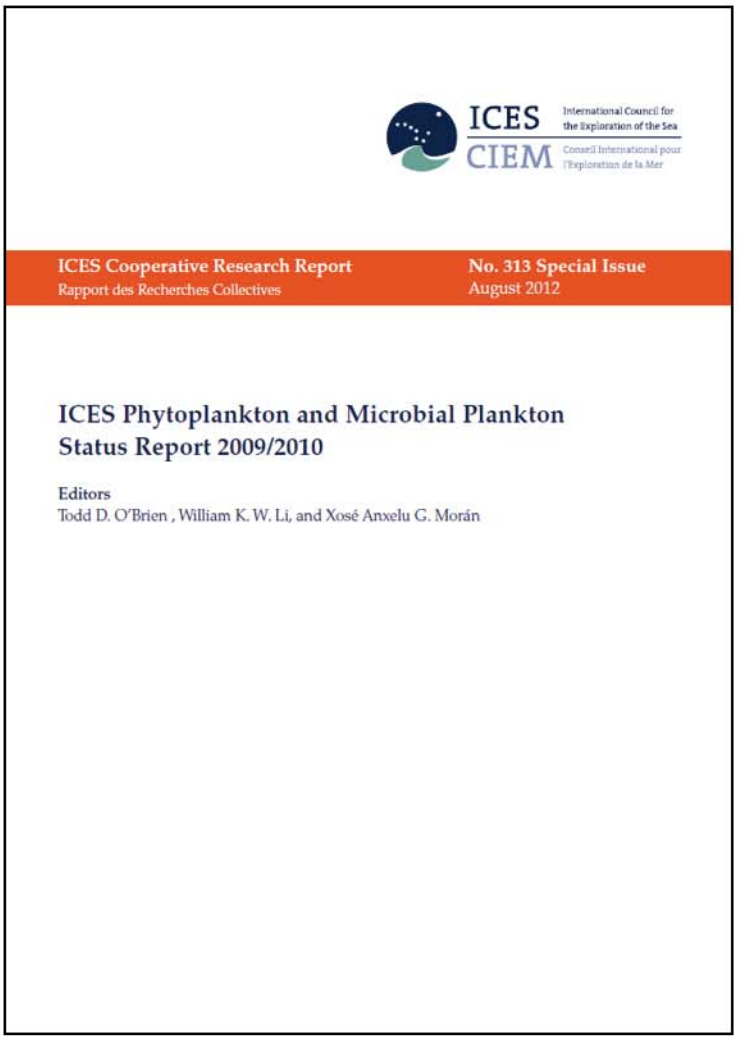

The pages in this PDF contain a single section extracted from the

ICES Plankton and Microbial Plankton Status Report 2009/2010

The full electronic document is available online at:
http://WGPME.net

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http://ICES.dk

O'Brien, T. D., Li, W. K. W., and Morán, X. A. G. (Eds). 2012.
ICES Phytoplankton and Microbial Plankton Status Report 2009/2010.
ICES Cooperative Research Report No. 313. 196 pp.

The time-series analyses and figures used in this report were created using COPEPODITE:
http://www.st.nmfs.noaa.gov/copepodite

3.4 Scotian Shelf (Sites 4–6)

William K. W. Li

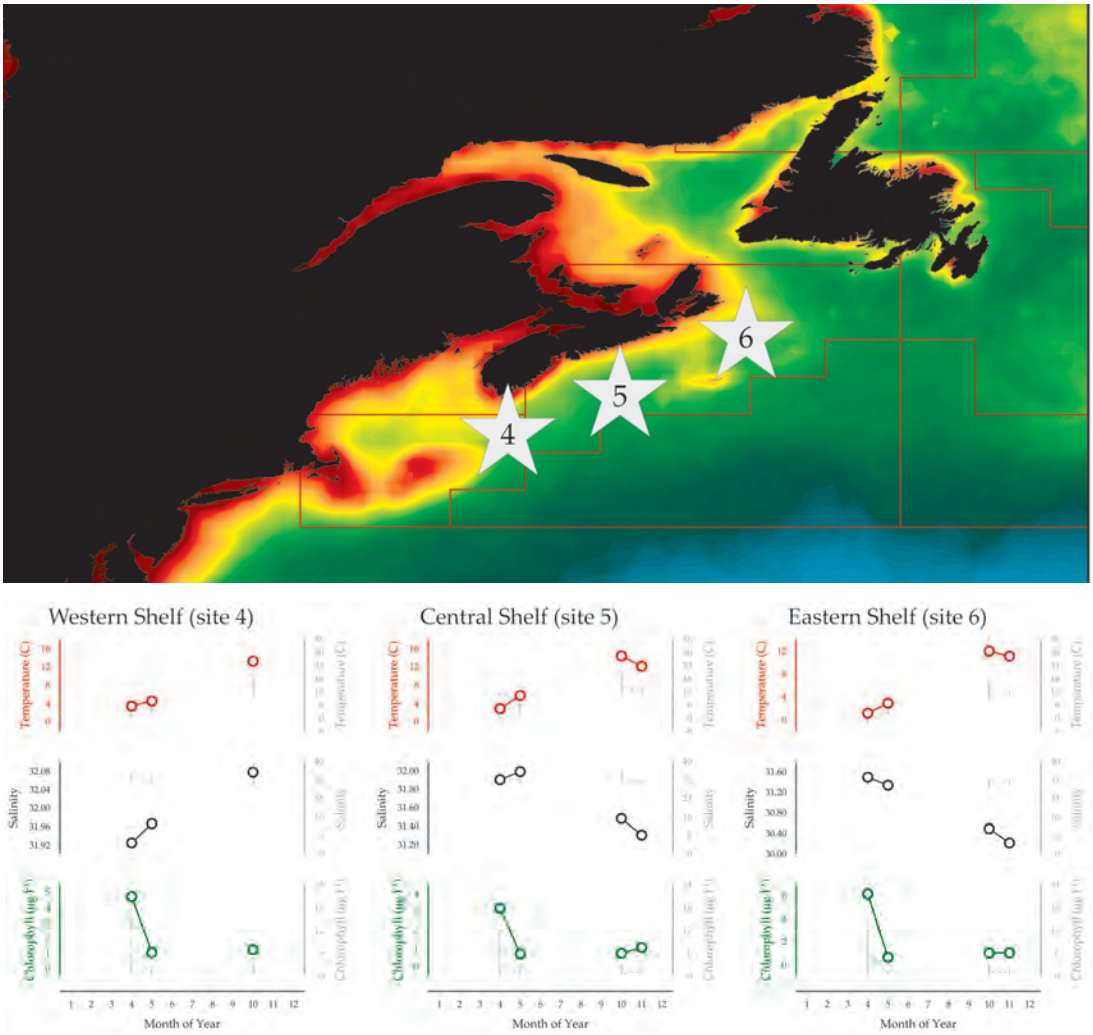

Figure 3.4.1
Location of the Scotian Shelf plankton monitoring areas (Sites 4–6), plotted on a map of average chlorophyll concentration, and their corresponding environmental summary plots (see Section 2.2.1).

The Atlantic Zone Monitoring Programme (AZMP) is a multifaceted, multiplatform oceanographic observation programme in the Northwest Atlantic Shelf conducted by Fisheries and Oceans Canada, with the aim of increasing capacity to understand, describe, and forecast the state of the ocean environment and marine ecosystem (Therriault *et al.*, 1998). The main objectives of AZMP are twofold: (1) to collect and analyse biological, chemical, and physical data to characterize and understand the causes of oceanic variability at the seasonal, interannual, and decadal scales; and (2) to provide the multidisciplinary datasets that can be used to establish relationships among the biological, chemical, and physical variability. Regular reports of the optical, chemical, and biological oceanographic conditions on the Scotian Shelf are made to the Canadian Science Advisory Secretariat (Harrison *et al.*, 2009).

Three different oceanographic regimes of the Scotian Shelf are sampled: (1) at the western end of the shelf, where tidal mixing fundamentally alters water-mass structure (Browns Bank Line BBL); (2) at the central shelf, where slope water plays a greater, if not dominant, role (Halifax Line HL); and (3) at the eastern end of the shelf (Louisbourg Line LL), where St Lawrence water dominates, but slope water is exerting a significant influence. Methods and protocols for sampling and analyses are documented in Mitchell *et al.* (2002). In this report, regional averages are computed across seven primary stations that lie across the shelf along these three lines, namely BBL1 to BBL7, HL1 to HL7, and LL1 to LL7. Phytoplankton are characterized by chlorophyll *a* concentration measured by *in vitro* fluorescence, and by cell abundance in size classes measured by flow cytometry. Bacterial abundance is measured by flow cytometry after cells have been

stained with SYBR Green I, a nucleic acid-binding fluorochrome. The values for samples collected in the upper 100 m are averaged to represent the state of upper ocean waters.

Seasonal and interannual trends (Figure 3.4.2)

Across the entire Scotian Shelf, there is strong seasonality in climatic factors and in phytoplankton development. Most notably, the average abundance of picophytoplankton (represented by *Synechococcus* and picoeukaryotes) is approximately 2 orders of magnitude higher in autumn, when it is warm, than in spring, when it is cold. Generally, it appears that there has been an increase in picophytoplankton abundance and a decrease in nanophytoplankton abundance over the years of observation.

In searching for broader patterns, an assessment is made of multiyear change in nutrients, phytoplankton, and zooplankton on the Scotian Shelf by examination of normalized, seasonally adjusted, annual anomalies of aggregate indices. These indices are based on near-surface and deep nitrate inventories, on chlorophyll inventories, the magnitude, timing, and duration of the spring chlorophyll bloom, and on the abundance of zooplankton *Calanus finmarchicus*, *Pseudocalanus* spp., total copepods, and total non-copepods. To date, covariance has been weak among the aggregate indices over the years, even when large swings in anomalies have been observed (Harrison *et al.*, 2009). Thus, at the annual time-scale, mechanistic linkages from the physical–chemical environment of temperature, salinity, stratification, and nutrients to the biological communities of phytoplankton and zooplankton are obscured by complexity and indeterminacy of ecosystem trajectories.

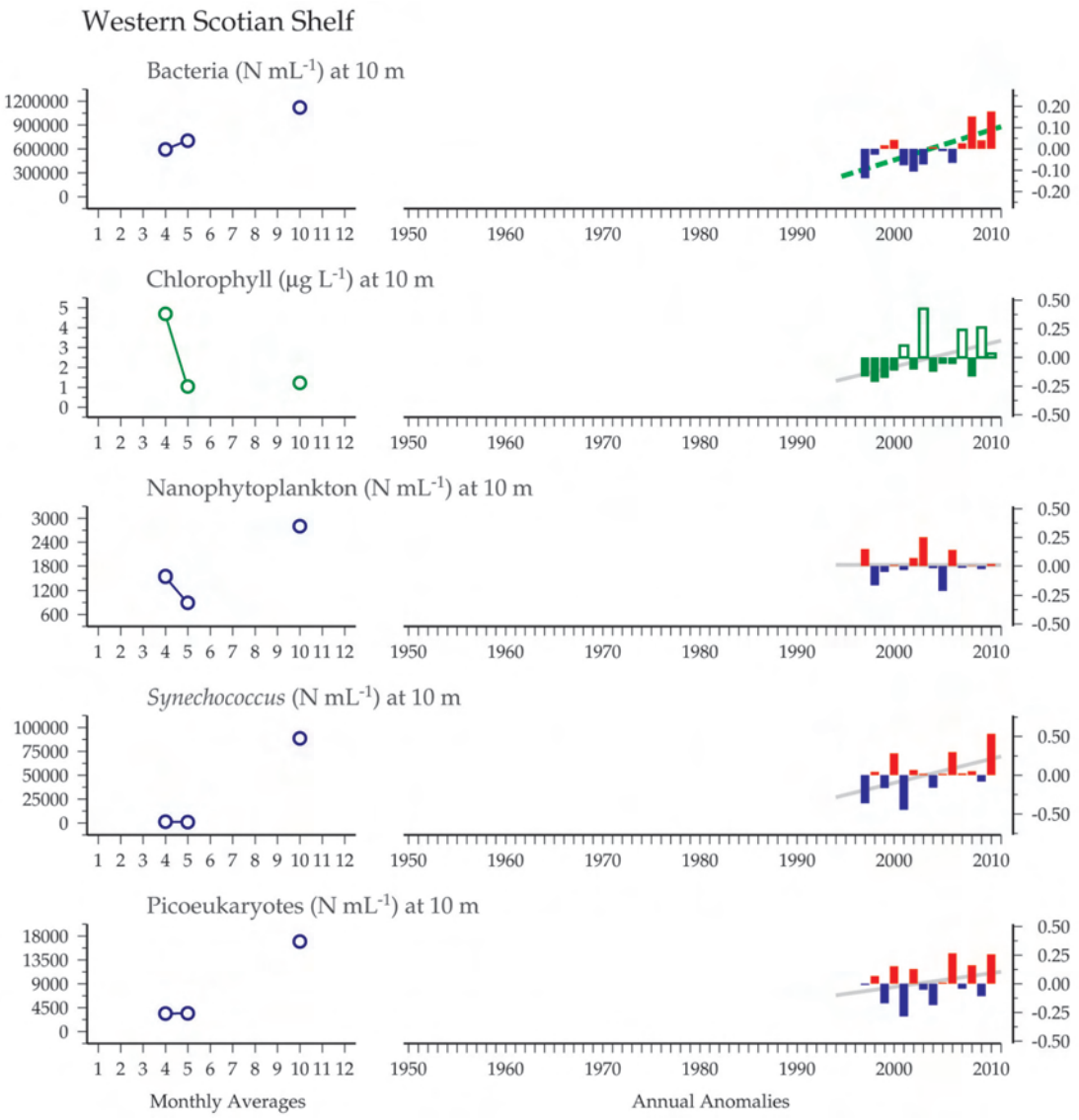

Figure 3.4.2
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Western Scotian Shelf plankton monitoring site. Additional variables from this site are available online at http://wgpme.net/time-series.

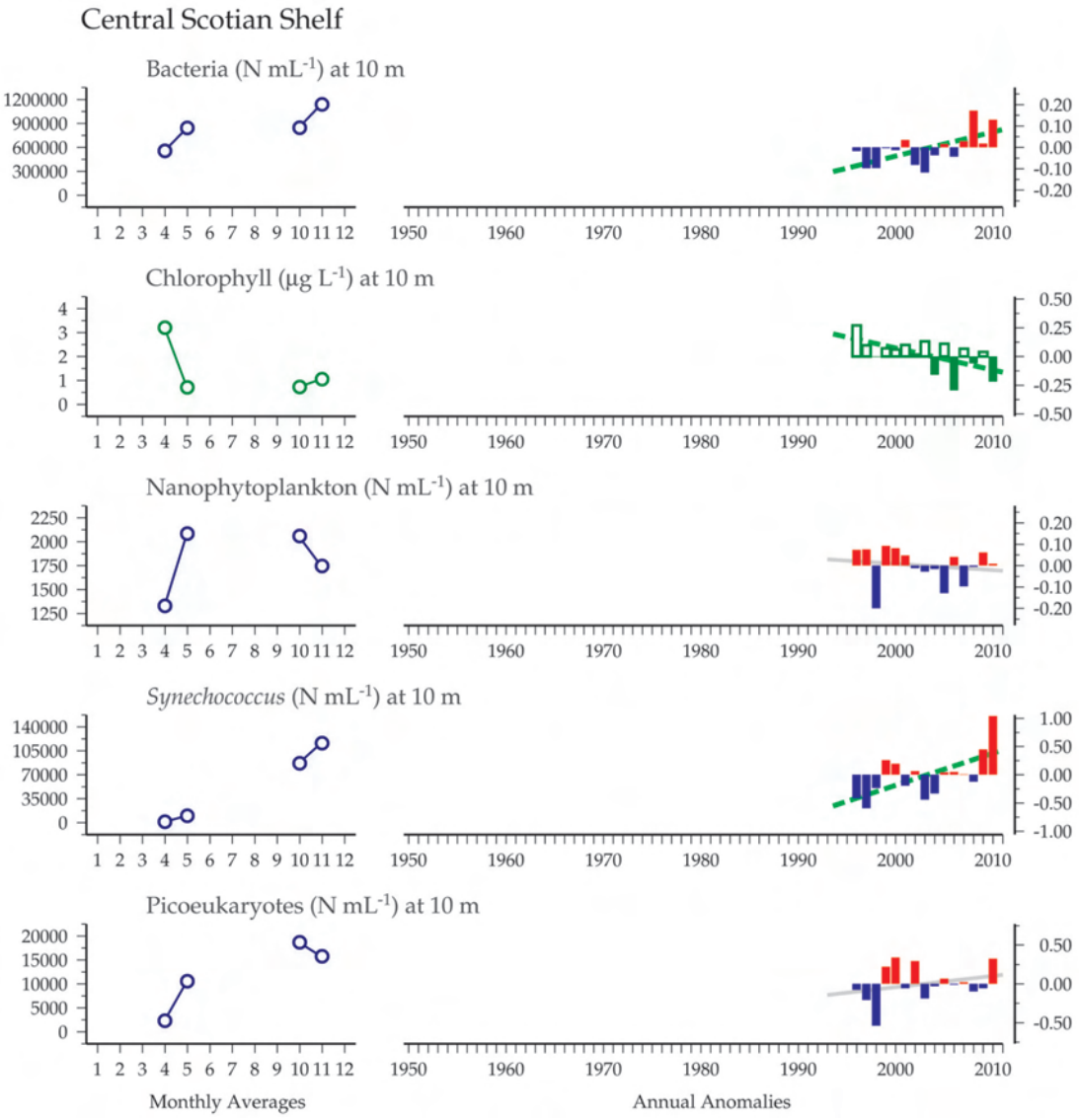

Figure 3.4.3
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Central Scotian Shelf plankton monitoring site. Additional variables from this site are available online at http://wgpme.net/time-series.

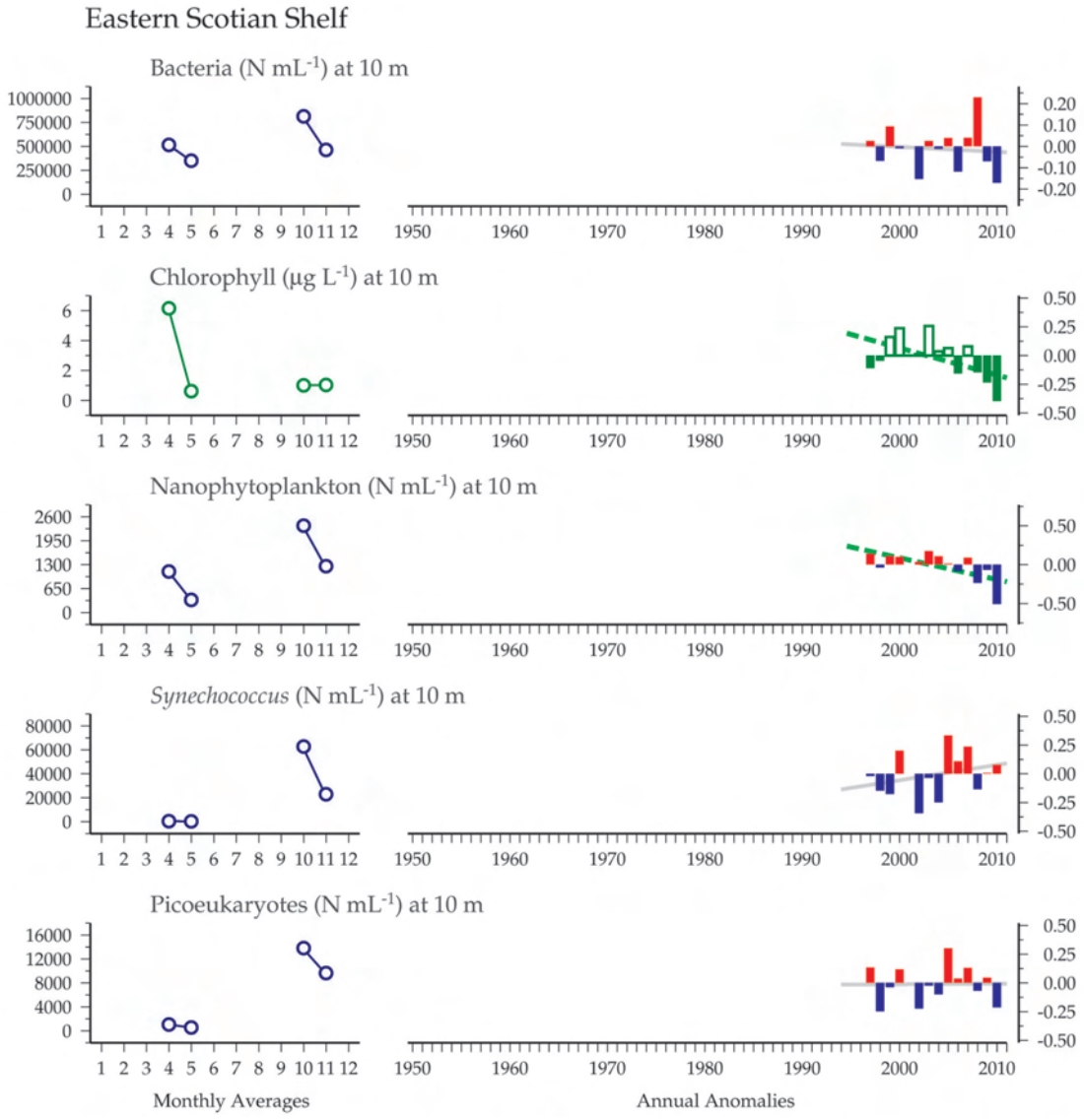

Figure 3.4.4
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Eastern Scotian Shelf plankton monitoring site. Additional variables from this site are available online at http://wgpme.net/time-series.