



ICES Phytoplankton and Microbial Plankton  
Status Report 2009/2010

Editors

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## *ICES Plankton and Microbial Plankton Status Report 2009/2010*

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The time-series analyses and figures used in this report were created using COPEPODITE:

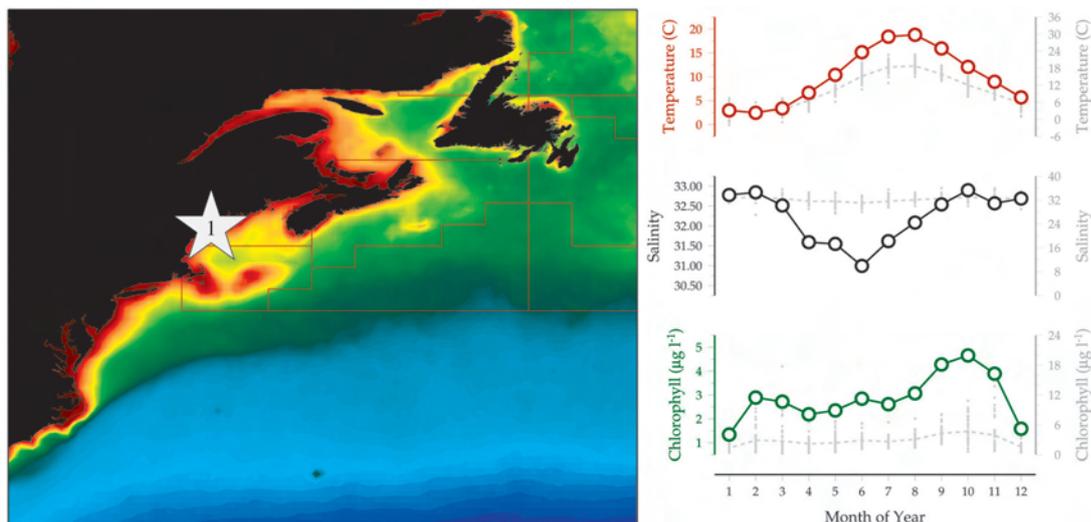
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### 3.1 Booth Bay, Maine (Site 1)

*Nicole Poulton and Michael Sieracki*

**Figure 3.1.1**  
Location of the Booth Bay, Maine plankton monitoring area (Site 1), plotted on a map of average chlorophyll concentration, and its corresponding environmental summary plot (see Section 2.2.1).



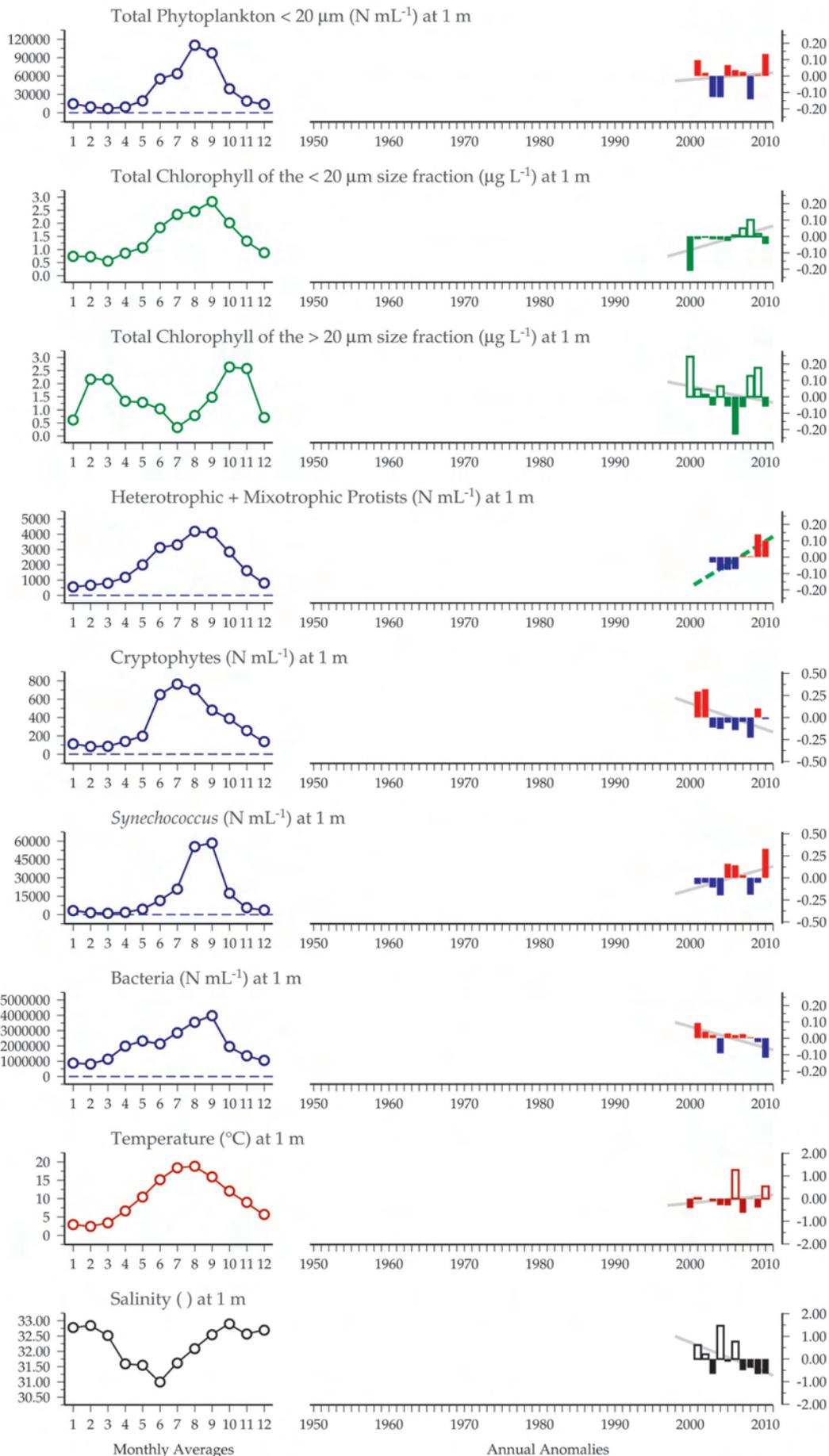
Booth Bay is a small mesotidal embayment located along midcoast Maine in New England, near the town of West Boothbay Harbor, with no direct major river input. Circulation is dominated by strong semi-diurnal tidal mixing with offshore Gulf of Maine coastal waters. The monitoring site was initiated from a floating dock in 2000 located near the State of Maine's Department of Marine Resources. The purpose of the study is to monitor long-term physical and chemical changes, and phytoplankton population dynamics. Weekly observations at high tide of phytoplankton, bacteria, and eukaryotic heterotrophs are made using flow cytometry. Temperature, salinity (refractometer measurements), and size-fractionated chlorophyll *a* (< 3, 3–20, and >20 µm) are also determined. Flow cytometric taxonomic groups are defined and enumerated (*Synechococcus*, cryptophytes, and total phytoplankton < 20 µm). Bacteria are detected and enumerated using PicoGreen, a DNA stain (Invitrogen; Veldhuis *et al.*, 1997). Heterotrophic and mixotrophic eukaryotes (microflagellates and small ciliates) are detected using the food vacuole stain Lysotracker Green (Invitrogen; Rose *et al.*, 2004). Microplankton taxonomic distribution (15–300 µm) and abundance are collected using an imaging cytometer, FlowCAM (Sieracki *et al.*, 1998). As of 2012, samples for nutrient analysis and zooplankton (vertical net tows) are also collected.

#### Seasonal and interannual trends (Figure 3.1.2)

Strong seasonal patterns emerge with all of the plankton populations and chlorophyll *a* that correlate with changes in temperature and the onset of spring and autumn phytoplankton. This site experiences a strong seasonal cycle in temperature, ranging from 1 to 20°C. Cryptophytes and *Synechococcus* bloom on an annual basis within a narrower period of time, usually July and September, respectively. Bacteria often increase following the spring bloom and then increase again as water temperature increases. Larger microphytoplankton (not shown) are imaged by the FlowCAM, capturing the onset of the spring and autumn blooms. The spring bloom is dominated by diatoms, typically *Thalassiosira*, *Chaetoceros*, and *Skeletonema*, and the autumn bloom is a more diverse mix of diatoms and dinoflagellates, usually *Prorocentrum*.

Over the 10-year period, different trends were observed among the plankton. *Synechococcus*, total phytoplankton (< 20 µm), heterotrophic and mixotrophic eukaryotes all increase, with the largest positive anomalies observed from 2009 to 2010. Since 2000, positive trends are observed in sea surface temperature and chlorophyll *a*, whereas negative trends are observed in salinity and bacteria. These data provide a basis for future modelling of planktonic organisms capable of quickly tracking changing environmental conditions.

Booth Bay - Maine



**Figure 3.1.2**  
Multiple-variable comparison plot (see Section 2.2.2) showing the seasonal and interannual properties of select cosampled variables at the Booth Bay, Maine plankton monitoring site. Additional variables from this site are available online at <http://wgpme.net/time-series>.