



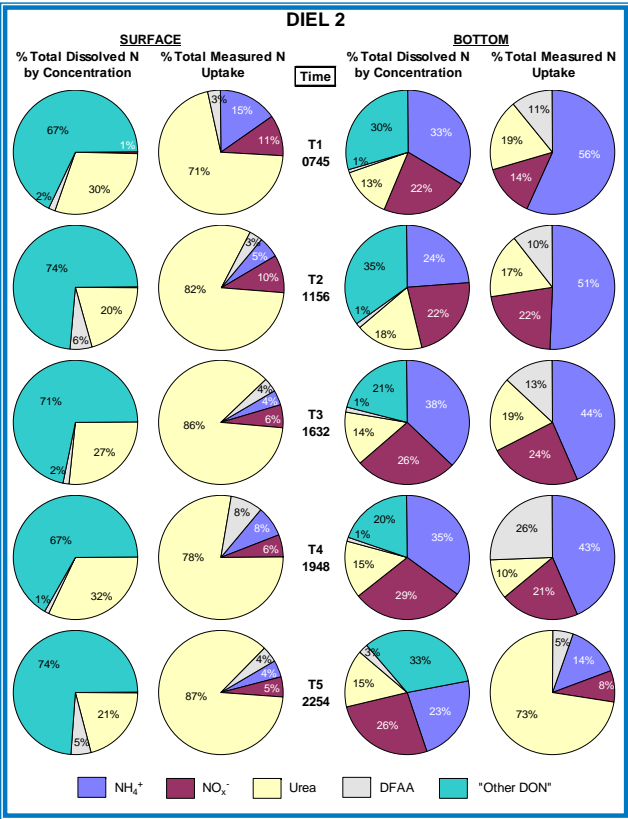
Uptake of Inorganic and Organic Nitrogen by Plankton Over Two Diel Periods in the Mid-Atlantic Bight

Environmental Issue

Nitrogen inputs to coastal waters often have distinct consequences with respect to ecosystem health and function. Delivered to estuaries and the coastal ocean via rivers, land runoff, and groundwater discharge, nitrogen stimulates phytoplankton growth and leads to eutrophication, which frequently results in harmful algal blooms, depletion of oxygen, and loss of habitat. Therefore, knowledge of the fate of nitrogen in coastal ecosystems is essential to understanding how those inputs will influence productivity and health.

Project Overview

We characterized ambient nutrient concentrations and measured uptake rates for dissolved inorganic nitrogen (DIN: ammonium, nitrate and nitrite) and dissolved organic nitrogen (DON: urea and amino acids) at the Long-Term Ecosystem Observatory (LEO-15) on the New Jersey continental shelf. During two diel sampling periods from July 20-22, 2002, concentrations and rates were measured every 3-5 hours in both surface and bottom waters.



Acknowledgements:

Other collaborators on this project were: D.A. Bronk, M.P. Sanderson, and L.J. Kerkhof. Thanks also to K.C. Filippino and P.W. Bernhardt for their assistance with sample analyses. Funding for this project was provided by the Dept of Energy's BI-OMP program. Map of NJ courtesy of The General Libraries, The University of Texas at Austin.

Scientific Approach

We used wet chemical techniques to measure ambient concentrations of ammonium, nitrate, nitrite, urea, amino acids, and bulk DON from surface and bottom water at each time point. Phytoplankton versus bacterial uptake rates were measured using the traditional size fractionation (filtration) approach. Rates were also measured using a method I am refining that employs flow cytometric sorting to distinctly separate phytoplankton from bacteria. We hypothesize that the sorting approach using flow cytometry will produce more accurate uptake rates for the phytoplankton fraction.



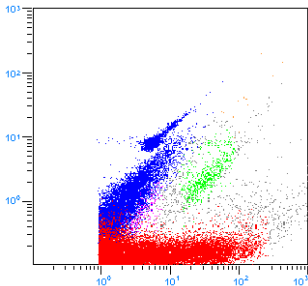
Beckman Coulter's Epics Altra Flow Cytometer



Results and Impact

Preliminary results indicate that the water column was highly stratified, with surface waters devoid of inorganic nitrogen. Consequently, about 83% of the nitrogen utilized in surface waters was organic, primarily urea. In the bottom waters, DIN comprised approximately 58% of all dissolved nitrogen and was the primary source of nitrogen to plankton.

This research is important in coastal environments where the fate of nitrogen loads in estuaries often determines the extent of eutrophication. A better understanding of the autotrophic or heterotrophic fate of specific nitrogen forms entering estuaries would help managers target load reductions more efficiently by being able to predict the outcome of such nitrogen additions.



Example of the output from a flow cytometer. Each point represents a cell or particle in water collected from the York River, VA on 14 July 2004. Different colors correspond to distinct groups of phytoplankton.