Constraining Biological Rates Governing the Western North Atlantic Annual Cycle in Phytoplankton Biomass

Françoise Morison[1], Gayantonia Franzè[1], Jason Graff[2], Elizabeth Harvey[3] & Susanne Menden-Deuer[1]

[1]Graduate School of Oceanography, University of Rhode Island, Narragansett, RI
[2]Botany & Plant Pathology, Oregon State University, Corvallis, OR
[3]Skidaway Institute of Oceanography, University of Georgia, Athens, GA

Interactions between phytoplankton and their grazers have been hypothesized to be a major ecological factor governing dynamics of phytoplankton biomass accumulation over the annual cycle, including when the North Atlantic spring bloom initiates (Behrenfeld & Boss 2014). A major goal of the North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) was to define environmental and ecological controls on plankton communities, to build a predictive understanding of the structure and function of plankton systems.

During the four NAAMES field campaigns conducted in November 2015, May 2016, September 2017, and March 2018 in the Western North Atlantic (38-48 W, 40-55 N), we measured phytoplankton growth and grazer/virus-induced mortality rates in a total of 193 two-point dilution experiments. Concurrent measurements of physical, chemical, and biological properties provided an environmental context for the rate measurements. Some stations sampled at different seasons overlapped in their physical and chemical properties, reflecting the latitudinal extent and the mesoscale physical complexity of the study region. Seasonal and geographical variability in grazing impact on primary production remains to be investigated; yet phytoplankton biomass accumulation rates were overall generally positive, implying a prolonged growth period and a relatively shorter period of net biomass loss.

Consequently, seasonal biogeochemical fluxes and the transfer of matter and energy through the western North Atlantic food web may be processes that are sustained over the yearly cycle, rather than defined by short bloom events.