GAP experiments 3 years after - Electron & Biomass Dynamics of Cyanothece under interacting nitrogen & carbon limitations.

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In 2017 Algatech hosted workshop on Aquatic productivity (GAP). More than 60 scientists and students met for a week and worked together at several "real" experiments in the field of aquatic microbiology, biotechnology and cyanobacterial photosynthesis. These days most of the obtained data has been already published. I will start with an overview of the results obtained. Then, I will summarize the main outputs from the experiment 3 that studied the regulation of photosynthesis under different nitrogen supply regimes.

The unicellular, diazotrophic cyanobacterium Cyanothece is widely found in coastal subtropical oceans. We analyze the consequences of diazotrophy on growth efficiency, compared to NO3--supported growth, to understand how cells cope with N2 fixation when they also have to face carbon limitation, a situation that populations may encounter in coastal environments, or during blooms of phytoplankton communities. When grown in obligate diazotrophy, cells face the double burden of a more ATP-demanding, N-acquisition mode and additional metabolic losses imposed by the transient storage of reducing potential as carbohydrate, compared to a hypothetical N2 assimilation directly driven by photosynthetic electron transport. Further, this energetic burden imposed by N2 fixation could not be alleviated, despite the high irradiance level within the cultures, because photosynthesis was limited by the availability of dissolved inorganic carbon (DIC), and possibly by a constrained capacity for carbon storage. As DIC limitation exacerbates the costs on growth imposed by nitrogen fixation, the competitive efficiency of diazotrophs could be hindered in areas with insufficient renewal of dissolved gases and/or with intense phytoplankton biomass that both decrease available light energy and draw the DIC level down, so potentially during bloom periods.