Can cyanobacterial blooms in nutrient-poor lakes accelerate eutrophication? Perspectives from modeling

Gloeotrichia echinulata is a large nitrogen-fixing cyanobacterium that is causing nuisance blooms in oligotrophic and mesotrophic lakes in northern New England. We hypothesize that G. echinulata accelerates eutrophication by alleviating nitrogen (N) and phosphorus (P) limitation. Previous work in eutrophic lakes has established that meroplanktonic G. echinulata translocate significant amounts of P from sediments into the water column during recruitment, though the magnitude of N additions has not been previously calculated. Using extrapolations of recruitment data for Lake Sunapee, NH, we suggest that G. echinulata may add as much P as a small tributary, and predict that it could become comparable to a major tributary if recruitment continues to increase.

While data collection and analysis have been part of this project for several years, mathematical modeling is a newer component. Initial forays into modeling the interactions between G. echinulata, in the different phases of its life cycle, and N and P show that the addition of life-cycle components and the interaction of a second nutrient change the predictions of simple, one-element models. This modeling work is key in predicting the extent to which increases in the duration and extent of G. echinulata blooms might impact lake water quality.