11TH U.S. SYMPOSIUM ON HARMFUL ALGAE

MODELING CYANOBACTERIA BLOOM FORMATION AND TOXIN PRODUCTION AS A FUNCTION OF ENVIRONMENTAL N:P STOICHIOMETRY

Cyanobacteria harmful algal blooms (HABs) produce chemicals that can suppress grazers and competing phytoplankton populations. It has been shown that the production of some cyanotoxins are influenced by environmental nutrient stoichiometry. In the work presented here, we employed a numerical lake system model to investigate how inflows and nutrient loading may influence population dynamics of cyanobacteria when cyanotoxin production is a function of N:P stoichiometry. For this purpose, we adapted the Phytoplankton Ecology Group (PEG)-numerical model parameterized with environmental conditions typical of warm monomictic systems in the southcentral USA. Key model features included seasonally variable temperature, mixing depth, and light. Zooplankton and phytoplankton populations, as well as nitrogen and phosphorus concentrations were dynamic. The model design was unique in that it incorporated a population-rich phytoplankton assemblage, where life history traits of members were based on ecological principles (trade-offs between traits), allowing the assemblage to organize over time based on nutrient competition and grazing vulnerability. The model was altered so that one of the many phytoplankton populations reflected life-history characteristics of a Microcystis sp. This included building in cyanotoxin production, which operated as a function of model nutrient stoichiometry, and negatively affected other phytoplankton and zooplankton populations. Using the retro-fitted model, we tested a range of inflows and nutrient loadings, informed using the Hydrologic and Water Quality System (HAWQS) for Texas reservoirs, examining conditions that led to bloom formation of the theoretical cyanobacteria population. Model results will be compared to in-field measurements that employed various methods to describe the occurrence and composition of cyanobacteria populations and their toxins in Texas reservoirs spanning a pronounced annual precipitation gradient.

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