

Effects of N:P Ratio on Harmful Algal Blooms

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Major: Environmental Science

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Urban and agricultural development has had dramatic effects on the biogeochemical cycles of nitrogen (N) and phosphorus (P). Such nutrient-rich conditions cause cyanobacteria to dominate the phytoplankton, thereby causing a number of problems in the water bodies they inhabit. Cyanobacteria exhibit rapid growth under high nutrient conditions, and as such have been increasingly referred to as harmful algal blooms (HABs) when they become overabundant in aquatic ecosystems. While nutrient run-off is thought to be the primary cause of HABs, it has been found that it is not necessarily the independent quantities of nitrogen and phosphorus that favor cyanobacteria, but rather the N:P ratio. Interestingly, management strategies that aim to increase N:P ratios in lakes have not always resulted in the dominance of less harmful phytoplankton. Lake Choctaw, located in Madison County, OH, has been experiencing HABs that have been producing high levels of cyanotoxins. This study examined how the N:P ratio influences phytoplankton community composition and dominance of cyanobacteria in lakes. As expected, there was a strong correlation ($r^2 = 0.91$) between increasing cyanobacteria dominance and low N:P ratios. What was not expected, however, was a similarly strong relationship ($r^2 = 0.89$) between total algal biomass and Secchi disk depth, providing a potentially effective and low-cost monitoring tool for lake managers. However, caution should be taken when extrapolating this relationship to other systems, where different forms of algae or other suspended solids might affect Secchi disk readings. Further research should focus on laboratory experiments, manipulating the various nutrient concentrations in order to determine the relative importance of each in algal intraspecific competition.