Cyanobacteria dominance: Quantifying the effects of climate change

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ABSTRACT: An increase in cyanobacteria bloom formation within lakes has been forecasted as a result of global warming. We investigated the particular physical and chemical thresholds for cyanobacteria performance in a lake model system, the polymictic eutrophic Müggelsee, which has been affected by significant warming trends and substantial reductions in external nutrient load. To identify key physical and nutrient thresholds favoring cyanobacterial performance, we applied classification tree analysis to water temperature, Schmidt stability, oxygen, pH, nutrient (including phosphorus, nitrogen, and their relative ratios), and zooplankton abundance during periods of summer thermal stratification. Although total phosphorus (TP) concentration was the principal force driving cyanobacteria contribution to total algal mass, climate-induced changes i the thermal regime, rather than direct temperature effects, positively influenced cyanobacteria dominance. Stratification periods exceeding 3 weeks and exhibiting a Schmidt stability of >44 g c cm^{-2} favored cyanobacteria proliferation within a critical TP concentration range (70-215 µg L^{-1}). The dominating genera *Aphanizomenon*, *Anabaena*, and *Microcystis* achieved the highest biomass in cases in which total nitrogen concentrations exceeded 1.29 mg L^{-1}, stratified conditions exceeded a duration of 3 weeks, and TP concentrations exceeded 215 mg L^{-1}, respectively. Give the observed broad range of TP thresholds within which climate warming enhances the probabil of cyanobacteria dominance, the incidence of cyanobacteria blooms will certainly increase in many lakes under future climate scenarios.