

Cyanobacteria in eutrophied fresh to brackish lakes in Barataria estuary, Louisiana

Ren, L, Mendenhall, W, Atilla, N, Morrison, W, Rabalais, N N

Louisiana Universities Marine Consortium, 8125 Hwy. 56, Chauvin, LA 70344

Introduction

Lakes Cataouatche, Salvador and des Allemands in upper Barataria Bay estuary, LA were historically oligotrophic to hypereutrophic fresh and brackish waters. Mississippi River diverted water into Cataouatche and Salvador since late 2003 changes salinity and introduces high nutrient loads. Lac des Allemands does not directly receive diverted water, but receives high nutrient loads from adjacent lands.

Hypotheses

We examined cyanobacteria to detect increases in the extent and duration of cyanobacterial blooms and HABs in response to nutrient additions, particularly the high nitrogen load from the Mississippi River.

Methods

We conduct monthly and biweekly surveys for epifluorescent counts of HABs, HPLC pigments, chlorophyll biomass, and associated water quality. 10-L microcosm experiments of nutrient additions and mixtures of Mississippi River water with lake water have been used to examine nutrient limitation shifts in community structure, and stimulation of potentially toxic HABs. Limited toxin analyses have been conducted.

Results

Common cyanobacteria (and their toxins) include *Anabaena* cf. *circinalis* (saxitoxins and microcystins), *Microcystis* spp. (microcystins), *Cylindrospermopsis raciborskii* (anatoxin), *Anabaenopsis elenkinii*, *Planktonlyngbya* spp., *Raphidiopsis curvata*, and other *Anabaena* spp. (hepatotoxins and/or neurotoxins). In Lakes Cataouatche and Salvador, where diatoms generally dominated phytoplankton communities, cyanobacteria were mostly detected in late spring and summer. The highest concentrations of *A. circinalis* in August had significant increase from 6×10^6 cells L⁻¹ in 2003 to 1.1×10^7 in 2004, whereas *R. curvata* remained at the same level of 5×10^5 cells L⁻¹. HPLC pigment analyses and chemical taxonomy results suggest an increase in overall chlorophyll *a* reaching over 70 µg L⁻¹ in Lake Salvador in 2003 and 180 µg L⁻¹ in spring 2004. *Microcystis* sp. and *Anabaena* spp. were the main contributors to these elevated chlorophyll *a* levels. Lac Des Allemands had higher levels of chlorophyll *a* in comparison to the other lakes due to high abundances of *Anabaena* spp and *Microcystis* sp.. The phytoplankton community was generally dominated by *A. circinalis* during most annual cycles (3.9×10^4 - 6.0×10^7 cells L⁻¹) as indicated by good correlation between its biomass and chlorophyll data. *A. circinalis* counts were high in 2003-2004 in Lac des Allemands, while other cyanobacteria such as *Cylindrospermopsis* spp., *Raphidiopsis* spp. and *Aphanizomenon* sp. increased in 2004 compared to 2003. Dense cyanobacterial blooms occurred in all three lakes in spring and early summer of 2005. Microcosm experiments indicate that phytoplankton growth in the lakes is potentially N limited most of the time. Nutrient additions stimulated the growth of most potentially harmful cyanobacteria. Microcystins were detected in Lake Salvador in April 2005 at levels of 0.3-0.6 µg (protein phosphates inhibition assay; G. Boyer, SUNY-Syracuse, unpubl. data).

Conclusion

The Davis Pond Mississippi River diversion is not yet fully operational, but limited outflows are affecting the salinity and nutrient regimes in Barataria estuary. Nutrient inputs, either from periodic diverted Mississippi River water or adjacent areas, have increased the growth of harmful bacteria and changed the phytoplankton community in three upper basin lakes. Little is known about trophic transfer of cyanobacterial toxins, but recent studies indicate there may be both environmental effects and human health concerns.