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The Challenges Behind Cyanobacteria in Southern Florida

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Abstract

Cyanobacteria are microorganisms that are important in the formation of the earth's atmosphere as well as in the process of nitrogen fixation. In Lake Okeechobee, algae blooms of *Anabaena* and *Microcystis* strains of toxic cyanobacteria have been increasing since 1987. Due to an increase of the water level, the U.S. Army Corps of Engineers have been forced to release water from the lake, allowing the cyanobacteria and nutrients to flow into the waterways. We researched multiple methods of cyanobacteria filtration and compiled what we believe are the most effective methods into one system. We recommend the use of filtration strip switchgrass and filtration plates to filter out the nitrogen and phosphorous and remove the cyanobacteria in the long term.

Project Goals

- Analyze methods of removing phosphates and nitrates from agricultural runoff
- Analyze methods of removing adequate amounts of cyanobacteria, phosphates and nitrates from Lake Okeechobee and its surrounding tributaries
- Consider feasible methods of implementing a feasible and cost effective solution



Herbert Hoover Dike along Lake Okeechobee

Methods

- We researched the political and environmental situations in Florida. Both are complex situations on their own.
- We decided to focus on the environmental aspect of the issue.
- We compared various methods of extracting cyanobacteria, phosphates and nitrates from water. Our group compiled all the researched extraction processes into one filtration system.
- In this system phosphates and nitrates are extracted both at the source of pollution and in the lake water as well and cyanobacteria would be extracted on the locks of the gates
- Assessed the cost feasibility of implementing our system during current rehabilitation works on the Herbert Hoover Dike on Lake Okeechobee.

Conclusions

Nutrient rich runoff from agricultural land near Lake Okeechobee is causing toxic cyanobacteria to thrive more rapidly, negatively impacting the economy ecosystem and livelihood of southern Florida. To solve this, cyanobacteria must be removed from the water and systems must be created to eradicate and to prevent further buildup of phosphate and nitrate and to filter the exiting water.



Toxic algal bloom (pictured above) on the Caloosahatchee River, one of Lake Okeechobee's tributaries.



Pictured above is switchgrass, which can be used as a buffer to filter out phosphates and nitrates from water.

Background

- Blue - green algae produces cyanotoxins which have side effects on humans ranging from abdominal cramps, nausea, diarrhea, and vomiting to liver damage.
- The toxic cyanobacteria blooms are leading to deaths in the populations of dolphins, manatees, shellfish, reefs, sea grasses, oysters, and has even been linked to human deaths.
- Cyanobacteria obtain their energy through photosynthesis and thrive under conditions with high nitrogen and phosphorus levels.

Recommendations

- Installing switchgrass around Lake Okeechobee and nearby farms
- Installing filtration plates (phosphorus-binding clay, denitrifying bacteria and chlorophyll-binding proteins) on Herbert Hoover dike.
- Removing cyanobacteria through mechanical separation process



Santa Fe River, May 2012.
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Outcomes

- Prevention of nitrates and phosphates from entering Lake Okeechobee from agricultural runoff using switchgrass biomass filter strips
- Implementation of filtration plates on dam locks to remove the existing cyanobacteria from the water as the water is released into Lake Okeechobee's tributaries