Algal Bloom Events and Environmental Drivers in Big Cypress and Brighton Seminole Reservations in Florida

Andrea Nocentini[1], *Keith Morton*[1], *Avery Delmaine*[1], ***Rosanyely Santana***[1]
Environmental Resource Department, Seminole Tribe of Florida, FL, USA

In recent years South Florida has been increasingly impacted by harmful algal blooms (HABs). In July and August 2023, thick algal mats, characterized by intense green to blueish coloration and strong odor, were reported in the Big Cypress and Brighton Seminole reservations as well. The likelihood that these were HABs raised concerns. In response, we conducted surface water field sampling and analysis to identify and quantify algal species and to assess water quality conditions. Surface water was tested for chloride, magnesium, potassium, silica, sodium, alkalinity, nitrogen (organic and inorganic), phosphorus, pH, conductivity, temperature, dissolved oxygen, and solids content.

Using non-metric multidimensional scaling (nmds) and k-means clustering, we categorized algal communities into four distinct clusters (ALGAE1–4). Clusters ALGAE3 and ALGAE4 contained the highest relative abundance of potentially toxic (ptox) cyanobacteria species, notably belonging to the *Sphaerospermopsis* and *Dolichospermum* genera, which dominated samples during peak bloom events. Dissimilarities in species composition among clusters were driven by elevated water temperature ($r^2 = 0.52$) and by elevated levels of total Kjeldahl nitrogen ($r^2 = 0.77$) and total phosphorus ($r^2 = 0.49$). In contrast, ALGAE1 represented communities characterized by much lower potential toxicity and accounted for 81% of the samples.

Flowing water proved to be an effective strategy for reducing blooms' severity. For example, both bloom density and toxicity decreased after increasing water flow in the internal ditch network, resulting in a shift from ptox- to non-ptox-dominated communities. Regression analyses revealed significant correlations between algal bloom severity and additional surface water parameters that can be monitored as indicators of algal blooms formation and proliferation, such as dissolved oxygen ($r = 0.77$), pH ($r = 0.70$), and turbidity ($r = 0.71$). Our findings highlight the importance of nutrient management and hydrologic interventions in preventing HABs. Elevated nutrients enter the Seminole reservations from upstream sources. Strategies such as reducing external nutrient inputs and maintaining water flow seem effective in mitigating bloom risks. Clear correlations between algal bloom severity and several other surface water characteristics were observed. Surface water features such as color, turbidity, mat thickness, and odor proved to be useful field indicators for an initial qualitative assessment of the potential toxicity of the blooms.