August 10, 2020

Dr. Thomas Frazer
Chief Science Officer
3900 Commonwealth Blvd.
Tallahassee, FL 32399

Re: Comments on cyanobacteria issues discussed by the Florida Blue-green Algae Task Force meeting on July 29, 2020

Dear Dr. Frazer and members of the Florida Blue-green Algae Task Force:

Thank you for soliciting comments regarding cyanobacteria issues discussed by the Florida Blue-green Algae Task Force (BGATF) meeting on July 29, 2020.

Our fundamental premise is that the Florida Department of Environmental Protection (FDEP) should adopt water quality standards incorporating numeric thresholds for cyanotoxins and similarly, the Florida Department of Health should adopt swim advisories for the same cyanotoxins and numeric thresholds determined by FDEP.

I. Water quality standards for cyanotoxins provide a basis for requiring enforceable swim advisories.

To date, the BGATF has considered the implications of adopting cyanotoxins as new water quality standards largely independent of swim advisories. Swim advisories clearly have an intended nexus to public health but may not have a legal basis. However, the U.S. Environmental Protection Agency (EPA) recommended that states adopt the cyanotoxin guidelines for both new water quality standards *and* swim advisories because of the overlap in public health criteria associated with both water quality standards (used for protecting designated uses per Clean Water Act Section 101(a)(2)) and swim advisories typically implemented by the state health departments. State water quality standards must be approved by EPA and consistent with the Clean Water Act intended to protect human health and aquatic life in waters of the U.S., states, territories and authorized tribes. Water quality standards form a legal basis for controlling pollutants entering the waters of the United States.

Recreation is defined as a designated use for Class III waters in Florida (F.A.C. Chapter 62-302) and has implications for public health as explained above. The water quality standards for fecal indicator bacteria are one example where the standards are determined with a legal basis for protecting the designated use (recreation) whereas swim advisories typically represent guidelines that may not have a legal basis depending on the state. Similarly, cyanotoxins should be adopted as water quality standards that define impairment for protecting the designated use of recreation for Florida Class III waters and why EPA has an expectation that the same standards for water quality, enforceable under the Clean Water Act, should establish a legal basis for swim advisories (https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods)

Establishing numeric thresholds for cyanotoxins creates a defensible legal basis in the context of water quality standards. Using a minimum detectable concentration as a threshold for decision, as FDEP has proposed, may vary depending on the capability of detection by the laboratory in question and is less definitive than numeric thresholds well within detectable limits for the standards in question.

II. Microcystin or other cyanotoxins are relevant for defining water quality impairment.

FDEP has consistently taken the position that microcystin frequency of occurrence or concentration in the context of the EPA 2019 Guidelines would not add an additional or complementary definition of impairment when chlorophyll data is co-occurring with microcystin.

Chlorophyll is not appropriately comparable to cyanotoxins for characterizing impairment due to factors of occurrence in waters with conditions that promote or suppress chlorophyll differently than for toxins such as microcystin from cyanobacteria.

A number of studies have described the competitive advantage that cyanobacteria have over phytoplankton under a variety of conditions especially those being influenced by climate change and warming waters (Pearl and Fulton 2006; Pearl and Huisman 2009; Zhenyan et al. 2020). Cyanobacteria have adapted to maximize available light near the surface utilizing vacuoles for buoyancy whereas most phytoplankton contributing to chlorophyll concentration don't have this advantage (Pearl and Fulton 2006). Additionally, the presence of mat forming cyanobacteria or very high cell densities in the water column would likely contribute to light limitation of co-occurring phytoplankton that may ultimately suppress sample chlorophyll concentrations.

High levels of tannins and other macrophyte derived allelochemicals are found to inhibit phytoplankton that contribute to water column chlorophyll (Mulderij, 2006). Conversely, cyanobacteria proliferate in Florida waters such as the Caloosahatchee River and Lake Okeechobee with high tannins, allelochemicals and other dissolved organic compounds (CDOM) derived from plant decomposition. Additionally, microcystin producing *Microcystis* have been shown to have some resistance to macrophyte derived allelochemicals that more negatively affect other phytoplankton species (Dziallas and Grossart 2011; Zilleges et a. 2011; Leunert et al, 2014).

Thus, *Microcystis* avoids light limitation by forming surface mats and appears to have some resistance to the same allelochemicals found in water bodies with relatively high tannins and dissolved organic plant derivatives that would more negatively impact groups of eukaryotic planktonic algae without similar adaptive strategies for dominance as cyanobacteria. In the example described, cyanobacteria would likely dominate the aquatic community and indirectly suppress or outcompete phytoplankton, indirectly reducing water-column chlorophyll. In such a scenario chlorophyll would under-represent the potential impairment of recreation as a designated use.

III. FDEP's cyanotoxin sampling protocol may underestimate the potential for public health risk and bias the assessment of cyanotoxins as indicators of impairment.

The current sampling protocol described by FDEP at the July 29 BGATF meeting and previously, was a FDEP adopted protocol specific for phytoplankton blooms. Most phytoplankton blooms don't form surface mats or scums as cyanobacteria do. As such, FDEP's cyanotoxin sampling protocol for phytoplankton avoids sampling cyanobacteria concentrated at the surface likely resulting in a reduced toxin estimate from latent intracellular toxin release when present. FDEP's Dr. Whiting stated that to

incorporate cyanobacteria biomass that may be part of a cyanobacteria surface mat would require following a "biological sample" protocol. Cyanobacteria samples having some cyanobacteria biomass collected by Calusa Waterkeeper and analyzed by GreenWater Laboratories in 2018 resulted in microcystin concentrations ranging from 5,300 ug/l to 38,450 ug/l. It's probable that collecting those same samples some distance from the surface mat at depth of 0.5 m as FDEP likely does and without incorporating more concentrated cyanobacteria at the surface would result in much lower microcystin concentrations. This same issue of sampling bias was reported by (Lantigua 2017).

For more accurate estimates of toxin potential it may be necessary to develop and adopt a specific protocol that blends elements of the FDEP protocols for phytoplankton blooms and biological sampling. A protocol specific to cyanobacteria with more meaningful potential for toxin estimates is critically important for understanding public health risk addressed by swim advisories and Class III waters designated for recreation and for a more thorough evaluation as a parameter defining impairment. Just because an adopted protocol does not currently exist specific to cyanobacteria does not necessarily mean that such a protocol should not be pursued.

IV. FDOH signage for HAB public health risk must be a requirement not voluntary by county health units.

The FDOH response to post public health risk signs at waterbodies with cyanobacteria has been nonexistent or inconsistent at best. The poor response by FDOH is a result of allowing each county health unit to voluntarily implement a so-called statewide policy. Apparently, the county health units rely on local policy makers with little or no training in public health issues to make the decision on posting signs. The reason behind a voluntary decision threshold for county health units to post signage is because there is apparently no legal basis in Florida for compelling them to do so. There will need to be a legal basis determined by FDOH for warning the public of health risk from cyanobacteria before there can be an enforceable policy for posting signage at public access points. Until a consistent and enforceable process is in place, the public will continue to be at risk from exposure to cyanotoxins based on past FDOH action with regard to signage. This signage uncertainty issue has been a problem since 2016. Just because there is no underlying enforcement mechanism currently does not mean that the BGATF should not recommend one.

V. Utilizing microcystin as a new water quality standard does not necessarily mean FDEP will have excessive or impractical expectations for resource allocation.

Currently the majority of sampling for parameters that define impairment in Florida waters is conducted by a variety of non FDEP partners including local government, federal government and NGOs. Adding another parameter for cyanotoxins would not add an unrealistic expectation of FDEP in the context of public health risk stemming from increasing frequency and severity of cyanobacteria blooms in Florida waters especially where non FDEP laboratories would conduct the analysis. Furthermore, it is not likely EPA would recommend that the states adopt new water quality standards without justification.

VI. Water quality standards and swim advisories should be set in the context of relative public health risk.

During the July 29 BGATF meeting there was a discussion of what standards and advisories for microcystin other states have developed in various contexts of implementation. It should be noted that

many of those standards or advisories were developed many years ago especially for relatively high swim advisories that were thought to be low or moderate risk at the time. More recent research has demonstrated growing evidence that a suite of toxins may be associated with cyanobacteria blooms in Florida and elsewhere (Metcalf et al. 2018, Metcalf et al. 2020). Additionally, cyanobacteria produce the neurotoxin β-methylamino-L-alanine (BMAA) which has been identified at high levels in aquatic food webs in Florida where human consumption of fish and shellfish could create health risk (Brand et al. 2010).

BMAA has also been detected at high levels in the brains of stranded dolphins and a subset of dolphins from Florida had a three-fold higher concentration of BMAA than the stranded dolphins from Massachusetts (Davis et al. 2019). The BMAA levels reported by Davis et al. 2019 in the brains of stranded dolphins was 1.4-fold greater than amounts in the brains of patients with Alzheimer's Disease and Amyotrophic Lateral Sclerosis. More recently Metcalf et al. 2020 found BMAA and its isomers at a high level from samples collected during a co-occurring *Microcystis* and *Karenia brevis* bloom in southwest Florida during 2018.

While considering the water quality or swim advisory for microcystin, it should be in the context that microcystin may not be the most toxic or prevalent cyanotoxin occurring in cyanobacteria blooms in Florida. Protecting public health is a serious priority; setting more protective values for at least recreational exposure such as those proposed by EPA for microcystin and cylindrospermopsin in 2016 referencing 4 ug/l for microcystin and 8 ug/l for cylindrospermopsin, that incorporate contributing risk factors such as dermal exposure and consumption of seafood in addition to incidental ingestion is necessary. Both the 2016 and 2019 EPA guidelines for recreational exposure defined exposure risk in the context of occurring during a summer recreational season. In Florida, the recreation season is arguably longer or perhaps every month of the year in south Florida compared to most other higher latitude states indicating longer exposure and another reason to recommend the more protective cyanotoxin standards and advisories identified by EPA in 2016.

We look forward to the BGATF's summary of the July 29 meeting and hope that our concerns and recommendations discussed here will be given serious consideration.

Respectfully and with endorsement by Waterkeepers Florida,

John Cassani

Calusa Waterkeeper

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