"Protecting the public health and natural resources of the White River watershed through advocacy, education, and research"

WHITE RIVER WATERKEEPER®

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Re: Harmful Algae in the Buffalo National River

Directors and Superintendent,

Thank you for your agencies' efforts to protect public health and the natural resources of the Buffalo National River (BNR). As the crown jewel of Arkansas, with a thriving toursit economy, and dozens of communities throughout the watershed, protecting our first national river and those that visit, requires a collaborative approach. Although partnerships and collaborative projects are often more difficult to execute and coordinate, White River Waterkeeper commends the effort to pool resources and expertise to best address water quality and human health concerns in the BNR. Continued partnerships, and inclusion of diverse stakeholders, will ensure everything that can be done, is being done.

Following continued reports of nuisance algae on the Buffalo River, and confirmed presence of harmful algae (cyanobacteria), *Microseira wollei*, from locations between Spring Creek and Dillard's Ferry, and information that a joint project between Arkansas Department of Environmental Quality (ADEQ), Arkansas Department of Health (ADH), and Buffalo National River (BNR) is underway, I submit the following joint letter to your agencies and other relevant officials.

Toxins of Concern

White River Waterkeeper is aware of ongoing efforts to monitor the presence and concentrations of two common cyanotoxins, microcystin and cylindrospermopsin. Recent studies have cited cylindrospermopsin as a known toxin produced by *M. wollei*[1][2], and numerous others have noted the production of saxitoxins - potent, acutely lethal neurotoxins[3][4][5][6][7].

Human Health Threat

While there is still much the scientific community does not know when it comes to harmful algal blooms (HABs), a considerable amount of research and readily available literature provide insight into the public health threats associated with cyanotoxins. Although your agency and personnel are likely well informed about HABs and the threats posed to human health from exposure to cyanotoxins, it is worthwhile to note a few key facts regarding saxitoxins:

> "*The oral LD50 for humans is 5.7 µg/kg, therefore approximately 0.5 mg of saxitoxin is lethal if ingested and the lethal dose by injection is about ten times lower. The human inhalation toxicity of aerosolized saxitoxin is estimated to be 5 mg/min/m3. Saxitoxin can enter the body via open wounds and a lethal dose of 0.05 mg/person by this route has been suggested. Saxitoxin is 1,000 times more toxic than the potent nerve gas sarin."*[8]

Saxitoxins can also be accumulated in freshwater fish.[9] No antidote exists for saxitoxin toxicity, making supportive care the only available means of treatment.

Algae and Cyanotoxin Monitoring

At present, it is acknowledged that recent monitoring efforts by ADEQ, ADH, and BNR have been conducted to evaluate the presence and concentrations of microcystin and

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[1] Seifert, M., McGregor, G., Eaglesham, G., Wickramasinghe, W., & Shaw, G. (2007). First evidence for the production of cylindrospermopsin and deoxy-cylindrospermopsin by the freshwater benthic cyanobacterium, Lyngbya wollei (Farlow ex Gomont) Speziale and Dyck. *Harmful Algae*, 6(1), 73-80.
[2] McGregor, G. B., & Sendall, B. C. (2015). Phylogeny and toxicology of *Lyngbya wollei* (Cyanobacteria, Oscillatoriales) from north-eastern Australia, with a description of *Microseira* gen. nov. *Journal of Phycology*, 51(1), 109-119.
[3] Carmichael, W. W., Evans, W. R., Yin, Q. Q., Bell, P., & Moczydlowski, E. (1997). Evidence for paralytic shellfish poisons in the freshwater cyanobacterium Lyngbya wollei (Farlow ex Gomont) comb. nov. *Applied and Environmental Microbiology*, 63(8), 3104-3110.
[4] Foss, A. J., Phlips, E. J., Yilmaz, M., & Chapman, A. (2012). Characterization of paralytic shellfish toxins from Lyngbya wollei dominated mats collected from two Florida springs. *Harmful Algae*, 16, 98-107.
[5] Onodera, H., Satake, M., Oshima, Y., Yasumoto, T., & Carmichael, W. W. (1997). New saxitoxin analogues from the freshwater filamentous cyanobacterium *Lyngbya wollei*. *Natural Toxins*, 5(4), 146-151.
[6] Lajeunesse, A., Segura, P. A., Gélinas, M., Hudon, C., Thomas, K., Quilliam, M. A., & Gagnon, C. (2012). Detection and confirmation of saxitoxin analogues in freshwater benthic *Lyngbya wollei* algae collected in the St. Lawrence River (Canada) by liquid chromatography–tandem mass spectrometry. *Journal of Chromatography A*, 1219, 93-103.
[7] Mihali, T. K., Carmichael, W. W., & Neilan, B. A. (2011). A putative gene cluster from a *Lyngbya wollei* bloom that encodes paralytic shellfish toxin biosynthesis. *PLoS One*, 6(2), e14657.
[8] Patockaa, J., & Stredab, L. (2002). Brief review of natural nonprotein neurotoxins. ASA Newsletter, 89, 16-24.
[9] Galvao, J. A., Oetterer, M., do Carmo Bittencourt-Oliveira, M., Gouvêa-Barros, S., Hiller, S., Erler, K., ... & Kujbida, P. (2009). Saxitoxins accumulation by freshwater tilapia (*Oreochromis niloticus*) for human consumption. *Toxicon*, 54(6), 891-894.

cylindrospermopsin, confined mostly (noting sampling location downstream of Spring Creek) to public access locations on the mid to lower Buffalo. However, from my own visual observations and monitoring, I have concerns that the locations and analytes are not as robust as they should be.

Despite the need to quantify saxitoxin concentrations, my personal observations and monitoring efforts indicate that *M. wollei* are presently localized considerable distances from public access points along the river. With many people confined to floating lower sections of river this time of year, the chance of encountering these algae and their associated toxins are high for many people. My own observations noted presence of *M. wollei* confined to the margins along shallow banks near gravel bars, mixed with mats of green algae.

While it may seem reasonable to inform the public that contact with algae are avoidable, it also must be acknowledged that it's nearly impossible to get out of one's canoe or kayak without wading through algae if one desires to get out of their boat to swim, or even just take a break on a gravel bar along the river. However, as mentioned above, direct contact with water is not the only mode of assimilating these toxins, a fact that the public needs to be aware of.

Advisories

In the interim of finalizing a comprehensive response plan, given the serious threat these blooms could pose to public health, it is prudent that the public is made aware of the potential health effects and how best to safeguard themselves. It is also necessary that this is done in a timely fashion. Being open and transparent with the public should be considered the **bare minimum** action that should be taken. Despite knowing how best to proceed at present, **it must be acknowledged that a significant threat exists**.

If thresholds for advisories and river closures are still being discussed, that does not negate the agency's responsibility to provide the public with useful and comprehensive educational information in the interim. However, since draft response plans and current analytical sampling omits monitoring and actions to be taken with regard to presence and concentration of saxitoxins, there should be concerns about whether or not the action plan is comprehensive enough to address known, and suspected, concerns in the Buffalo National River.

Future Steps

As BNR, ADH, and ADEQ move forward with developing monitoring and response plans, White River Waterkeeper would like to be advised of and involved in the process. While I understand that staff resources can be limiting, and I applaud the effort to further investigate HABs on the Buffalo River; however, I also believe more should ***and can*** be done.

Being a Waterkeeper means being the eyes, ears, and voice of the waterbodies for which we speak. This includes monitoring and patrolling of our watersheds. As BNR's press release last Friday stated *"concerned citizens, communities, and agencies are working together to better understand the sources of the problems, determine the potential risks, and evaluate the best practices for eliminating or managing the threats,"* White River Waterkeeper would like to, once again, request to be included in this multifaceted partnership as plans and developments move forward. This should be an easy step, as I have personally partnered with many of your field staff and personnel on projects over the past ten years.

Now is the time for pooling resources to adequately protect the public's health.

Illness Reporting

Having had personal conversations with individuals reporting symptoms commonly associated with exposure to cyanotoxins after visiting the Buffalo River, I am aware that ADH and the National Park Service (NPS) are engaged in documenting and facilitating examinations and diagnostic testing. However, if a reporting system has been made available to the public, it is not readily apparent to most.

To better document illness reports and identify commonalities in symptoms and exposure events, White River Waterkeeper has developed a Recreational Water Quality Illness Survey[10]. These results will be summarized and shared with your agencies, omitting any personal or identifying information of participants. However, **we respectfully request an immediate response regarding contact information to disseminate to participants, so they can report to you directly as well.**

Diagnostic Testing

To date, there is probable cause to attribute multiple illness reports to exposure to cyanotoxins on the Buffalo River. However, personal communications with those reporting illnesses have not indicated that specific diagnostic testing has been conducted at the behest of ADH or NPS to confirm the presence of cyanotoxins in patients.

Although I am aware this is a field of evolving technology, there are studies reporting convincing evidence for successfully isolating and quantifying cyanotoxins, particularly saxitoxin, from human blood and urine samples[11][12]. If ADH and NPS are not already moving forward with requesting such tests, please respond as to what the current limitations and hesitations are.

I look forward to individual responses from your agencies, as all are playing separate and integral roles.

Respectfully,

Jessie J. Green

Jessie J. Green
Executive Director & Waterkeeper

[10] https://www.whiteriverwaterkeeper.org/survey
[11] Wharton, R. E., Feyereisen, M. C., Gonzalez, A. L., Abbott, N. L., Hamelin, E. I., & Johnson, R. C. (2017). Quantification of saxitoxin in human blood by ELISA. *Toxicon*, 133, 110-115.
[12] Bragg, W. A., Garrett, A., Hamelin, E. I., Coleman, R. M., Campbell, K., Elliott, C. T., & Johnson, R. C. (2018). Quantitation of saxitoxin in human urine using immunocapture extraction and LC–MS. *Bioanalysis*, 10(4), 229-239.

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