Harmful Algal Blooms (HABs)

Background:

There are many different photosynthetic aquatic organisms that have historically been called "algae." Though there are some functional similarities among the different forms of "algae," these organisms have a wide range of physical attributes and origins. "Blue-green algae" are actually bacteria and are thus even more distinct from other types of algae. Blue-green algae are simple aquatic organisms that exist naturally in marine and freshwater waters, rivers, lakes, wetlands, and ponds. When they are present in low numbers, they are a normal part of a healthy ecosystem. Blue-green algae are also known as cyanobacteria. These bacteria are a world-wide problem and the Environmental Protection Agency (EPA) has a great deal of information/research available here.

At times, blue-green algae can reproduce very rapidly, creating a dense growth known as a bloom. A "harmful algal bloom," or HAB, refers to a dense growth of algae that has the potential for creating toxins or other nuisance compounds. Some species and strains of blue-green algae produce a variety of toxins, which in some cases are released from healthy cells, but in other cases are released only when they become stressed and/or die. It is still not fully understood why these compounds are produced – whether they are adaptations that benefit the organism, or whether they are merely by-products of some other important process. Cyanotoxins can have acute and chronic effects on liver, kidney, lungs, and nervous system, and there are no known antidotes. The cyanotoxin most commonly found in Kansas lakes is a family of compounds called microcystins, which primarily affects the liver.

Not all strains of a given species produce toxins, but a majority of the potentially harmful blue-green algae that have been seen in Kansas belong to one of three genus groups: *Microcystis*, *Aphanizomenon*, and *Dolichospermum* (formerly called *Anabaena*). These species become a problem when nutrients (phosphorus and nitrogen) are present in concentrations above what would occur naturally. Under these conditions, algae can "bloom," or grow very quickly to extreme numbers. Summer heat and calm, clear water can increase the likelihood of a bloom occurring, because blue-green algae are especially adapted to take advantage of such conditions. The water could be colored pea-green, blue, or blue-green, and a cyanobacterial bloom can look like a vivid paint spill or floating grass clippings.

The Kansas Department of Health and Environment (KDHE) HAB Response Program was established in 2010 with over 100 water bodies affected by HABs in the past 10 years. More information about the program which is complaint-based and only addresses blooms on public waters is available here. Managers of private waters are encouraged to perform a jar test and use private labs if they believe they are experiencing a bloom, more information is available here. Under the KDHE program, there are three levels of Advisories. A **Watch** is triggered by microcystin concentrations over 4ug/l or cyanobacterial density over 80,000 cells/ml, a **Warning** for microcystin over 8 ug/l or cyanobacterial density over 250,000 cells/ml, and **Hazard** for microcystins over 2,000 ug/l or cyanobacterial density over 10,000,000 cells/ml.

Current Problem:

Over the past three years, there has been a steady increase in Kansas lakes that have developed a HAB and had an advisory of some level: 2017-26 lakes, 2018-32 lakes and 2019-37 lakes, see Figure 1. Information provided by KDHE is likely leading to more vigilance and informed reporting, however the nutrients continue to accumulate in water bodies, providing the fuel for the possibility of increasing the number, severity, and duration of HABs. Additionally, long-term analyses have shown that blue-green algae blooms are increasing over time. For example, recent Kansas Biological Survey (KBS) reports have shown that blue-green algae have substantially increased in Marion, Milford, and Kanopolis lakes over time – with the most rapid increases over time occurring since ca. 2000. The cause for the strong increase since ca. 2000 is currently unknown, but shows that blooms are getting worse in some of the most visited lakes in Kansas. This information is available on the KBS website related to on-going HAB research.

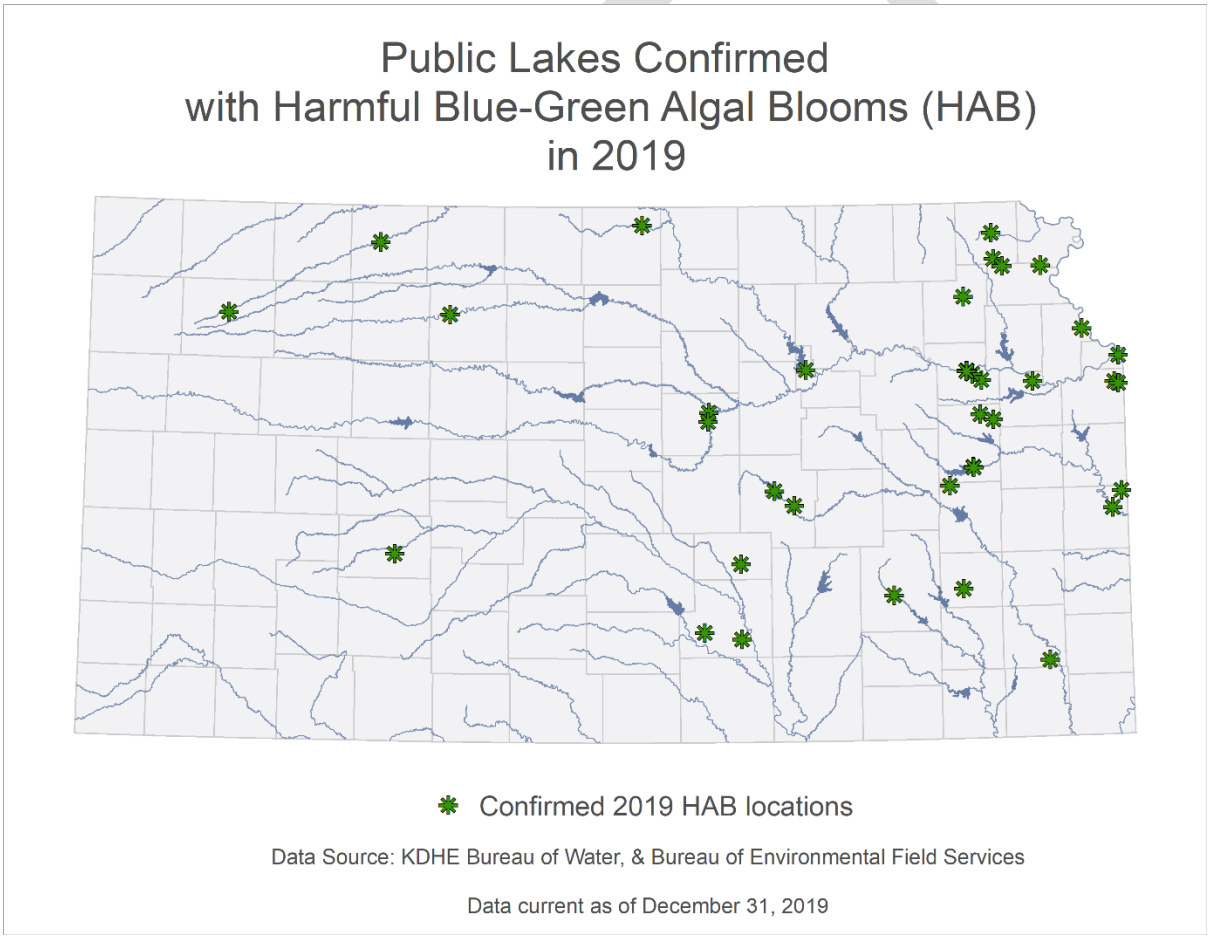

Figure 1.

Budget Needs:

The current budget needs include maintaining the KDHE HAB response program, improving outreach and education, evaluating if blooms are increasing and underlying causes of recent increases, evaluating

blooms in the context of long-term trends, improving prediction and detection methods using satellite imagery or in-lake high-frequency data collection, and improving monitoring and laboratory analysis technologies. Other funding needs include reducing watershed nutrient inputs through land management practices to remove or divert nutrients from vulnerable waterbodies. Several of these items are partially funded under the State Water Plan Fund (SWPF), ex.: Milford RCPP, Kansas Reservoir Protection Initiative, KDA programs, and KDHE programs. The Kansas River Water Quality study conducted by the USGS is an on-going partner driven study also partially funded with SWPF with study details located here. There are other HAB related research projects taking place within the state as well.

Regional Advisory Committee (RAC) Goals and Action Plans: (this section will be adjusted as the RAC Goals and Action Plans are finalized)

The Kansas RAC has Goal #5 -*After 2020, reduce duration and frequency of Harmful algal bloom disrupting recreation in lakes such that blooms last under a week and do not occur until after Labor Day.* While the specific nature of this goal may be infeasible to accomplish, the concepts of reducing the magnitude, duration and frequency of HABs and their effects on recreation and drinking water are still valid aspirations. The Action Plans to accomplish this were to provide more money for Best Management Practices (BMP's) in watersheds, limit nutrients through multiple programs, use of in-lake technologies to treat HABs, and coordinated water releases to reduce HABs. The Neosho RAC has Goal #3 – *Reduce frequency of algal blooms in Marion Reservoir to no more than every 3 years through 2035. Evaluate the role of water level fluctuations in remediating and reducing algal bloom frequency*. The Action Plans to accomplish this included the formation of a working group to provide information related to a reduction in blooms. With the revisiting of the RAC Goals other HAB related Goas may become part of the Kansas Water Plan. There are six other RACs that have sediment reduction or the use of BMP's to reduce sediment that would also help limit nutrient loading into streams and reservoirs.