



Virtual workshop series: Water quality and aquatic plant management

Natural Resources PFT

Kansas Center for Agricultural Resources and the
Environment (KCARE)



KCARE
Kansas Center for Agricultural
Resources and the Environment

K·STATE
Research and Extension

Water quality and aquatic plant management in ponds

- Offered as a Professional Development Event in PEARS for county extension agents

Kansas State University is committed to making its services, activities and programs accessible to all participants. If you have special requirements due to a physical, vision, or hearing disability, contact Melissa Harvey, 785-477-4540.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service
K-State Research and Extension is an equal opportunity provider and employer.

Today's format

- If you haven't already, **please mute** your microphones.
- Speakers will present for 30-40 minutes
- Panelists will join the discussion at the end
- Please ask questions through the **chat** function (located at the lower part of your screen).
- Although our “end time” is posted for 9:30 a.m., participants are welcome to remain longer if they want to discuss the topic further.
- Please take a moment to participate in the survey.





Water quality and aquatic plant management in ponds

Blue-green algae and its dangers to livestock and pets

Tuesday, June 23

Speakers



Steve Ensley
K-State College of
Veterinary Medicine



Scott Fritz
K-State Veterinary
Diagnostic Laboratory



Jody Holthaus
Extension Agent,
Meadowlark District



Elizabeth Smith
KDHE, Bureau of
Water

Panelists

Will Boyer, KCARE Watershed Specialist

Jeff Davidson, KCARE Watershed Specialist



Harmful Algal Blooms in Kansas - an Introduction

K-state Extension • 23 June 2020

Overview

- Harmful Algal Blooms
 - What are blue-green algae?
 - What are the risks?
 - How can we control them?
- KDHE and HABs
 - Response program
 - Public water supplies
 - Health reporting
 - Research and mitigation

WARNING

Harmful Algae Expected or Present

People and animals may get sick



**No Water Contact,
Swimming, Wading**



**No Skiling or
Jet Skis**



**No Pets or
Livestock**

- Don't let people/pets eat dried algae or drink untreated lake water
- Clean fish well and discard guts
- If people/pets contact lake water: wash with clean, potable water as soon as possible
- Avoid areas of visible algae accumulation

In case of harmful algae contact, call doctor/veterinarian if people/animals have nausea, vomiting, diarrhea, rash, irritated eyes, seizures, breathing problems or other unexplained illness

Report new algae blooms to Kansas Department of Health and Environment at <http://www.kdheks.gov/algae-illness/> or by calling **785-296-5606**

Report possible algae-bloom illness Call Local Health Department in Kansas:



For more information: Scan this code or visit kdheks.gov/algae-illness

Kansas Department of Health and Environment, 1000 SW Jackson, Topeka, Kansas 66612, 785-296-1500 www.kdheks.gov

Advisory signage developed by KDHE

“Algae” is a functional category

Diverse group of “proto-plants” ranging from giant seaweeds to tiny plankton (many are single-celled)



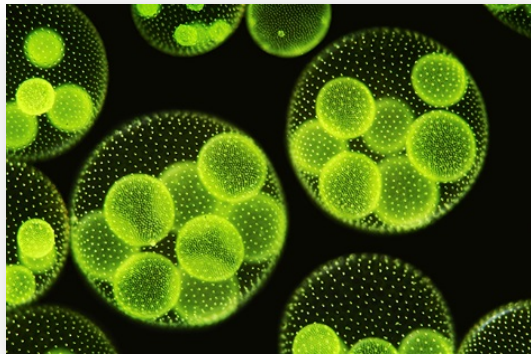
Contain chlorophyll and other pigments but lack stems, roots, leaves, and vascular tissue



Produce oxygen through photosynthesis



Foundation of marine and freshwater food web



What are Blue-Green Algae?

- Not closely related to other algae
- Gram-negative bacteria:
Cyanobacteria
- Photosynthetic pigment
phycocyanin works with
chlorophyll to capture light
- Most form colonies or clumps
- Many can regulate buoyancy
- Some species can produce **toxins**
- Comprise most *harmful* freshwater
blooms



Blue-Green
Algae Present



Lakewood Lake, 2018

Cyanobacteria of most concern in KS: Dolly, Fanny, Mike



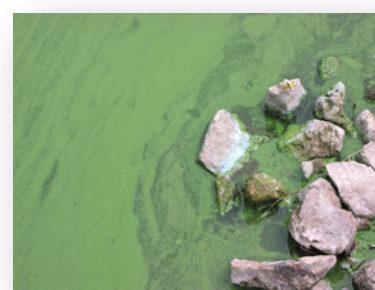
Dolichospermum
(was *Anabaena*) *



Aphanizomenon *



Microcystis



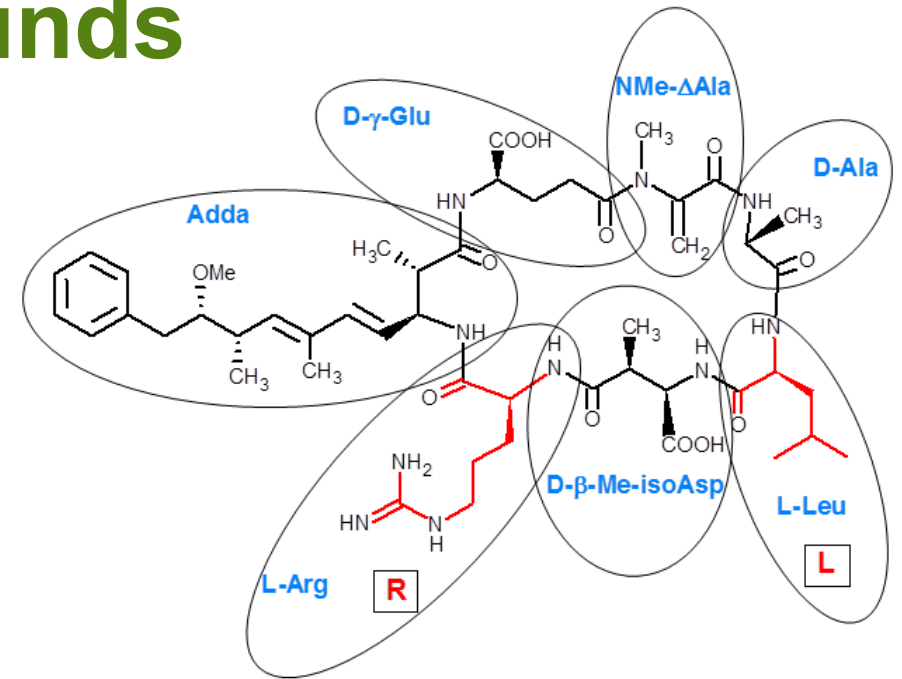
Cylandrospermopsis *



* many can fix atmospheric nitrogen

Cyanotoxins and other compounds

- Many toxins can be produced by many species
 - No 1:1 relationship
 - Not all strains produce toxins, and rates vary
- Diverse chemicals, multiple modes of toxicity
 - Nerve toxins, e.g. anatoxin-a
 - Liver/kidney toxins, e.g. microcystins
 - Skin and respiratory irritants, even from cell walls
- Both acute and chronic effects possible
- **No known antidotes**
- Other compounds such as geosmin and 2MIB, while not toxic, can affect water taste/odor



Microcystin-LR chemical structure.

Microcystins are the most common cyanotoxins in Kansas lakes.

Challenges in monitoring and managing

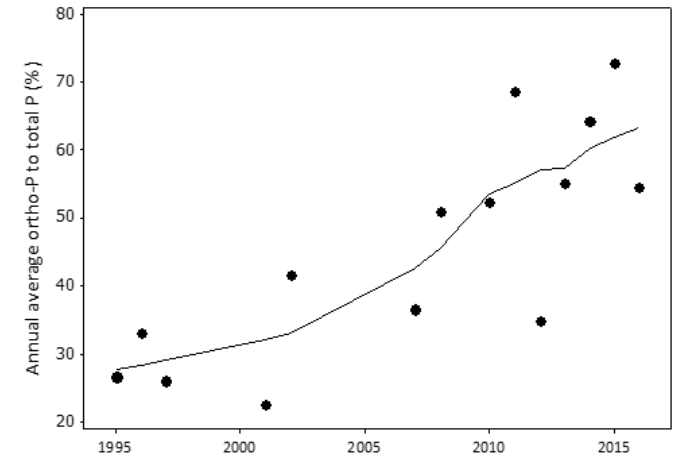
- Blooms may develop very rapidly
- Favored by warm, still, clear water
- Moved by wind & waves; buoyant
- Specialized cells survive freezing & drying
- Microscope ID of algae can tell what toxins *might* be produced, but lab testing required to determine if any are present
- Killing cyanobacteria can release toxins
- Climate changes may exacerbate blooms
- *Reducing nutrients is a complex, long term endeavor*



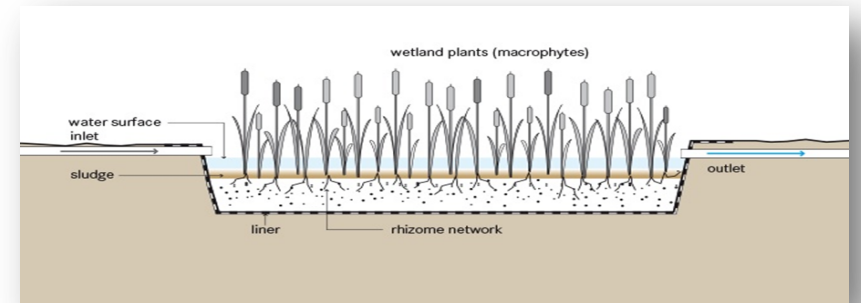
How can we control them?

- Prevent nutrients from entering water body
 - Reduce nutrient input from watershed
 - ‘Treatment train’ or retention wetland
 - *Complex, slow – but an ounce of prevention counts in the TMDL!*
- Remove or bind nutrients already in water body
 - Macrophytes, floating wetlands
 - Dredging, phoslock/alum, etc.
 - *Very expensive + bailing a leaky boat?*

Ortho-P increase in Milford Lake



Unknown for Years: 2000 (Ortho-P <0.020); and, 2003, 2004, 2005, 2006, 2009 (Ortho-P <0.250)

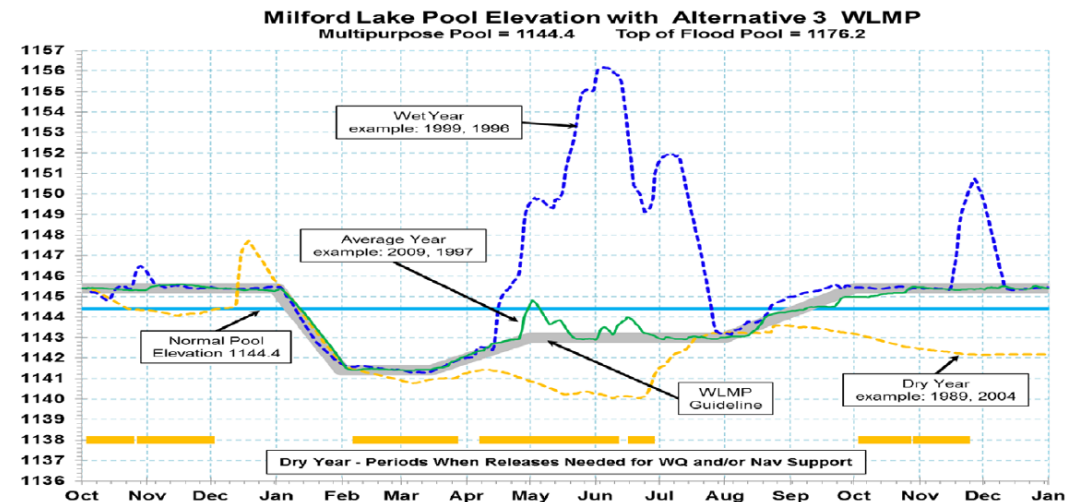


Tilley, E.; Luethi, C.; Morel, A.; Zurbrugg, C.; Schertenleib, R. (2008): Compendium of Sanitation Systems and Technologies. Duebendorf, Switzerland: Swiss Federal Institute of Aquatic Science and Technology (EAWAG) and Water Supply and Sanitation Collaborative Council (WSSCC).

How can we control them, cont'd?

- Discourage growth
 - Manage water level, habitat, mixing/flow
 - Bacteriostatic compounds?
 - *Options depend on water body characteristics*
- Kill algae
 - Many algaecides can cause collateral damage (e.g., copper)
 - Peroxide is targeted but expensive
 - *Blooms return if underlying problem remains*

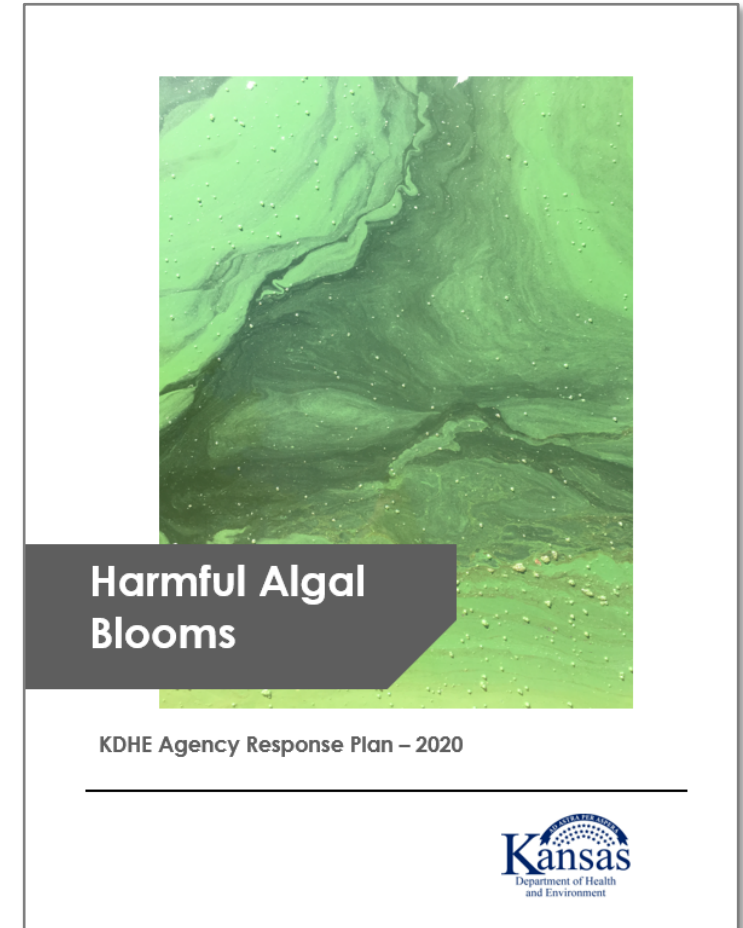
Lake Level Management Plan



Kansas HAB Response Program

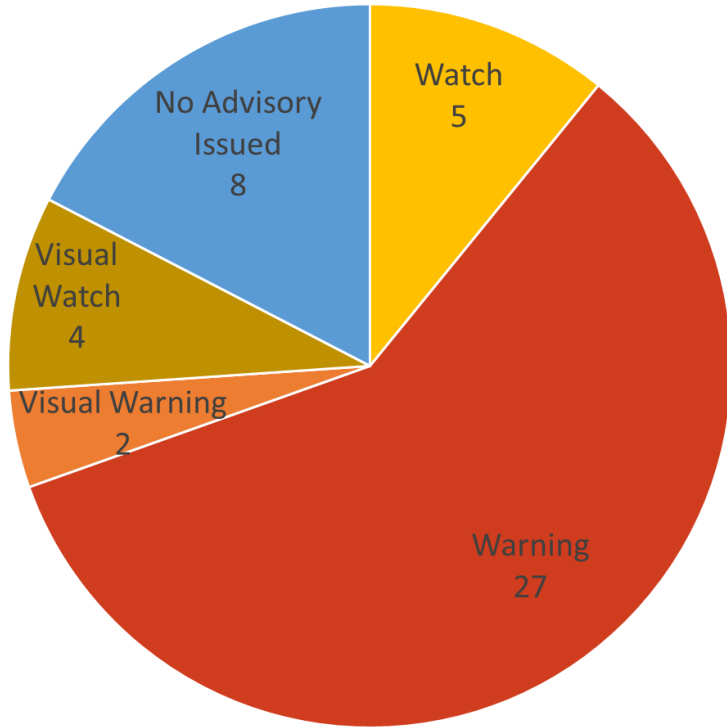
- Est'd in 2010, uses existing staff and resources
- Complaint-based response program
- Public lakes only (govt agency, public access, or PWS)
- Focus on recreational exposure, April 1–October 31
- Thresholds based on cell counts and microcystin conc.
- Details & reporting at www.kdheks.gov/algae-illness

ADVISORY LEVEL	MICROCYSTIN (ug/L)		CYANO CELL DENSITY (cells/mL)		DOCU. VISUAL CONDITION
NONE	< 4.0	AND	< 80,000		
WATCH	> 4.0	OR	> 80,000	OR	Confirmed bloom
WARNING	> 8.0	OR	> 250,000	OR	Sig. surface scum
HAZARD	> 2,000	OR	> 10 million		



The 2020 HAB Response Plan (cover)

2019 Lakes Tested for HABs
Highest Advisory Level Shown

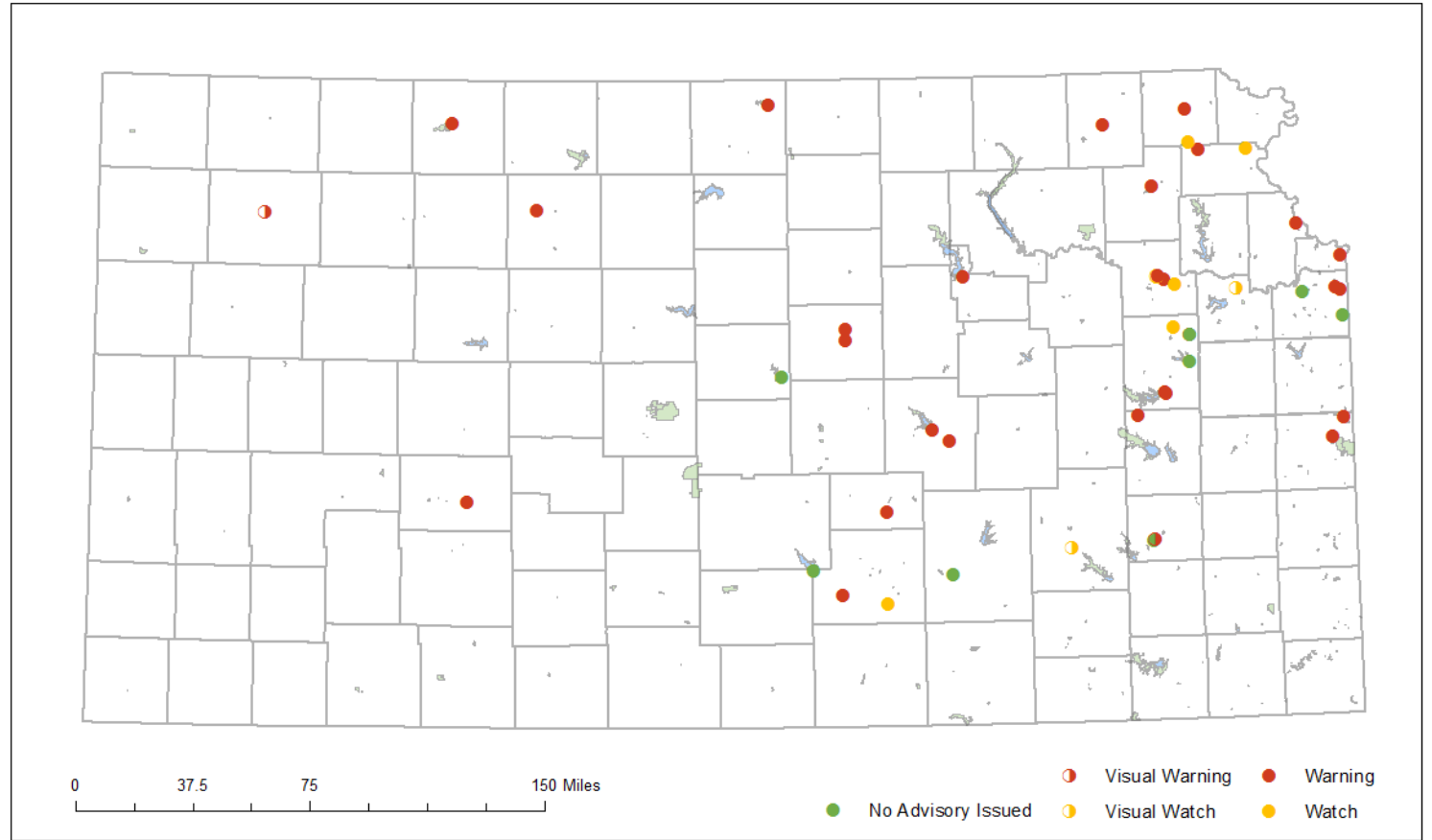


38 lakes affected

257 samples taken from 167 sampling events

- 172 cell count analyses
- 257 toxin analyses

Response Program: 2019 Advisories



Public Water Supply

- Drinking water thresholds much lower than recreational
- In 2019, KDHE Public Water Supply established voluntary monitoring program for water systems
 - Over 1/3 of surface water systems participate, weekly direct testing through KDHE labs
- PWS lakes are still high priority for Response Program



EPA 2019 Swimming Advisory Levels for Recreational Water

Microcystins	Cylindrospermopsin
8 ug/L	15 ug/L

EPA 2015 Health Advisory Levels for Finished Drinking Water

Age (yrs)	Microcystins	Cylindrospermopsin
Under 6	0.3 ug/L	0.7 ug/L
6 and up	1.6 ug/L	3.0 ug/L

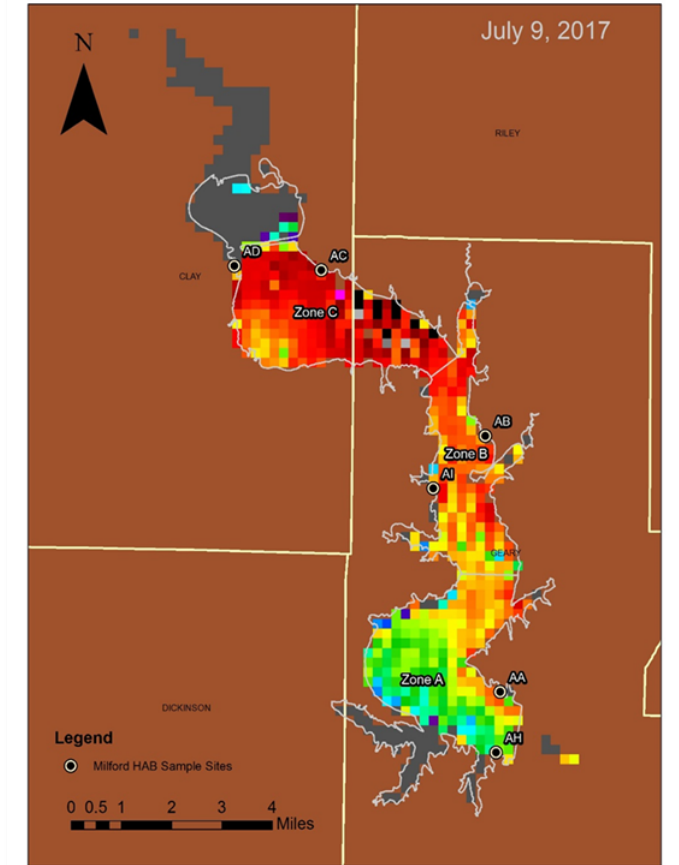
Human and Animal Health

- KDHE Public Health investigates complaints of suspected animal and human HAB illness (public and private wb)
 - Hotline & web reporting form
 - Protected Health Information if human
- Response Program collects environmental data to support investigations on public waterbodies
- Classified as Suspect, Probable, Confirmed, or not a case
 - Reported to US CDC OneHealth system
 - Allows tracking of emerging issues statewide
- 2019: 7 complaints yielded 3 probable cases
 - 2 human, 1 dog
- 2015-2018: 17 cases from 34 complaints



Collaboration and Research

- Confirm bloom complaints (Federal, State, Local agencies)
- Manage water levels at Milford: Spring drawdown to prevent summer blooms (KWO, USACE, KDWP)
- Improve monitoring and detection methods
 - Ground truth CyAN satellite imagery (USEPA, USGS)
 - Calibrate FlowCam automated microscopy (USEPA)
 - Investigate utility of qPCR for detection of toxin producing genes (USEPA and others)
- Understand the extent and nature of cyano blooms
- Explore prevention and treatment options



Satellite image of Milford Reservoir from CyAN, a multi-agency project of NASA, NOAA, USGS, and EPA

Mitigation Research

- Some funds provided by legislature
 - Ultimate focus is for larger public reservoirs with persistent issues
 - Pilot on smaller waterbodies
- Two large contracts underway
 - Peroxide algaecide treatment of Milford and Marion
 - Study of Marion to understand internal nutrient dynamics and determine feasibility of P-binding
- Smaller collaborative partner projects
 - Barley straw project



- *Bloom at Marion Reservoir, 2019*
- *Applying peroxide at Milford Gathering Pond, 2019*
- *Installing barley straw at Melvern Swim Pond, 2020*

Mitigation – Lessons To Date

- Mother nature is unpredictable, so we must be flexible
- All efforts and findings must be framed in watershed and weather context (e.g., 2019 flooding)
- Peroxide treatments may be effective but are unlikely to be “one and done”
- Difficult to anticipate long term costs
- Smaller water bodies are a good option for efficacy and safety studies



Marion Reservoir Picnic Area, June 2019



Big Eleven Lake in Wyandotte Co., June 2019

Questions?

Elizabeth.Smith@ks.gov

785-296-4332

KDHE.HABS@ks.gov

www.kdheks.gov/algae-illness

Extension Agent Online Training

KSVDL Update

Steve Ensley DVM PhD

Scott Fritz DVM



KANSAS STATE
Veterinary Diagnostic Laboratory

KSVDL Mission

- The mission of the Kansas State Veterinary Diagnostic Laboratory (KSVDL) is to develop and deliver accurate, innovative, and timely diagnostic and consultative services to the veterinary and animal health community in Kansas and the nation.
- In addition, the KSVDL provides an excellent environment of support for the teaching and research responsibilities of the Department of Diagnostic Medicine/Pathobiology, the College of Veterinary Medicine and Kansas State University.



Who we serve

- Some of our submissions are routine water monitoring for HOAs, Golf courses, private ponds, and animal water sources
- Other submissions are from veterinarians who are considering BG Algae as a potential diagnosis for cases they are working up
- The goal of this presentation is to outline what samples we need and the methods we use to reach a diagnosis



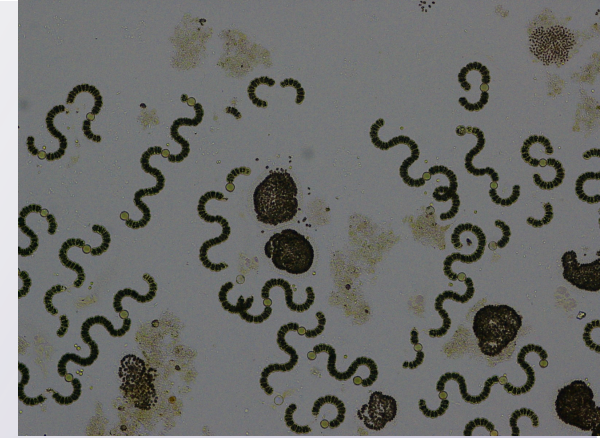
Who we are

- We are part of a team of veterinary diagnosticians who also hold teaching appointments within the veterinary school and the department of Diagnostic Medicine/Pathobiology at KSU
- Our primary objective is to assist field veterinarians in diagnosing causes of animal disease and death
- Most laboratories in KSVDL focus on infectious disease, our lab's focus is on deaths associated with poisonings – including blue-green algae



Tests Offered

- Microscopy - \$22.50
 - Look at the water sample under a microscope
 - Determines if potentially toxic species are present
- ELISA - \$150
 - Quantifies microcystin concentration in water
 - Same system most state departments use
- MBIO toxin detection system - \$100
 - New and faster system
 - Simultaneously quantifies microcystin and cylindrospermopsin in water
- LC/MS/MS – Currently under development
 - Specialized method to detect anatoxin-a



Testing

- Most of the testing we do is monitoring
 - HOAs are common
 - Producers see the water looks bad so they test it
- Simple microscopy first
- One of the commercial kits if the algae are present
 - Not all will go for toxin quantification but will simply avoid the water



Blue-Green Algae

- One of the few causes of “acute death” in cattle (especially mature cows) on pasture
 - Alive yesterday, dead today
- Hepatotoxins and Neurotoxins
 - Hepatotoxins more common
- Clinical signs are often not observed so we don’t get much information to go on
 - Have to rule out other potential causes
 - Usually rely on other supportive diagnostics
 - Diagnosis of exclusion



Ideal samples

- Hepatotoxins

- In cases of suspected intoxications ideal samples include:

- Water sample – preferably from the downwind side and refrigerated
 - See the algae under the microscope and detect toxin in water
 - Rumen/stomach contents – refrigerated
 - Microscopy and potentially toxin quantification
 - Liver – fresh and fixed in formalin
 - Microscopic lesions



Ideal Samples

- Neurotoxins
 - These cases are tough in that the toxin is so potent that the animal often will not live long enough to develop histopathological lesions
 - Presumptive diagnoses are made if we can prove exposure and confirmed if we can prove consumption
 - Water – microscopy, potentially LC/MS/MS
 - Rumen/stomach content – microscopy, LC/MS/MS
 - There are no lesions associated with the neurotoxins



Testing Obstacles

- Dynamic pond conditions and delayed sampling
- Usually an afterthought – inappropriate samples
- No great methods for tissue matrices
- No great commercial kits for anatoxin-a
- Analytical methods are expensive



Common questions

- When can I turn cattle back in?
- Can I treat the water? How?
- Will I get it again?
- How do I prevent it?
- Do I need to keep sampling all summer?



KSVDL YouTube Channel



KANSAS STATE
Veterinary Diagnostic Laboratory

KSVDL YouTube Channel

- https://www.youtube.com/watch?v=wOogJtDNUfQ&list=PLNjV05pK4JEVLnizQ_jEiqLN1eYdpJtdq&index=5



Thanks!



KANSAS STATE
Veterinary Diagnostic Laboratory

BLUE-GREEN ALGAE POND PROJECT

Cooperating with KDHE-Bureau of Water

KSU Vet Diagnostic Lab

KSRE Water Quality Specialists

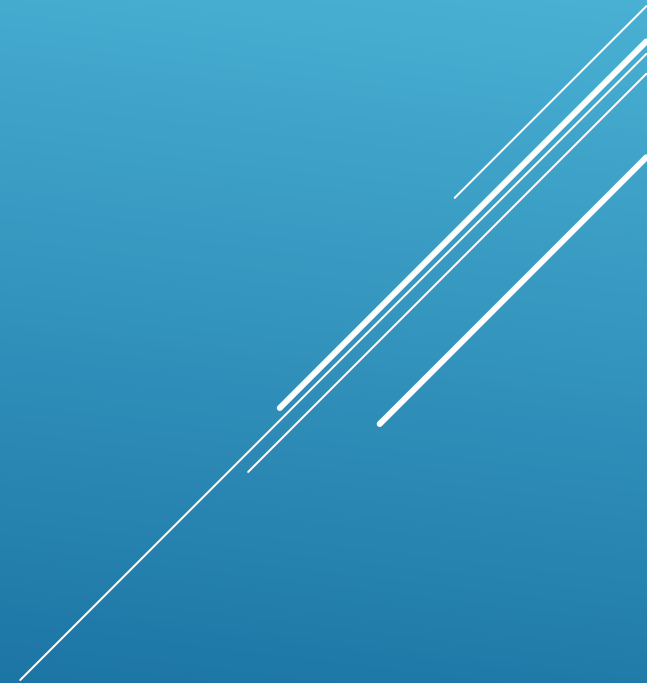
Meadowlark Extension District

KDHE- HAB MITIGATION PILOT PROJECT

WORKING WITH PUBLIC WATER-SHAWNEE COUNTY

CORPS OF ENGINEERS- MELVERN LAKE SWIM POND

KSRE-KSVDL-WQS





BARLEY STRAW LOCATED!

Barley straw was acquired from Simon Sheep Farm Quinter Kansas. They delivered two flatbed trailers To Eastern Kansas for the project.



LOCATED PONDS WITH PREVIOUS BLUE/GREEN ALGAE

Dosing rate 7 bales/acre of water

Staked down around the edge of pond

At least 20 feet apart

At least half submerged



KDHE BASELINE WATER TESTING

Water will be retested every month for:

Nutrient Profile

Toxins-Microcystins, Nodularins, Cylindraspermospsin
and Anatoxin-a

Total Chlorophyll and Algal taxonomy



BALES INSTALLED PRIOR TO BLOOM

Spaced about 20 feet apart

Using two stakes

$\frac{1}{2}$ to $\frac{2}{3}$ of the bale in the water

Prior to bloom season: prevention, not intervention



WHAT WILL HAPPEN?

Bales will decompose and release polyphenols and other chemicals

These compounds will not kill existing blooms, but they can suppress growth

Factors affecting success: water turnover (dilution), algal species present, other factors – we will find out!



ABOUT THE PONDS

Ponds ranged from $\frac{1}{2}$ acre to 3 acres

Management on all the ponds differed

Ponds used for recreation and/or livestock water

Three sites have a control pond to compare to

Ponds located in Jackson, Jefferson, Nemaha, Shawnee and Greenwood County-8 ponds in total

Good complement to the ponds/lakes chosen by other partners (larger and/or urban water bodies)



MANY THANKS TO THE CREW!

Elizabeth Smith

Will Boyer

William Blair

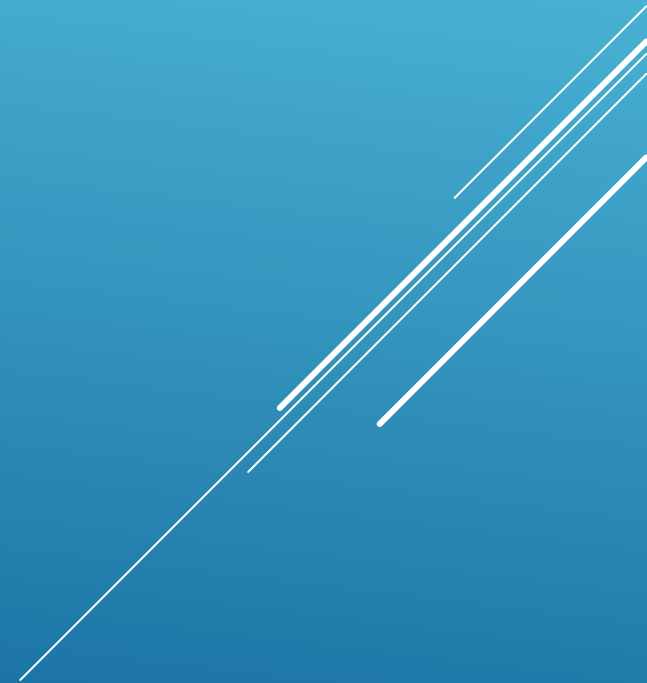
Jeff Davidson

Patrick Olson

Pond Owners

Dr Steve Ensley

Dr Scott Fritz





2020



06/08/2020



06/01/20



Kansas Center for Agricultural Resources and the Environment (KCARE)

- KCARE Home
- Meet Our Team
- Watershed Research and Implementation Partnership (WRIP)
- Kansas Water Resources Institute (KWRI)
- Irrigation and Ogallala Research
- Fertilizer Research
- Prescribed Burning and Smoke Management
- Great Plains Grazing
- Funding Opportunities
- Training Opportunities**
- Livestock Overview
- Publications
- News and Information
- Links



Kansas State University
44 Waters Hall
Manhattan KS 66506
(785) 532-0393

Theme 2: Water quality and aquatic plant management in ponds

Exclusively for county agents, this workshop series will provide overviews on a variety of key issues related to livestock pond management. There are three sessions included in this series: topics include aquatic plants and vegetation control in ponds; sources of water contamination and monitoring methods; and issues associated with blue-green algae and prevention strategies in livestock ponds, with examples from ongoing projects.

Using an online format, experts will provide a live, 40-minute presentation followed by a discussion forum with a panel that will include county agents, extension specialists or watershed specialists. Participants will be able to ask questions and follow up with both presenters and panelists. At the end of the training, participants will be able to access digital online documents that include the slides, extension publications, and other materials relevant to each topic.

These series are offered as Professional Development Event by Natural Resources PFT and the Kansas Center for Agricultural Resources and the Environment (KCARE). Interested participants can [contact KCARE](#) for more information about accessing the training sessions via Zoom.

Please visit the links in the right-hand menu of this page to access videos, presentations and resource materials for **Theme 1 training sessions**. An [overview of Theme 1](#) (Water quality impacts of livestock operations and grazing management) is also available.



Day 3: Tuesday, June 23, 2020

8:30-9:30 a.m.

Blue-green algae and its dangers to livestock and pets

Presenters: Steve Ensley, College of Veterinary Medicine, Kansas State University; Scott Fritz, Kansas State University Veterinary Diagnostic Laboratory; Jody Holthaus, Extension Agent, Meadowlark District; and Elizabeth Smith, KDHE Bureau of Water

Theme 1: Water quality impacts of livestock operations and grazing management

[Day 1: Confined Feeding Sites: Helping producers with site selection and planning](#)

[Day 2: Non-confined Feeding Sites: Assisting producers with site selection and planning](#)

[Day 3: Increase Your Water IQ and Extending the Grazing Season](#)

[Day 4: Livestock Watering Systems](#)

[Day 5: Electric Fencing Systems](#)

Theme 2: Water quality and aquatic plant management in ponds

[Day 1: Aquatic plant management in ponds](#)

[Day 2: Water contaminants affecting cattle health](#)

[Day 3: Blue-green algae and its dangers to livestock and pets](#)

WANT TO
REVISIT ANY
TOPICS
FROM THIS
TRAINING?

THANK YOU FOR BEING HERE!

We want to continue to provide quality training experiences to benefit you. To help us improve, we will be following up with each of you in the coming days to ask for your feedback on this training event.

Please join us for future KCARE/Natural Resources PFT training events.



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