Volunteer Monitoring: Lake Monitoring

Tony Thorpe and Mary Skopec
National Water Quality Monitoring Council
Webinar Series

Agenda:

- NWQMC & VM Workgroup
- Lake Monitoring
  - Missouri
  - Iowa
- Q & A

Introductions

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The Lakes of Missouri Volunteer Program

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LAKES of MISSOURI VOLUNTEER PROGRAM

University of Missouri
The Missouri Department of Natural Resources
Missouri Department of Health and Senior Services

Region V11, US Environmental Protection Agency, through the Missouri Department of Natural Resources, has provided partial funding for this project under Section 319 of the Clean Water Act

Lake Monitoring vs. Stream Monitoring

- More solitary experience
- Boats are expensive
- No invert monitoring on lakes, primarily chemistry
- Less variability in lakes

LAKES of MISSOURI VOLUNTEER PROGRAM

Lakes of Missouri Volunteer Program

- Housed at the University of Missouri
- Designed to augment our in-house summer monitoring
- Spring, Summer and Fall monitoring
- Small ponds to 22,000+ hectare reservoirs
- Involves citizens scientists

Why use volunteers to monitor lakes?

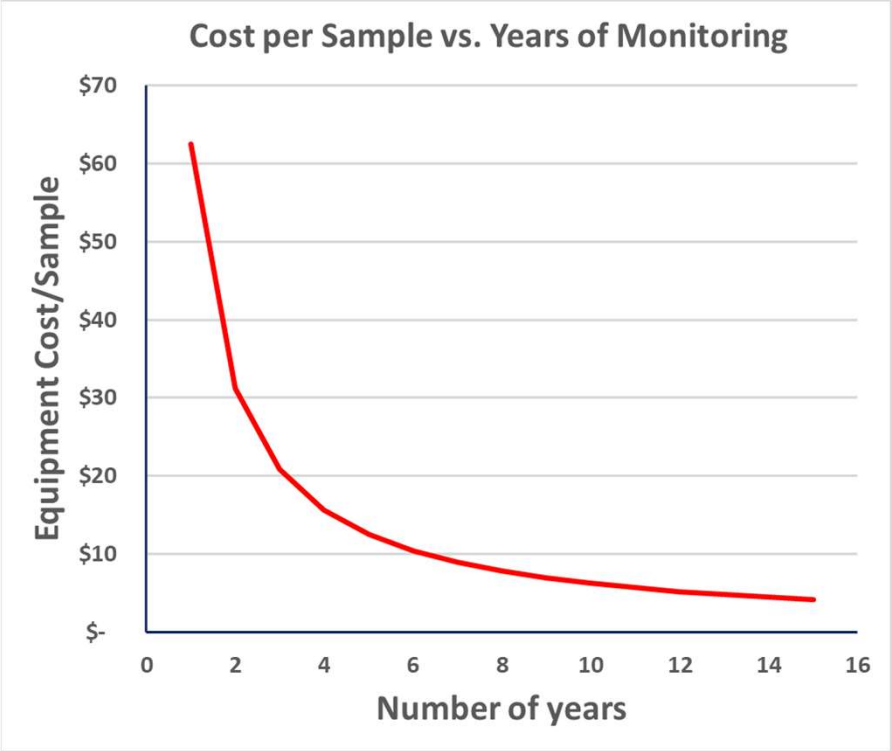
Why not just send out more field staff?

- Cost:benefit/sample
- Location near lake (eyes/ears argument)
- Volunteers are intended to augment, not replace field staff

LAKES of MISSOURI VOLUNTEER PROGRAM

Cost of volunteer monitoring

- Per-sample cost decreases with long-term volunteer involvement
- Time invested is well spent to increase retention
- On average, volunteers contributed $99 per sample collected in 2017



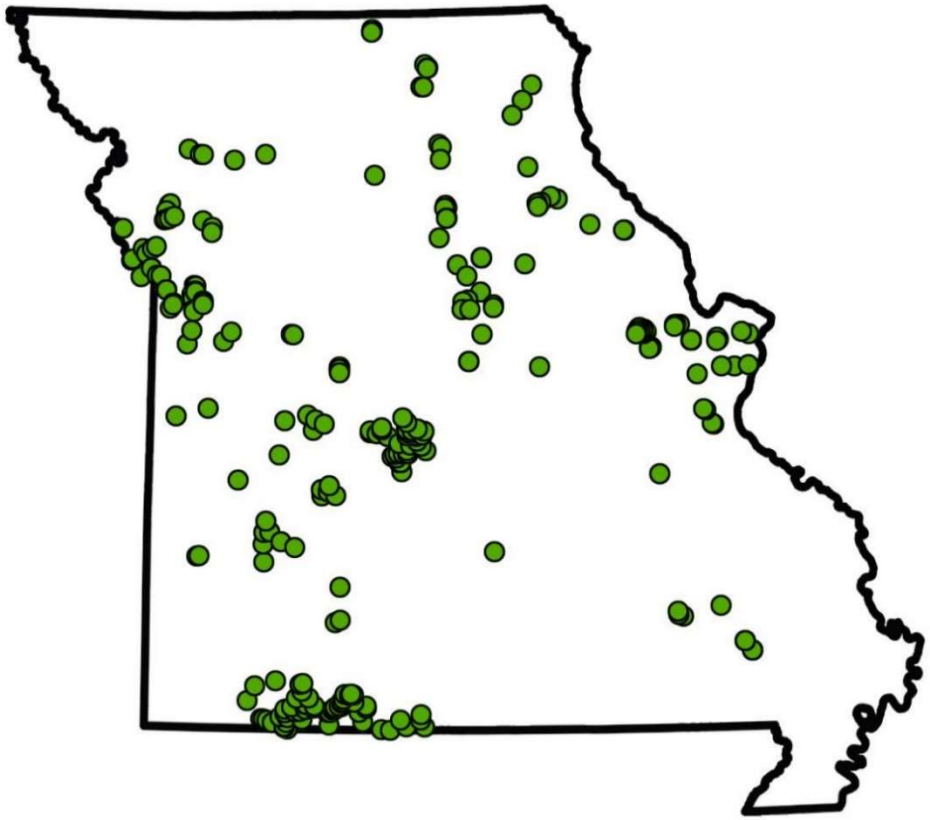
The typical LMVP volunteer

- Most live in rural or semi-rural areas
- Just over half live on a lake
- Many are retired
- Visit or spend time on lakes 161 days per year
- Word of mouth is our biggest recruiting tool

LAKES of MISSOURI VOLUNTEER PROGRAM

LMVP Sample Sites 1992-2017

- 285 sites monitored
- 125 lakes monitored
- In 2017: 115 sites on 63 lakes



Multiple Sites on Large Reservoirs

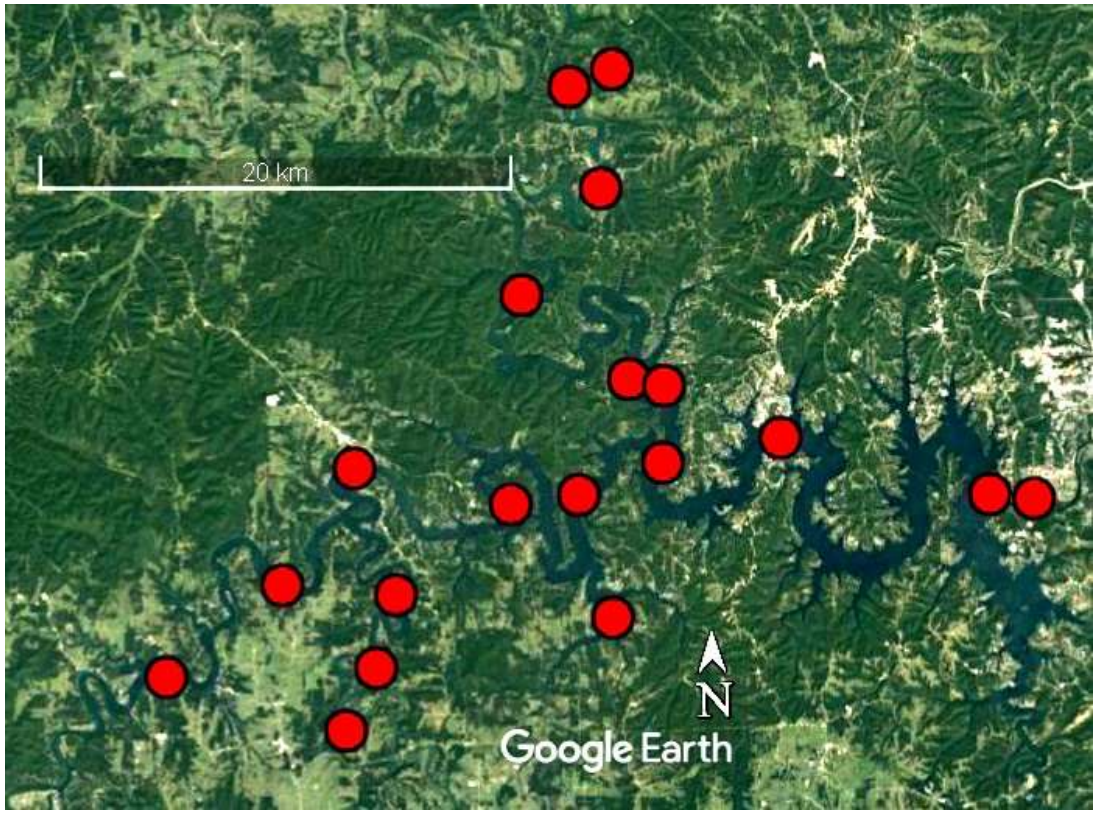


Table Rock Lake monitoring sites, 2017

How The Program Works

Candi and Lee – 27 years!

Volunteer Training

- One-on-one
- High investment in volunteer (equipment cost and staff time)
- Collect first sample together
- Establishes relationship
- Low turnover: typical volunteer has monitored for over 8 years.

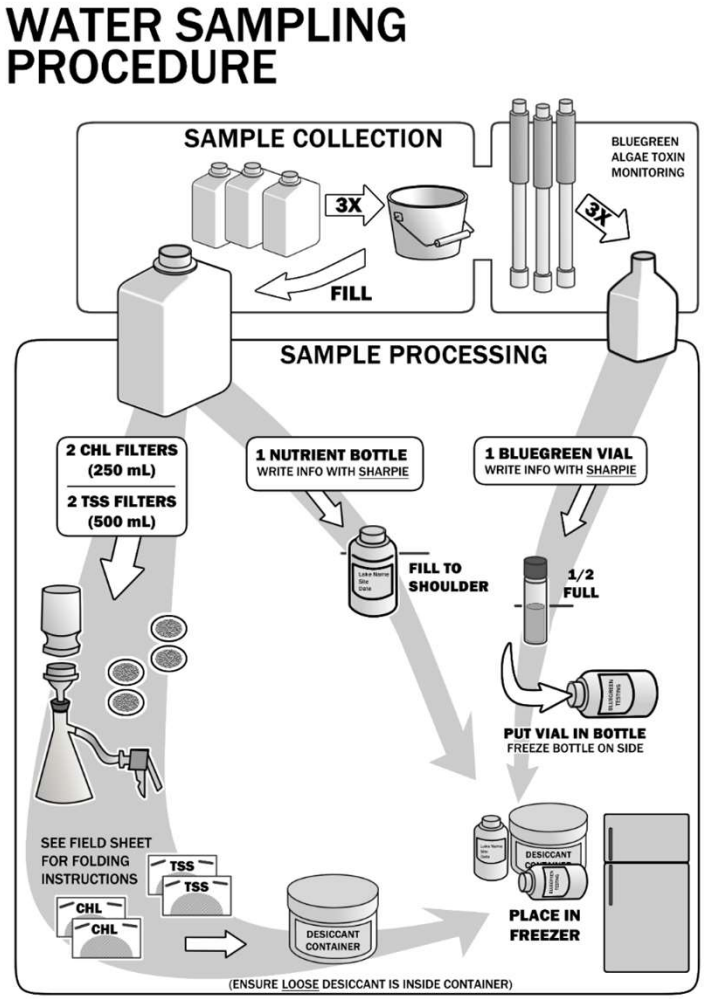
LAKES of MISSOURI VOLUNTEER PROGRAM

Monitoring

- 8 times per season
  (late April through mid September)
- Typically from boat near the dam
- Some reservoirs have multiple sampling sites

Sample Processing

- Takes less than an hour per sample
- Usually at home
- Processed samples are stored frozen



Sample Pickups – Twice per season

- July and October
- Large time investment
- Opportunities to interact with volunteers in person
- Helps with volunteer retention

Laboratory analyses

- High quality data
- Lower detection limits than streamside kits

What do we measure?

Parameters

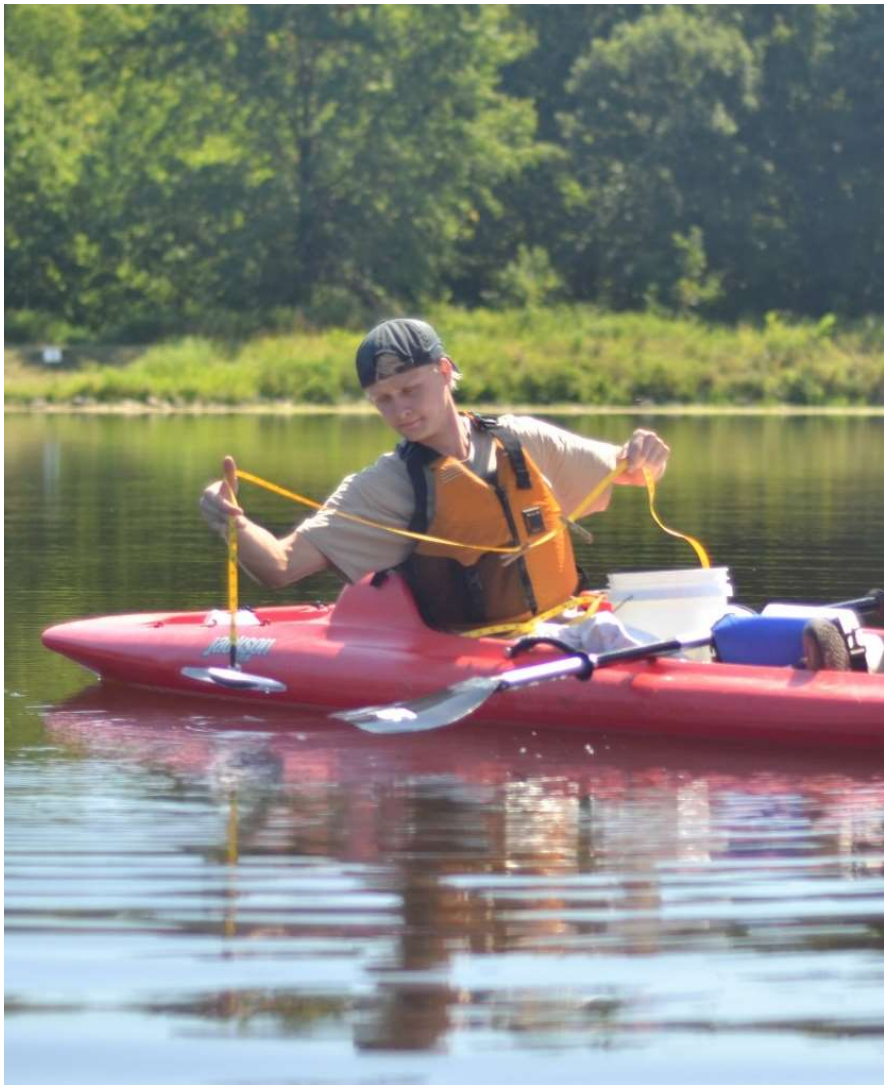
- Surface temperature
- Secchi
- Temperature/depth profiles (slow rollout)

- Nutrients: total phosphorus, total nitrogen
- Chlorophyll
- Suspended solids
- Algal toxins: microcystin, cylindrospermopsin (slow rollout)

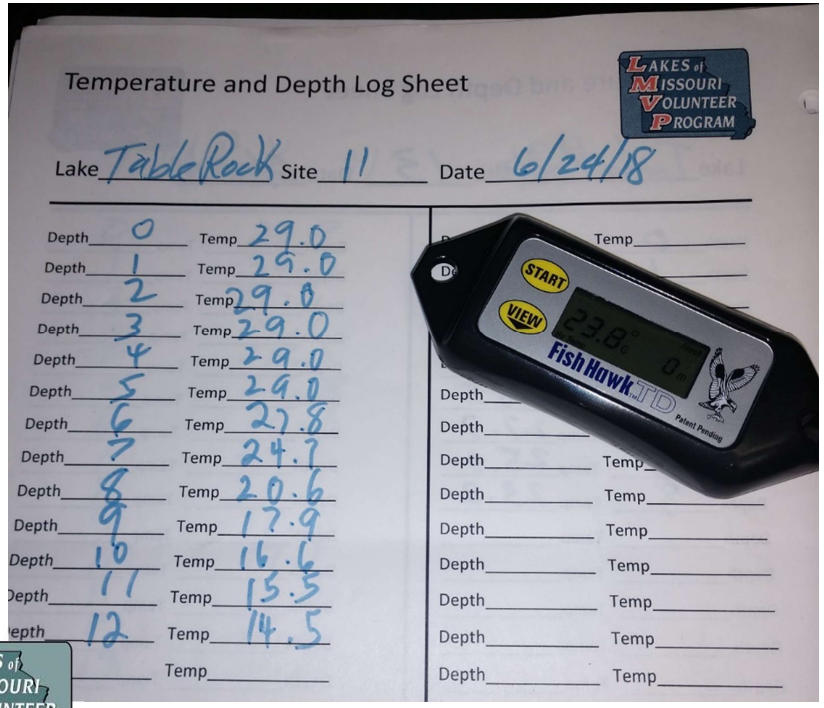
Secchi Transparency

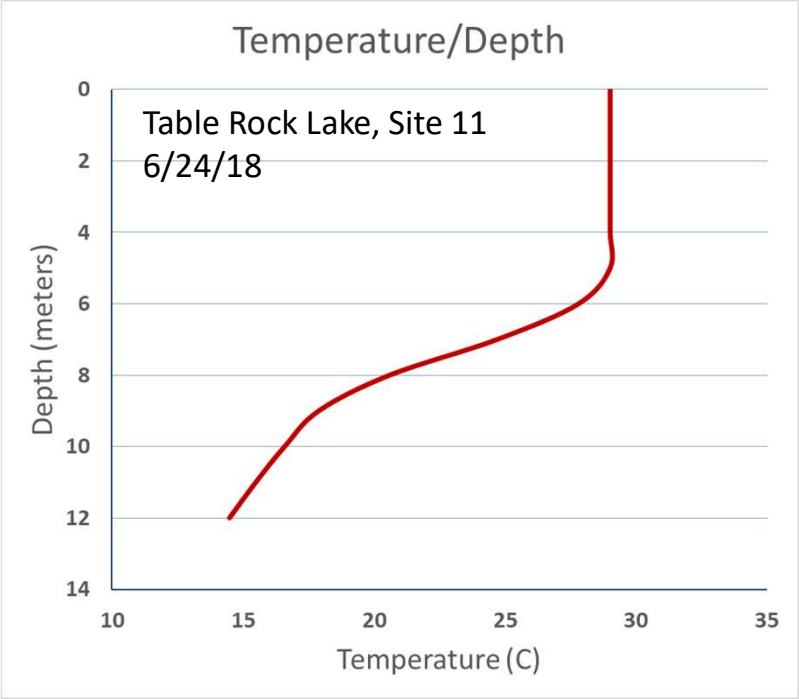
- A measure of water clarity

Happy 200th Birthday, Fr. Secchi!



Temperature/Depth Profiles





Nutrients

- Total Nitrogen
- Total Phosphorus

Chlorophyll

- An estimate of planktonic algal biomass

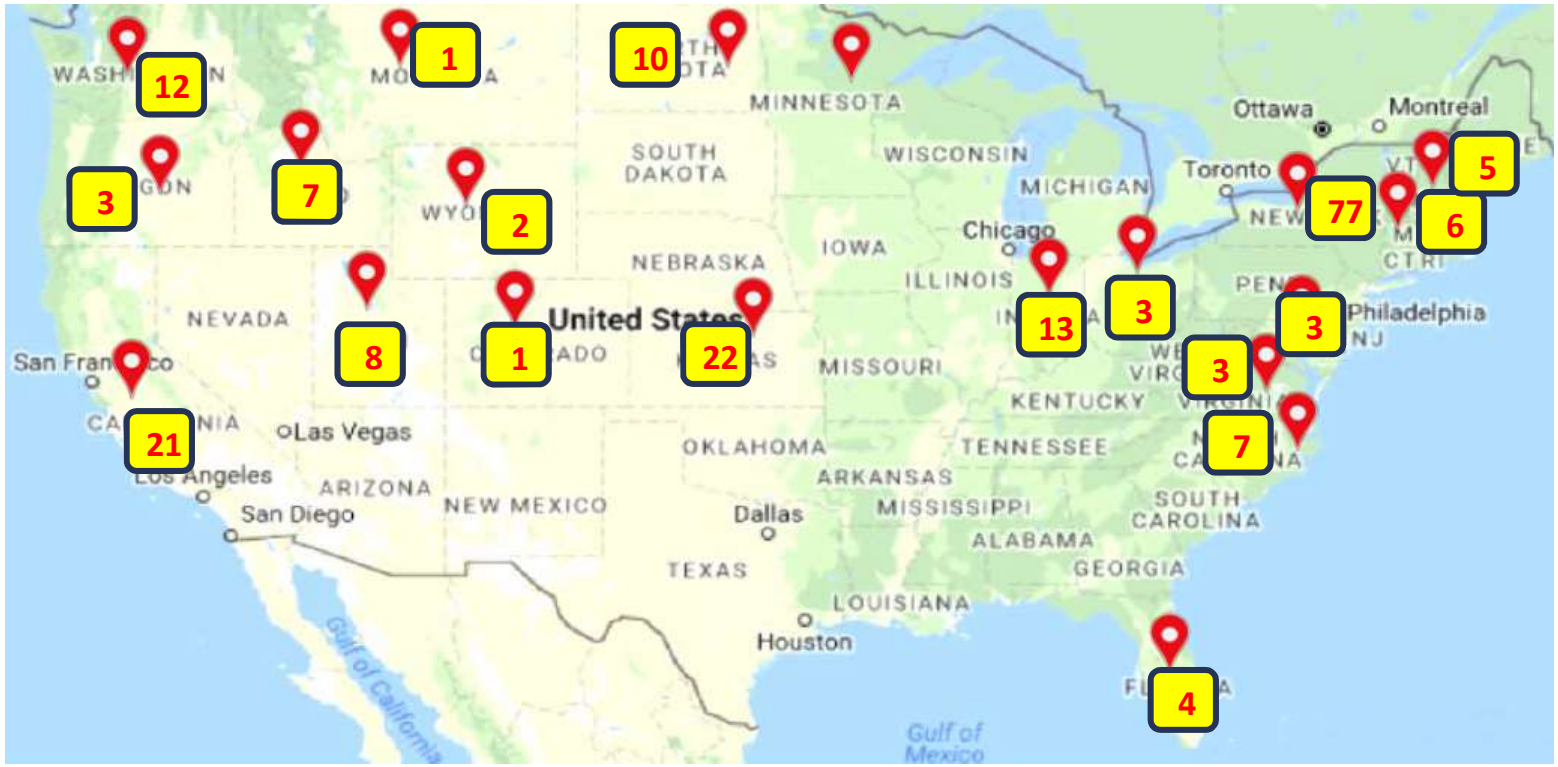
Suspended Solids

- Particulate Inorganic Matter (Nonvolatile Suspended Solids)
- A measure of (primarily) sediment materials in the water

Algal Toxin Monitoring

- Microcystin
- Cylindrospermopsin

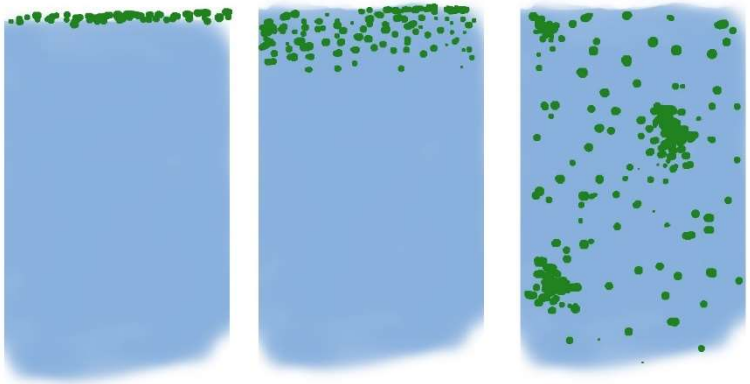
USA HABS: September, 2018 (non-comprehensive list)



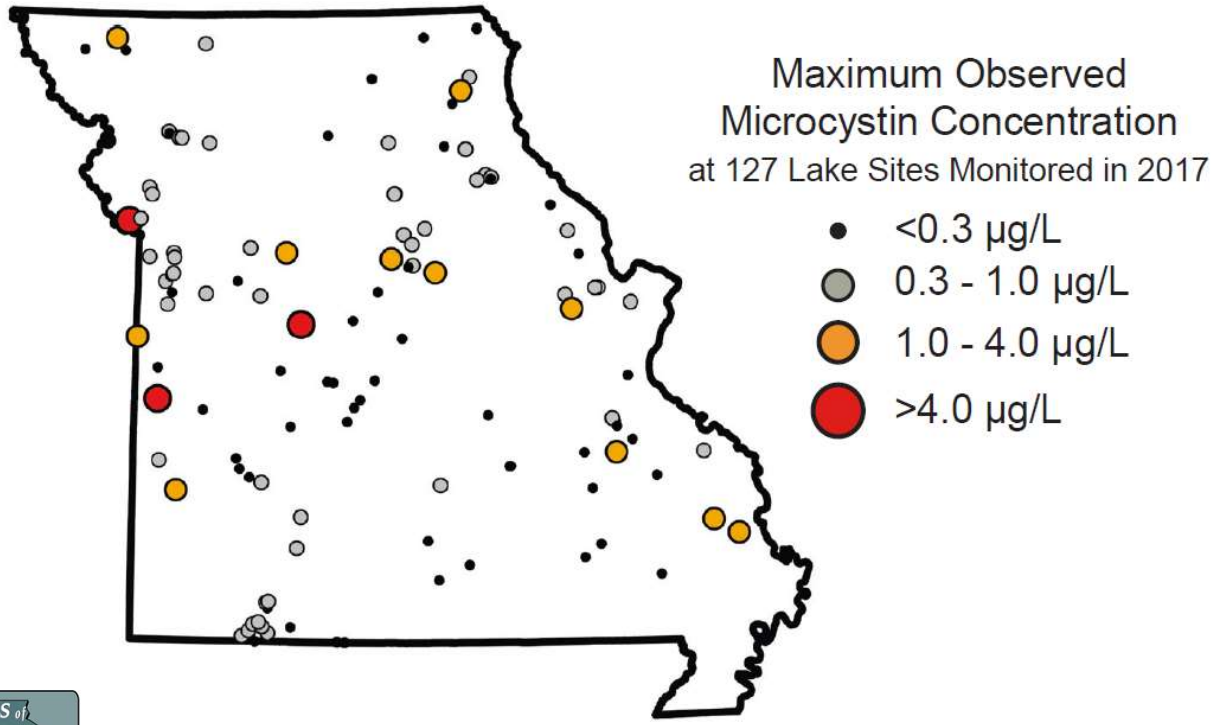
From the cyanoHABs newsletter. Email: epacyanohabs@epa.gov to sign up.

Algal Toxin Sample Collection

- Largely ambient (vs. targeted) monitoring
- Defined location, typically near dam
- 0.5 meter integrated sampler standardizes sample collection



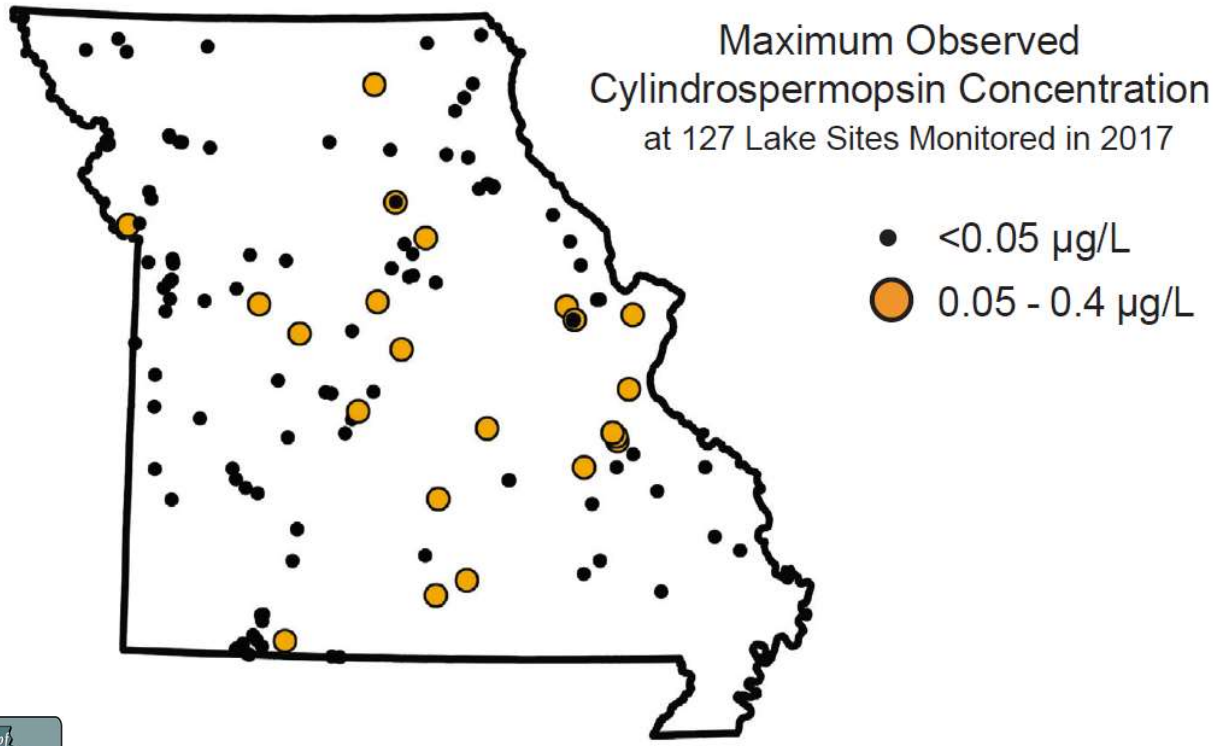
Microcystin in Missouri Reservoirs, 2017



	n
Samples	582
Reservoirs	101
Reservoir sites	127

Combines volunteer data with University of MO ambient monitoring data

Cylindrospermopsin in Missouri Reservoirs, 2017



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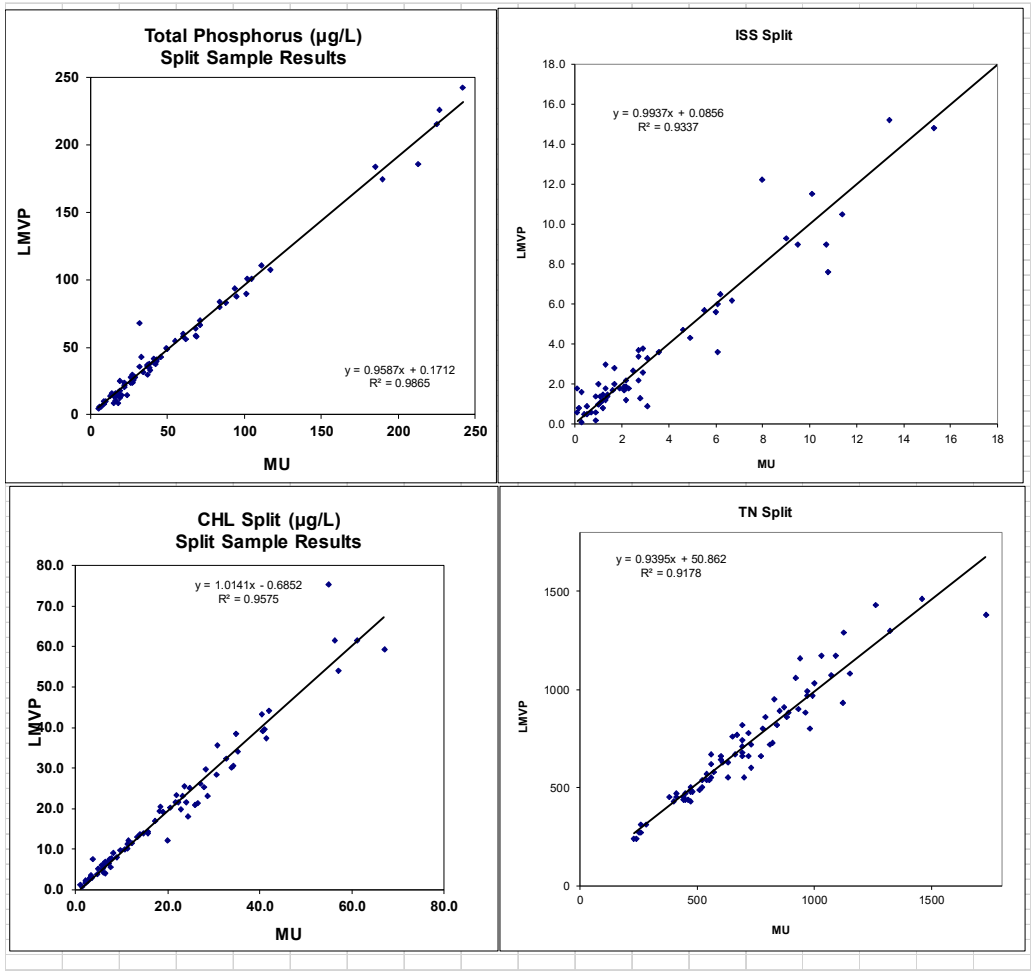
QA/QC

- Annual QAPP review
- Side-by-side sampling
- Volunteer feedback on chlorophyll replicate comparisons

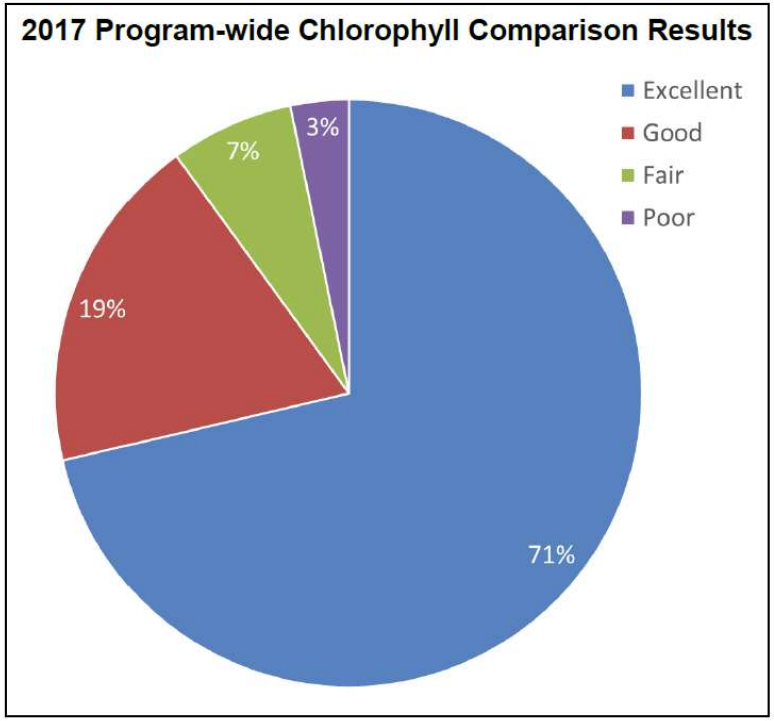


Chlorophyll Replicate Comparison

Jim and Joan Landewe

E=Excellent; G=Good; F=Fair; P=Poor

	Date	Filter 1	Filter 2	Rating
Lake Springfield 1	5/18/2017	7.2	7.5	E
Lake Springfield 1	6/8/2017	28.8	30.6	G
Lake Springfield 1	6/27/2017	23.5	24.3	E
Lake Springfield 1	7/13/2017	30.2	31.5	E
Lake Springfield 1	8/12/2017	31.9	32.6	E
Lake Springfield 1	8/28/2017	27.3	27.0	E
Lake Springfield 1	9/20/2017	32.3	33.0	E
Lake Springfield 2	5/18/2017	1.8	1.5	G
Lake Springfield 2	6/8/2017	1.3	1.2	E
Lake Springfield 2	6/27/2017	1.7	1.8	E
Lake Springfield 2	7/13/2017	18.0	18.2	E
Lake Springfield 2	8/12/2017	2.2	1.8	G
Lake Springfield 2	8/28/2017	1.8	1.6	E
Lake Springfield 2	9/20/2017	19.3	18.7	E



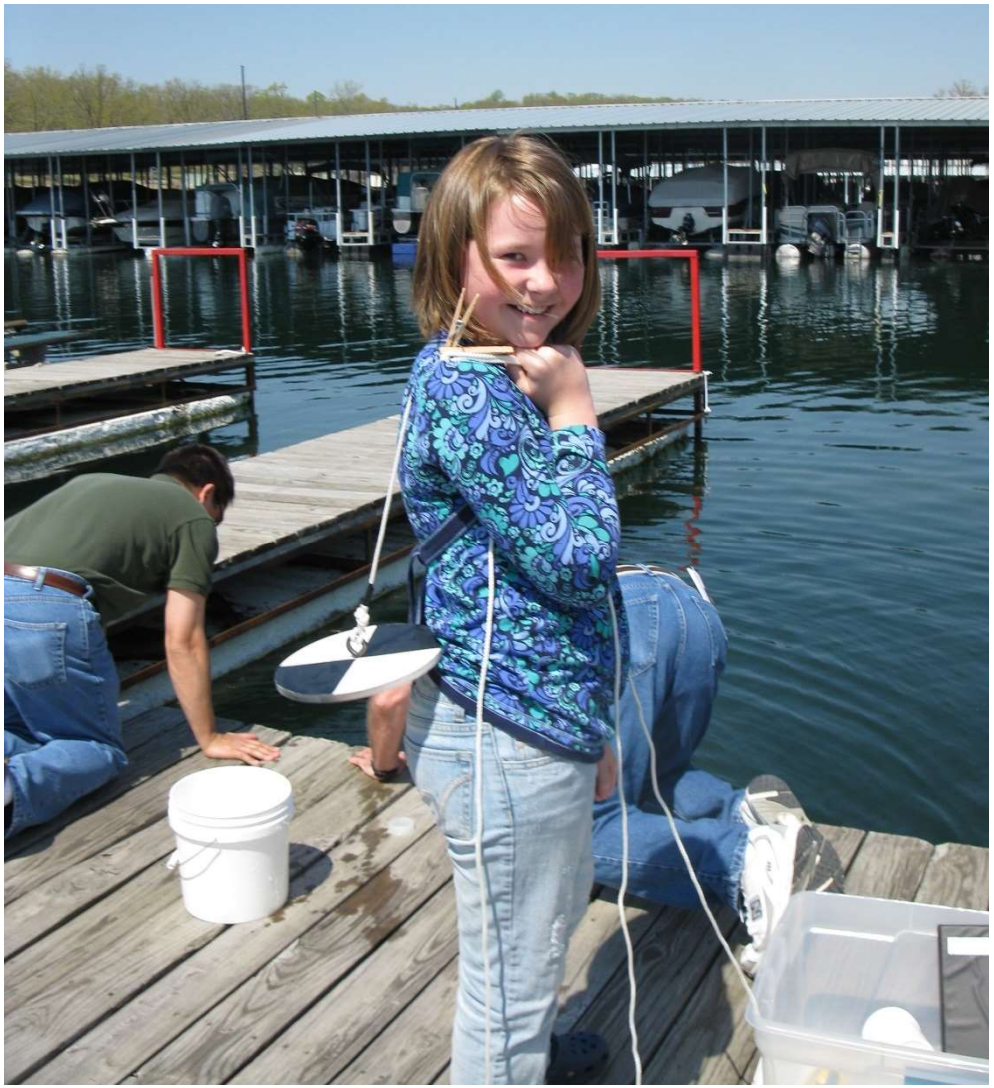
Summary

- Long running program
- Quality data
- Experienced volunteers
- Slow growth and high retention

LAKES of MISSOURI VOLUNTEER PROGRAM

Our Major Partners

- University of Missouri
- Missouri Department of Natural Resources
- United States Environmental Protection Agency
- Missouri Department of Health and Senior Services
- Amazing Volunteers!



LAKES of MISSOURI VOLUNTEER PROGRAM

www.LMVP.org

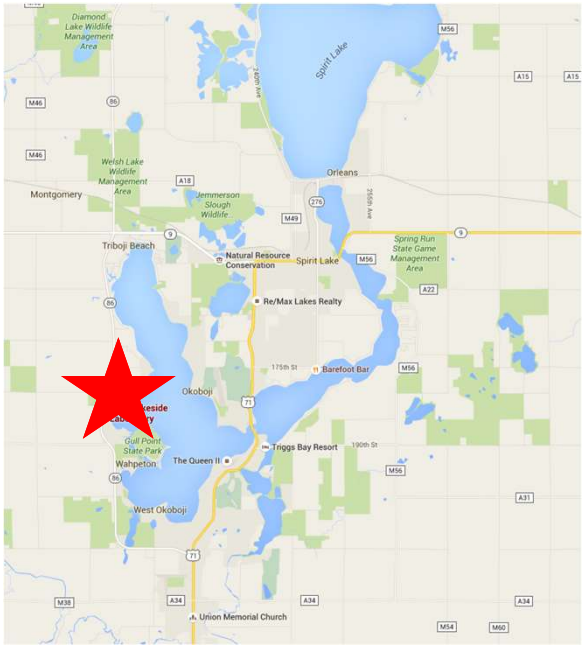
Iowa Lakeside Laboratory
Regents Resource Center

Acknowledgements

Jane Shuttleworth
Lakeside Education Coordinator

Dennis Heimdal
State Hygienic Laboratory

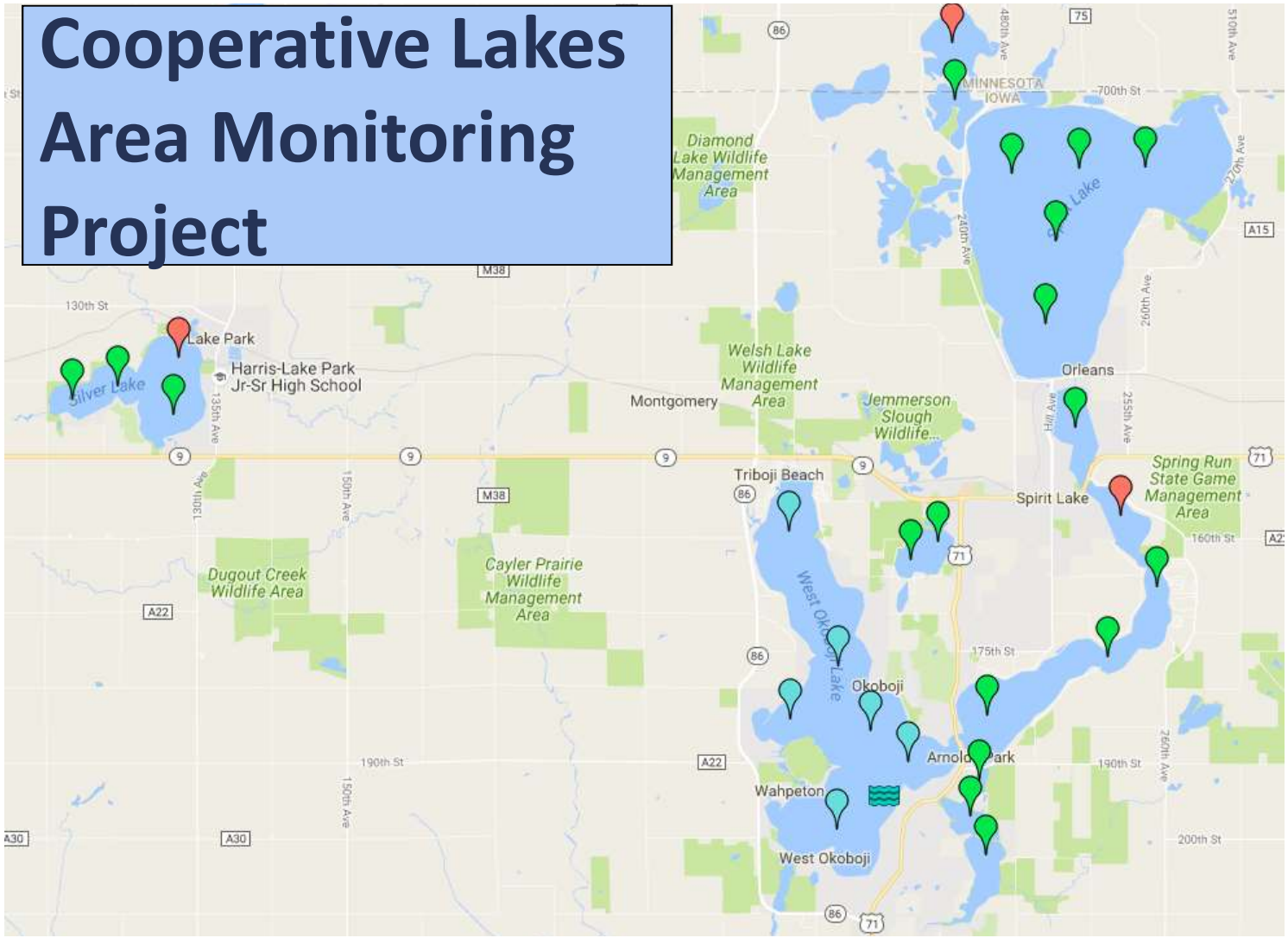
Located in the Iowa Lakes Region



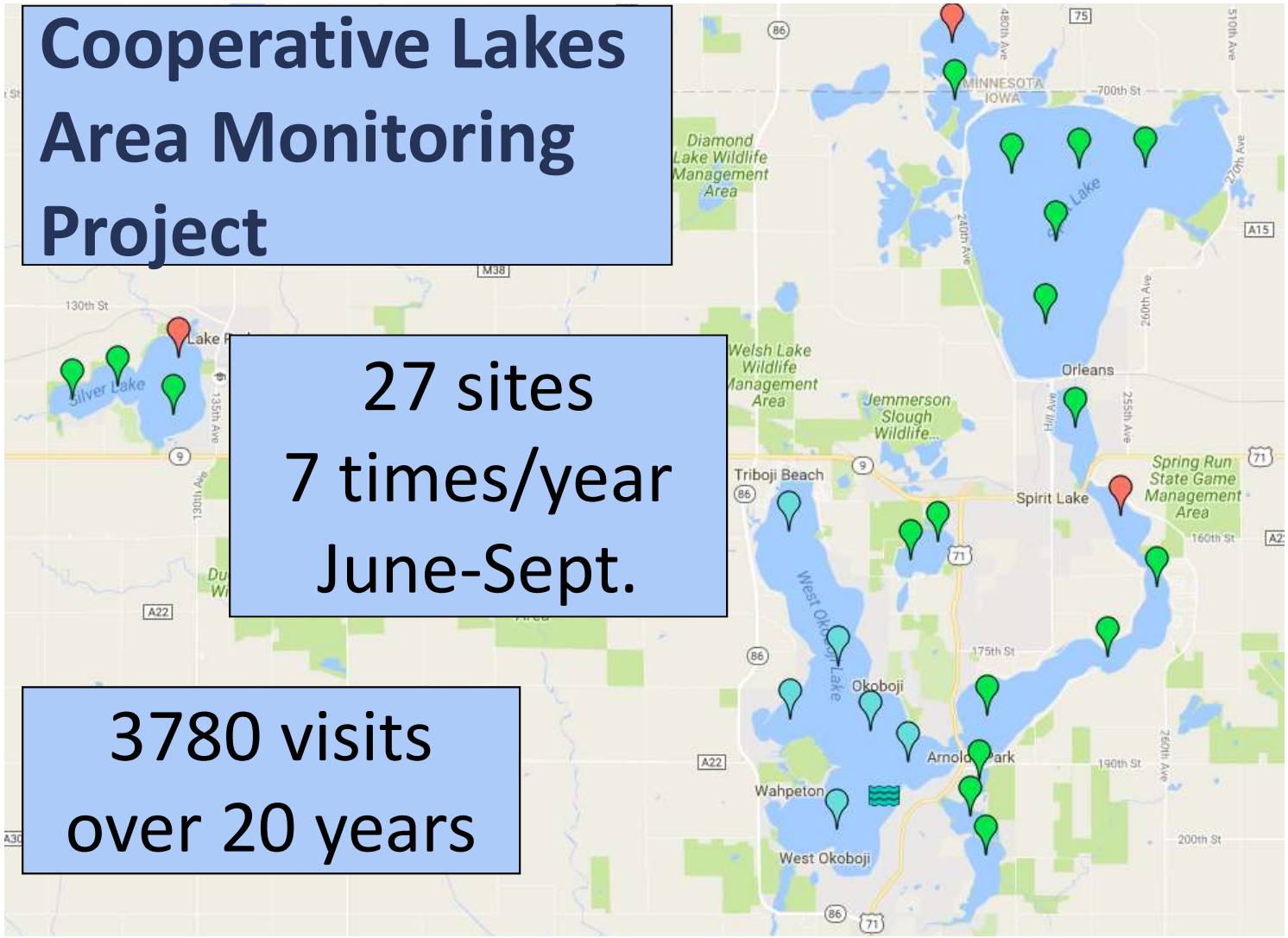
Cooperative Lakes Area Monitoring Project 1999-2018

NOT SURE IF EXCITED FOR 20TH BIRTHDAY
OR DEPRESSED I'LL NEVER BE A TEENAGER AGAIN
quickmeme.com

Cooperative Lakes Area Monitoring Project



Cooperative Lakes Area Monitoring Project



27 sites
7 times/year
June-Sept.

3780 visits
over 20 years

Longest Continuously Running Lake Monitoring Program in Iowa

Professional Lake Monitoring (Iowa DNR & ISU)

7 sites
3 times/year

17 years

Quality Assurance/Quality Control

- Annual Refresher Workshops
  - Including new YouTube channel of how-to videos
  - https://www.youtube.com/channel/UCq1GAng0kMoYp33W61r2DEw
- Samples are analyzed by State Hygienic Laboratory at the University of Iowa, co-located with Lakeside
- New volunteers are paired with experienced volunteers
- Field meters are calibrated before each sampling event

FIELD MEASUREMENTS

Chris Karlson

Water Clarity
Secchi Disk

Shirley Olson and Kayla Erlandson

Dissolved Oxygen and Temperature
YSI Meter

NUTRIENTS

Ray Miller, Big Spirit Lake

<u>Total Nitrogen</u> – Nitrate, Nitrite, Ammonia, Organic Nitrogen

<u>Total Phosphorus</u> – Dissolved and Organic Phosphorus

ALGAE ABUNDANCE: measured as Chlorophyll ‘a’

Blaine and Sheryl Strampe

Heidi Toale

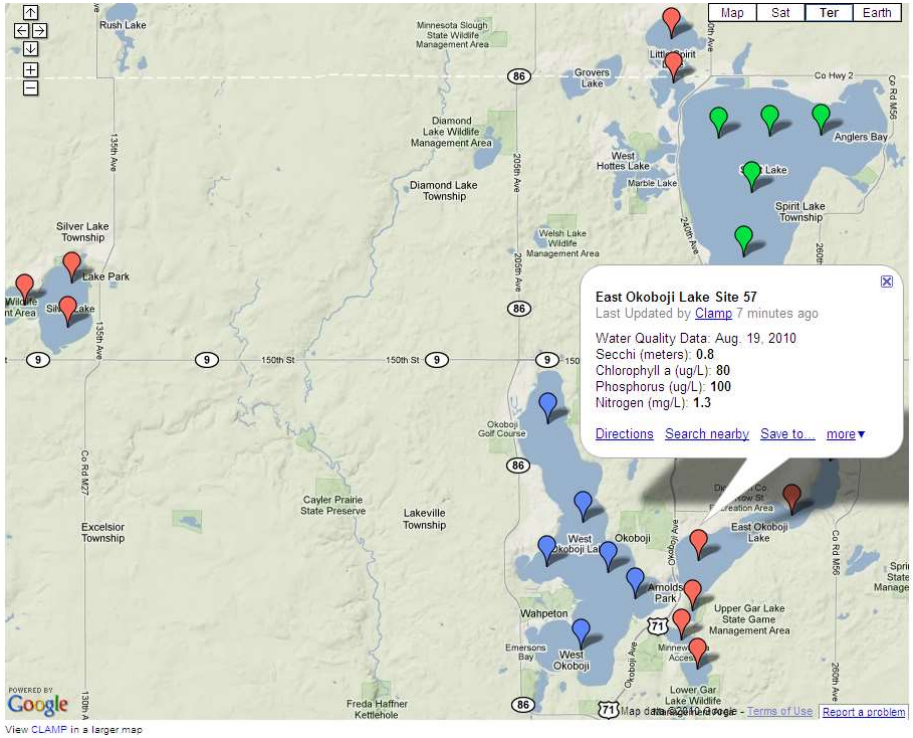
LAB ANALYSIS

New in 2018:
Microcystin

State Hygienic Laboratory
Iowa's Environmental and Public Health Laboratory
EST. 1904
The University of Iowa

Iowa Lakeside Laboratory

Data Availability www.clamp1909.blogspot.com



Access most recent data and graphs

MAP KEY

Red Balloon - Hypereutrophic
Poor water clarity
Heavy algae blooms
Excessive nutrients

Green Balloon - Eutrophic
Decreased water clarity
Algae blooms probable
High nutrients

Blue Balloon - Mesotrophic
Moderately clear water
Occasional algae blooms
Moderate nutrients

Lt. Blue Balloon - Oligotrophic
Very clear water
Little or no algae blooms
Low nutrients

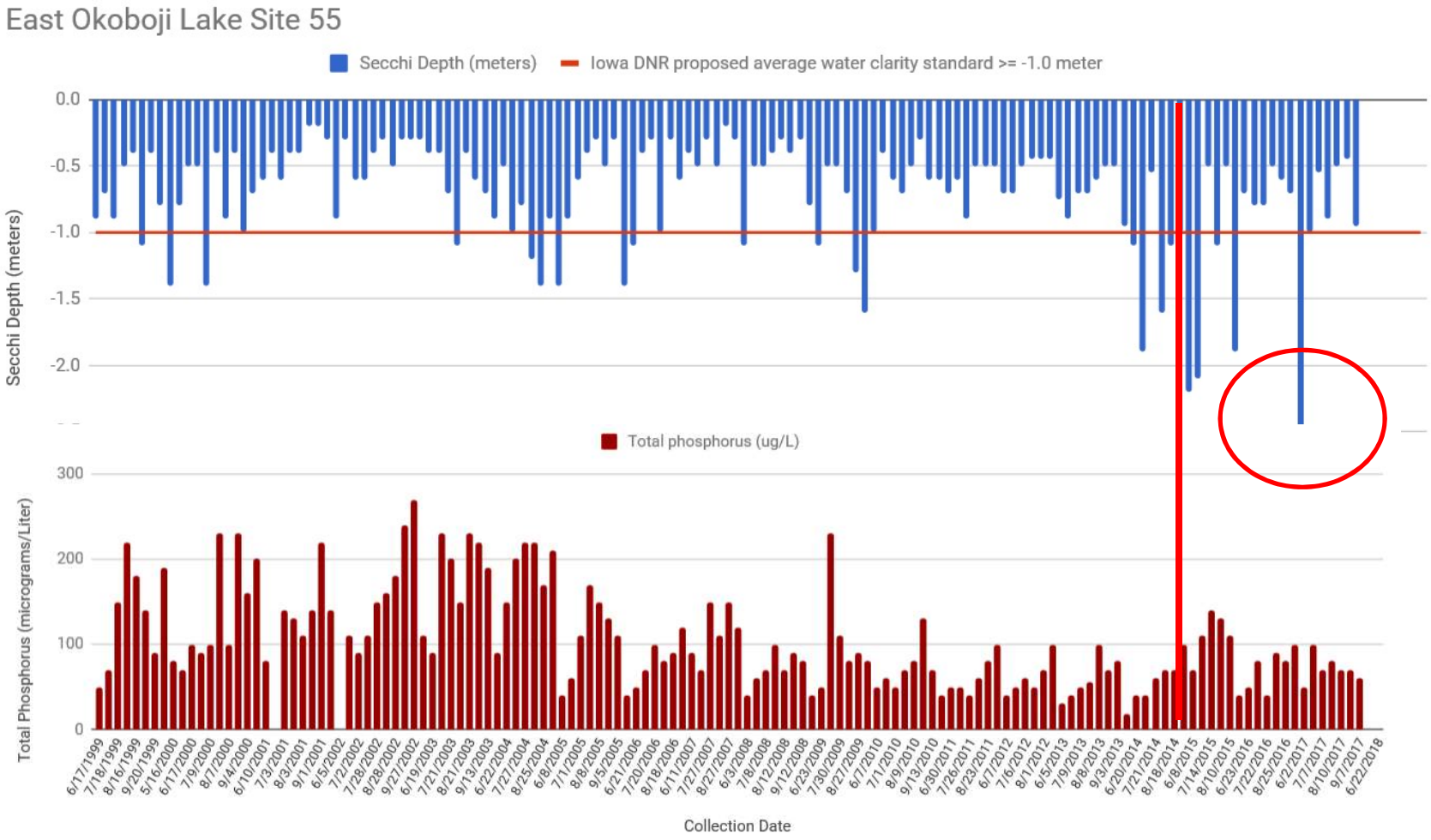
How are the data used?

1. Track changes through time (including evaluation of how big events are impacting the lakes)
2. Development of Watershed Plans
3. Engage and energize lake community
4. K-12 Education

Frequently heard comment:

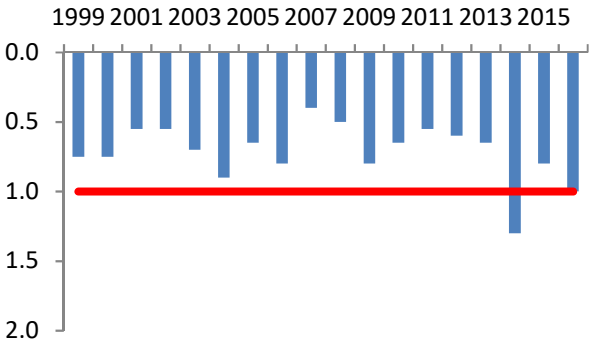
"The lakes are clear because of the zebra mussels"

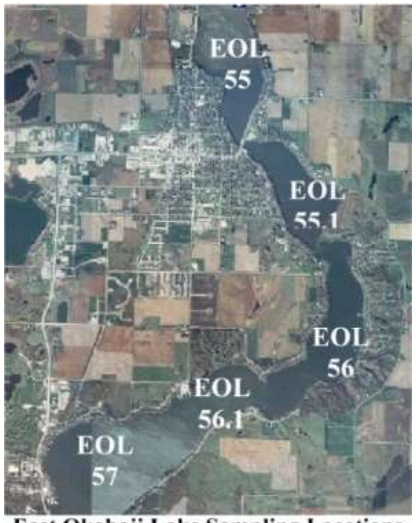
Zebra mussels were first detected in Okoboji Chain of Lakes in 2015


East Okoboji Lake Site 55
Secchi Depth (meters)
Iowa DNR proposed average water clarity standard >= -1.0 meter
0.0
-0.5
-1.0
-1.5
-2.0
Secchi Depth (meters)
Total phosphorus (ug/L)
300
200
100
0
Total Phosphorus (micrograms/Liter)
Collection Date

East Okoboji Lake June-Sept. CLAMP 1999-2016

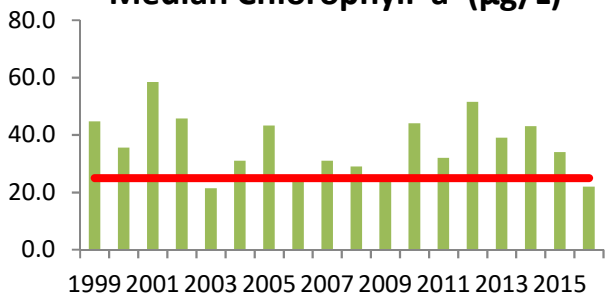
Median Secchi Depth (meters)



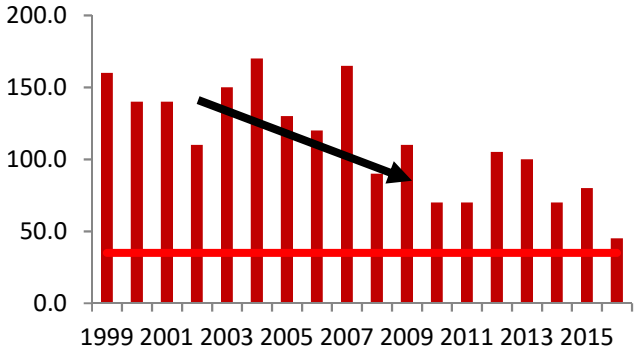


East Okoboji Lake Sampling Locations

Median Chlorophyll 'a' (µg/L)



Median Total Phosphorus (µg/L)

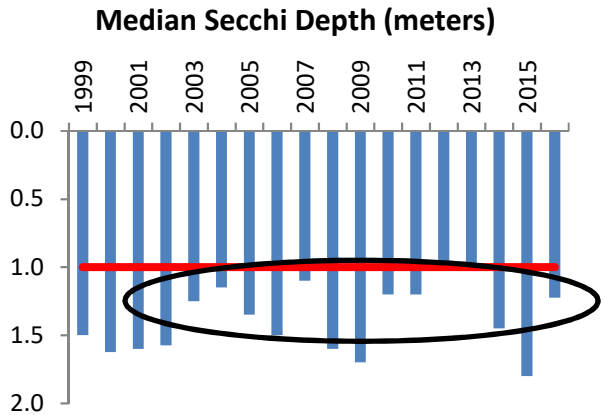


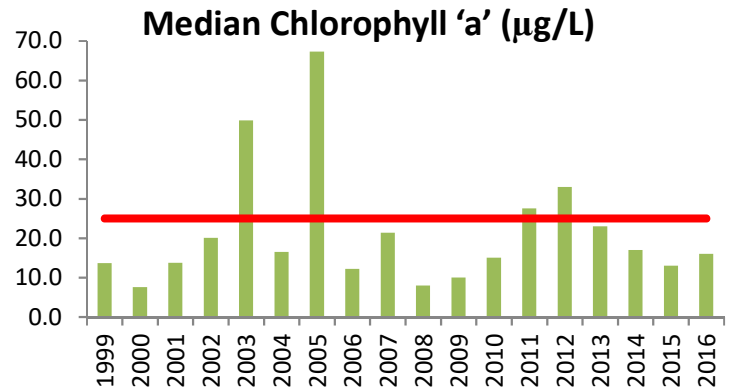
Red line – Recommended Iowa DNR standard

"Nutrient Criteria for Iowa Lakes, 2008"

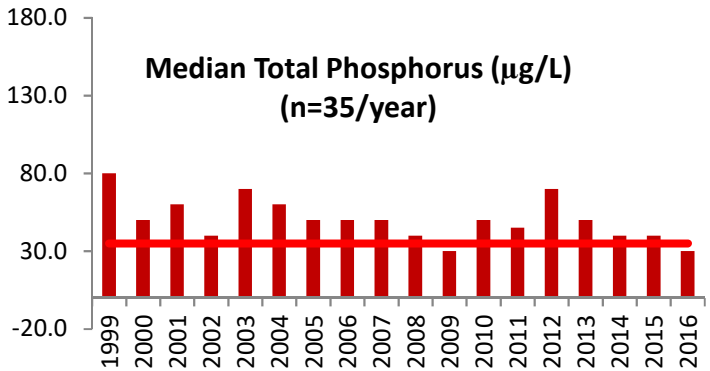
Big Spirit Lake June-Sept. CLAMP 1999-2016

(n=35 samples/year)



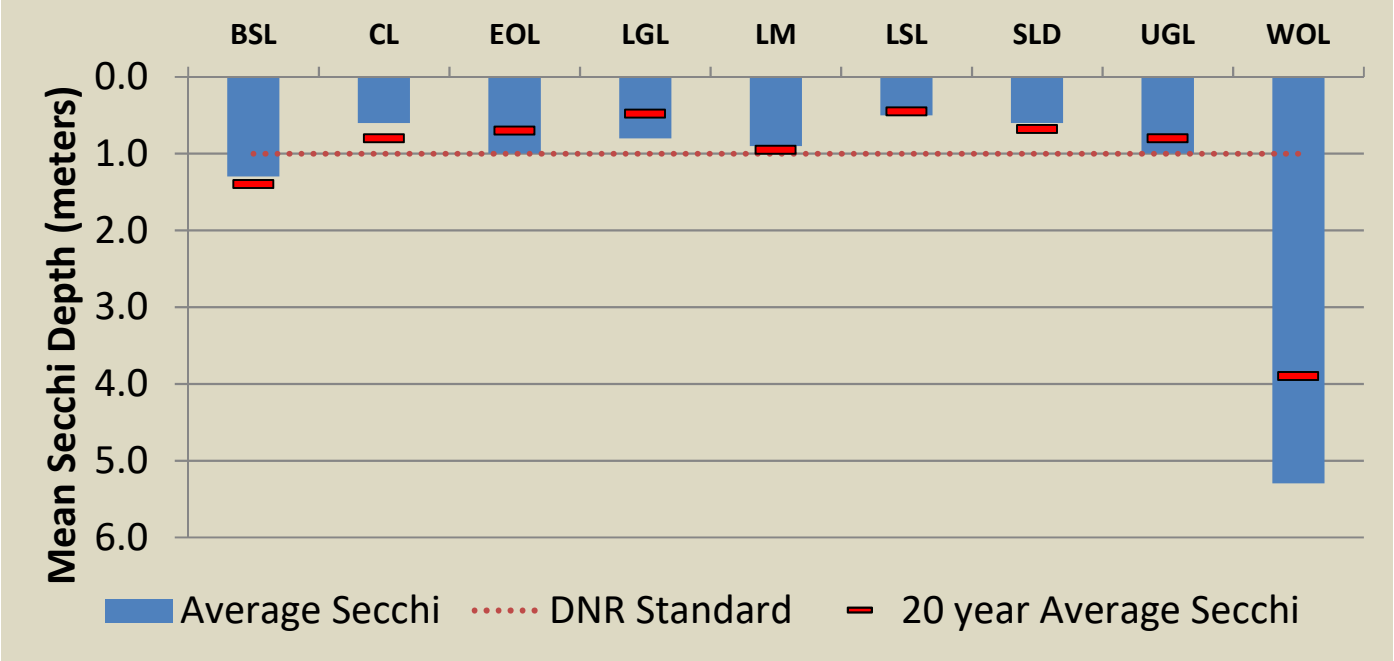


Big Spirit Lake Sample Locations



Red line – Recommended Iowa DNR standard

Average Water Clarity – CLAMP 2018



Question & Answer – Type in the chat

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VM Resources

- **National Water Quality Monitoring Council**
  - https://acwi.gov/monitoring/vm/resources.html

- **USA Volunteer Water Monitoring Network**
  - http://volunteermonitoring.org/

- **Listserves:**
  - The EPA volunteer monitoring listserve: To subscribe, send a blank email message to volmonitor-subscribe@lists.epa.gov
  - The extension listserve: https://list.uvm.edu/cgi-bin/wa?SUBED1=EXTVOLMONNETWORK&A=1
  - Citizen Science Association: http://citizenscience.org/elist/

National Water Quality Monitoring Council
Working together for clean water

Questions?