Lake Kanasatka Water Quality: Where We Have Been & Where We Are Now

Presenters:

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- **Dr. Amanda McQuaid, University of New Hampshire**
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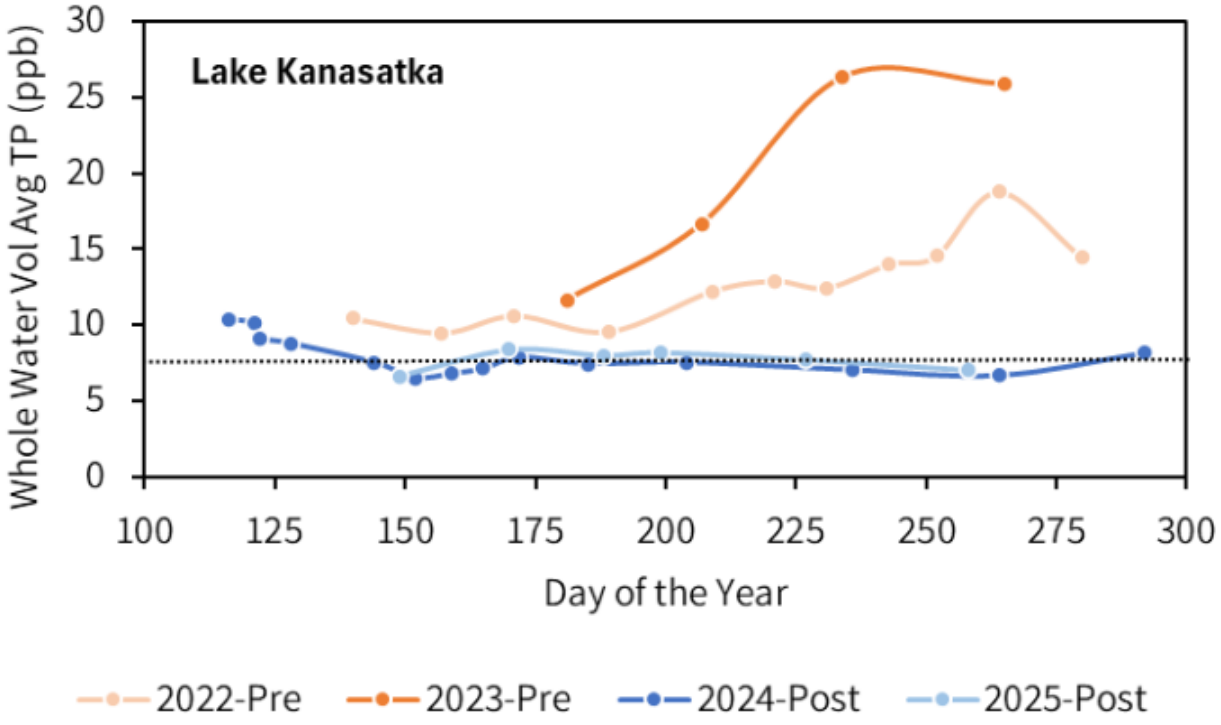
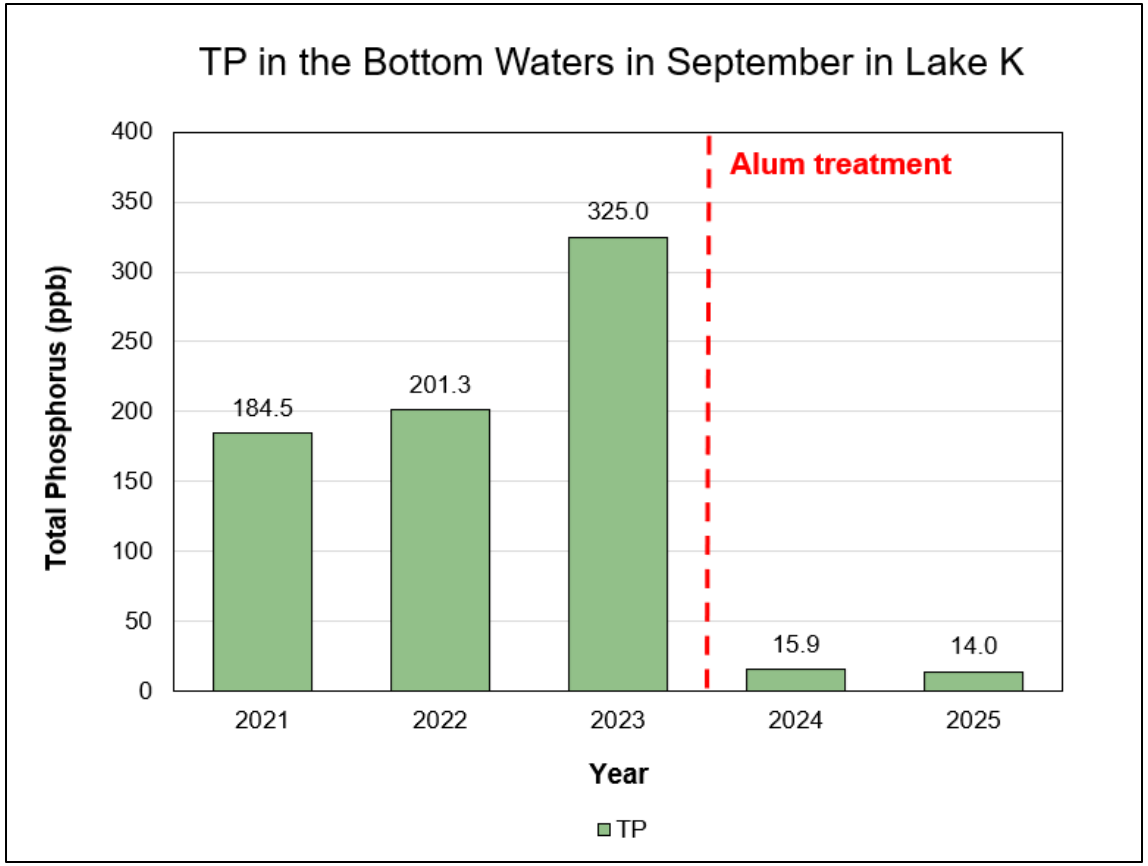
MAIN POINTS

- Alum treatment did its job
- Scale and magnitude matter when differentiating between blooms and shoreline accumulations
- External phosphorus load continues to be the major driver
- Restoration is a process, Lake K needs more time to find a new balance

Alum Treatment Substantially Reduced the Internal Phosphorus Load

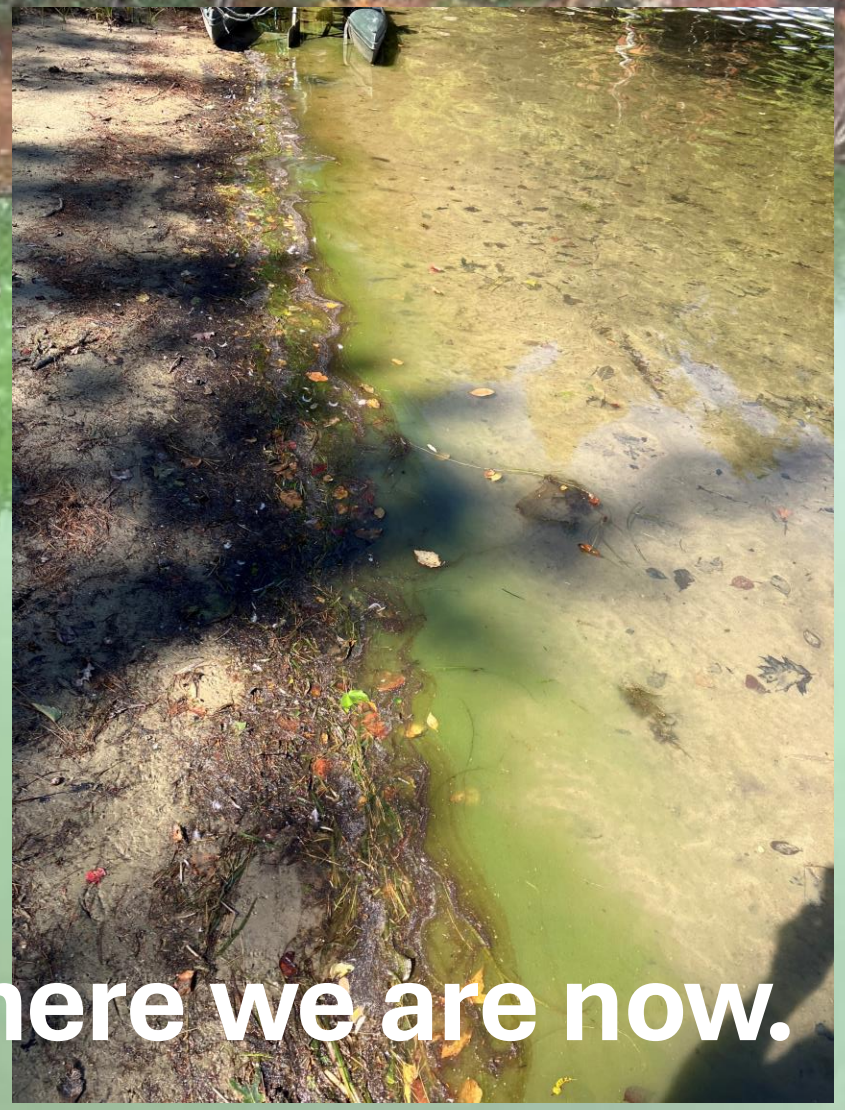




- Treatment covered the appropriate target area of anoxic sediment completely; no gaps; barge uses GPS tracking and flow meters
- Longevity based on external inputs settling on the lake bottom, a relatively small fraction of which settles in the form of cyano cells – but not the driver

*Total P at 13m at the Deep site in September before fall turnover *figure courtesy of Georgia Bunnell*

Reminder of where we came from...

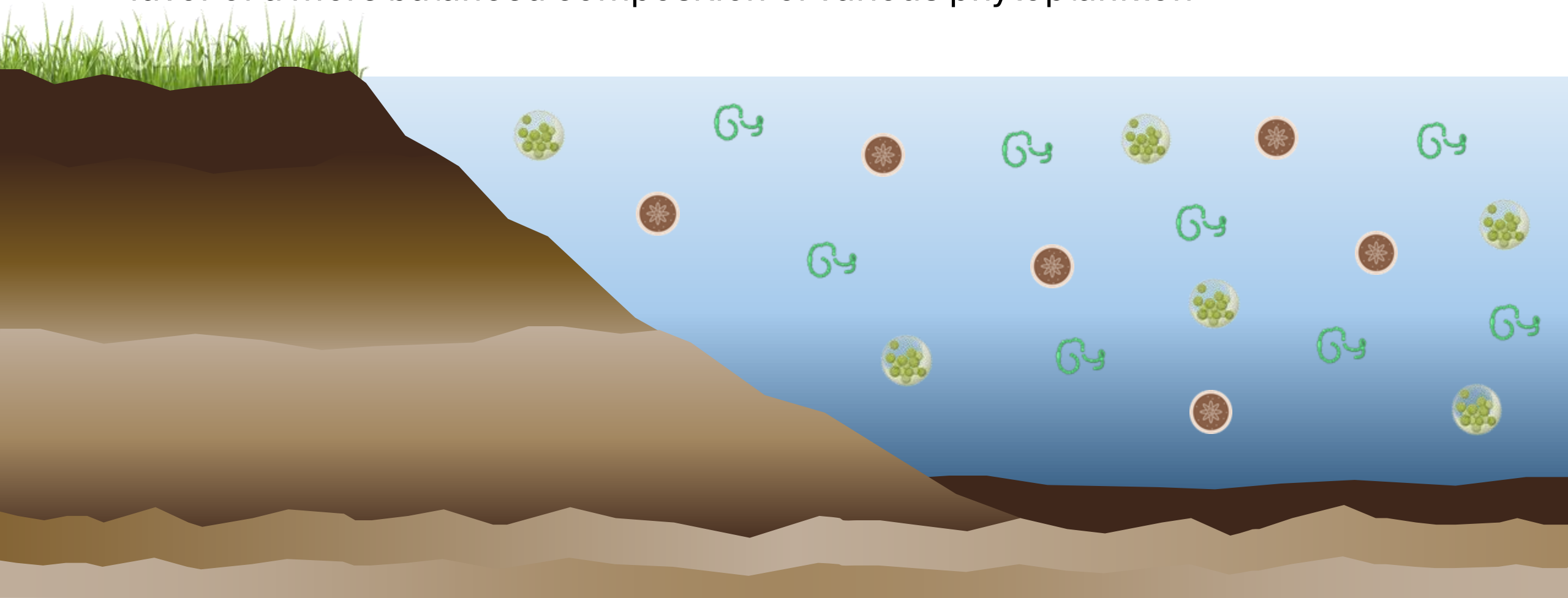


...and where we are now.

2023

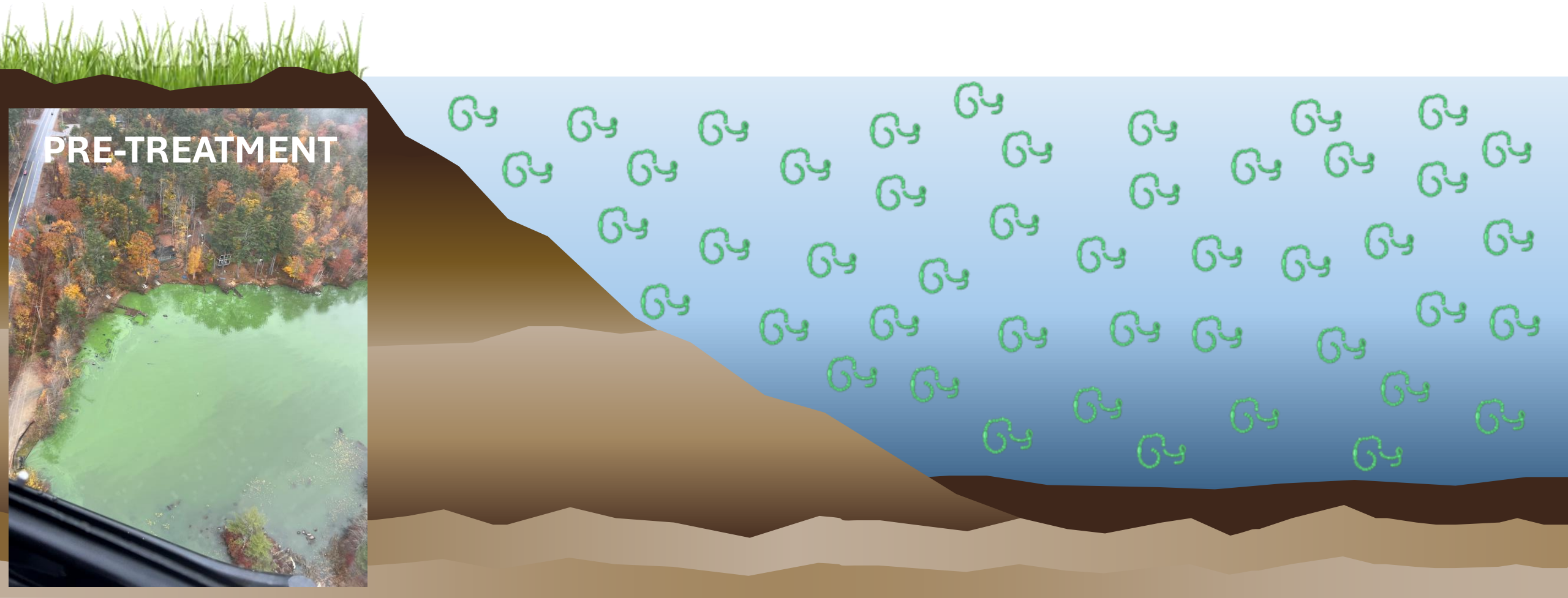
CONTEXT OF ‘BLOOMS’

- Cyanobacteria are a natural part of most aquatic systems – we will never eliminate them, but we can aim to control/limit their overall dominance in favor of a more balanced composition of various phytoplankton



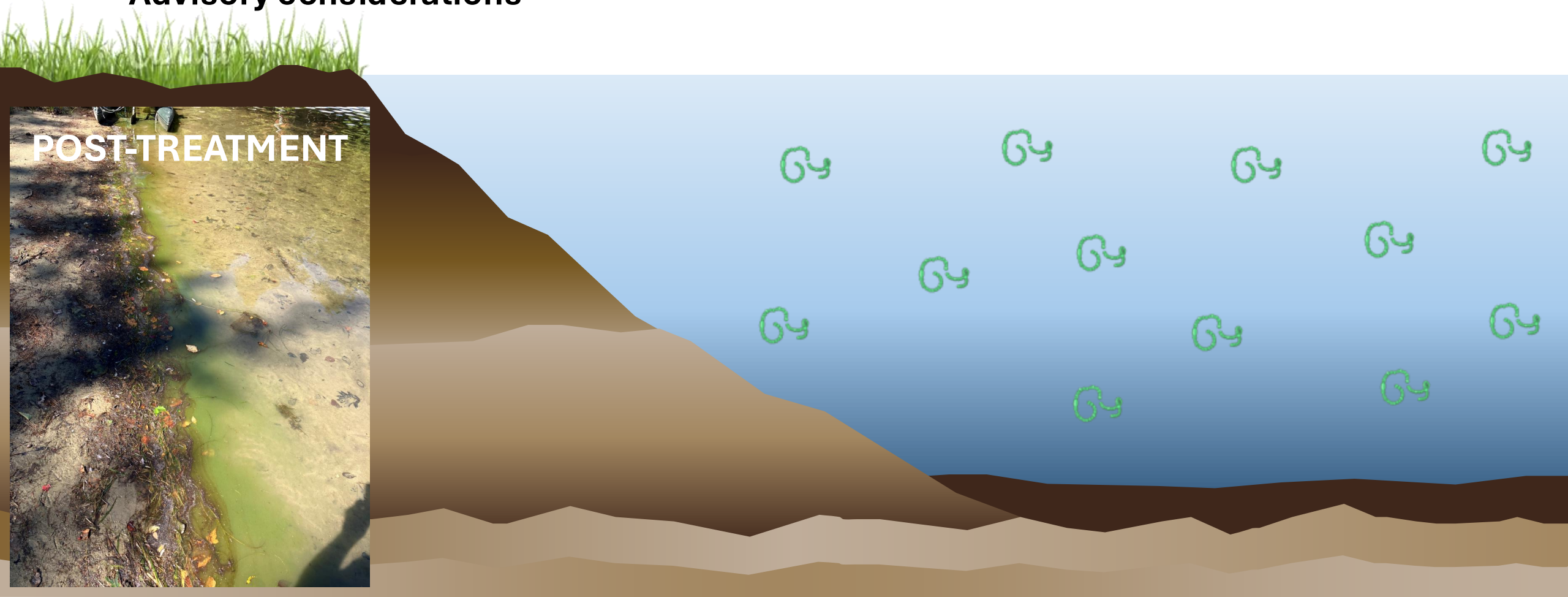
WHOLE LAKE BLOOMS

- Scale and magnitude matter when considering the distribution, density, duration, and persistence of cyanobacteria blooms



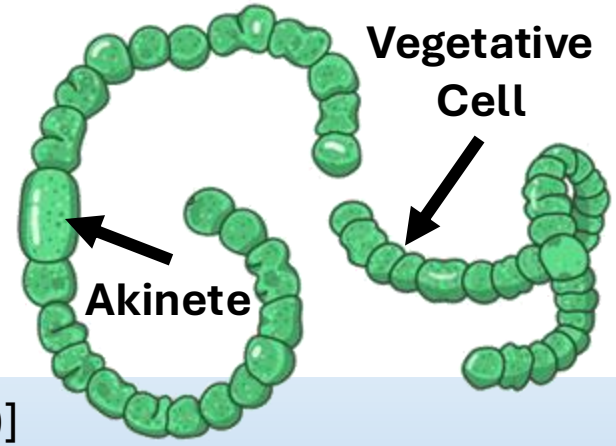
SHORELINE ACCUMULATIONS

- Scale and magnitude matter when considering the distribution, density, duration, and persistence of cyanobacteria blooms --- **sampling method matters too**
- **Advisory considerations**

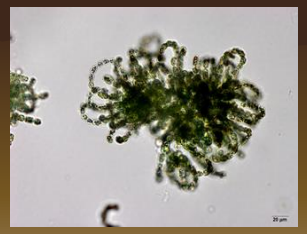


UNDERSTANDING CYANO DYNAMICS

- Cyanobacteria are getting their phosphorus everywhere in the lake
- Likely significant stock of akinetes (cyano 'seeds') built up in the sediment
- Influences from other critical elements availability, upwelling/flow/mixing, water temps, sunlight, cyano taxa mobility, luxury uptake, & N fixation, food web controls
- Link to external phosphorus input following June rain events (6→9 ppb)
- Possibly *some but limited* influence from road salting on lake food web



"Rule of 10" [nutrients – TP (ppb)]

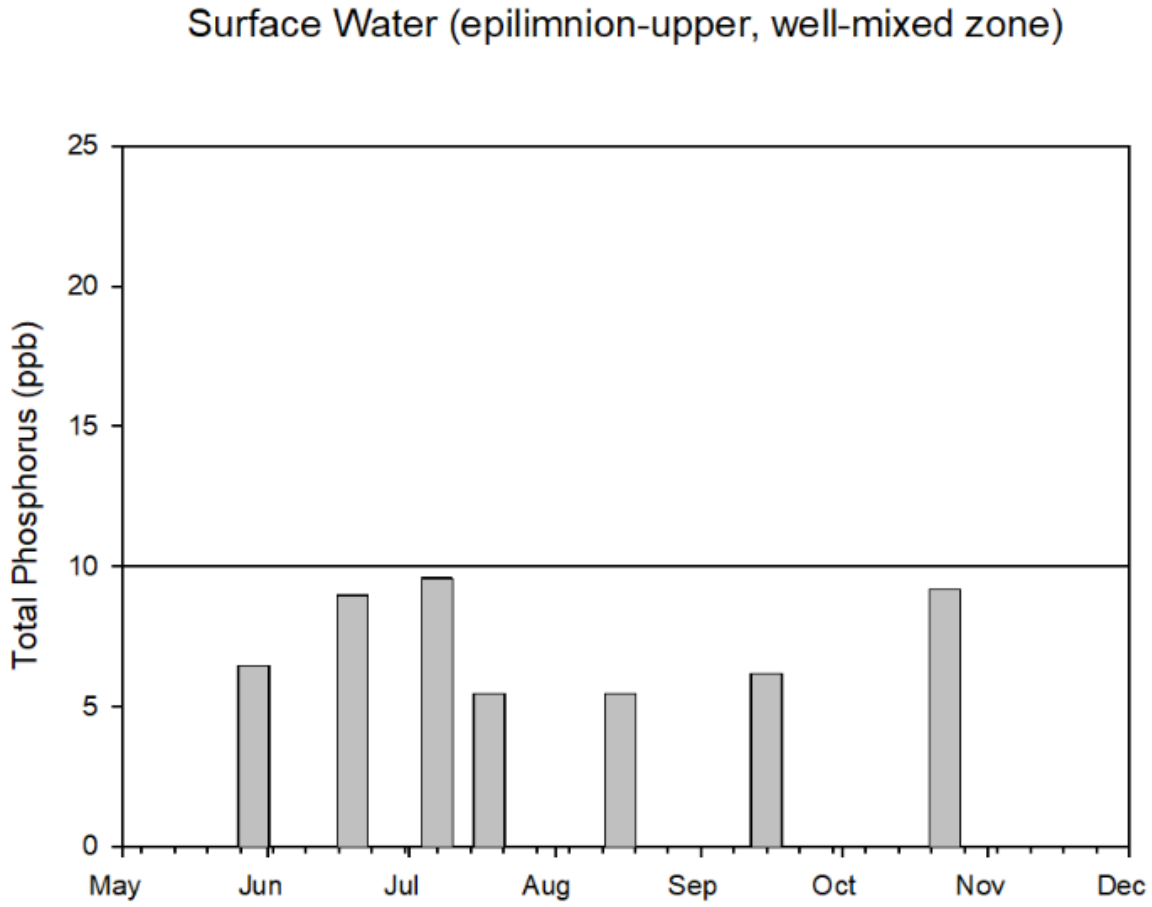


Taxa- dependent

Nutrient requirements
Habitat/ distribution
Food web niche

Lake Kanasatka 2025 Water Quality Results

Deep Site-Surface Layer (epilimnion) - 2025



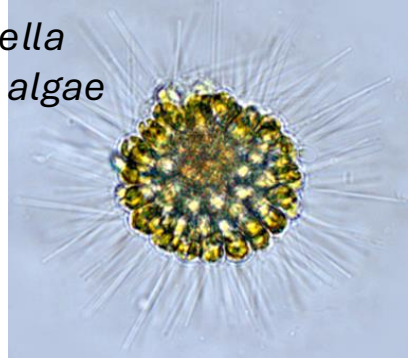
June rain event….external

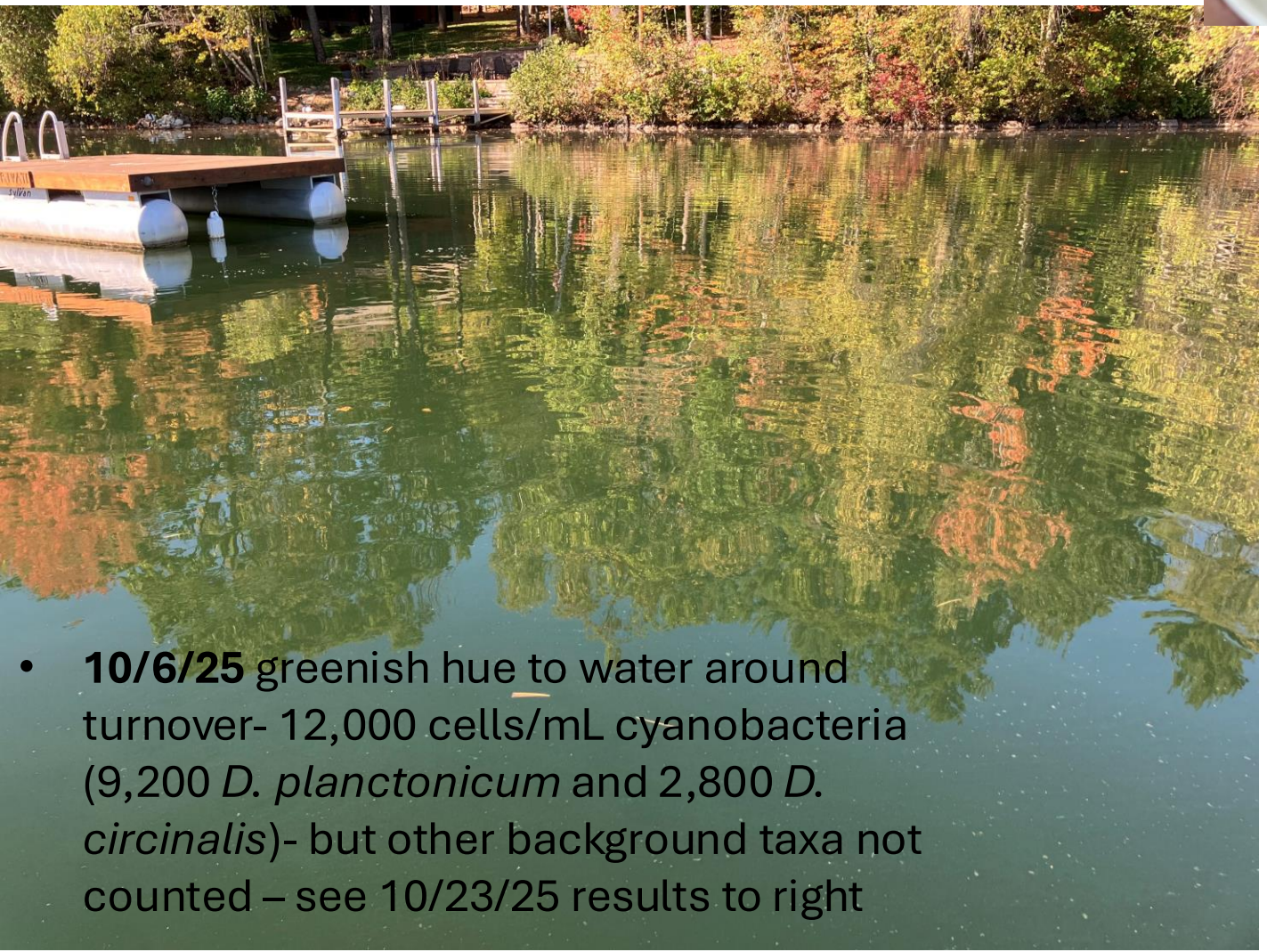
	Date	Depth	SD	Chl	Color	TP
CFB	5/29/2025	0-3.0	6.6	1.9	12.6	6.5
CFB	6/19/2025	0-3.0	6.3	4.9	14.9	9.0
CFB	7/18/2025	0-5.0	8.4	1.4	10.7	5.5
CFB	8/15/2025	0-3.5	7.8	1.9	9.7	5.5
CFB	9/15/2025	0-7.5	6.6	4.5	10.5	6.2
CFB	10/23/2025	0-10.0	4.3	10.0	12.3	9.2

October lake turnover…internal?

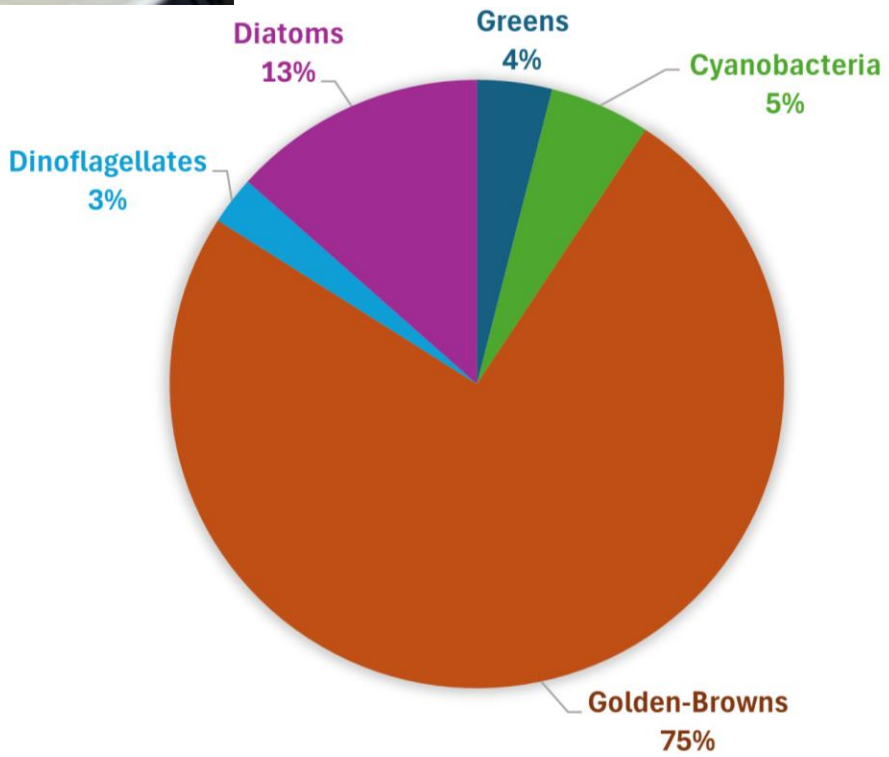
2025 FALL TURNOVER

Chrysosphaerella
Golden brown algae
(from Phycokey)



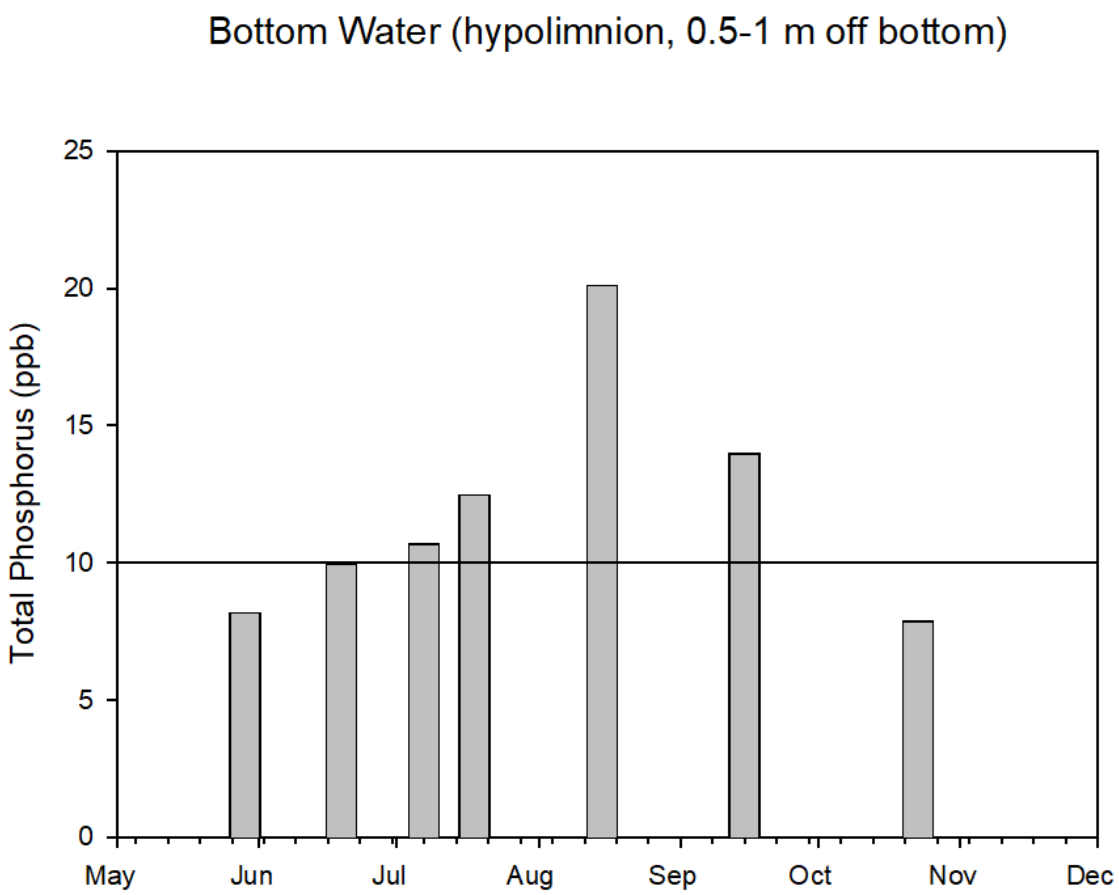


- **10/6/25** greenish hue to water around turnover- 12,000 cells/mL cyanobacteria (9,200 *D. planctonicum* and 2,800 *D. circinalis*)- but other background taxa not counted – see 10/23/25 results to right



- Algal community was mostly golden-brown algae (*Chrysosphaerella*) on 10/23/25 at deep spot
- **Only 5% was cyanobacteria**

Deep Site-Bottom Layer (hypolimnion) - 2025



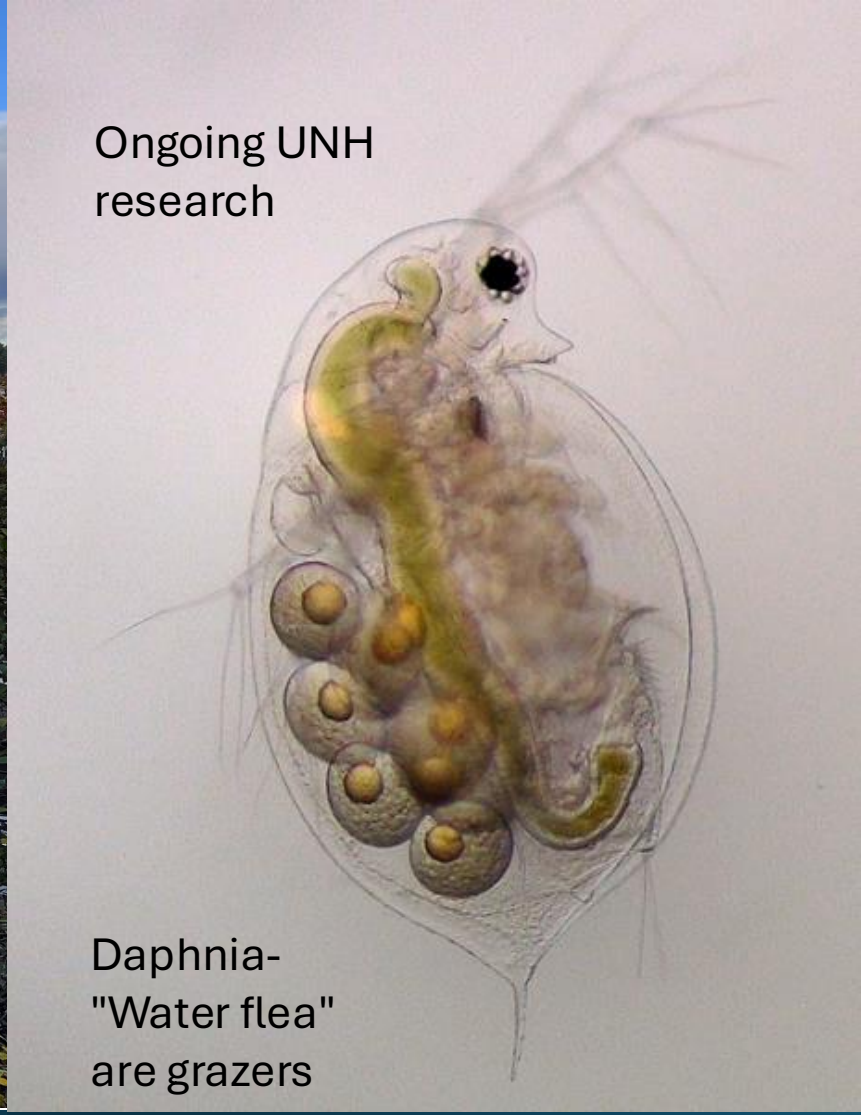
Bottom water phosphorus increased during low oxygen conditions- but not nearly to pre-aluminum levels (before aluminum range was 185-325 ug/L). But 20 ug/L can still contribute to cyanobacteria growth.

Planktothrix abundance in metalimnion contributing to deep water phosphorus fallout/sink as it oscillates in the water column, grows and decays.

New site in October- lake turnover already occurred

Lake	Site	Date	Depth	TP	SD
Lake Kanasatka	Near Sandy Cove	10/23/2025	0-6.5	**9.1**	4.3
Lake Kanasatka	Near Sandy Cove	10/23/2025	6.5	**8.7**	

Ongoing UNH research



Daphnia- "Water flea" are grazers

LAKE KANASATKA NEEDS TIME TO FIND A NEW BALANCE

How do grazers and food web dynamics influence cyanobacteria growth and distribution?

Bloom days according to NHDES Healthy Swimming Mapper:

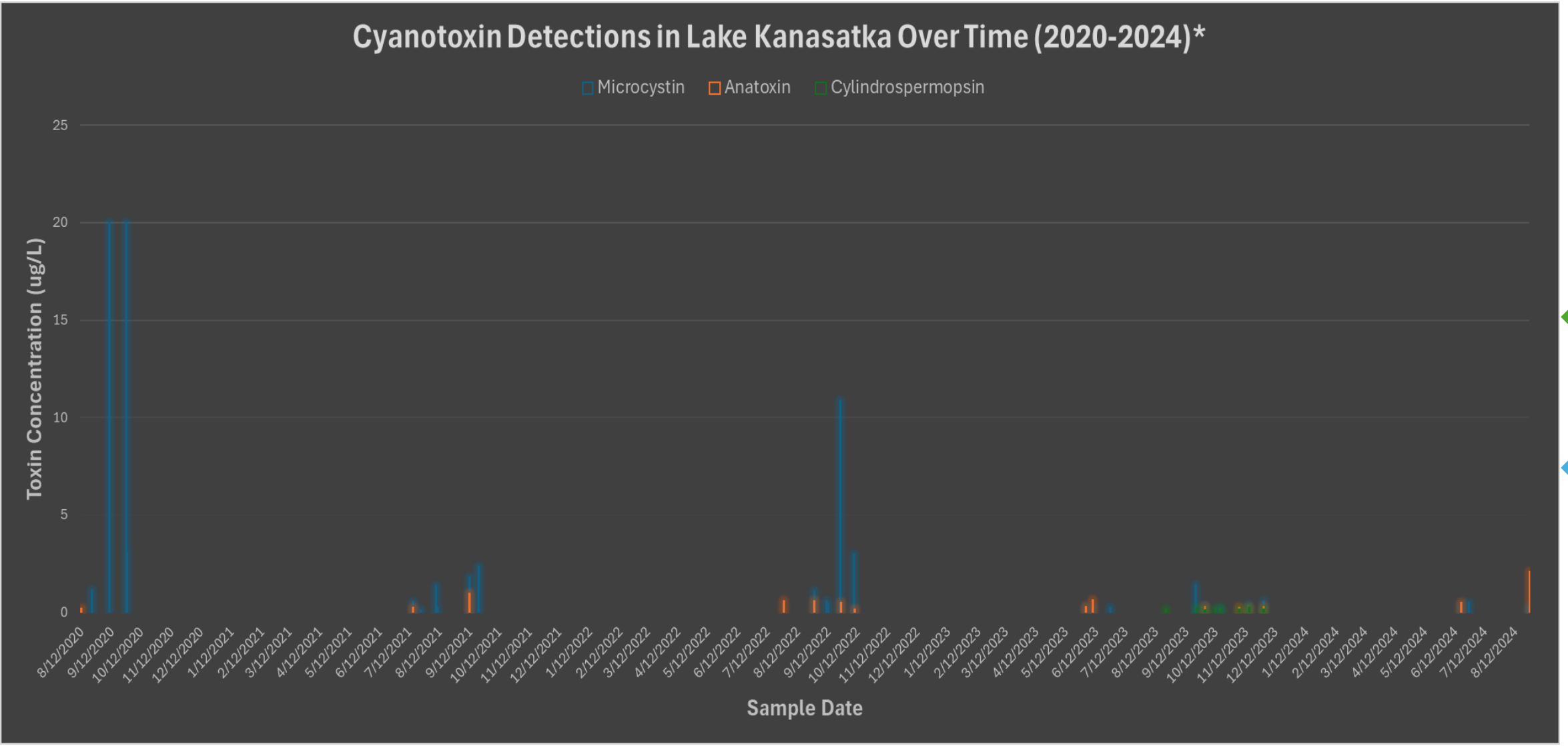
Year	Bloom Days	Comment
2020	24 days	Aug-Sept, mainly lakewide with some shoreline ribbons- local residents noticed change to color of water
2021	22 days	Aug-Sept, mix of lakewide and shoreline ribbons, but reports from around the lake
2022	92 days	Mostly shoreline ribbons/clouds around the lake
2023	122 days	June shoreline ribbons/clouds, Aug lakewide, Sept-Dec lakewide with downstream flow to Blackey Cove (Lake Winnipesaukee)
2024	14 days	Mostly shoreline ribbons, no lakewide blooms
2025	26 days (spring) + 59 days (fall)	Mostly shoreline ribbons, no lakewide blooms; spring shoreline ribbons following heavy rain (late May through June); quieter July/August; fall (September through present) shoreline ribbons leading up to and following turnover, some darker green color at deep spot with some surface flecks 10/6/25, 10/23/25 indicated golden brown dominance in water column


Cyanobacteria "ribbons"

Cyanobacteria Watches and Warnings Post Aluminum (or other) Treatment

- Cyanobacteria presence after an aluminum treatment is possible – including watch or warning level cyanobacteria occurrences
- Aluminum is added to reduce water column phosphorus during treatment, and bind phosphorus released from internal load from lake sediments for the longer term, *it is not a treatment or preventative specifically for cyanobacteria blooms*
- Cyanobacteria can and will take up nutrients where they are available, including a "luxury uptake" of nutrients that can be stored and used at a later time
- With a history of frequent, prolonged and occasionally dense cyanobacteria blooms in the lake, there could be cyanobacteria resting cells (**akinetes**) deposited from past blooms that are present in lake sediments, fueling growth
- Case study: Nippo Lake showed shoreline *Dolichospermum* ribbons/accumulations for two seasons after aluminum treatment before better in-lake food web balance was achieved, we are not there yet with Lake K.

Most blooms have not exceeded toxin thresholds



Cylindro. rec. thresh.

Microcystin rec. thresh.

*2025 samples will be processed over the coming winter months

Possible additional future monitoring

- Through the ice sampling
  - Check algal population composition
  - Check phosphorus concentration under ice "winter stratification" conditions
- Sediment sampling to determine presence and count of cyanobacteria akinetes (resting phases)
- Observations around the lake (by boat in summer) to determine bloom locations, or resident observations, with local record-keeping of prevailing winds to document bloom movement

RECOMMENDATIONS FOR NEXT STEPS

- **Remember that we can take steps to restore a lake - but there is no going back to original pristine condition**
- **Continue to monitor** water quality and cyanobacteria occurrences
  - Will tell us when the internal load starts to come back
- **Continue to address external sources –** which now accounts for 95% of phosphorus load to Lake Kanasatka
- **Let the lake come back into balance**
  - Significant changes in Lake K over the last four years
    - Three years of evolving/worsening blooms, with the plankton population out of balance
    - Akinetes built up in the sediments
    - Aluminum treatment applied to a large percentage of the lake, want to avoid further treatment into more ecologically sensitive shallow areas
- **Pause exploration of additional management options**
  - Additional Aluminum, Phoslock, drawdown, bottom raking….and any other products or actions discussed locally

SUMMARY

- Alum treatment did its job
- Scale and magnitude matter when differentiating between blooms and shoreline accumulations
- External phosphorus load continues to be the major driver
- Restoration is a process, Lake K needs more time to find a new balance

Data from near shore grab samples only

High cell counts can be a function of a naturally high bloom count, or exacerbated by sample method.

Samplers who work to collected as much cyanobacteria scum material as possible in a sample could bias actual counts.