

A Comprehensive Urban Shallow Lake Monitoring Plan to Understand Ecosystem Dynamics and Inform Holistic Lake Management



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CAPITOL REGION WATERSHED DISTRICT



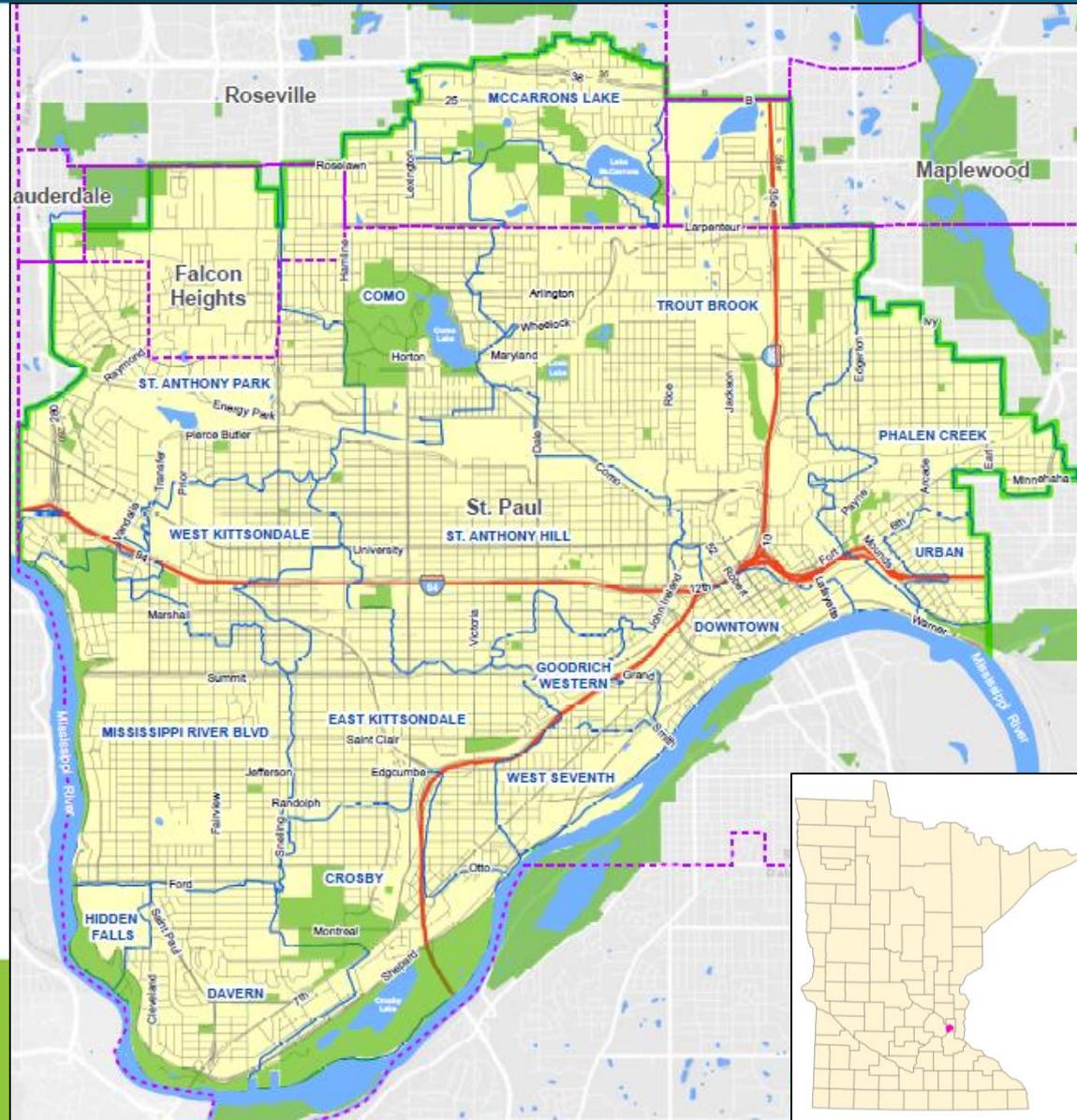
Presentation Outline

- CRWD Background
- Como Lake Background and Concerns
- 2014 Comprehensive Monitoring Plan
- Results
- How is data being utilized?
- Summary



Capitol Region Watershed District (CRWD)

- St. Paul, Minnesota
- Local unit of gov't
- Drainage area: **41 mi²**
 - 5 lakes
 - 13 mi. of Mississippi
 - Storm sewer network
- Highly urbanized
 - **42%+** impervious
 - Population: **245,000**



Como Lake Background and Concerns



Como Lake



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Como Park: Then and Now



1923



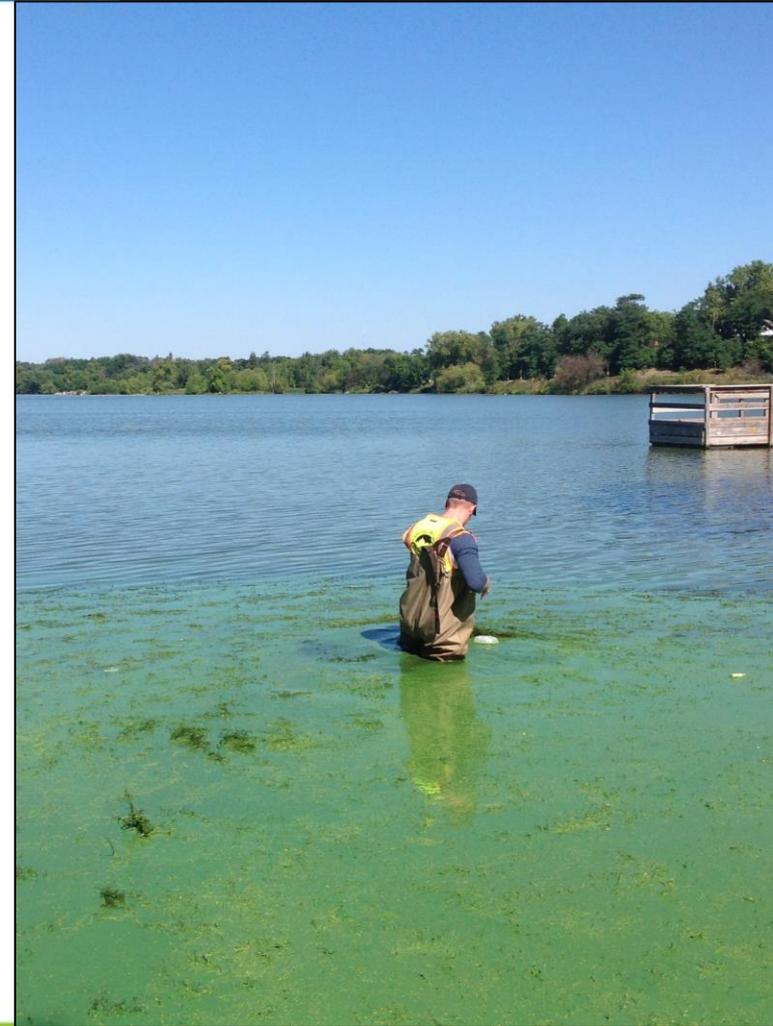
2018



Como Lake Concerns

Como Lake is impaired for excess nutrients

Parameter	MN Shallow Lake State Standard	Como Lake Historical Avg (1984-2018)
Phosphorus	<60 µg/L	173 µg/L
Chlorophyll-a	<20 µg/L	34 µg/L
Secchi Depth	<1.0 m	1.0 m



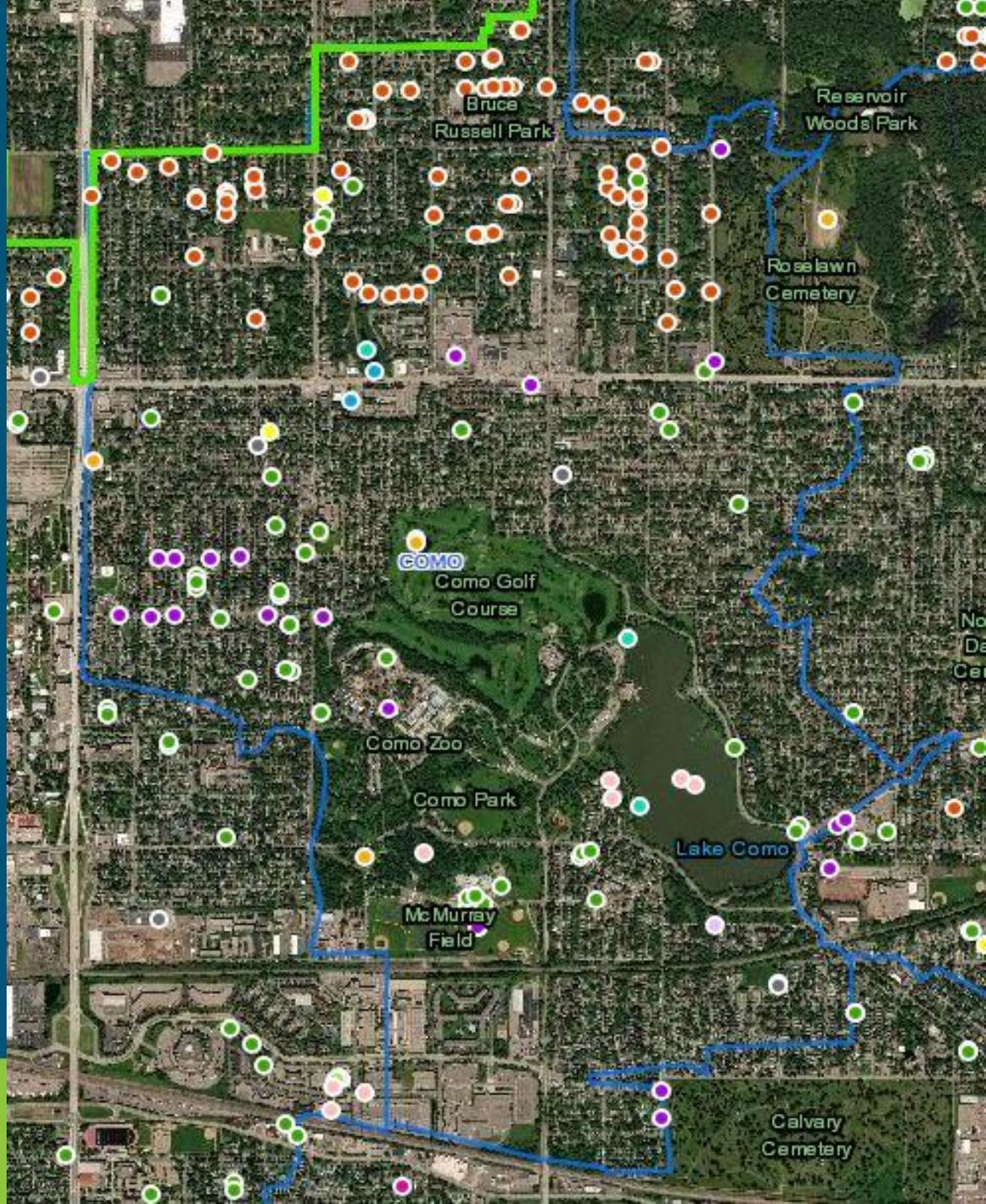
Historical Monitoring

- Chemical, physical, biological data since 1984
- Watershed monitoring



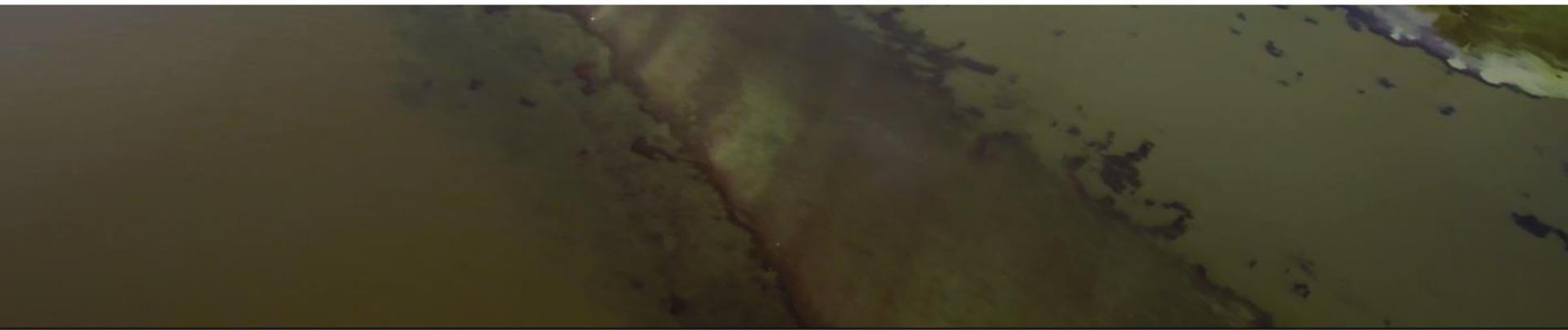
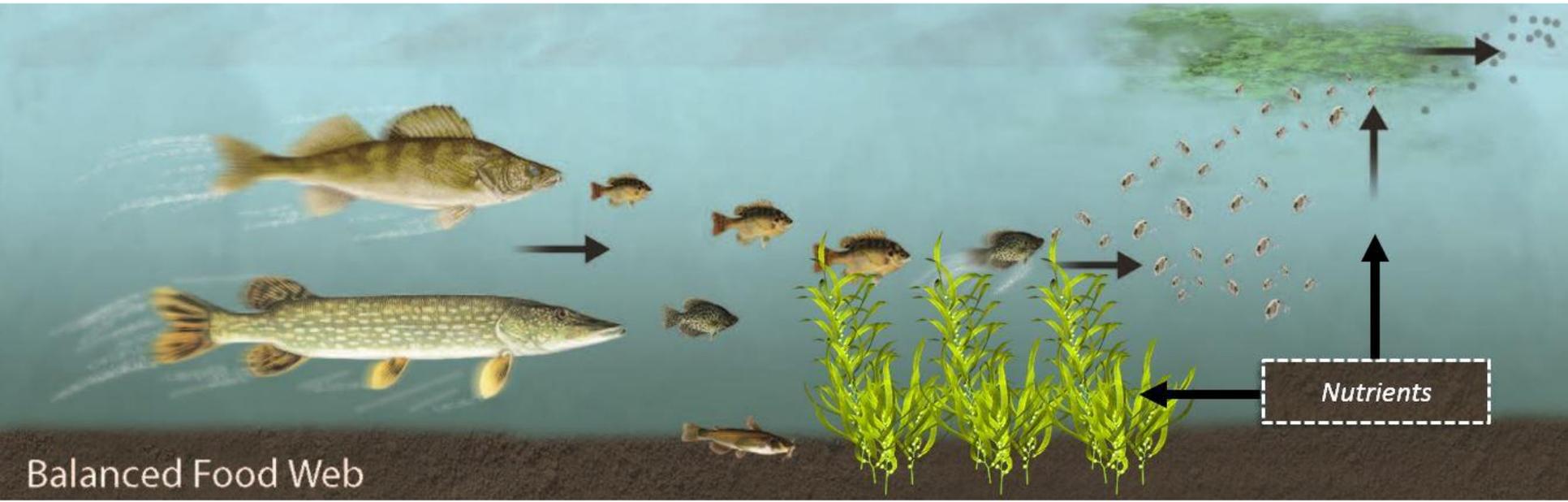
Como Lake Watershed Projects (2002-2017)

BMP Type	# Projects
Raingardens	43
Stormwater Ponds	7
Pervious Pavement	3
Native Buffer Plantings	3
Underground Infiltration	20
TOTAL	76+



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Not meeting water quality goals

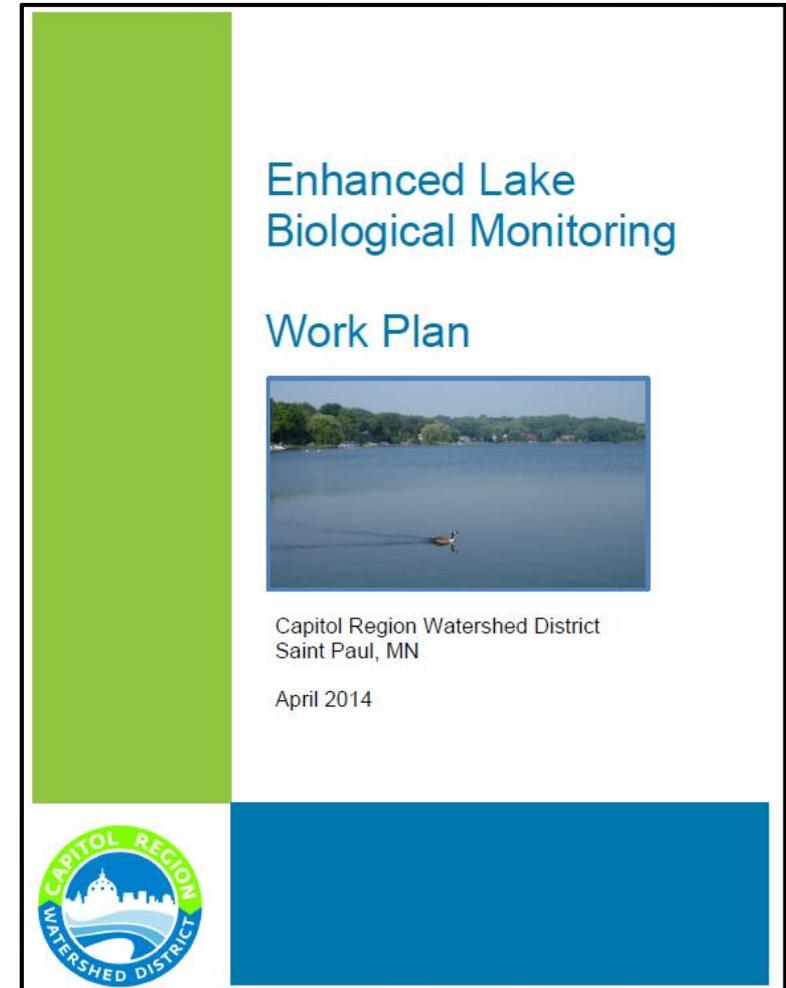


2014 Comprehensive Monitoring Plan



2014 Comprehensive Monitoring Plan

- Understand internal dynamics
 - Phosphorus
 - Ecosystem
- Needed to examine complete picture of lake health
- Adopted and implemented in Spring 2014



Data Collection Specifics

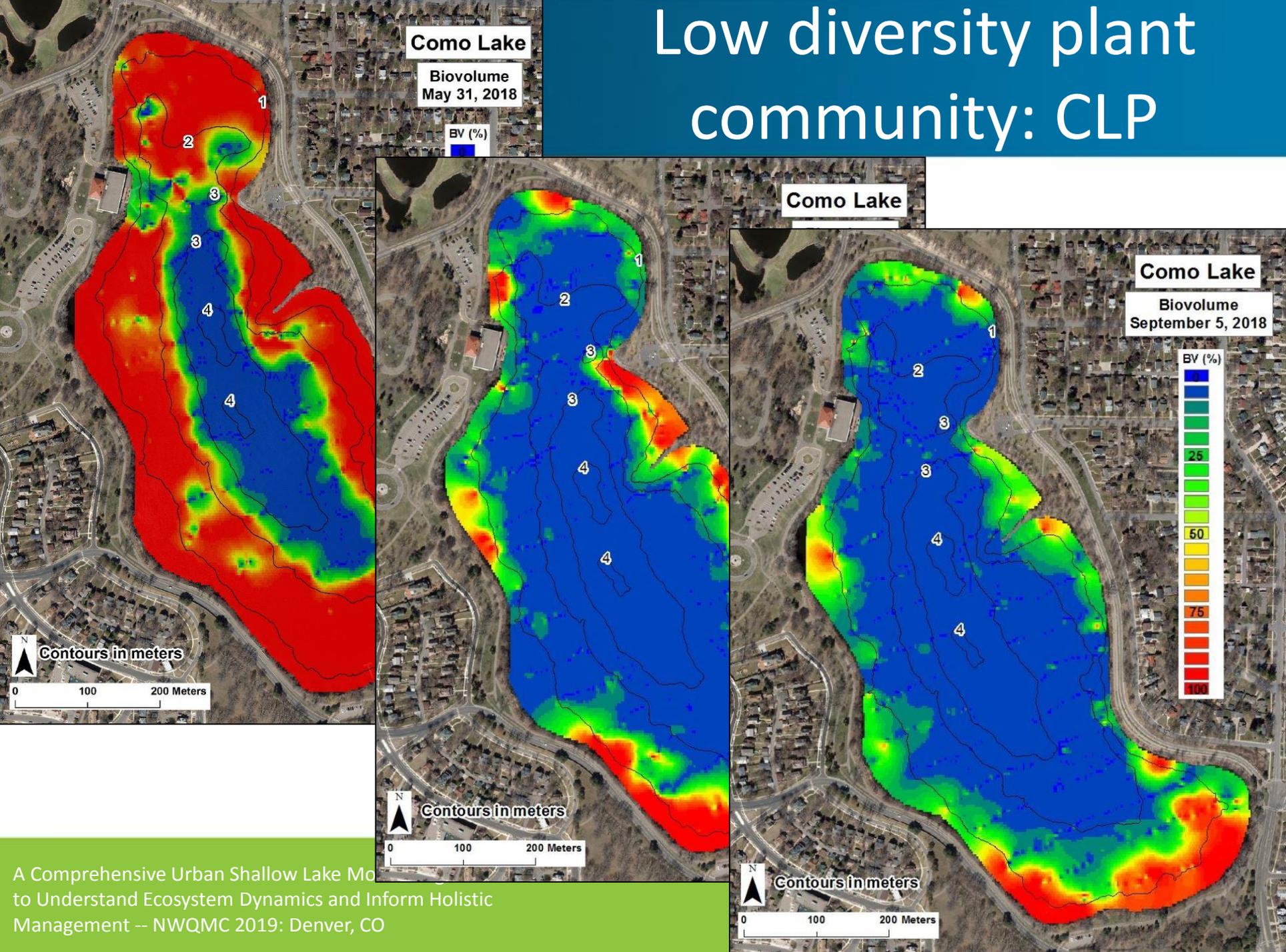
- Increased frequency:
 - Aquatic macrophytes
 - Phytoplankton
 - Zooplankton
 - Physical/chemical
 - Fish populations
- Monitoring additions:
 - Multiple locations
 - Continuous DO, temp, and level
 - Sediment cores
 - Winter monitoring



Results

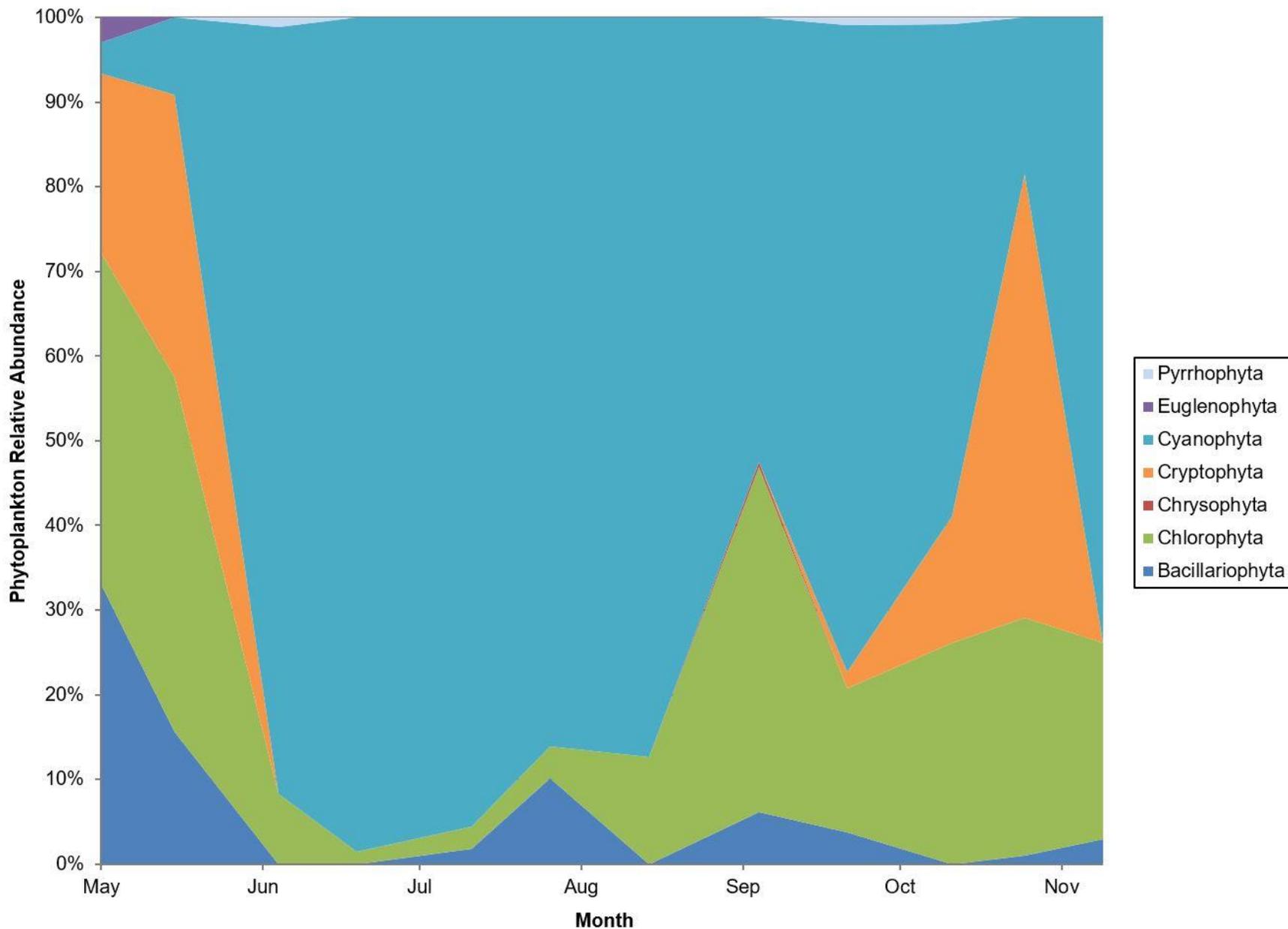


Low diversity plant community: CLP

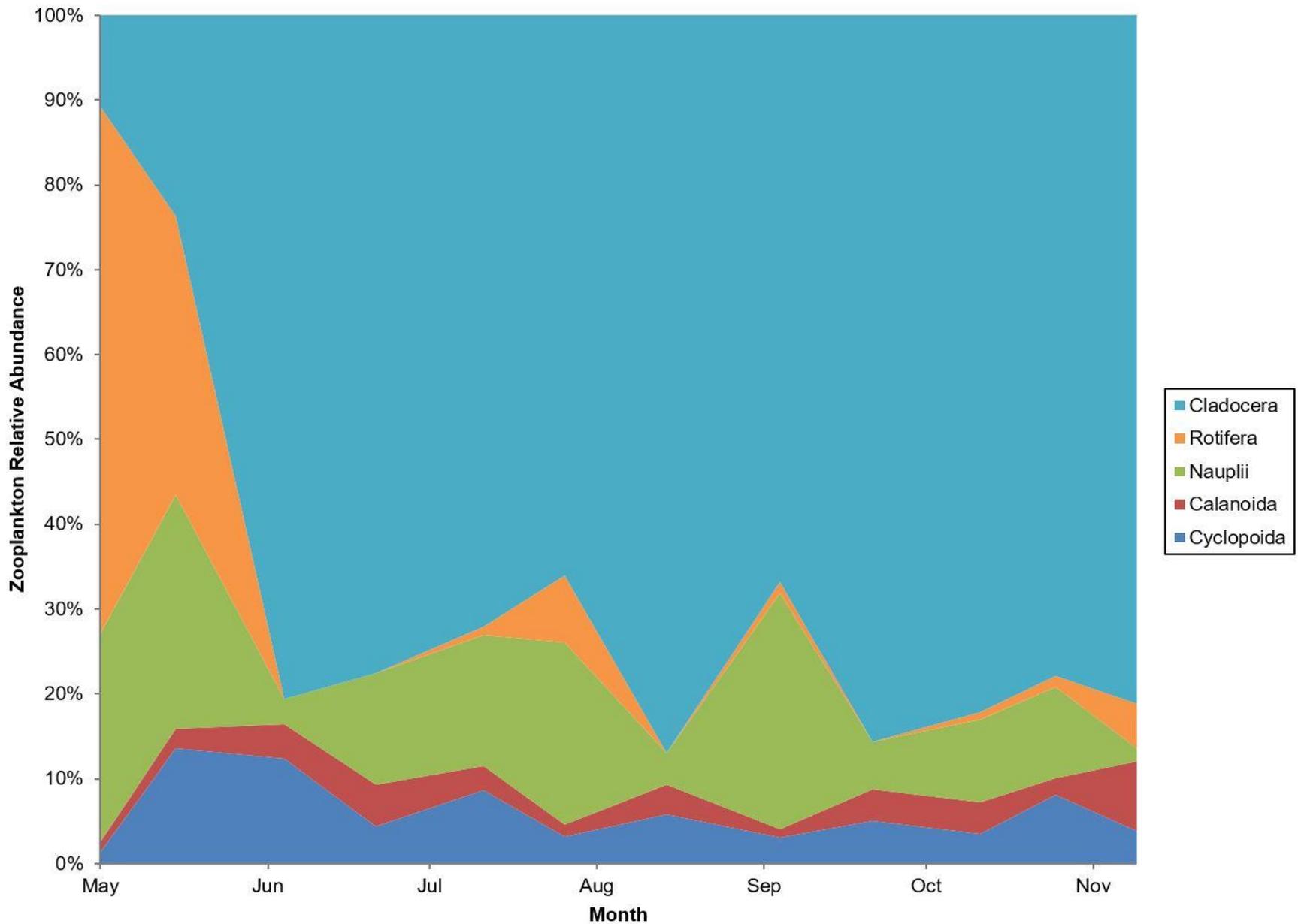


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Phytoplankton = Blue-green algae



Zooplankton = Cladocera



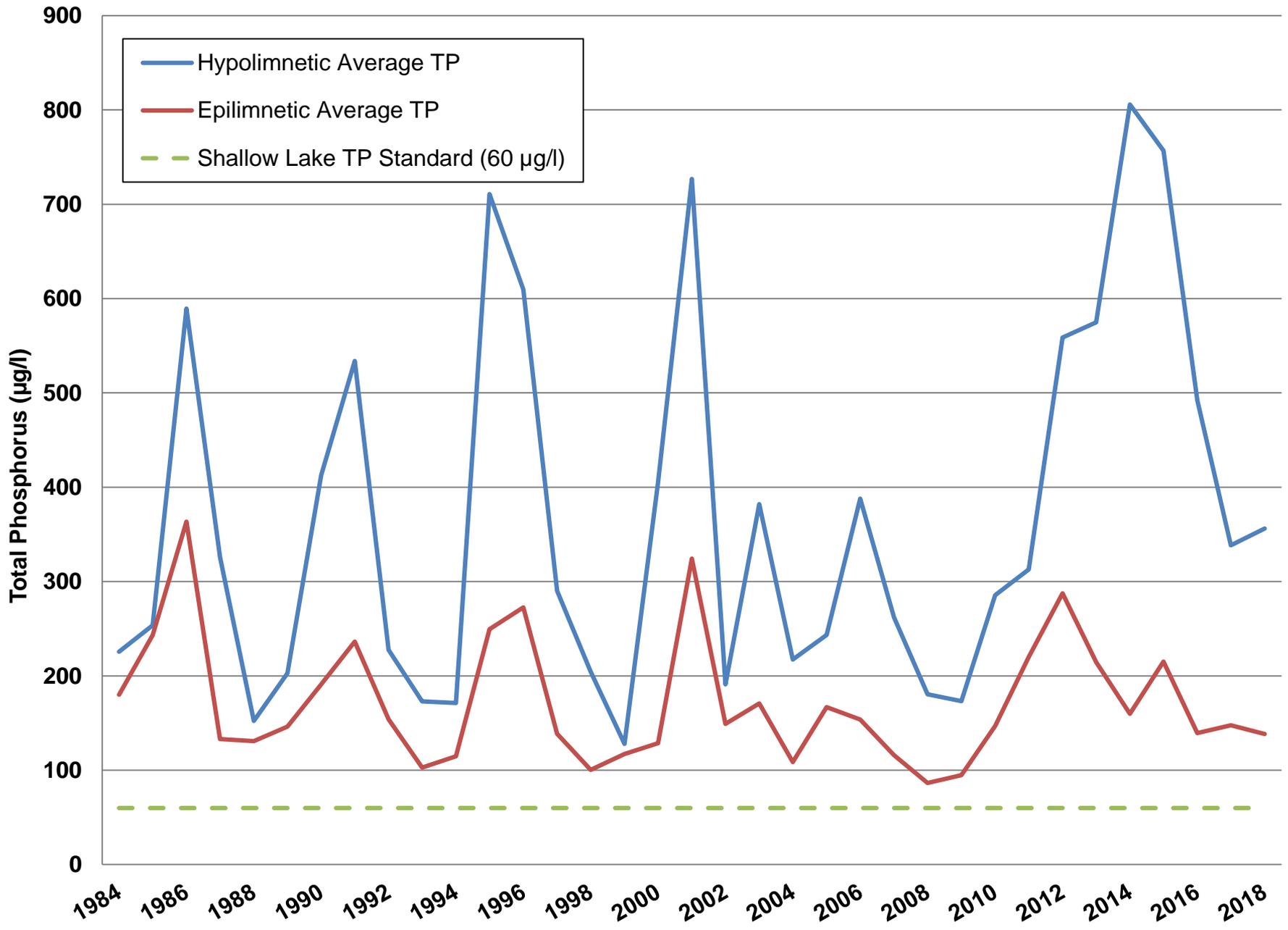
Imbalanced Fishery

2017 Fisheries Survey

Species	Number of fish caught in each category (inches)								Total
	0-5	6-8	9-11	12-14	15-19	20-24	25-29	30+	
Black bullhead	9	9	10	0	0	0	0	0	28
Black crappie	25	69	1	0	0	0	0	0	95
Bluegill	98	25	0	0	0	0	0	0	123
Channel catfish	0	0	0	0	0	2	0	0	2
Golden shiner	2	0	0	0	0	0	0	0	2
Green Sunfish x Bluegill Hybrid	0	2	0	0	0	0	0	0	2
Northern pike	0	0	0	0	1	0	0	1	2
Pumpkinseed Sunfish	16	6	0	0	0	0	0	0	22
Walleye	0	2	0	1	1	0	0	0	4
Yellow bullhead	0	0	1	0	0	0	0	0	1
Yellow perch	0	4	0	0	0	0	0	0	4



Hypolimnetic TP

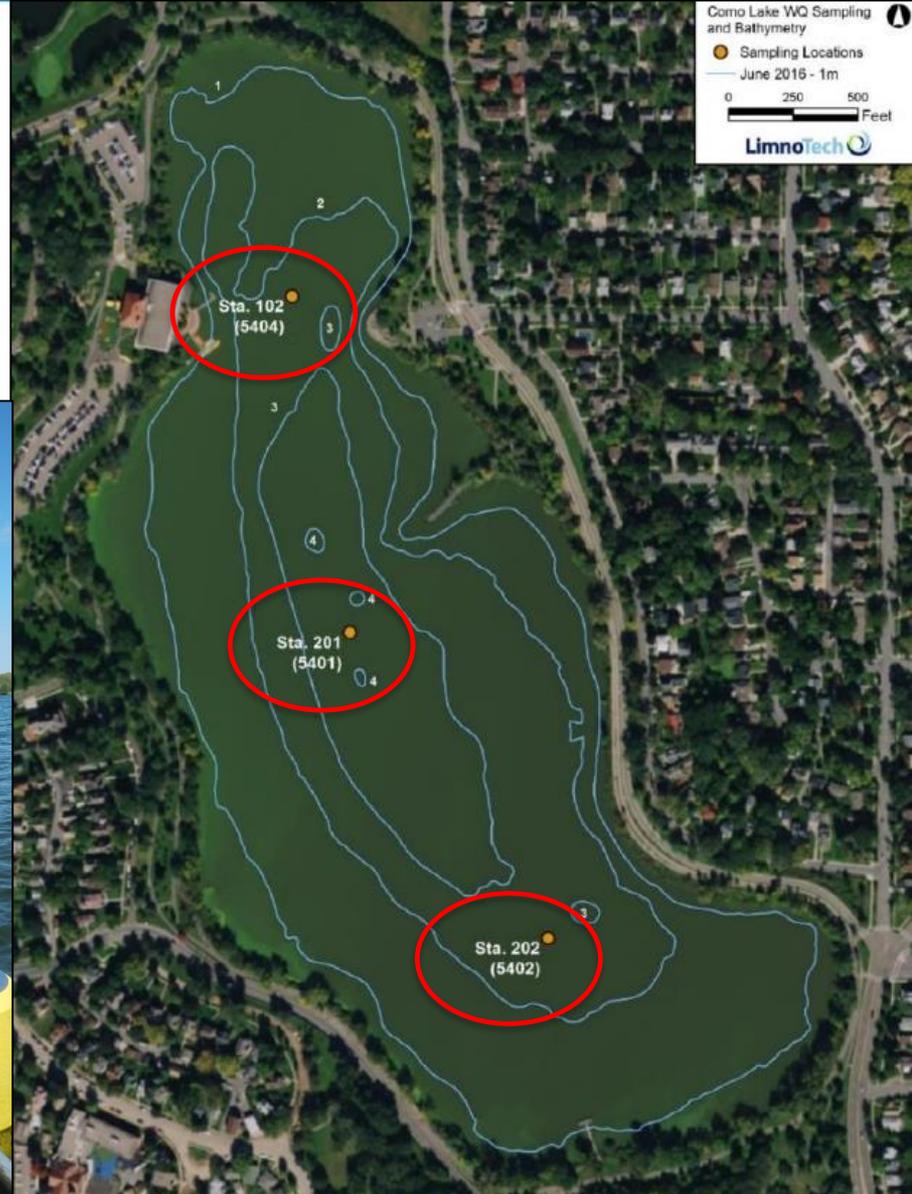


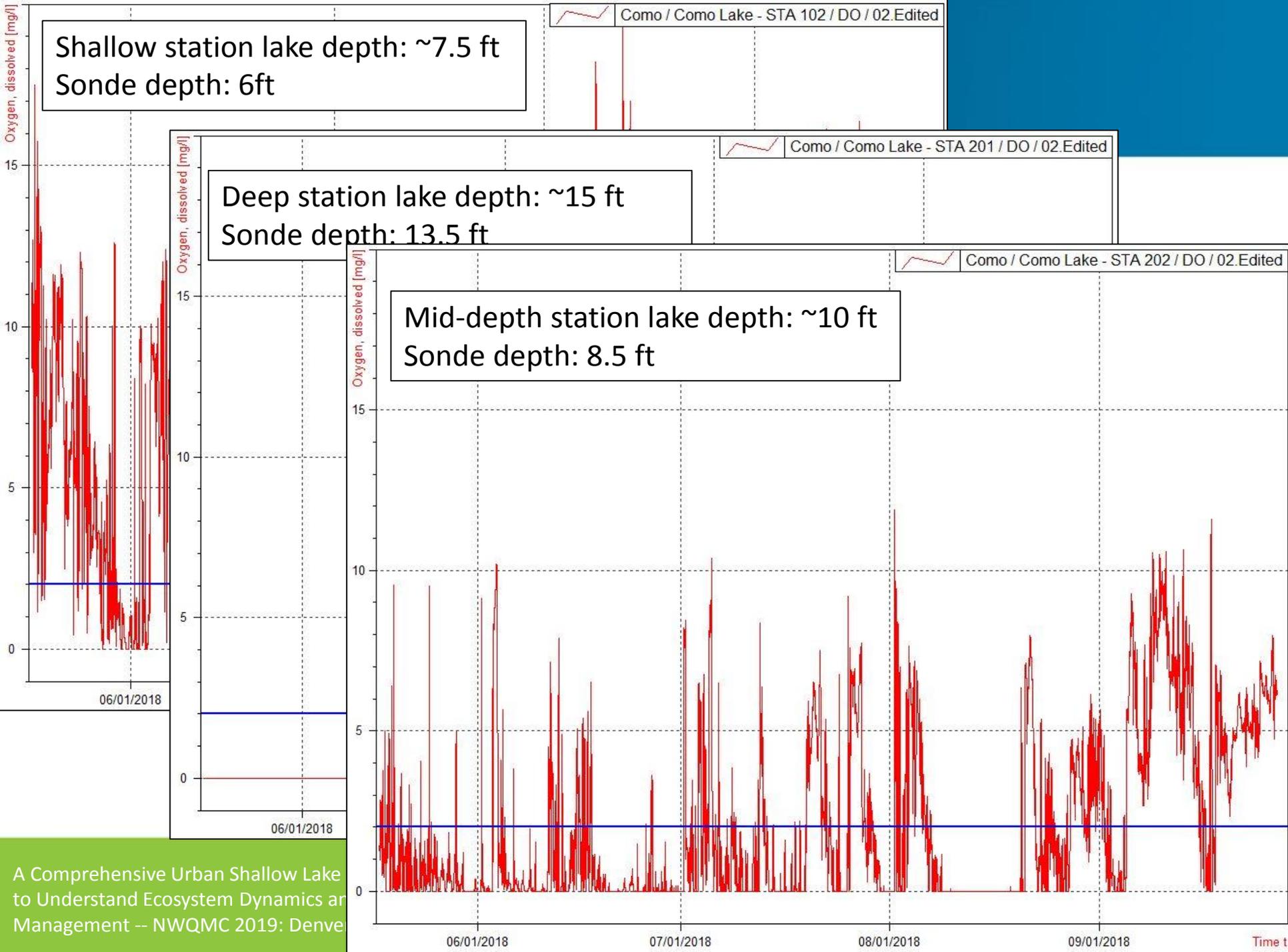
Total Diffusive Flux

Total Diffusive Flux =

- Sediment P release rate
- Duration of anoxia
- Aerial extent of anoxia

Como Lake WQ Sampling
and Bathymetry
● Sampling Locations
June 2016 - 1m
0 250 500
Feet
LimnoTech





Shallow station lake depth: ~7.5 ft
Sonde depth: 6ft

Deep station lake depth: ~15 ft
Sonde depth: 13.5 ft

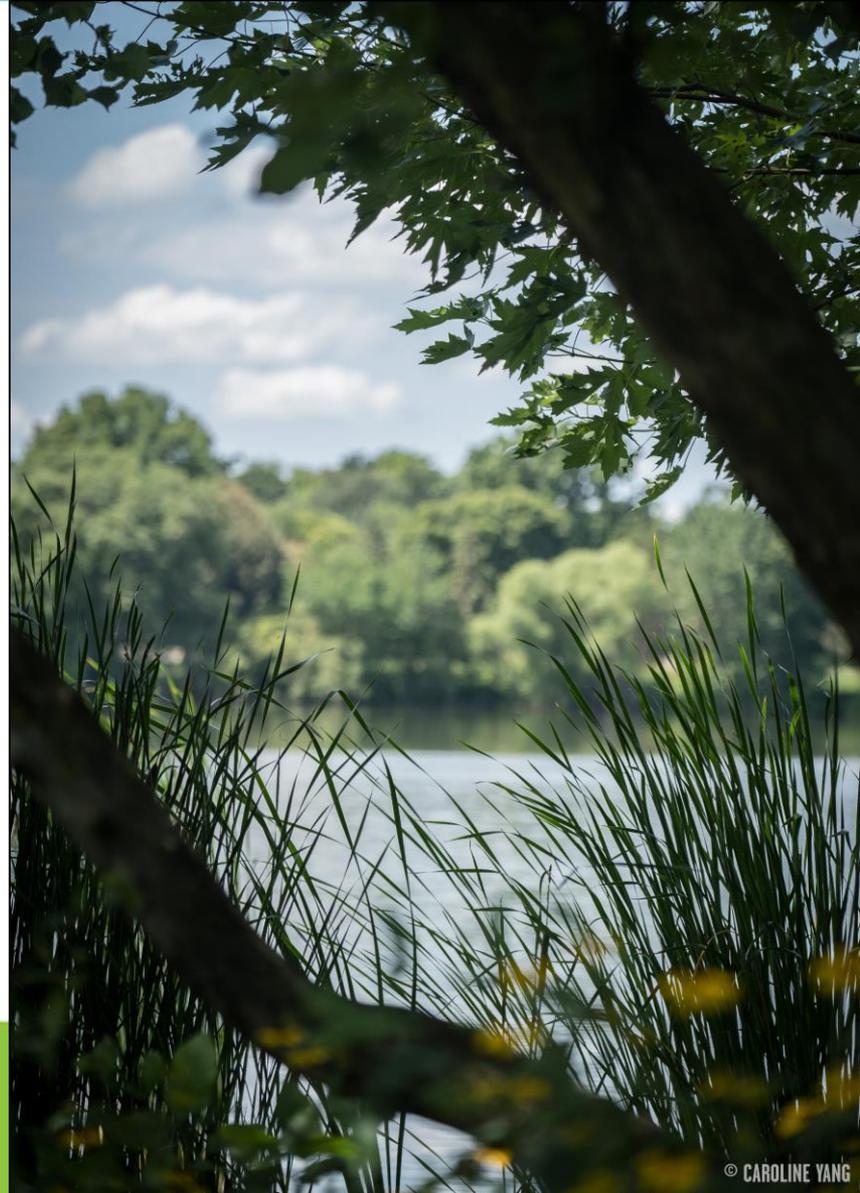
Mid-depth station lake depth: ~10 ft
Sonde depth: 8.5 ft

How is data being utilized?



Como Lake Management Plan

- Guidelines for achieving water quality goals for next 20 years
 - Adaptive management
- Holistic strategies for:
 - In-lake management
 - Watershed management



Summary

- Historical focus on external inputs to lake
- Enhanced monitoring focused more on internal parameters and biological data
- Increased data collection imperative for understanding lake health
- Future adaptive management strategies to meet long-term water quality goals



Questions?



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Continuous monitoring costs

- AquaTrolls: \$24000 for three
- Buoys: \$7000
- Add. Setup: \$9000
- Total: \$40,000



Sediment Cores

Como Lake Sediment Phosphorus Release Rates

Station	102	201
Aerobic rate (mg/m ² *d)	0.24	--
Anaerobic rate (mg/m ² *d)	5.75	6.51



Total Diffusive Flux =

- Duration of anoxia
- Aerial extent of anoxia
- P release rate

