Muskegon Lake: 2024 Status and Trends

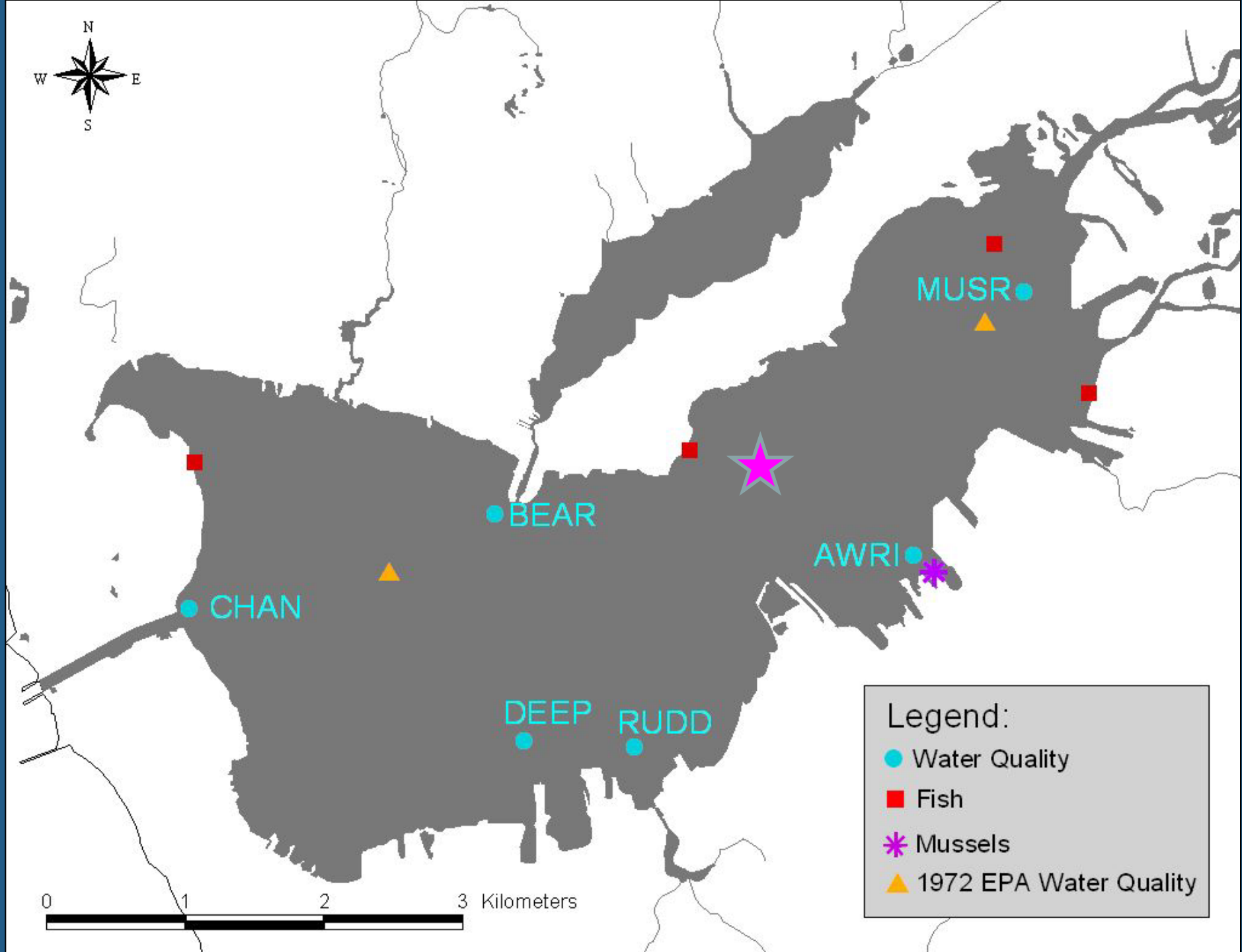
AWRI-GVSU

Photo by Marge Beaver:
www.photography-plus.com

AWRI Monitoring Program for Muskegon Lake

GOALS:

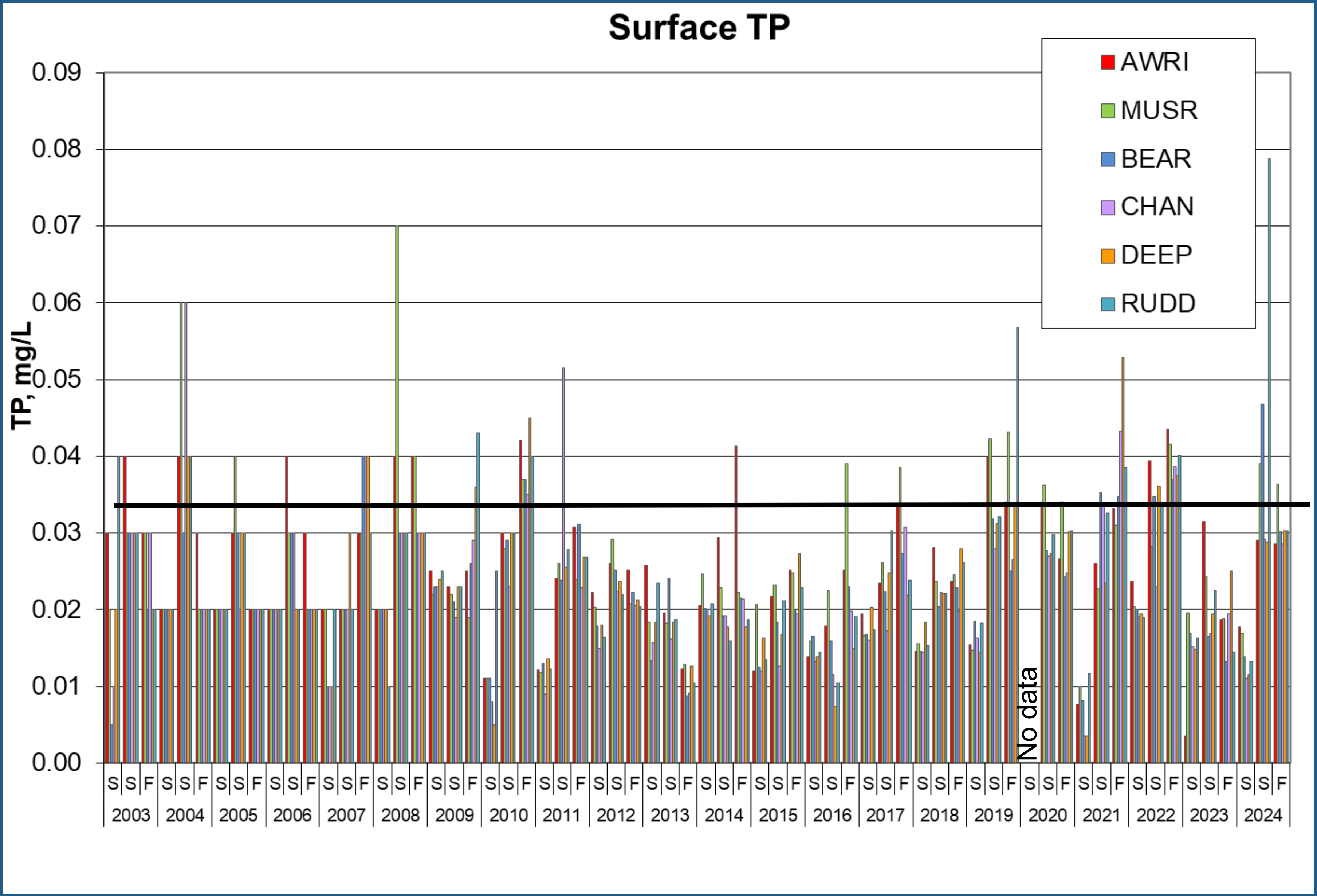
- Observe short-term and long-term changes in the ecological health of Muskegon Lake
- Use information to help de-list Muskegon Lake as an Area of Concern
- Engage Muskegon community in the process of ownership of the lake


N
W
E
S
MUSR
BEAR
AWRI
CHAN
DEEP
RUDD
Legend:
Water Quality
Fish
Mussels
1972 EPA Water Quality
0
1
2
3 Kilometers

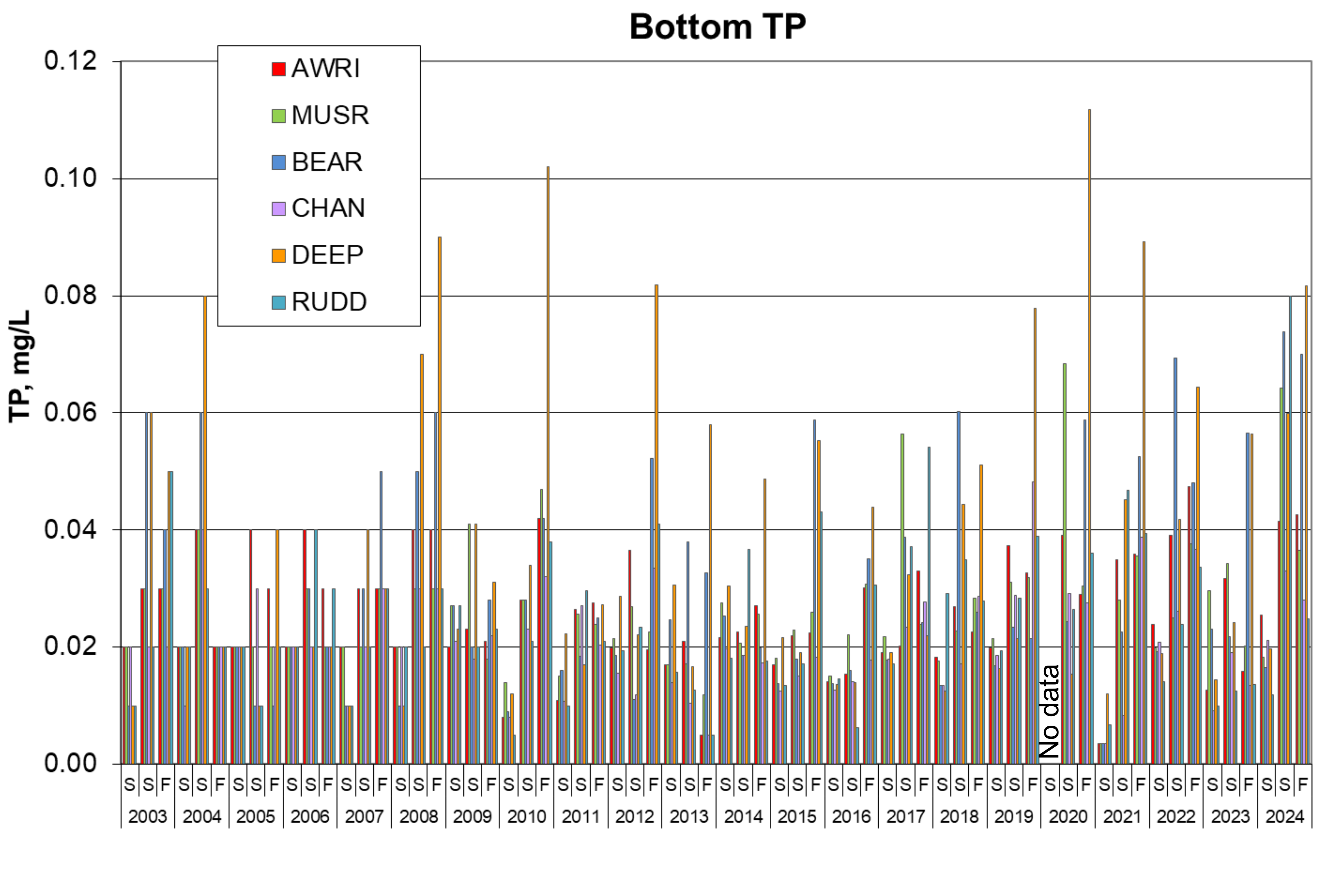
Selected Variables

- Total Phosphorus
- Chlorophyll *a*
- Algae
- Fish
- Dreissenid Mussels

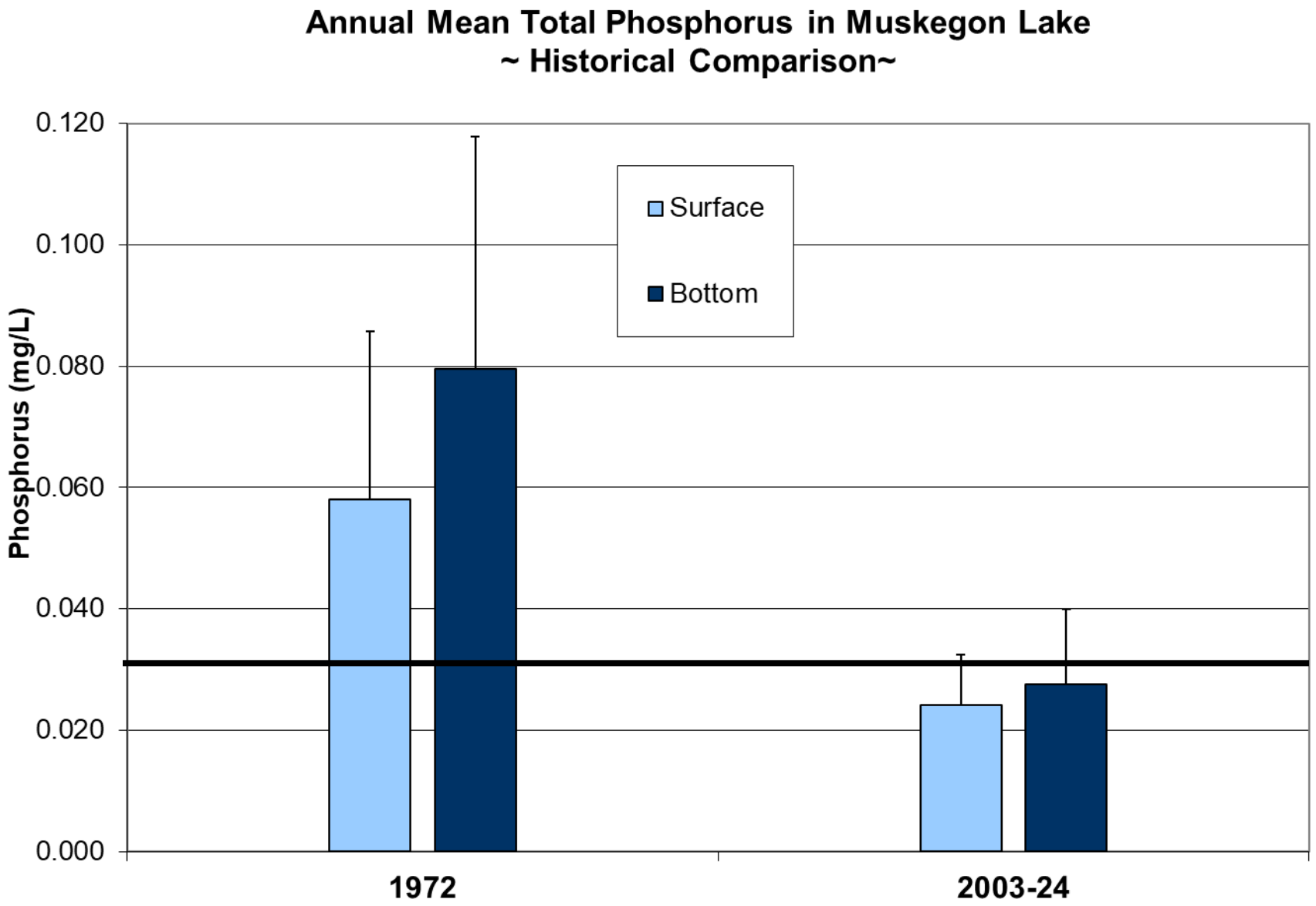
TOTAL PHOSPHORUS: 2003-2024



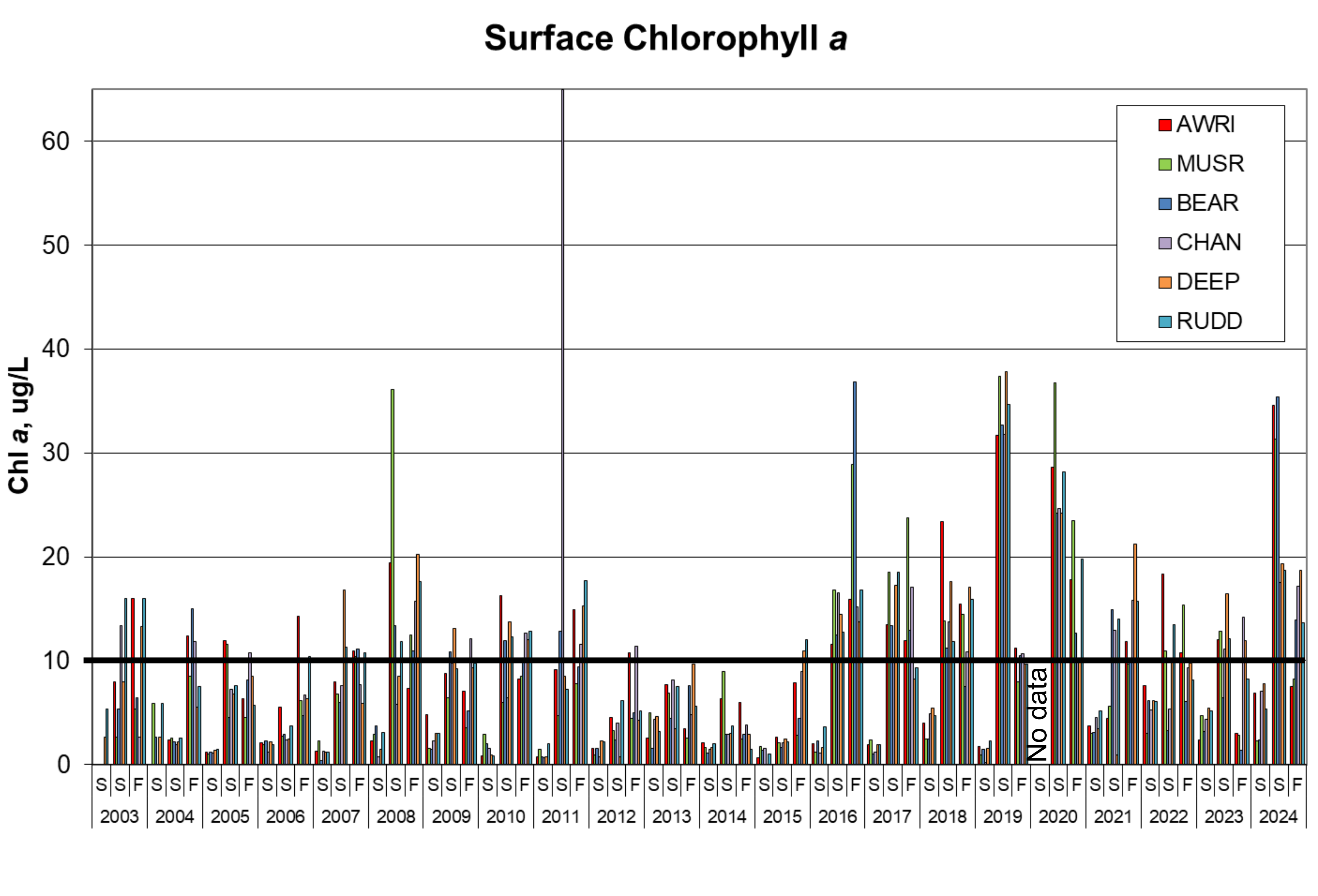
TOTAL PHOSPHORUS: 2003-2024



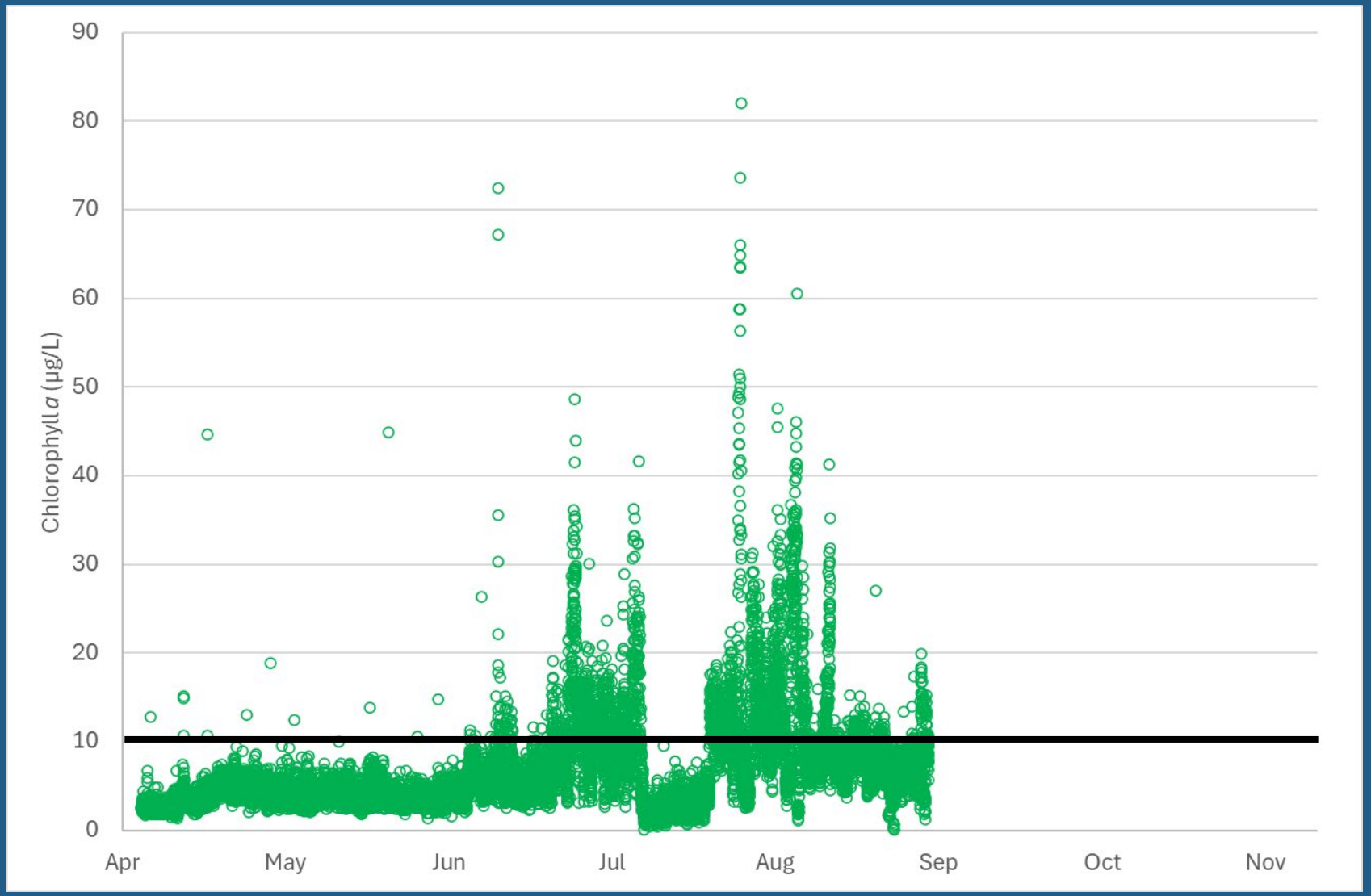
TOTAL PHOSPHORUS: ‘72 vs. ‘03-‘24



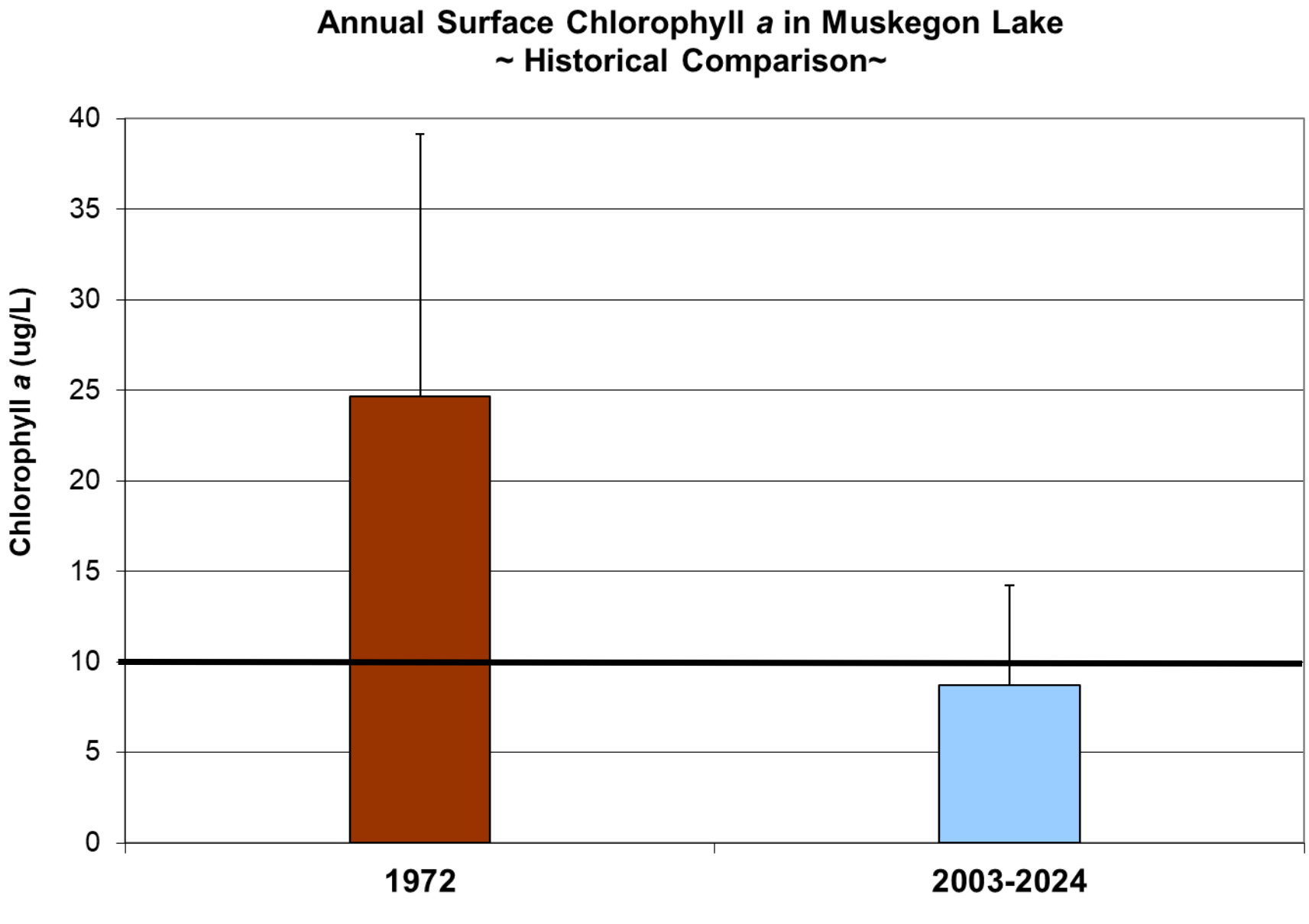
Chlorophyll *a*: 2003-2023



Chlorophyll *a*: 2024 (buoy)



Chlorophyll *a*: 2003-2024



Microcystis Formation

Phytoplankton (2003 – 2020)*

	% BGs / % Microcystis		
	Spring	Summer	Fall
2003	20% / 10%	44% / 19%	60% / 46%
2004	26% / 89%	53% / 62%	59% / 95%
2005	5% / 0%	67% / 69%	81% / 84%
2006	5% / 94%	32% / 78%	26% / 91%
2007	<1% / 0%	33% / 85%	62% / 92%
2008	4% / 0%	70% / 87%	100% / 62%
2009	<1% / 0%	6% / 68%	12% / 44%
2010	<1% / 0%	2% / 57%	5% / 72%
2011	3% / 0%	69% / 15%	7% / 53%
2012	<1% / 0%	10% / 24%	3% / 19%
2013	1% / 100%	7% / 59%	7% / 74%
2014	<1% / 0%	11% / 80%	2% / 1%
2015	<1% / 100%	11% / 12%	1% / 7%
2016	0% / NA	1% / 96%	4% / 1%
2017	3% / 0%	14% / 90%	23% / 72%
2018	18% / 6%	9% / 8%	9% / 32%
2019	<1% / 0%	10% / 8%	7% / 18%
2020	ND / ND	8% / 16%	11% / 3%

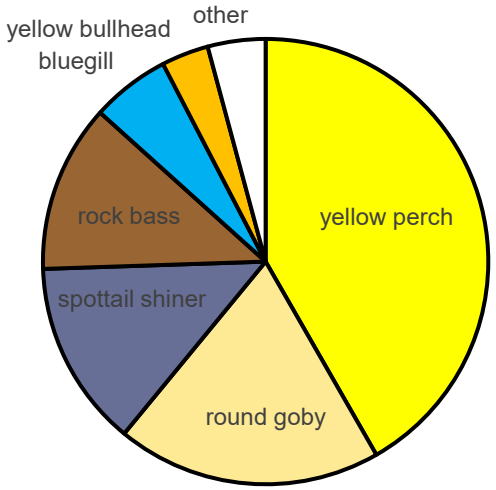
Muskegon Lake Fish Monitoring

- Fyke nets set in shallow littoral zone of lake
- Nets in place overnight
- Catch represents littoral fish community
- Results commonly reported as “catch per net night”

FYKE NET

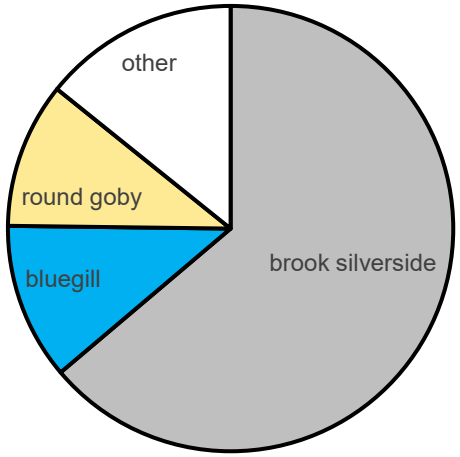
Spring Fish Data – Fyke Nets

2022



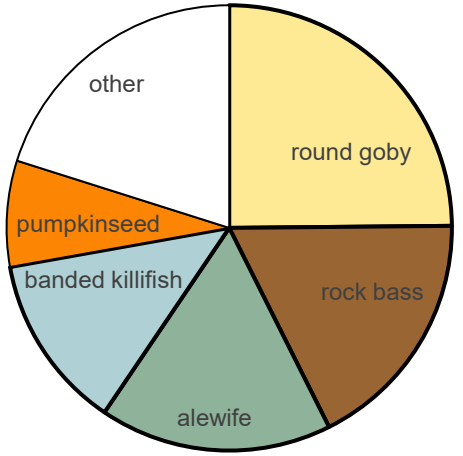
Total Catch / Net Night: 44

2023



Total Catch / Net Night: 147

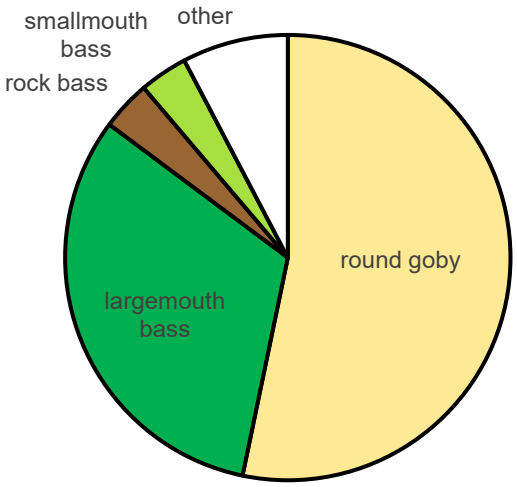
2024



Total Catch / Net Night: 28

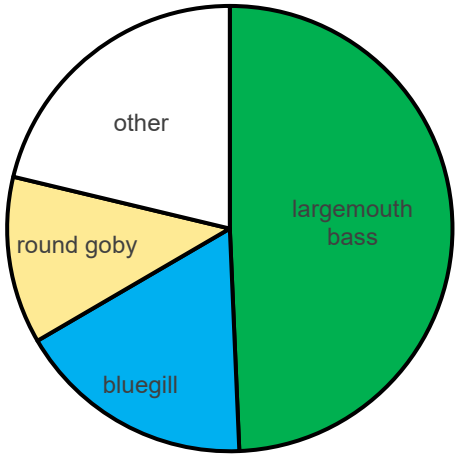
Summer Fish Data – Fyke Nets

2022



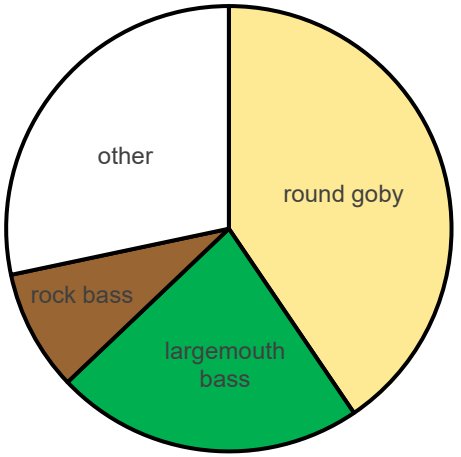
Total Catch / Net Night: 86

2023



Total Catch / Net Night: 80

2024

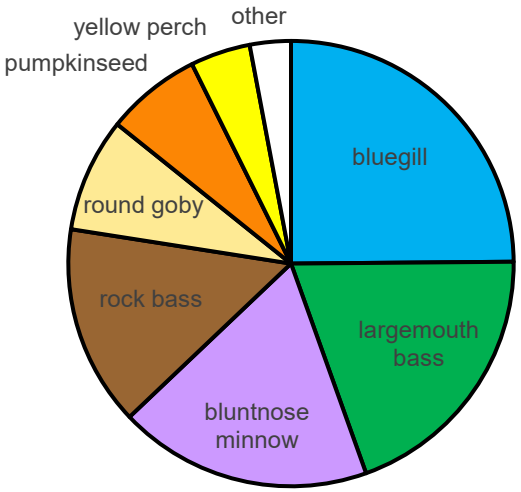


Total Catch / Net Night: 76

2024: first evidence of natural reproduction of Muskellunge in Muskegon Lake in recent times

Fall Fish Data – Fyke Nets

2022

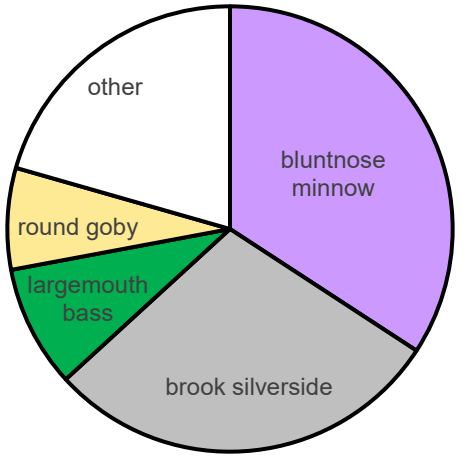


Total Catch / Net Night: 78

2023

Total Catch / Net Night: 48

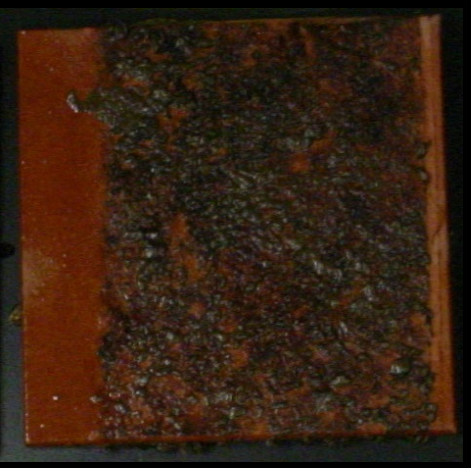
2024



Total Catch / Net Night: 196

Dreissena Mussel Colonization Study

Multi-year study to measure zebra & quagga mussel colonization & growth over time-scale intervals



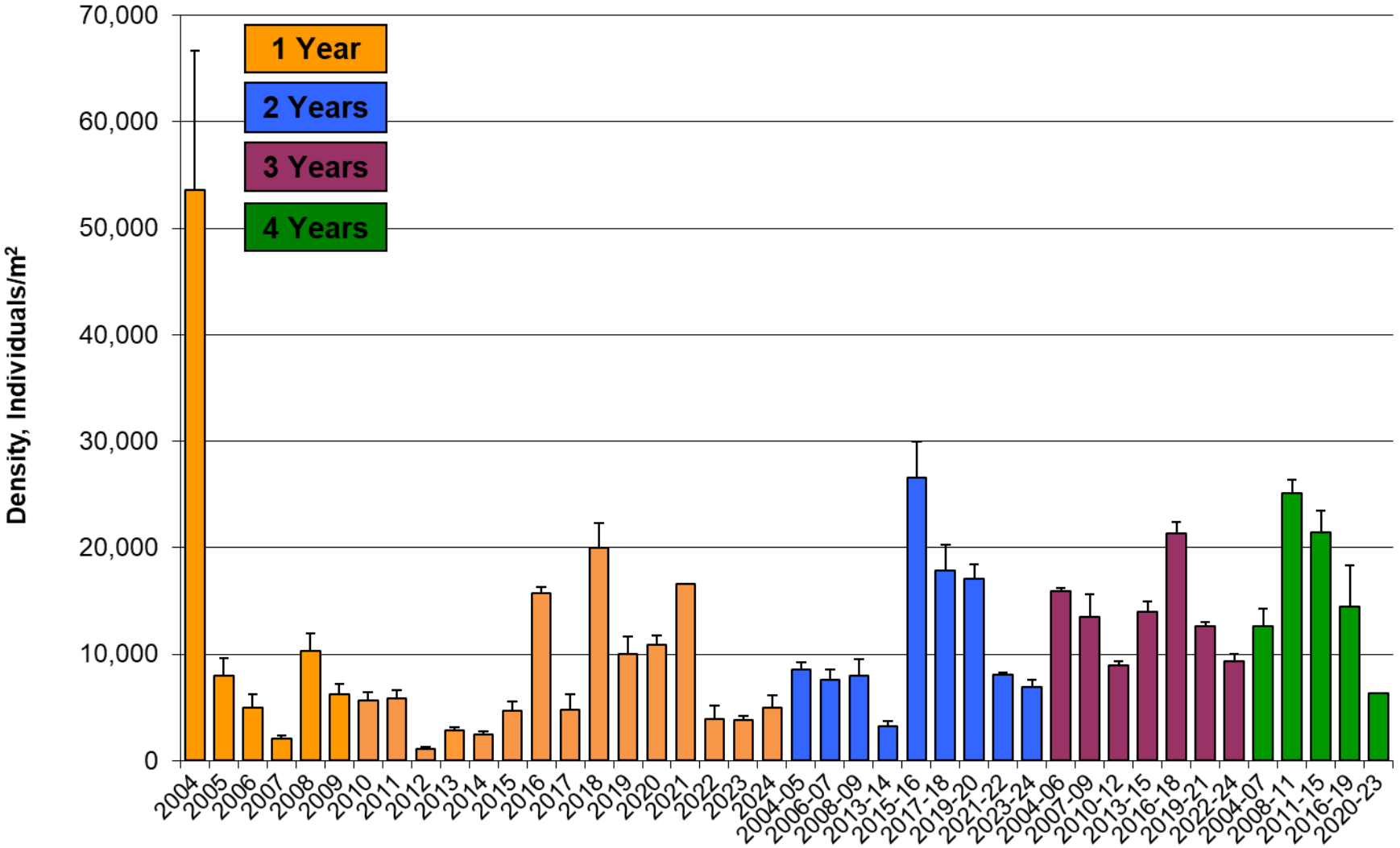
1 Year

2 Years

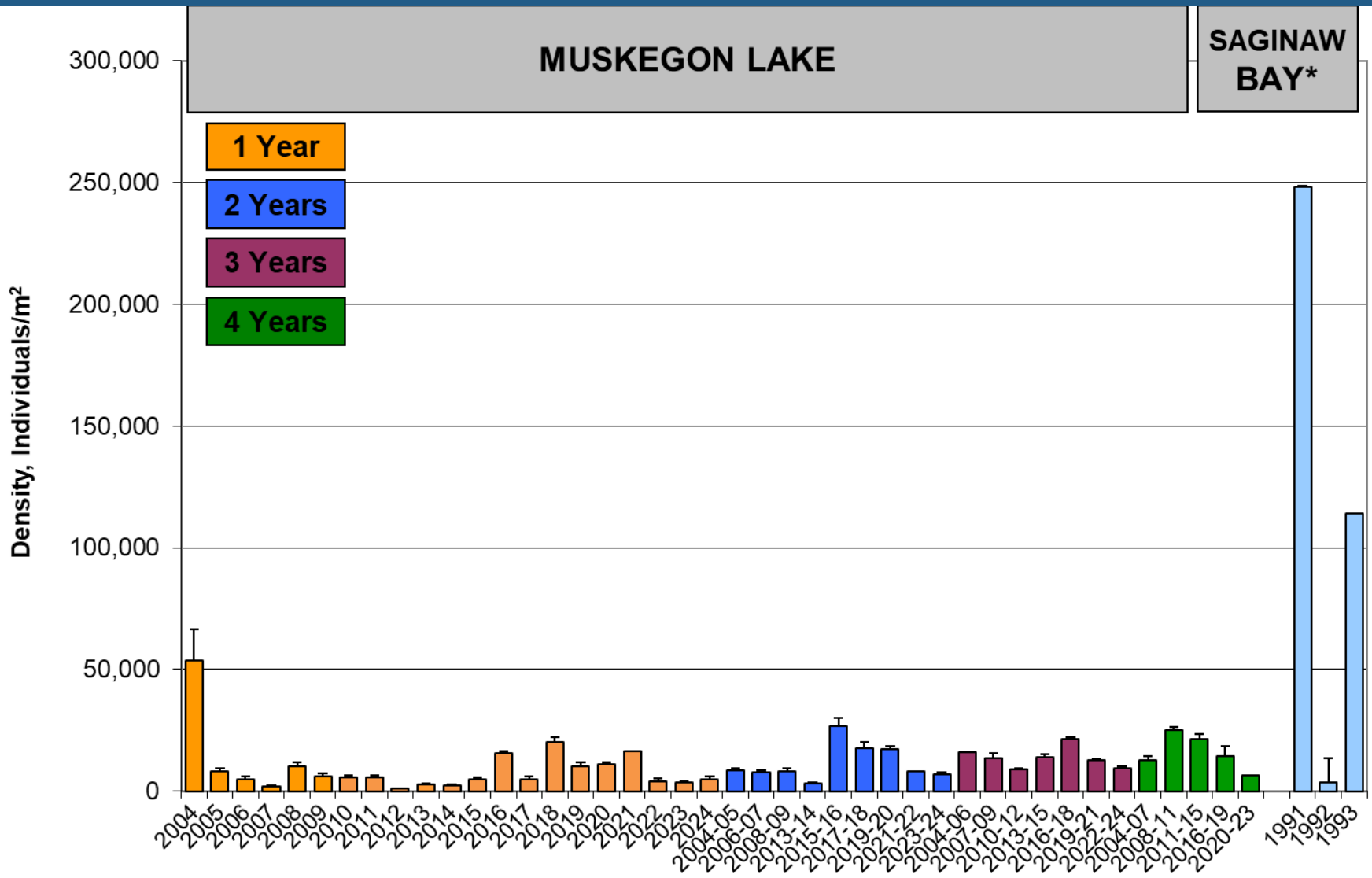
3 Years

4 Years

Dreissena Mussel Density

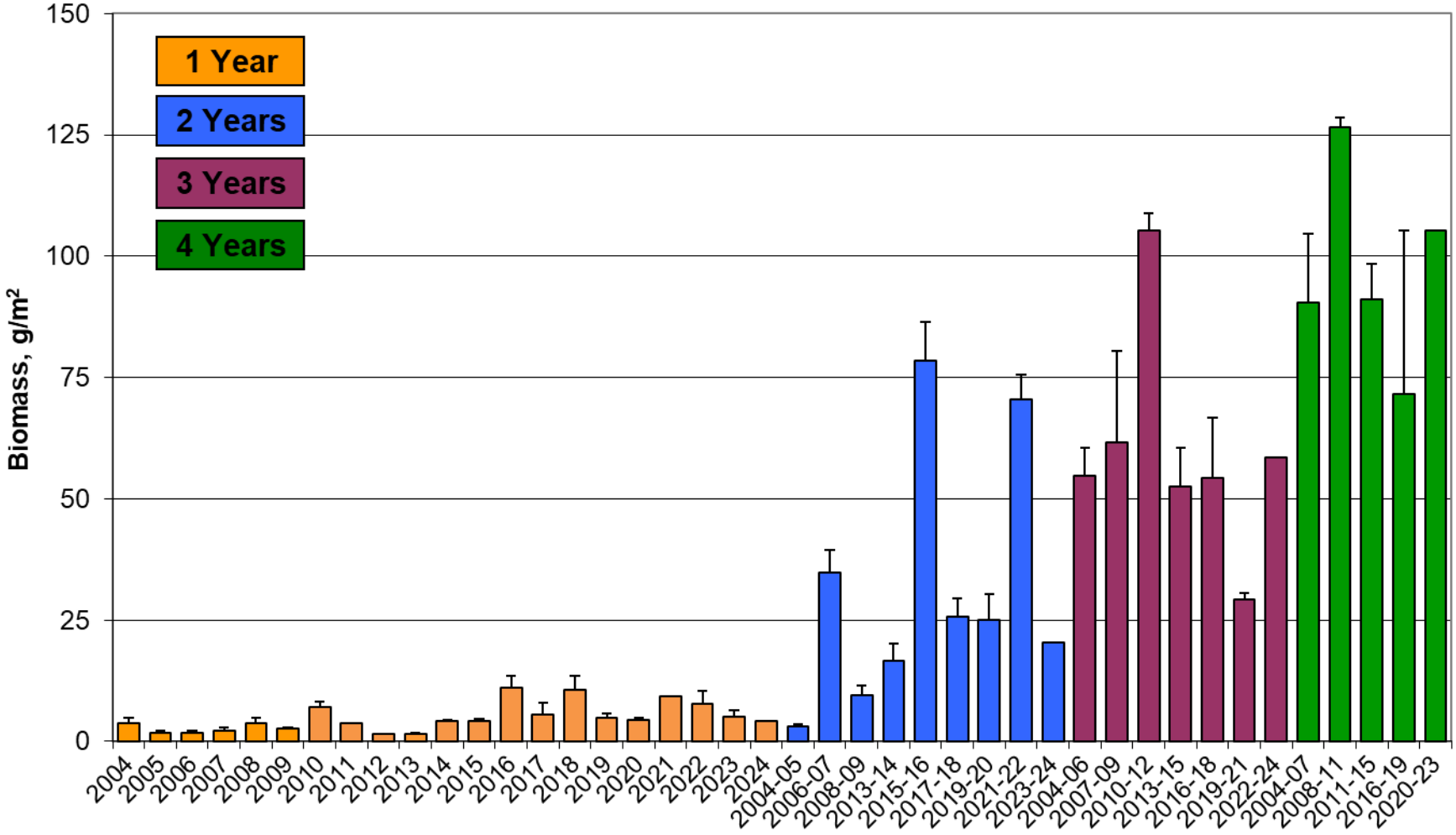


Dreissena Mussel Comparison



*Source: Nalepa et al. 1995, J. Great Lakes Res. 21(4):417-434

Dreissena Mussel Biomass



Muskegon Lake Observatory

Objectives:

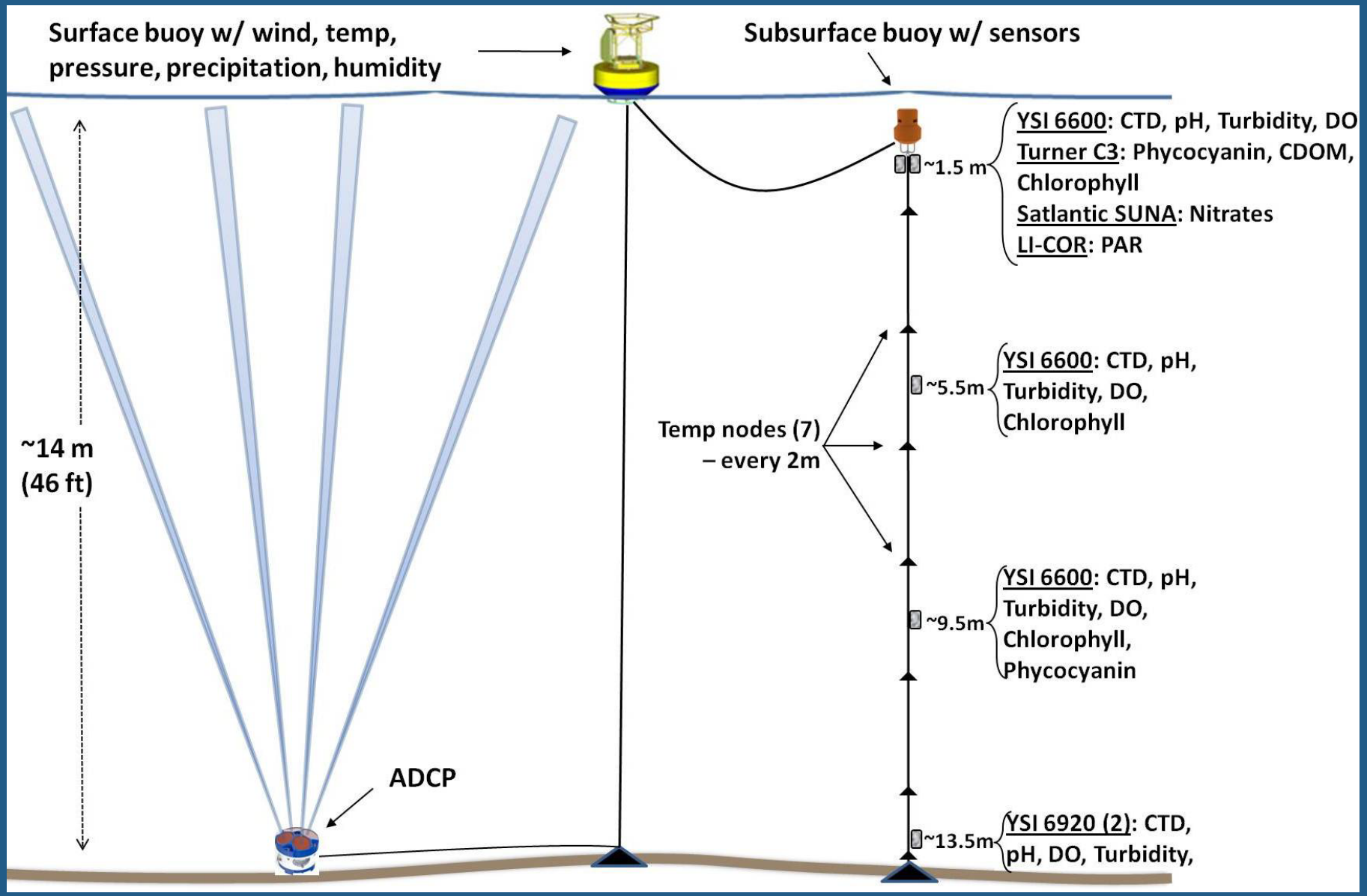
- Establish a continuous time-series monitoring system to measure biological, chemical and physical characteristics

- Link data to regional/global observatory networks

- Enable research, research training, education and outreach


GVSU Research

Lake Observatory Components



Lake Observatory Website

GRAND VALLEY STATE UNIVERSITY

SEARCH PEOPLE & PAGES

Muskegon Lake Buoy

- Home
- Current Conditions
- Data Graphing
- Buoy System

Welcome to the Muskegon Lake Buoy web site! From this site, you have at your fingertips current conditions and historic data from the Muskegon Lake buoy going back to 2011. The primary purpose of the buoy system is to help understand and manage this valuable water resource in the Muskegon area. However, data is openly accessible for everyone no matter what your interest:boating, fishing, wind surfing, paddle boarding, developing a lesson plan, working on a student project, doing lake research, or you just want to know weather conditions in the area.

The buoy system is typically deployed on the lake from April to November, and some

Outcome/Products

- Information used to de-list Muskegon Lake as an Area of Concern
- Information used to leverage new grants
- Model research system for faculty, students and postdoctoral research associates

Outcome/Products: 2003-2024

- 25 Graduate Student Theses
- 63 Student and Faculty peer-reviewed scientific publications
- 8 postdoctoral researchers
- Leveraged Funding (to date): >$27,750,000*

*(Sources: CFMC, NOAA, EPA, NSF, FACF, Alcoa, MSGC, EGLE, MDNR, NEMWI, private philanthropy)

Muskegon Lake Dashboard

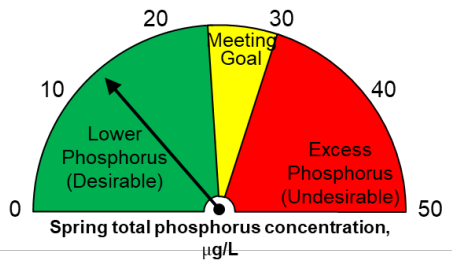
- The dashboard provides a visual representation of the current status and historical trends in Muskegon Lake water quality, by rating each indicator along a scale from desirable (green) to undesirable (red) conditions.
- More information on the dashboard is available on the website below.

www.gvsu.edu/wri/dashboard

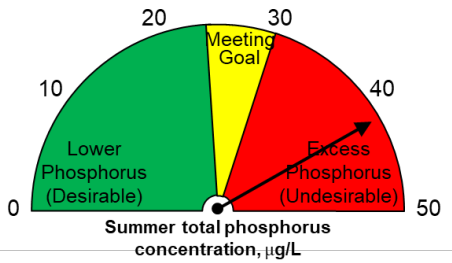
Current Status (2024) – Total Phosphorus

Target Concentration: 30 µg/L

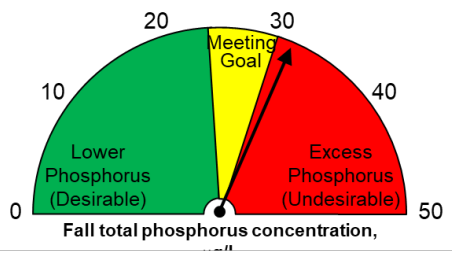
Spring

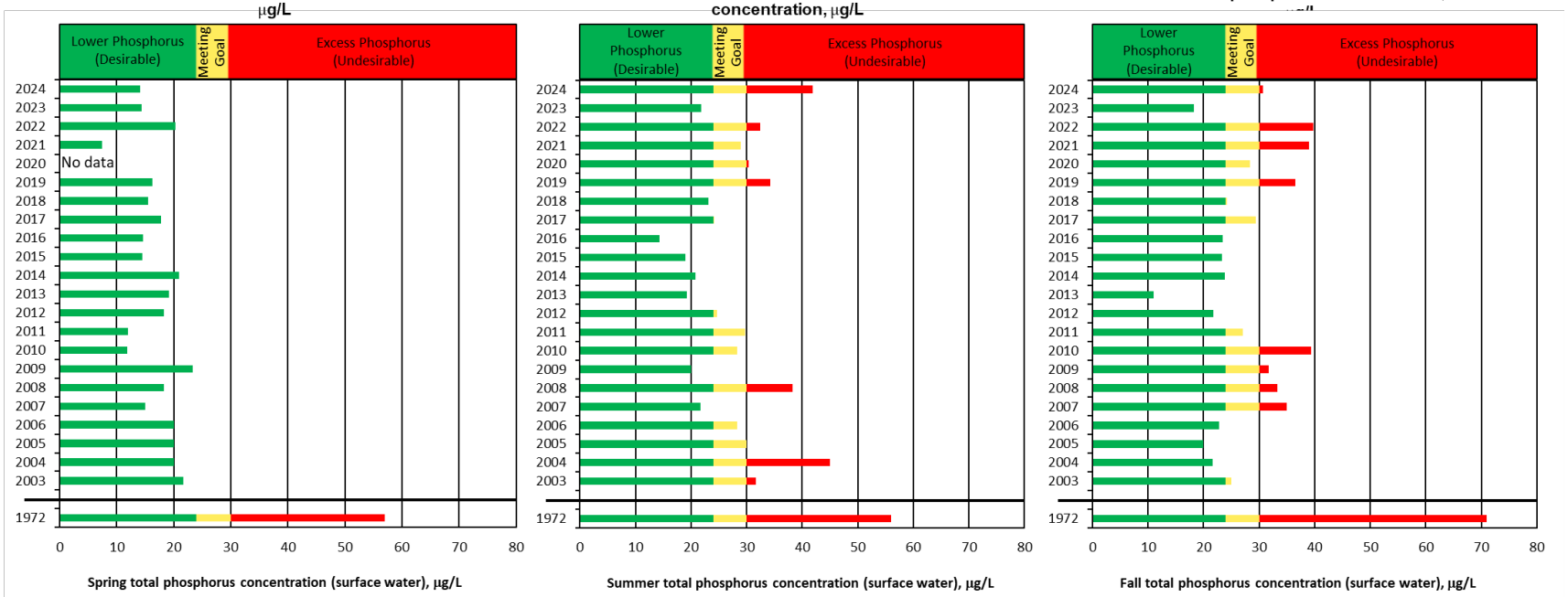


Summer



Fall



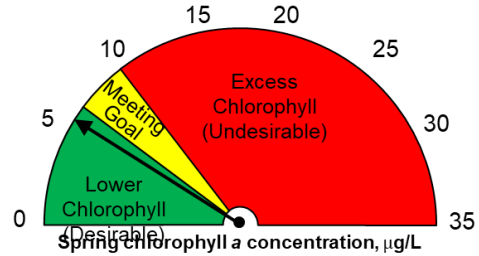


Data sources: Freedman et al. (1979); Muskegon Lake Long-term Monitoring Program, Steinman et al. (2008) and AWRI (unpublished data)

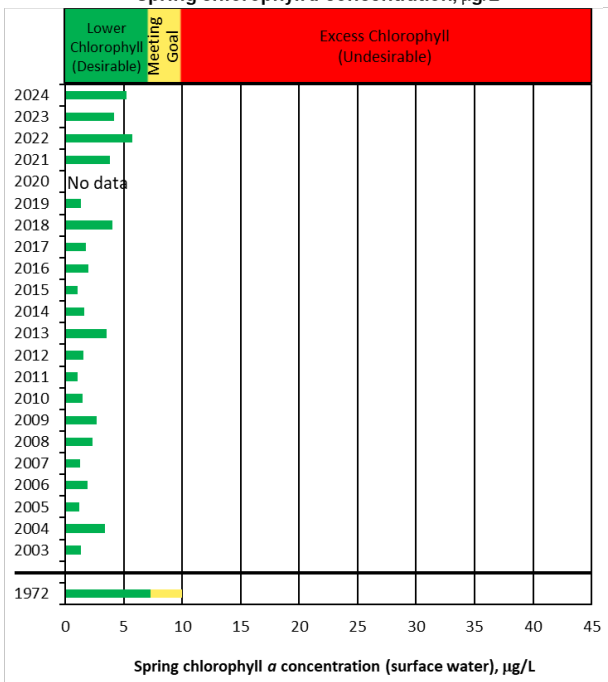
Current Status (2024) – Chlorophyll *a*

Target Concentration: 10 µg/L

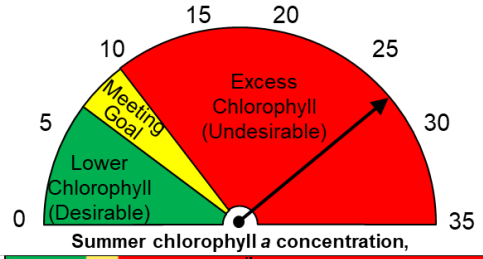
Spring



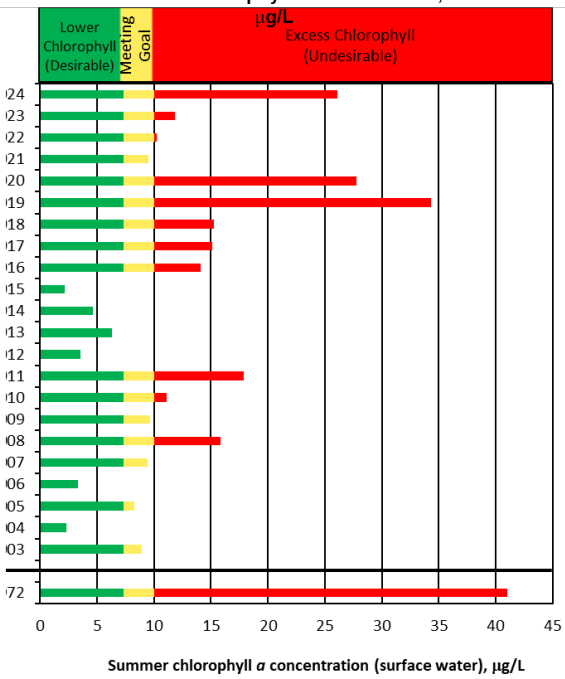
Spring chlorophyll *a* concentration, µg/L



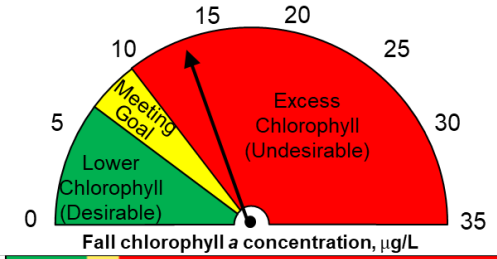
Summer



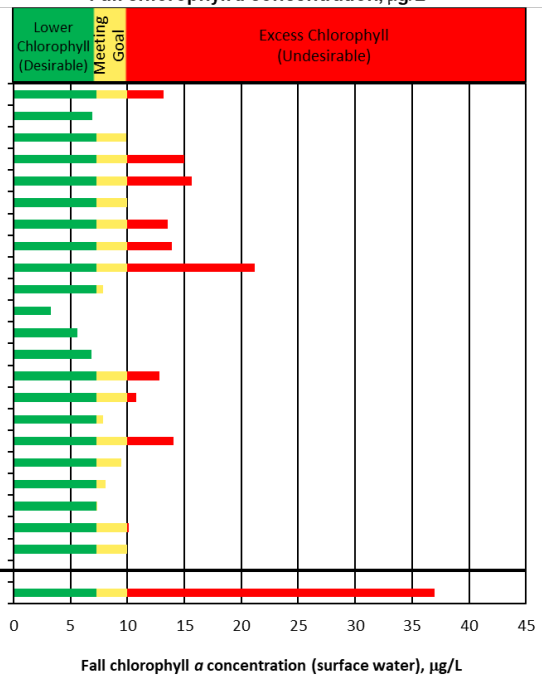
Summer chlorophyll *a* concentration, µg/L



Fall



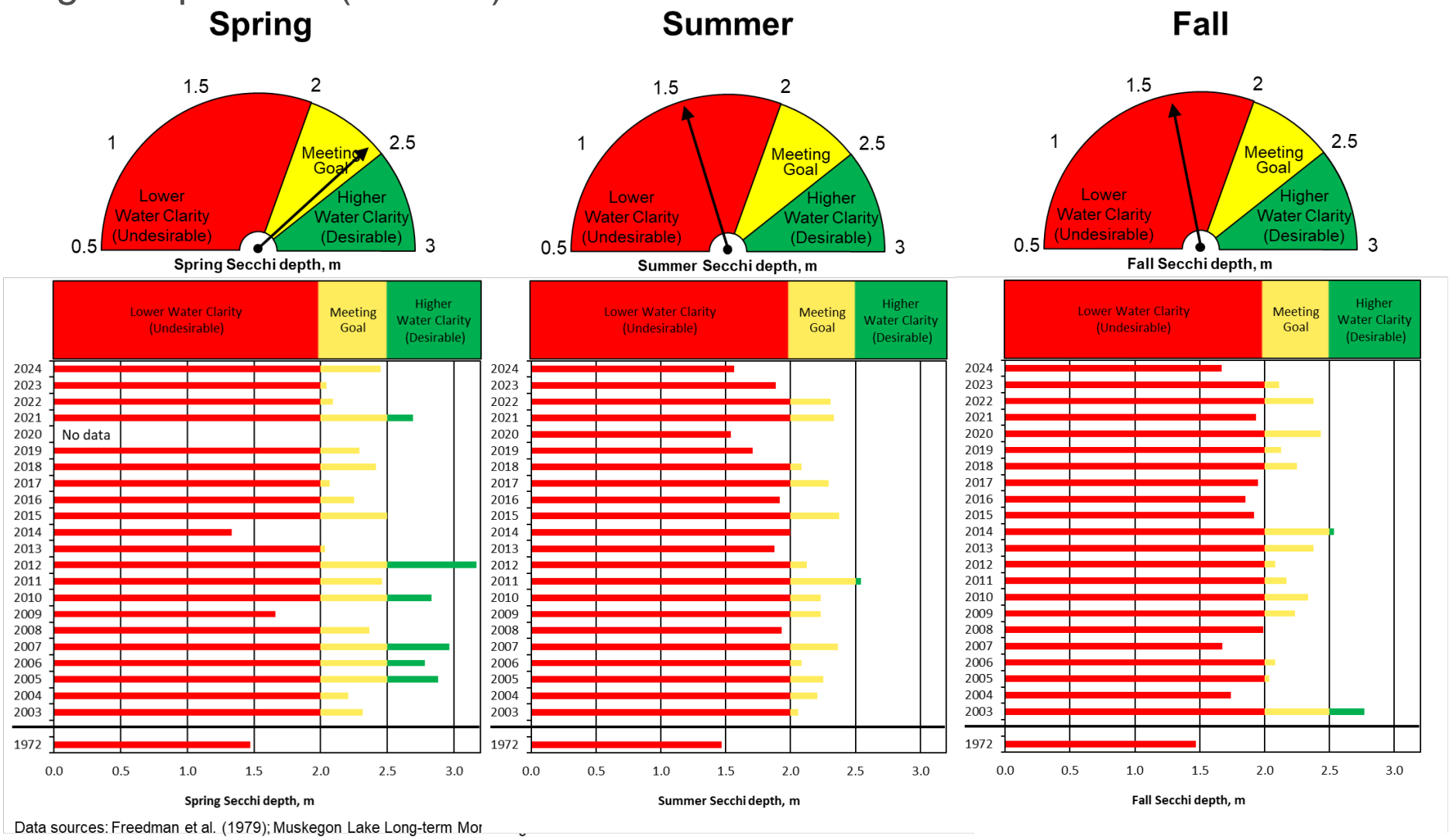
Fall chlorophyll *a* concentration, µg/L



Data sources: Freedman et al. (1979); Muskegon Lake Long-term Monitoring Program, Steinman et al. (2008) and AWRI (unpublished data)

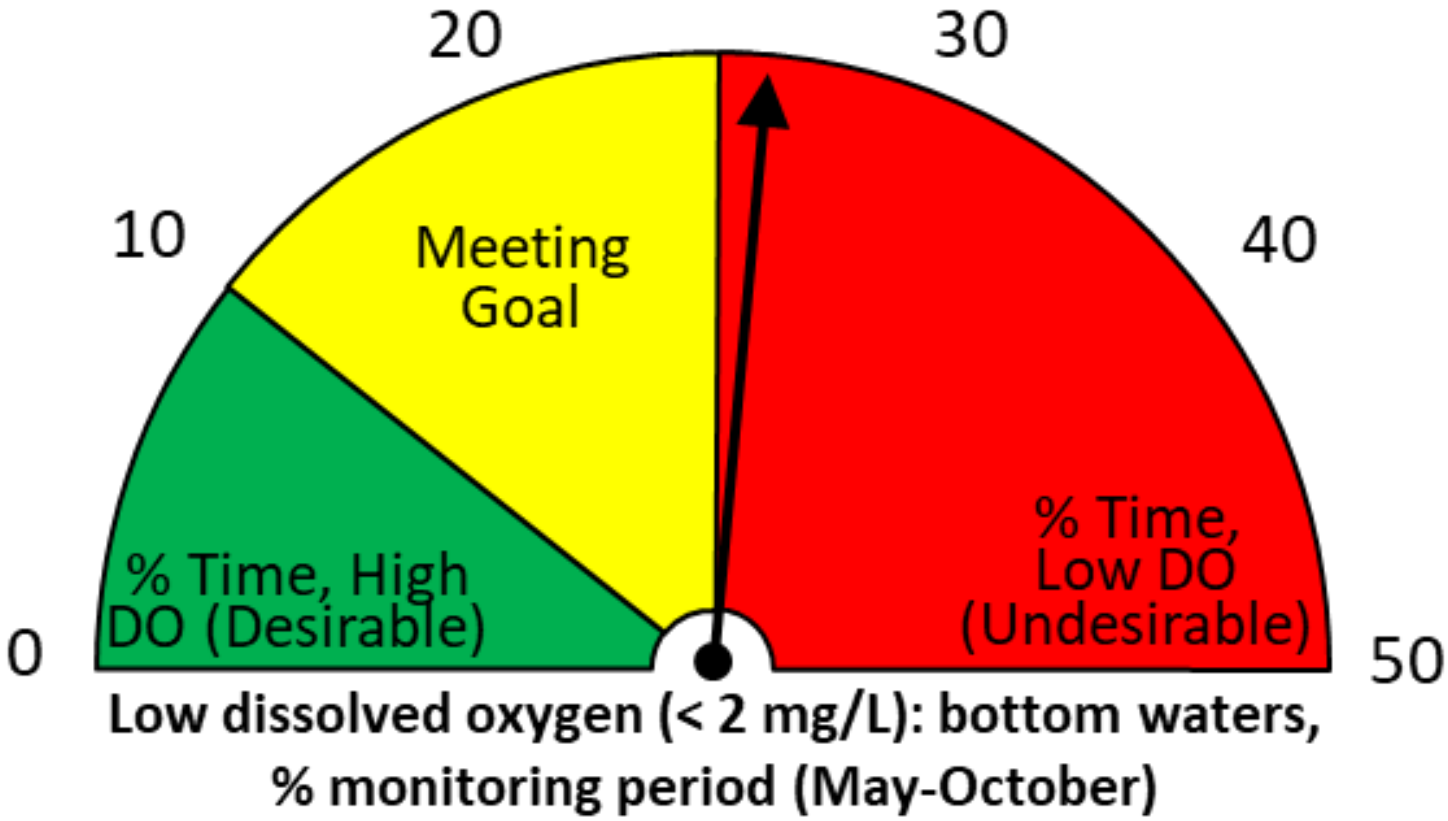
Current Status (2024) – Secchi disk depth

Target Depth: 2 m (~6.56 ft)



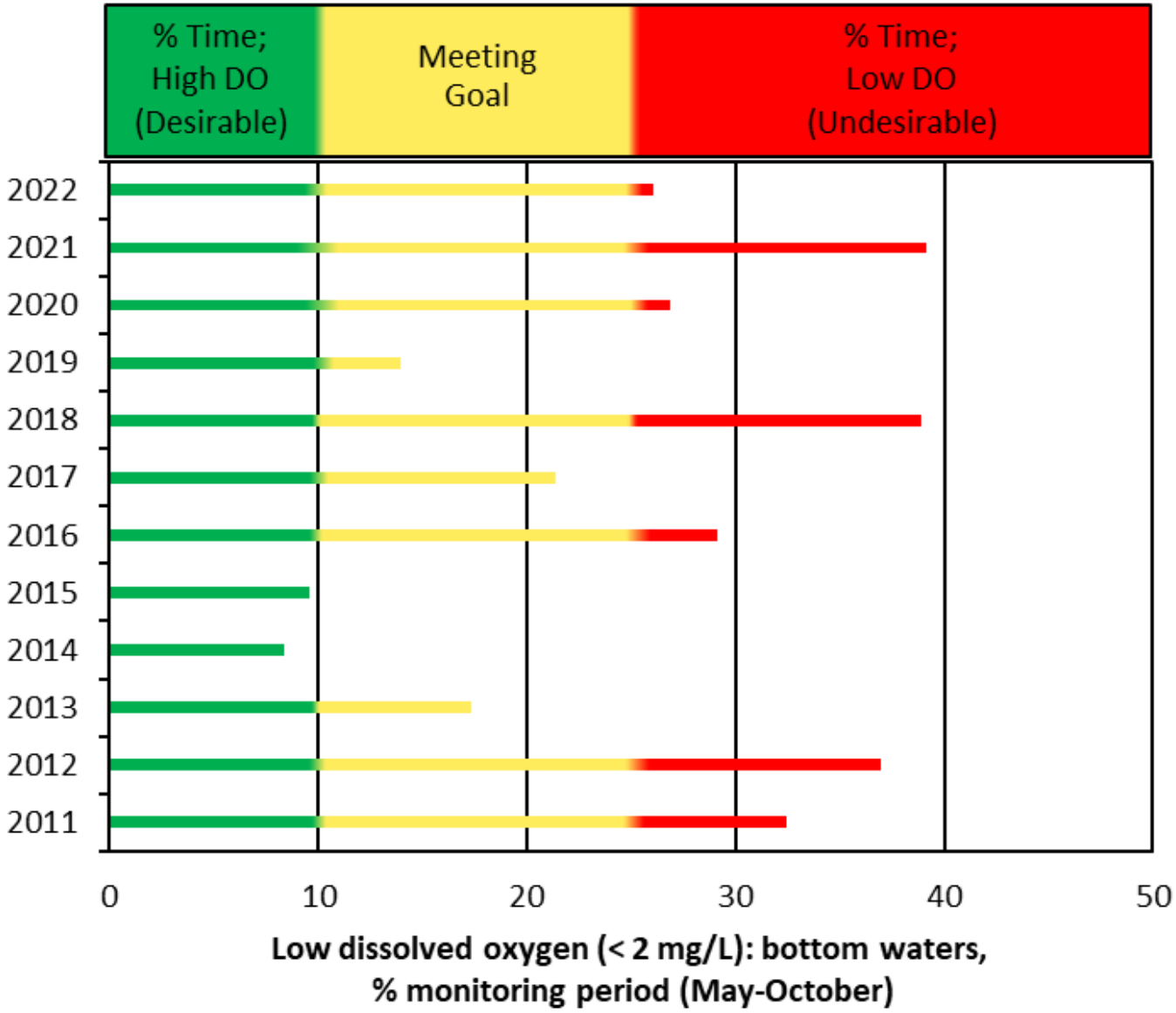
Data sources: Freedman et al. (1979); Muskegon Lake Long-term Mor
Program, Steinman et al. (2008) and AWRI (unpublished data)

Current Status (2022; no 2024 update)



Dissolved Oxygen, % monitoring period

Current Status (2022; no 2024 update)



www.gvsu.edu/wri/dashboard

Muskegon Lake Dashboard Summary

- Muskegon Lake's overall water quality in 2024 regressed slightly from 2023.
- This year-to-year variation is to be expected; the long-term trend remains positive → overall water quality has improved dramatically following the Clean Water Act
- However, Muskegon Lake still is impacted by invasive species, PFAS, and occasional HABs
- The lake's ecological health, while improved from the industrial era, still has room for improvement.

Acknowledgments

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- Community Foundation for Muskegon County
- Allen and Helen Hunting Research and Innovation Fund
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- NOAA – Great Lakes Environmental Research Lab

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- John Lawrence
- Emily Eberly