MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

Utility of National Aquatic Resource Surveys for Michigan Water Quality Assessment

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September 13, 2023

Michigan Wetlands Conference

Why NARS?

Over the years, states, federal agencies, and others implemented **water quality** monitoring using a variety of approaches. While valuable individually, they did not fulfill national monitoring and assessment needs.

Water Quality: Key EPA and State Decisions Limited by Inconsistent and Incomplete Data, U.S. General Accounting Office, 2000

Most **monitoring not done in a way that allows for statistically valid assessments of water quality in unmonitored waters.**	Information summaries from state 305**(b) reports** cannot **be meaningfully compared** and are **not appropriate for** national and **many** other uses

NARS Objectives

1. Assess the biological/recreational condition and changes over time of the nation's waters

2. Rank stressors based on the relative associations between indicators of condition and indicators of stress

3. Build/enhance state and tribal monitoring and assessment capacity

National Aquatic Resource Survey Schedule

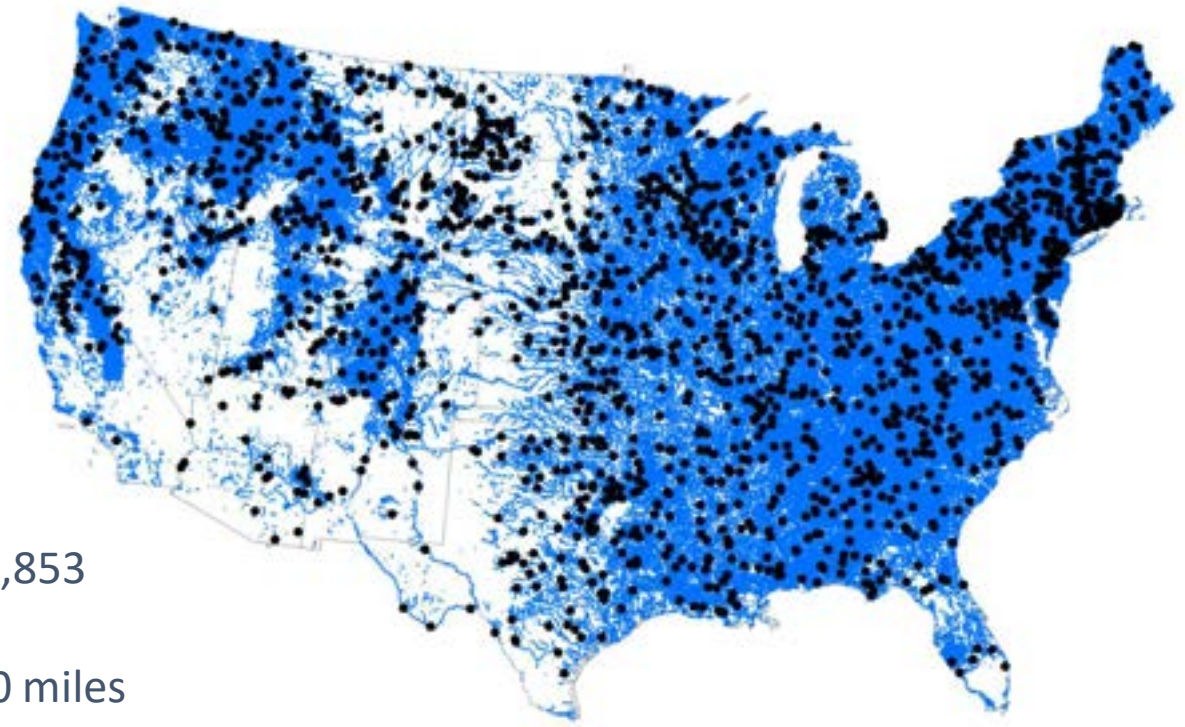
	FY16	FY17	FY18	FY19	FY20	FY21	FY22
Lakes	**Design**	Field	**Lab, data**	**Report**	Research	Design	Field
Rivers	Research	Design	Field	**Lab, data**	Report	Research	Design
Streams	**Report**	Research	Design	Field	**Lab, data**	Report	Research
Coastal	**Lab, data**	Report	Research	Design	Field	**Lab, data**	Report
Wetlands	Research	Research	Research	Research	Design	Field	**Lab, data**

National Consistency: NARS Approach

- Randomized design to report on condition of each resource nationally and regionally
  - 1,000 sites in lower 48
- Standard field and lab protocols
- Core indicators
- National QA and data management
- Nationally consistent and regionally relevant data interpretation and peer-reviewed reports

Site Selection/Locations

Example of NARS Design: Perennial Rivers and Streams

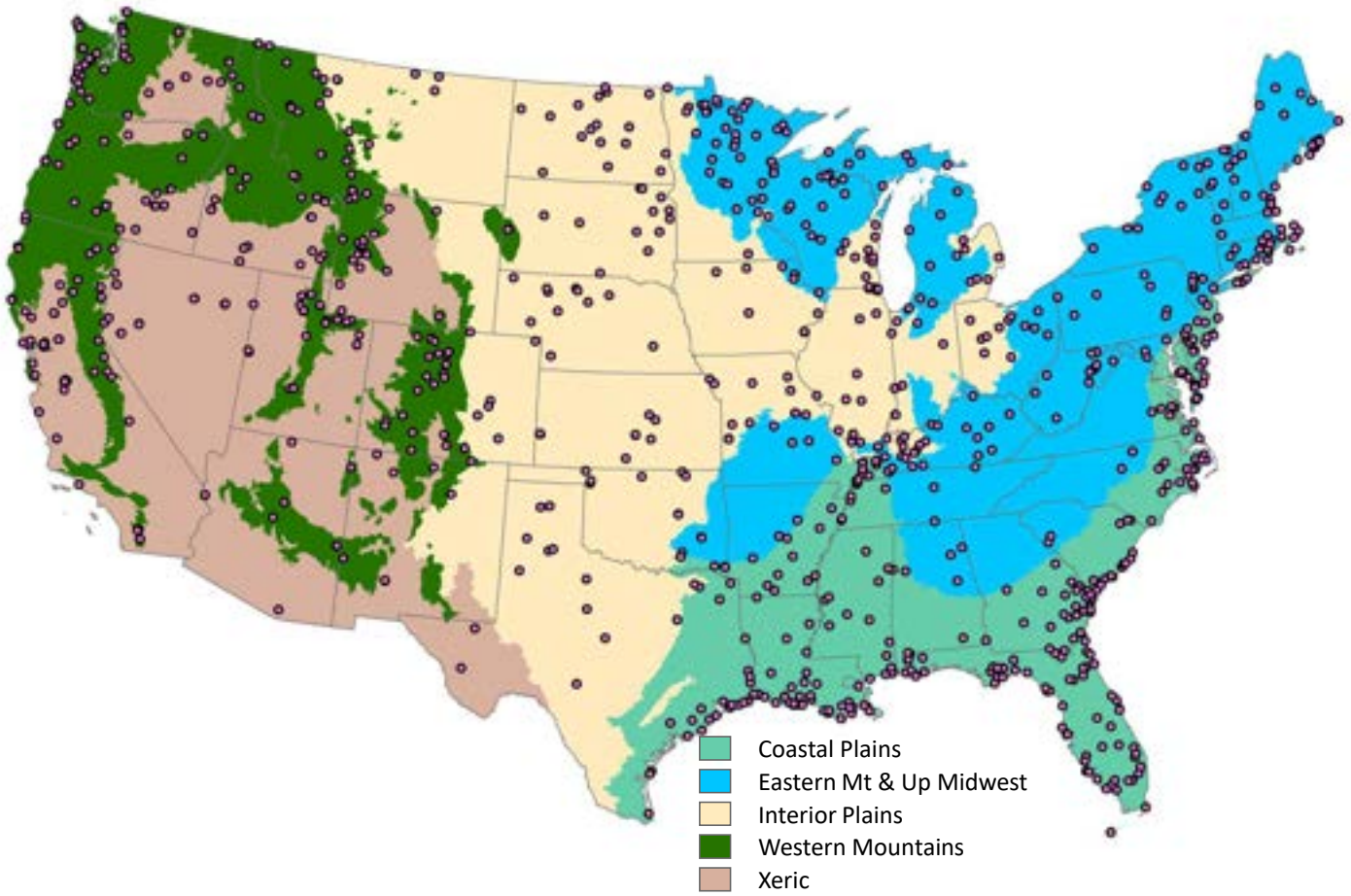


- Representative set of 1,853 sites were sampled
- Data represent 750,000 miles of rivers and streams

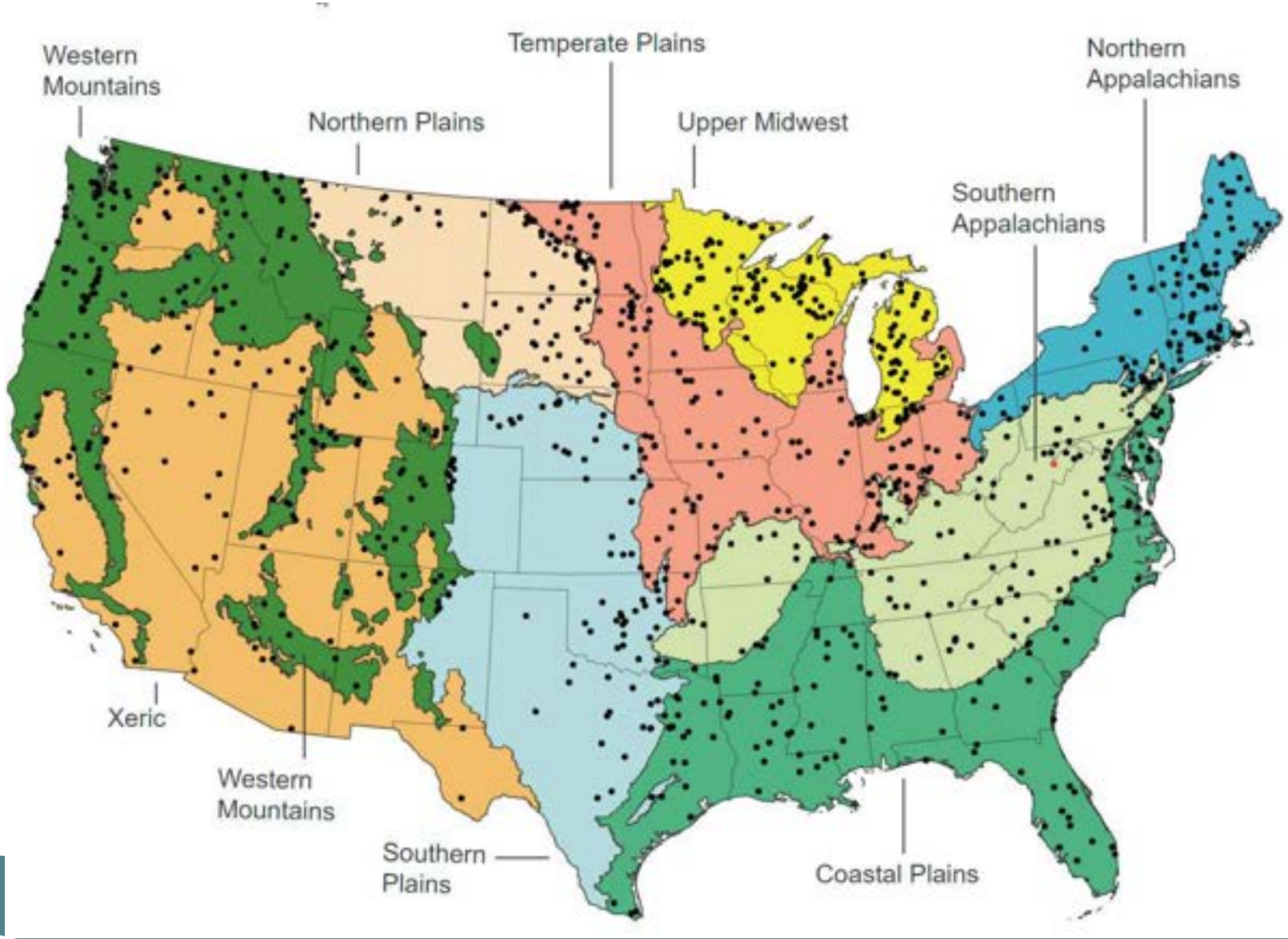
NRSA 2018/2019
Lake Superior
Marquette
Sault Ste Marie
Elliot Lake
Lake Michigan
Green Bay
WISCONSIN
Fond du Lac
Sheboygan
Midland
MICHIGAN
Madison
Milwaukee
Racine
Kenosha
Rockford
Waukegan
Chicago
Aurora
ILLINOIS
Gary
South Bend
INDIANA
Kalamazoo
Portage
Ann Arbor
Detroit
Windsor
Flint
Lansing
Waterford
Toledo
OHIO
Fort Wayne
Peoria
Lake Huron

National Wetland Condition Assessment 2016

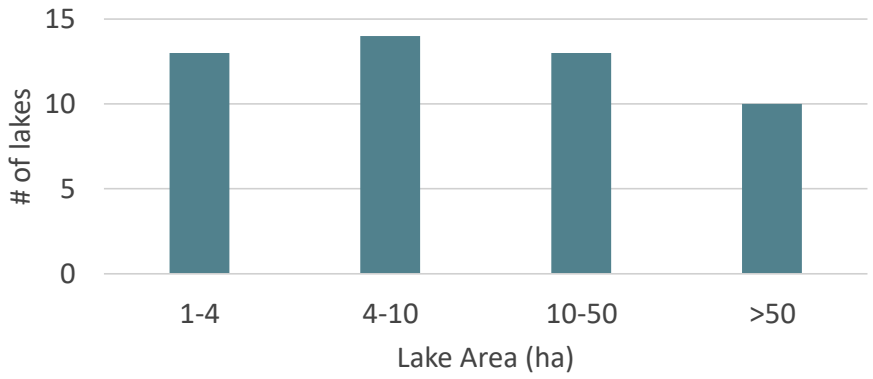
- Representative set of 967 sites sampled
- Data represent 95,694,241 acres of wetlands



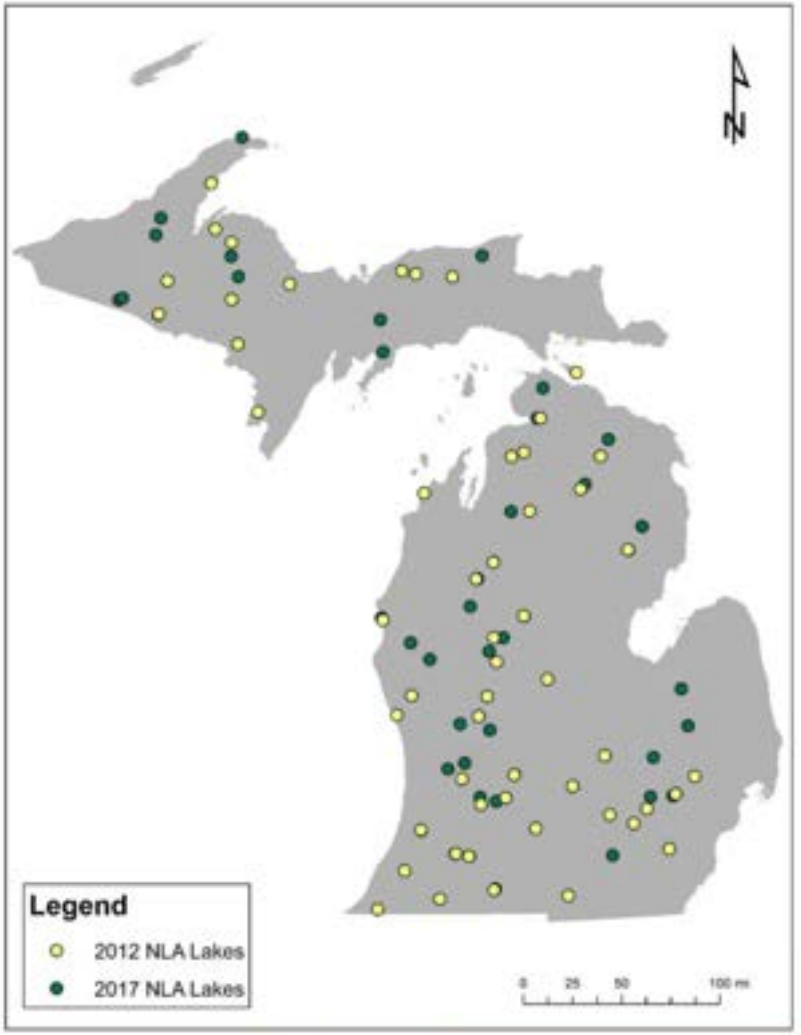
2017 NLA Sites and Ecoregions



2012/2017 Michigan NLA Lakes

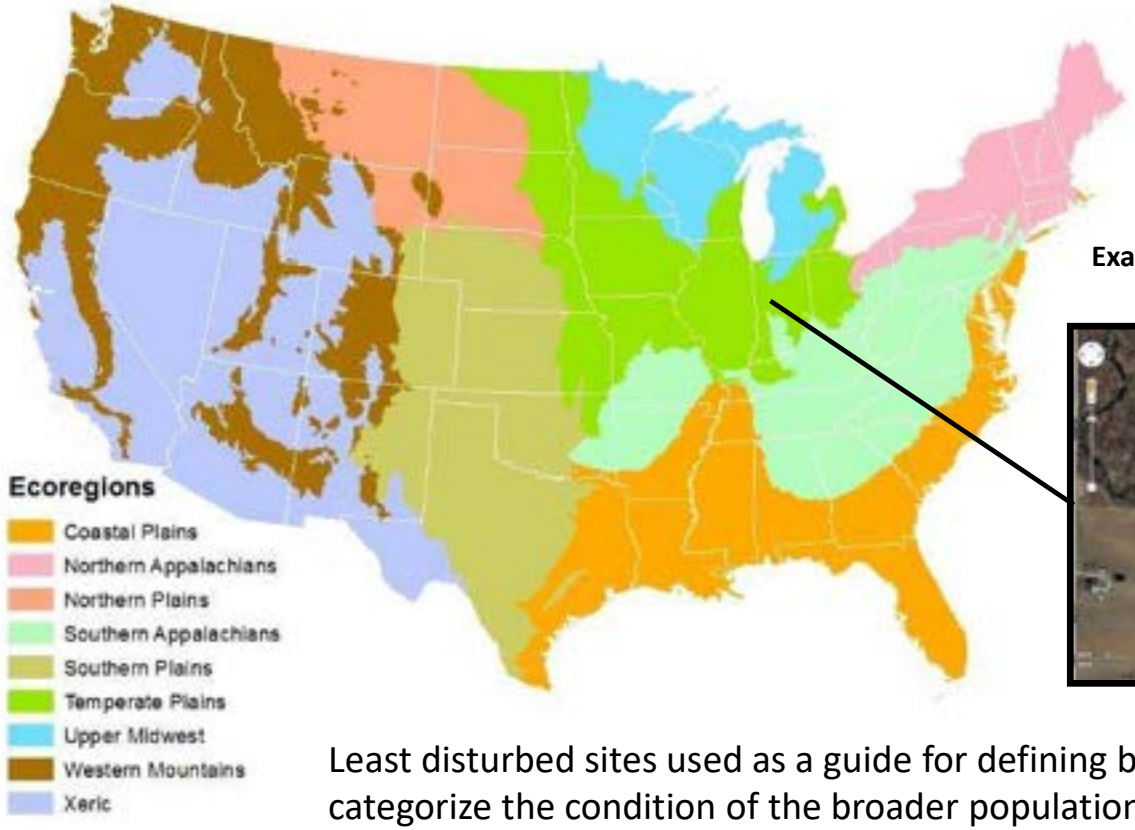


Lake	County	Area (ha)
Lake Mitchell	Wexford	1061
Crooked Lake	Emmet	969
Pere Marquette Lake	Mason	242
Palmer Lake	St. Joseph	198
West Lake	Kalamazoo	133
Saddle Lake	Van Buren	110
Au Sable Lake	Ogemaw	107



Design Sites for the
2010 National Coastal Condition Assessment
0
215
430
860
1,290
1,720
Kilometers
N

Geographically relevant benchmarks are used to assign condition classes



Example of a reference site from the Temperate Plains

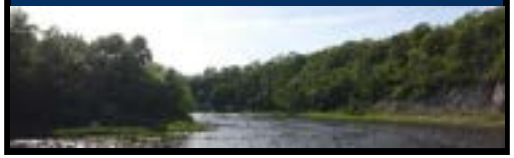
Least disturbed sites used as a guide for defining benchmarks to categorize the condition of the broader population within an ecoregion.

NARS Parameters/Indicators

Rivers and Streams Indicators

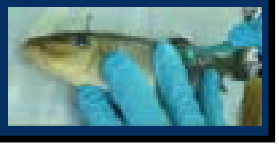
Biological
- Benthic Macroinvertebrates
- Fish Assemblage

Chemical
- pH, DO, Temperature, Conductivity
- Water Chemistry
- Chlorophyll *a*



Physical Habitat
- In-stream Fish Habitat
- Riparian Vegetation
- Riparian Disturbance
- Streambed Sedimentation

Human Use (Recreation)
- Algal toxins
- Enterococci
- Fish Tissue Mercury: Plugs & Fillets



Research Indicators
- Periphyton

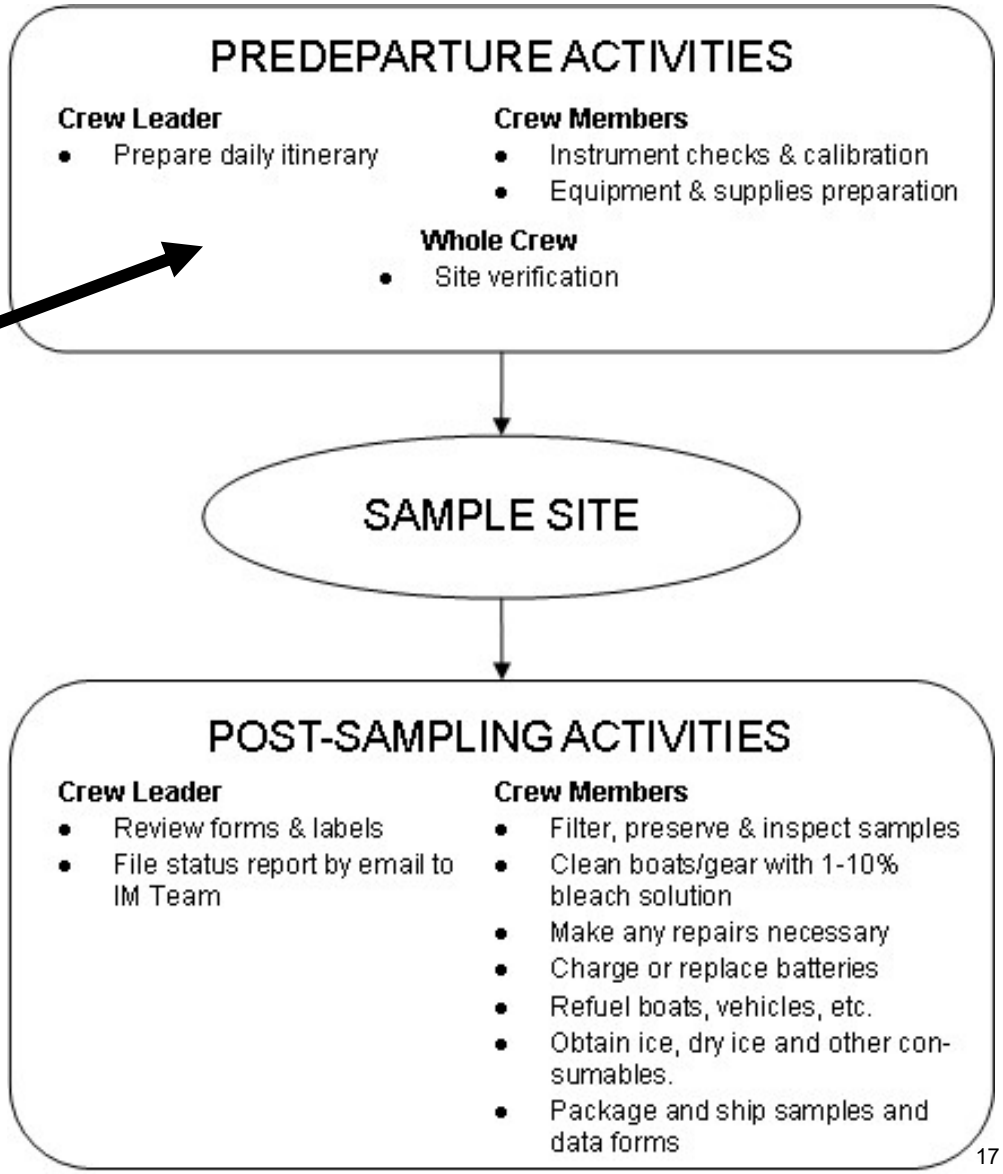
Images: Microcystis (John Wehr); Cymbella (Sarah Spaulding)

Lakes Indicators

Chemical	Trophic State	Biological	Physical	Recreational
•Dissolved oxygen •Nitrogen •Phosphorus •Atrazine	•Trophic State	•Benthic macroinvertebrates •Chlorophyll a •Zooplankton	•Drawdown •Human disturbance •Lakeshore habitat •Physical habitat complexity •Shallow water habitat	•Algal toxins •Cyanobacteria •Enterococci

Staff Training

Review the webinar!



Example Data Uses

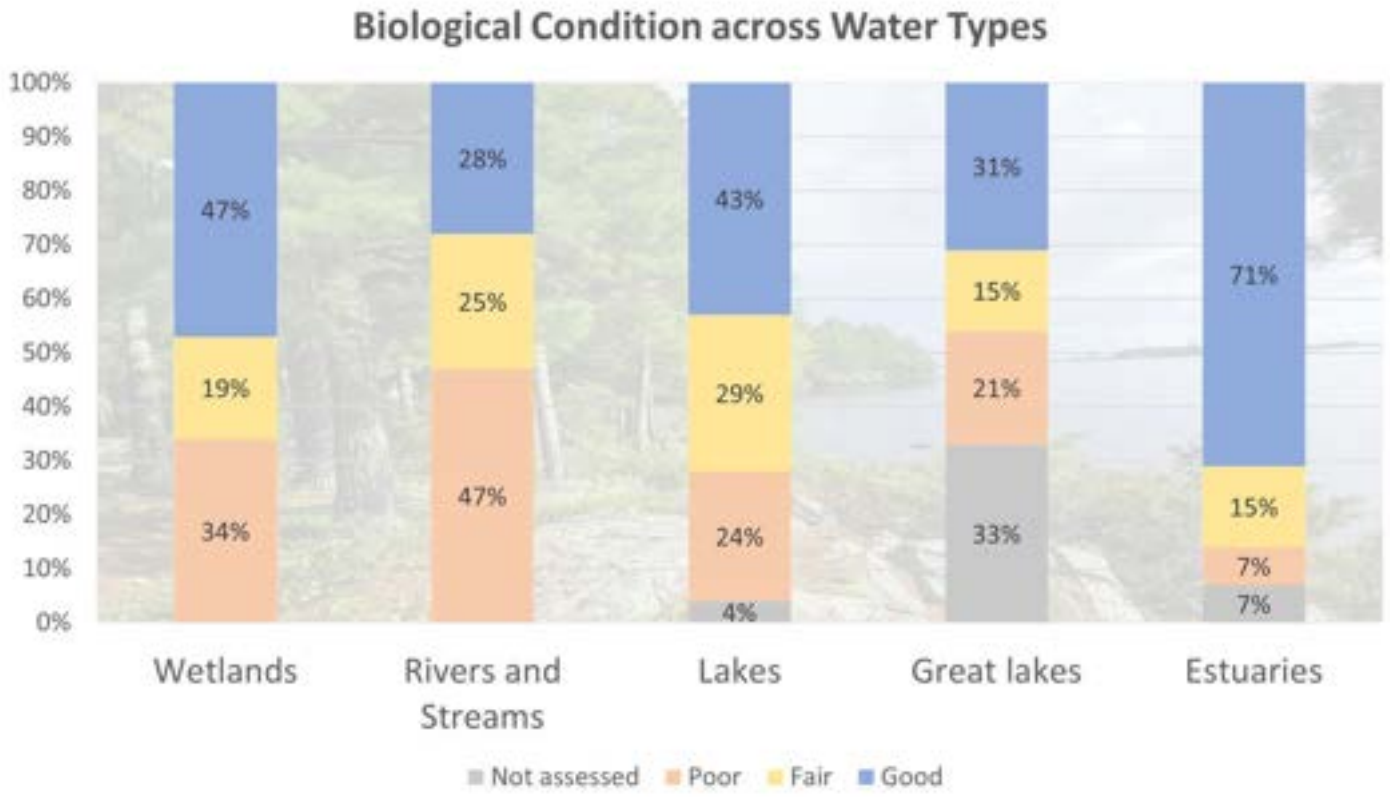
How widespread are key stressors?

Nutrients and degraded habitat are problems across the country

- Excessive levels of phosphorus are reported in 42% of rivers and streams, 45% of lakes and approximately 20% of coastal waters.

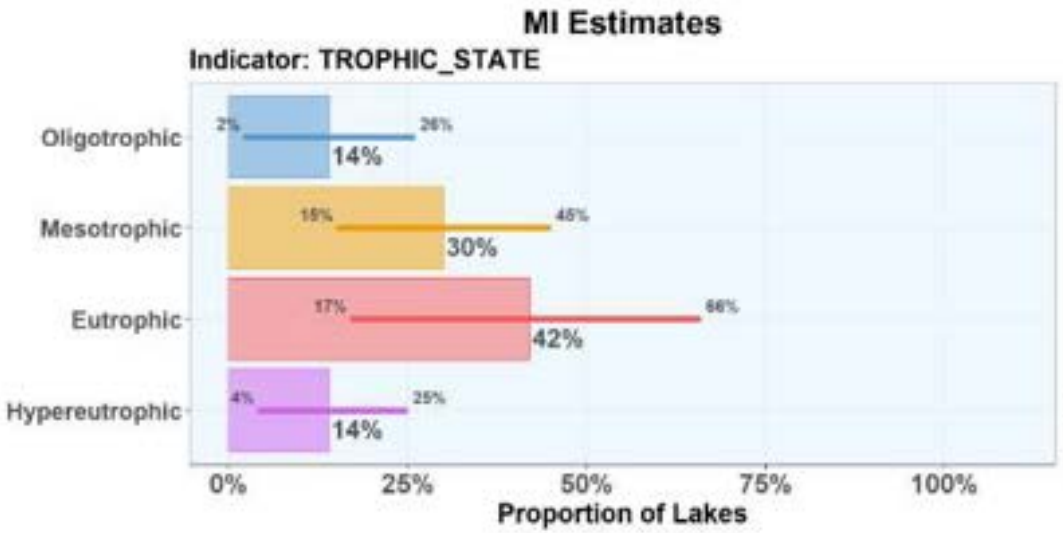
- Habitat degradation is widespread. Approximately a third of wetland area, lakes and river and stream miles are in poor condition.

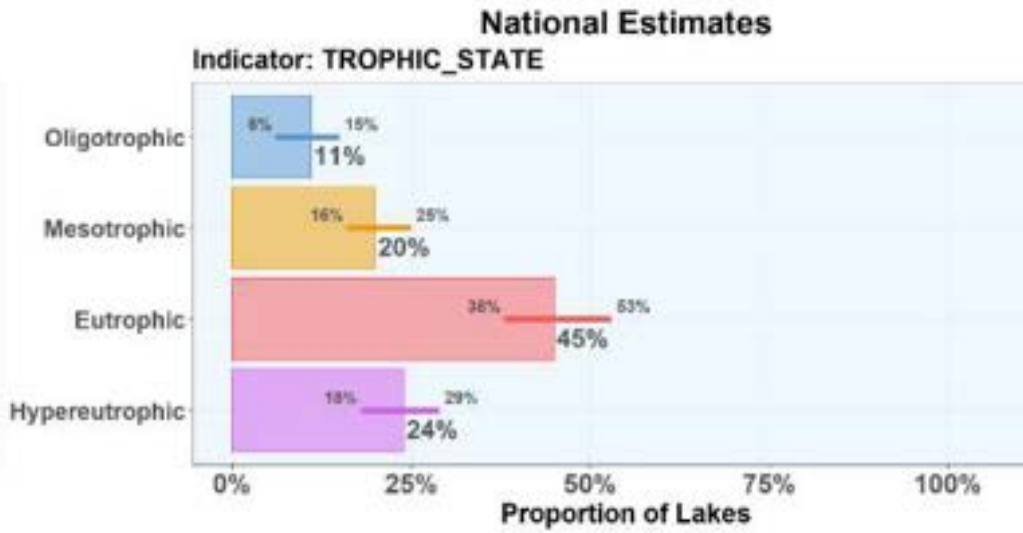
What is the biological condition of our waters?



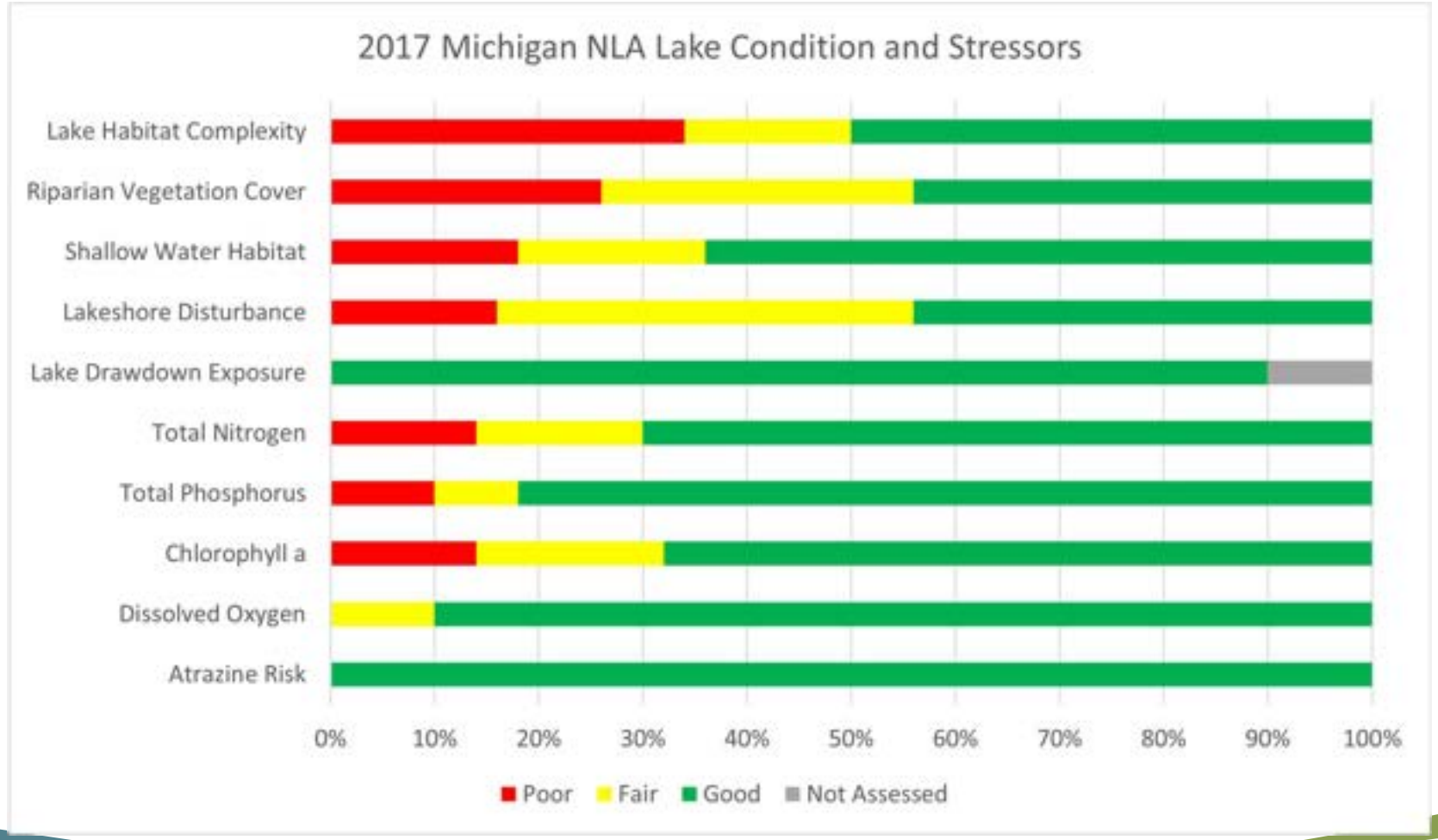
Coastal waters, rivers and streams and lakes based on benthic macroinvertebrates; wetlands based on vegetation.

2017 Condition - Trophic State

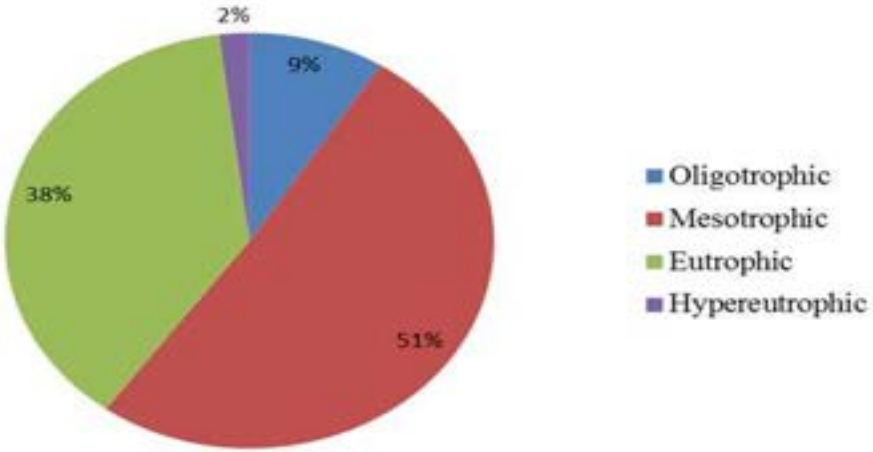




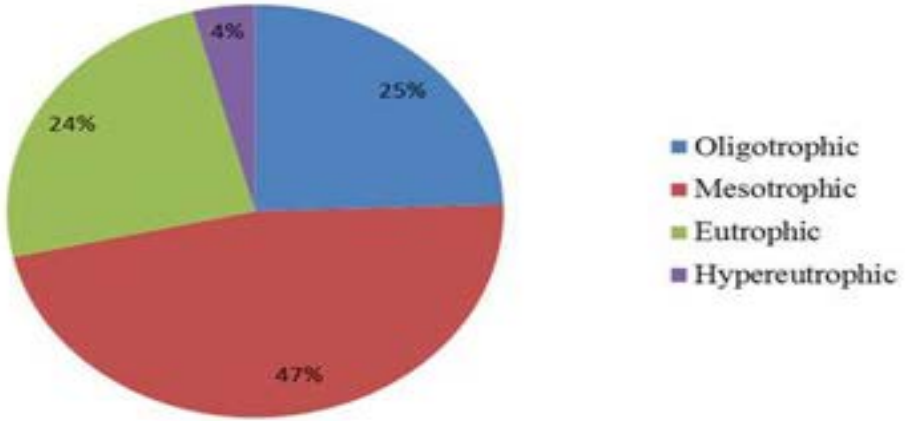
Oligotrophic	≤2	ug/L
Mesotrophic	>2 and ≤7	ug/L
Eutrophic	>7 and ≤30	ug/L
Hypereutrophic	>30	ug/L


2017 Michigan NLA Lake Condition and Stressors
Lake Habitat Complexity
Riparian Vegetation Cover
Shallow Water Habitat
Lakeshore Disturbance
Lake Drawdown Exposure
Total Nitrogen
Total Phosphorus
Chlorophyll a
Dissolved Oxygen
Atrazine Risk
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Poor
Fair
Good
Not Assessed

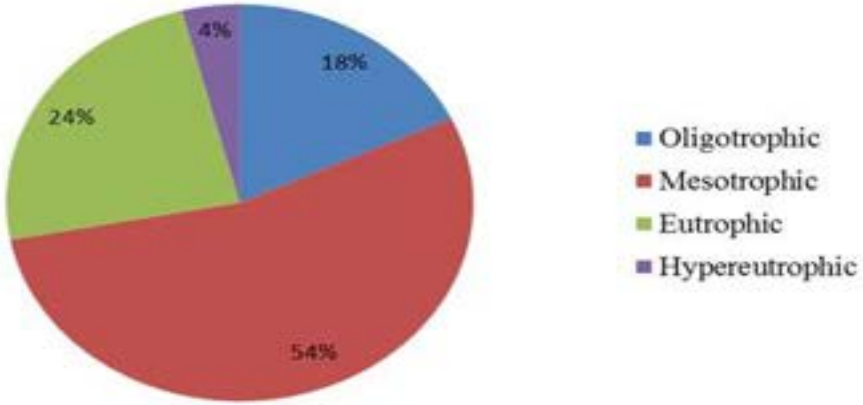
2012 NLA



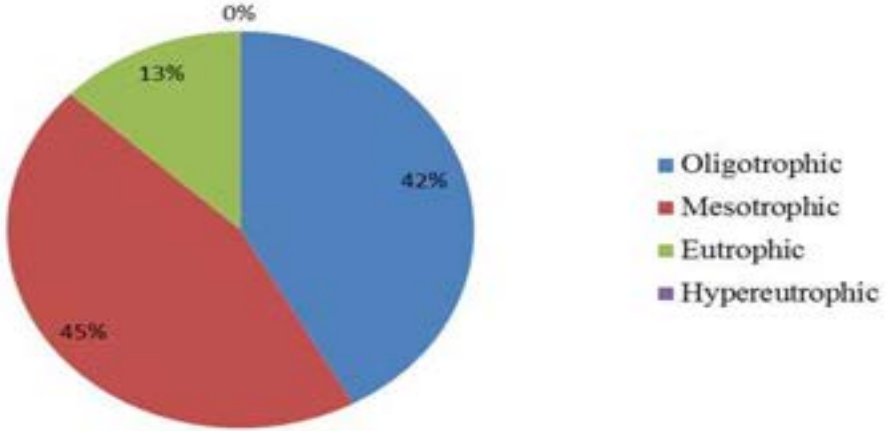
2007 NLA

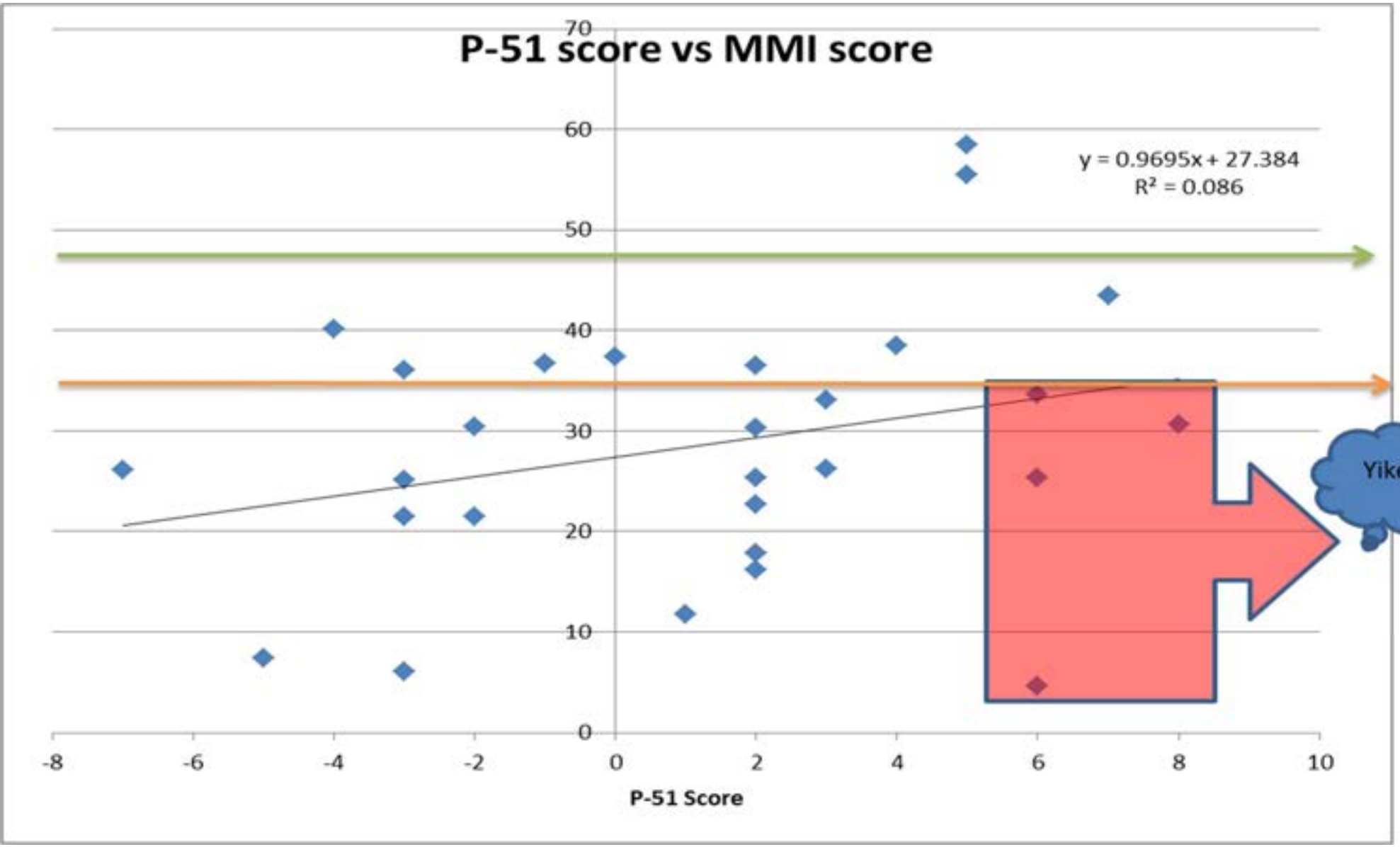


LWQA

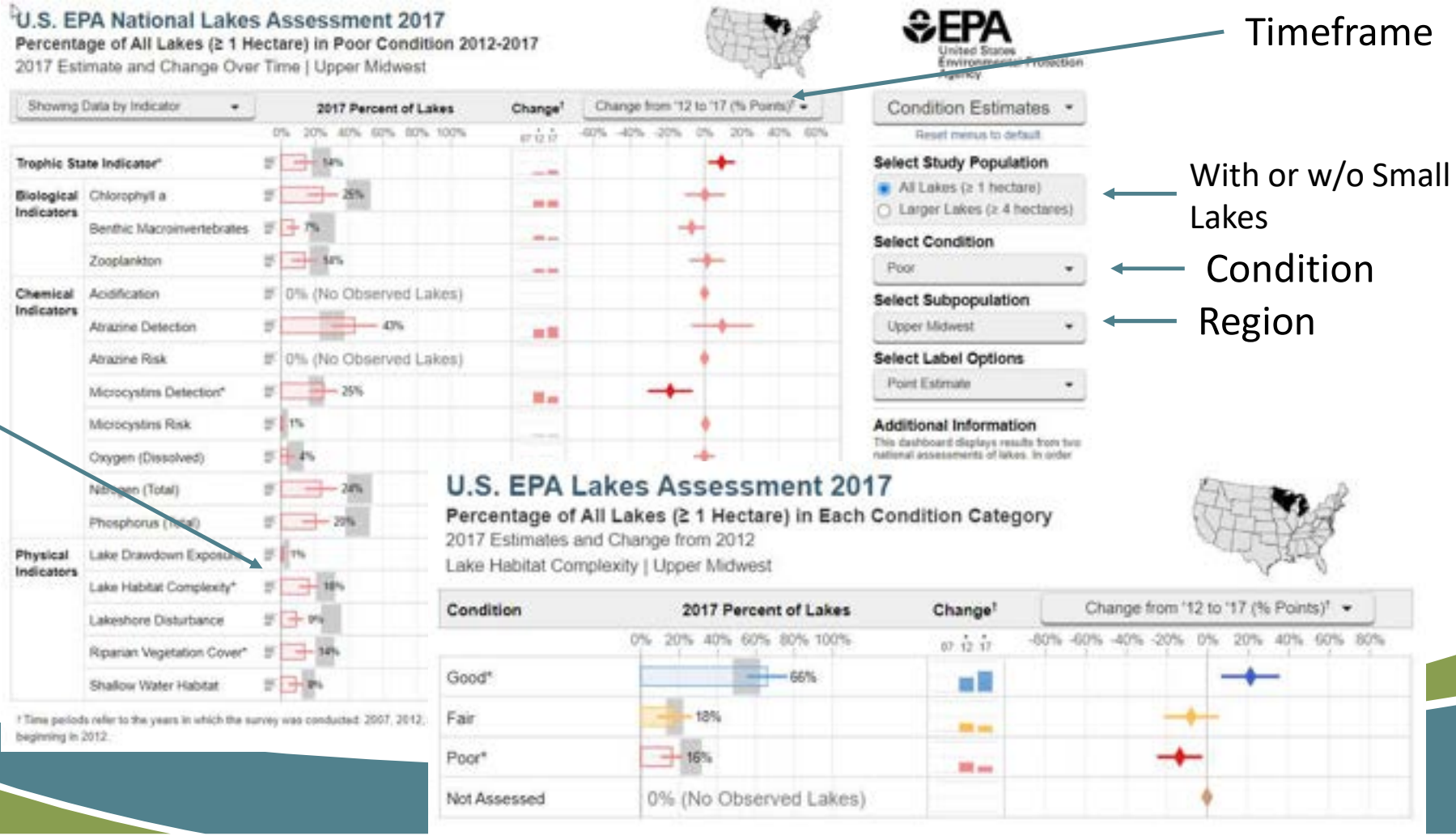


2012 MiCorps




P-51 score vs MMI score
y = 0.9695x + 27.384
R² = 0.086
Yikes !!
70
60
50
40
30
20
10
0
-8
-6
-4
-2
0
2
4
6
8
10
P-51 Score

Data Dashboard https://nationallakesassessment.epa.gov/



Timeframe

With or w/o Small Lakes

Condition

Region

Extra Graphs

Michigan Department of
Environment, Great Lakes, and Energy

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