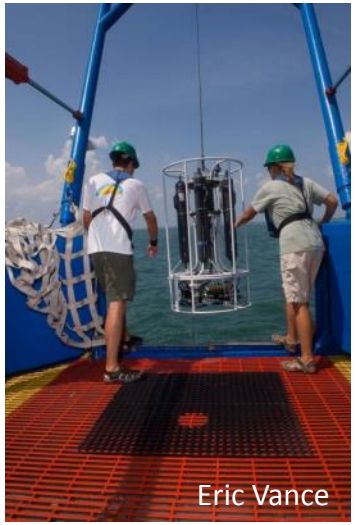
A Snapshot of Lake Health Across Wisconsin

Katie Hein & Ali Mikulyuk

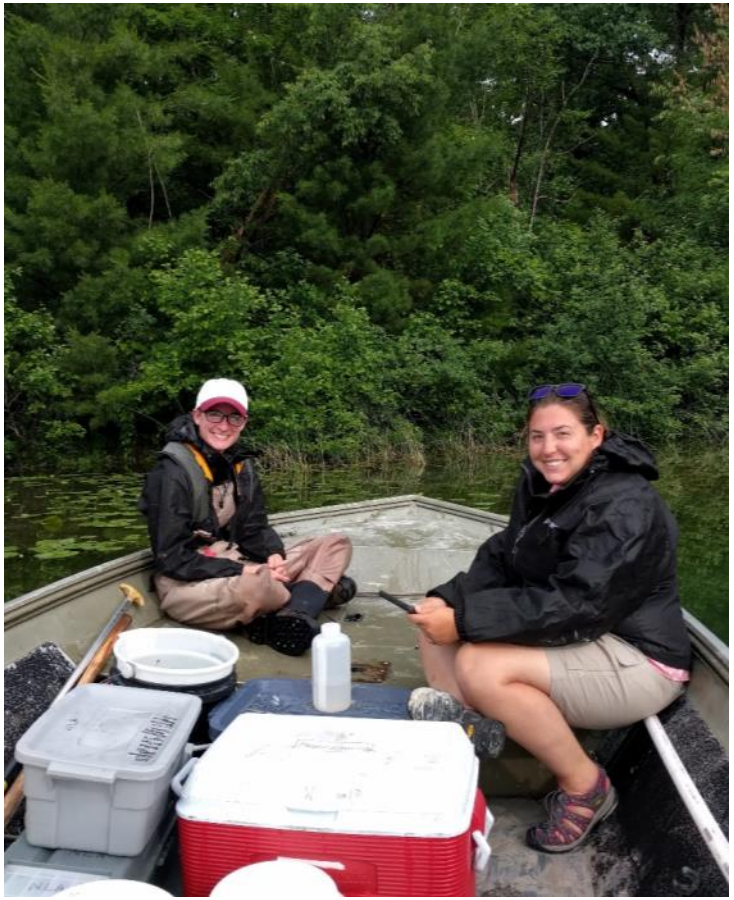
National Aquatic Resource Surveys

- Goal: Assess the quality of the nation's waters
- Water:
  - Coastal
  - Lakes and Reservoirs
  - Rivers and Streams
  - Wetlands
- Who:
  - EPA
  - States
  - Tribes

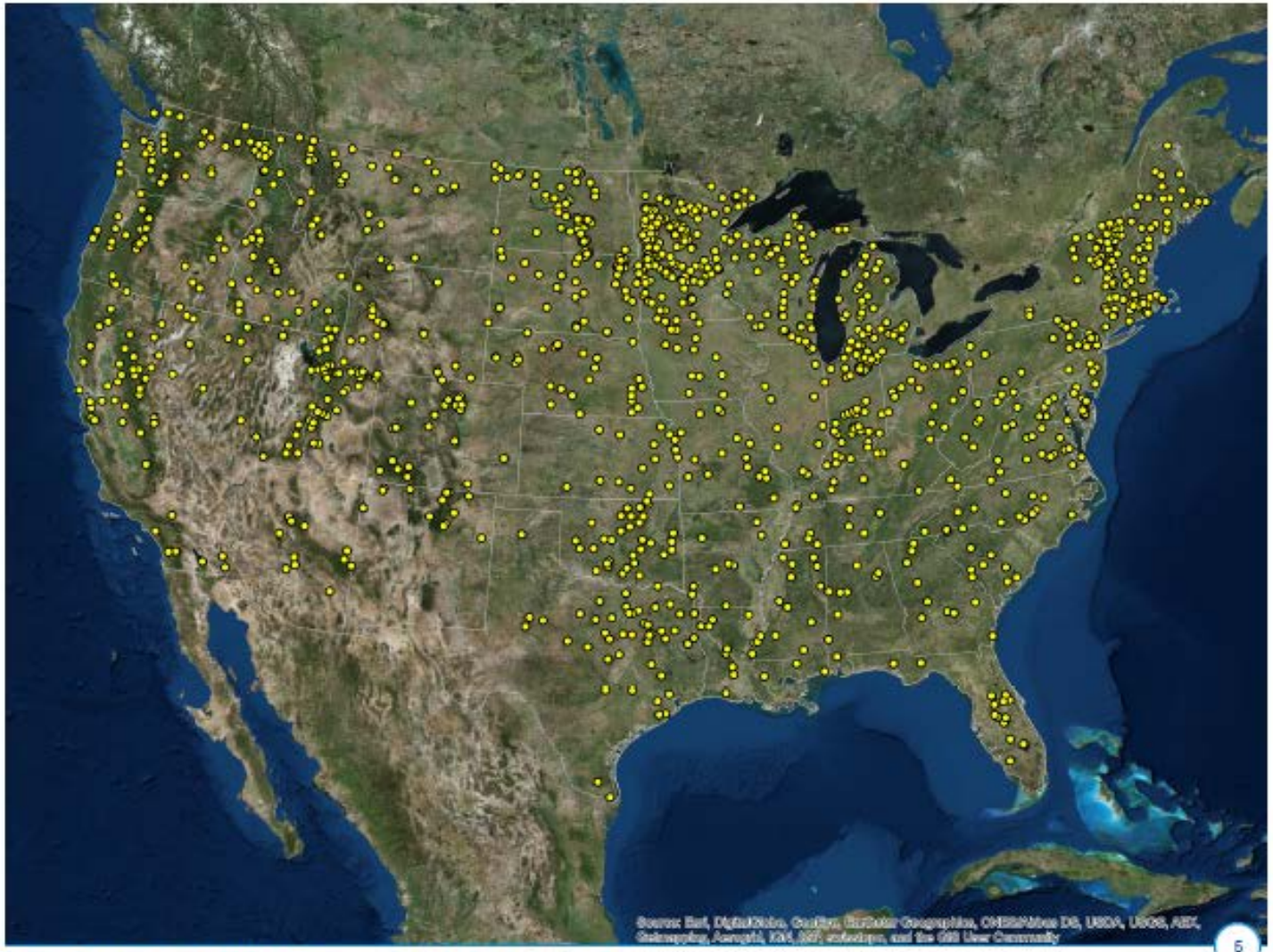


National Lakes Assessment

- What is the current biological, chemical, physical, and recreational condition of lakes?
- What are the most common water quality problems?
- Is lake condition improving or getting worse?



Extrapolate Results to ALL Lakes with a Probabilistic Survey



2012 National Lakes Assessment

- Nutrient pollution

  excess nitrogen in 35% of lakes

  excess phosphorus in 40% of lakes
- Lakeshore Habitat

  Degraded riparian and shallow habitat in 29% of lakes
- Biological condition

  degraded macroinvertebrates in 31% of lakes
- Algal Toxins & Herbicide

  high microcystin & atrazine in <1% of lakes

2017 NLA

46 - 52 lakes

Chemistry
Habitat
Biology

Aquatic Plants
AIS

National Lakes Assessment vs. Integrated Report to Congress

National Lakes Assessment

- Random sample
- 1 time sample
- Reference lakes in Upper Midwest

Integrated Report

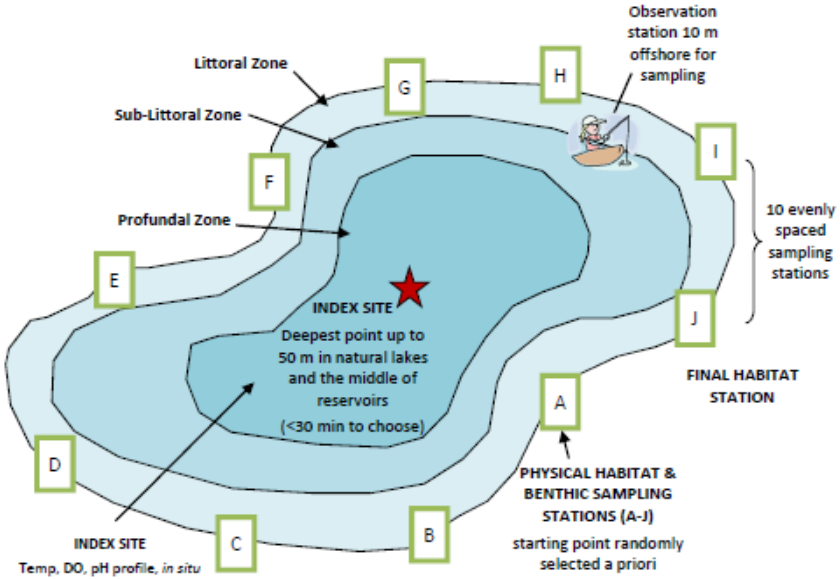
- All lakes sampled for any reason
- 6 samples over 2 years
- Wisconsin water quality criteria

Chemistry & Biology at Deepest Spot

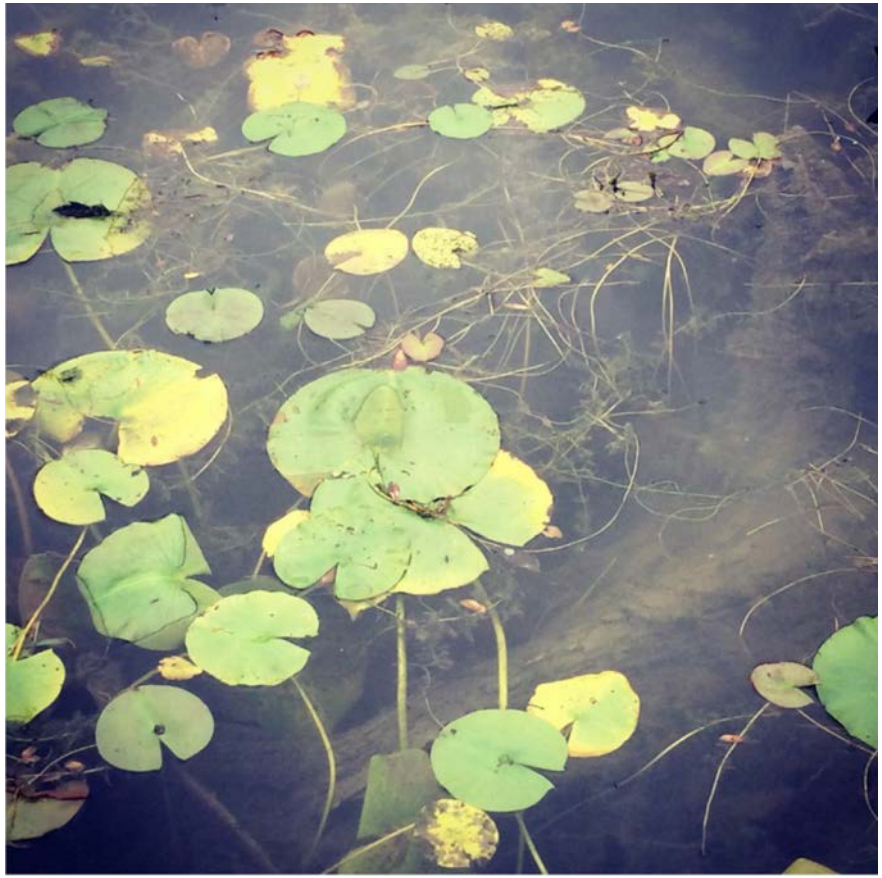
- Chemistry
- Nutrients
- Chlorophyll *a*
- Algal toxins
- *E. coli*
- Fish eDNA
- Phytoplankton
- Zooplankton

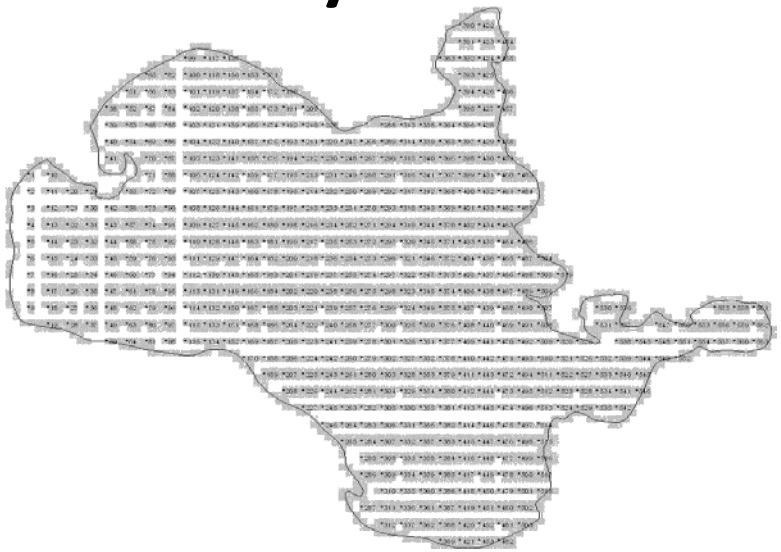
Habitat & Biology Nearshore

- Macroinvertebrates
- Riparian Habitat
- Shallow Water Habitat
- Human Influences



Aquatic Plant Surveys



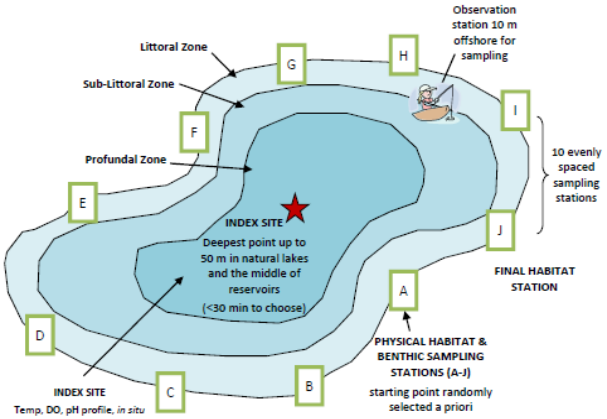


Aquatic Invasive Species

- Zebra/Quagga Mussels
- Spiny Waterflea
- Snails
- Riparian Plants
- Aquatic Plants

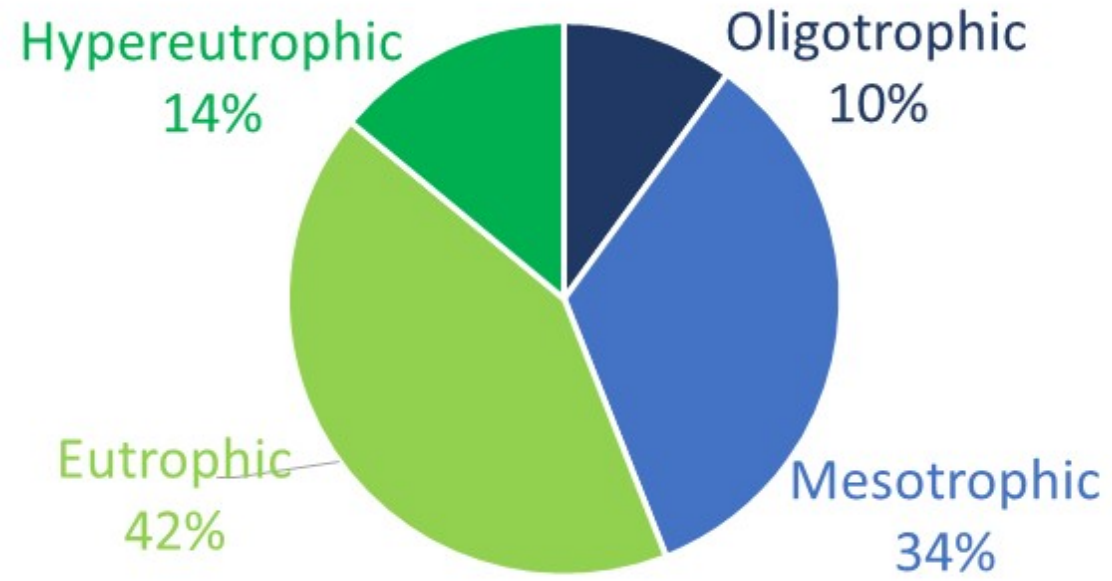

Paul Skawinski


Paul Skawinski



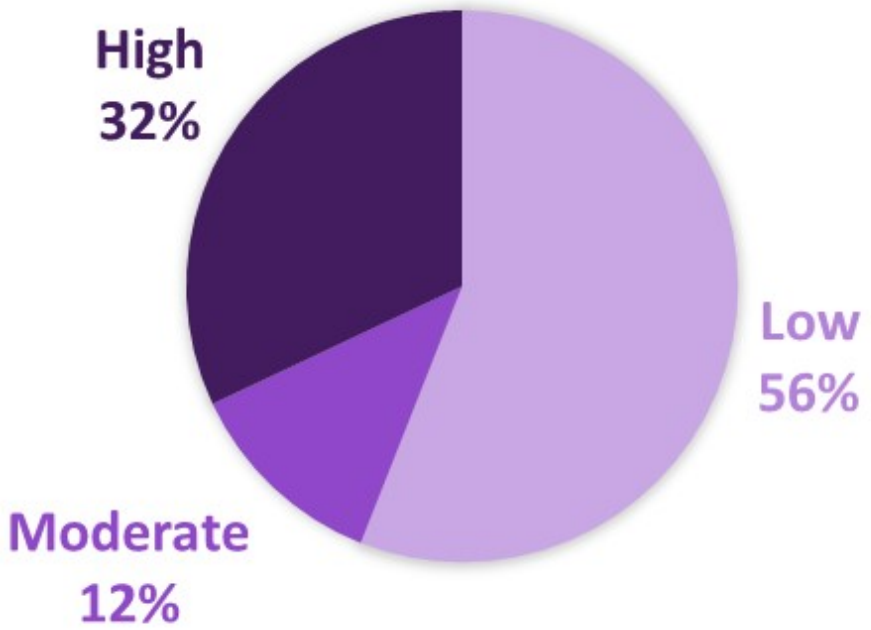
What we learned about Wisconsin lakes

Trophic Status



	Chl-a (ug/L)
Oligotrophic	≤ 2
Mesotrophic	>2 - 7
Eutrophic	>7 - 30
Hypereutrophic	>30

ALKALINITY

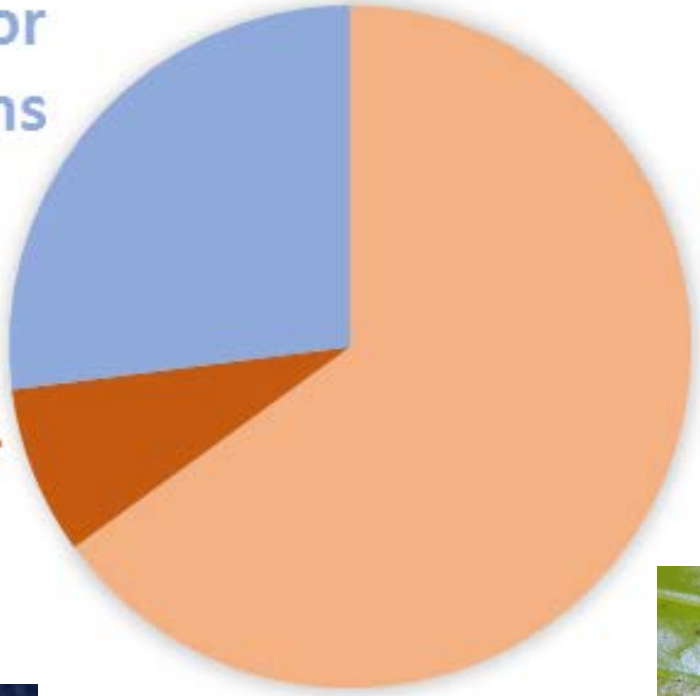


	mg/L
Low	<15
Moderate	15-30
High	>30

CALCIUM

Ian Gardner

Suitable for crustaceans 27%

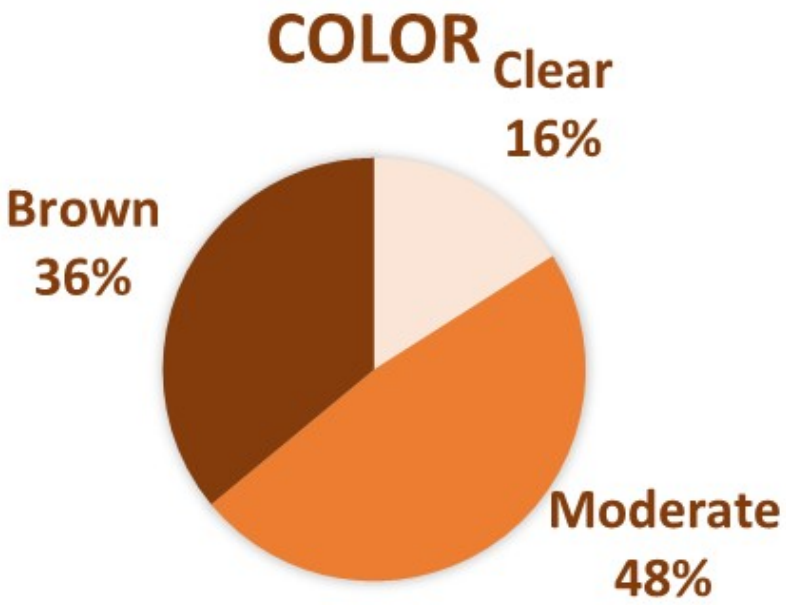


Not suitable for snails or zebra mussels 65%

Not suitable for zebra mussels 8%

Not suitable for snails or zebra mussels	<5 mg/L
Not suitable for zebra mussels	<10 mg/L
Suitable for crustaceans	>10 mg/L

Biopix



	SU
Clear	<10
Moderate	10-39.9
Brown	>40

Brown

Clear

Healthy macrophytes, healthy lakes

Chemical

- Nutrient cycling
- Oxygen/CO_2

Physical

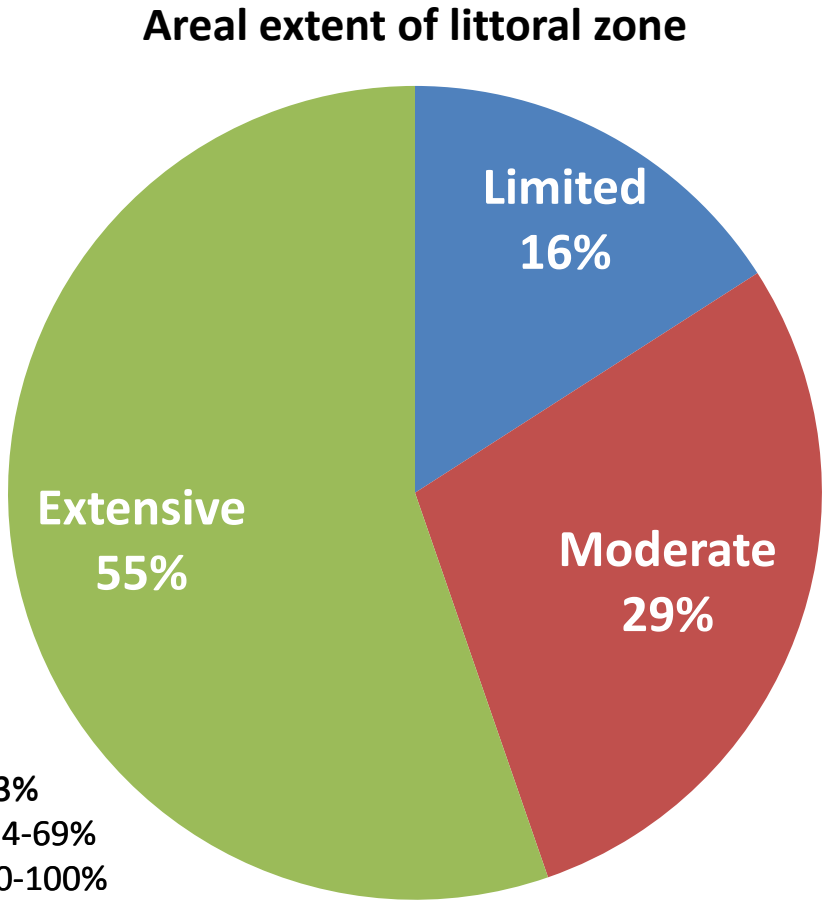
- Hydrodynamics
- Stability

Biological

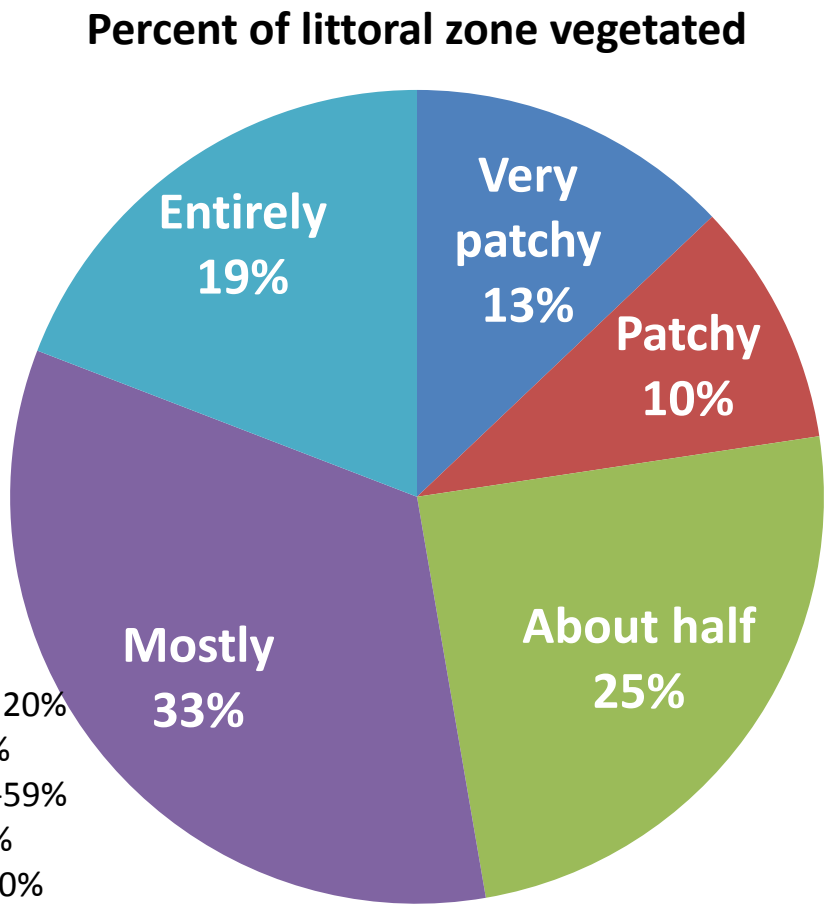
- Habitat
- Food web

Over half of WI lakes are “very” littoral

Limited: 0-33%
Moderate: 34-69%
Extensive: 70-100%

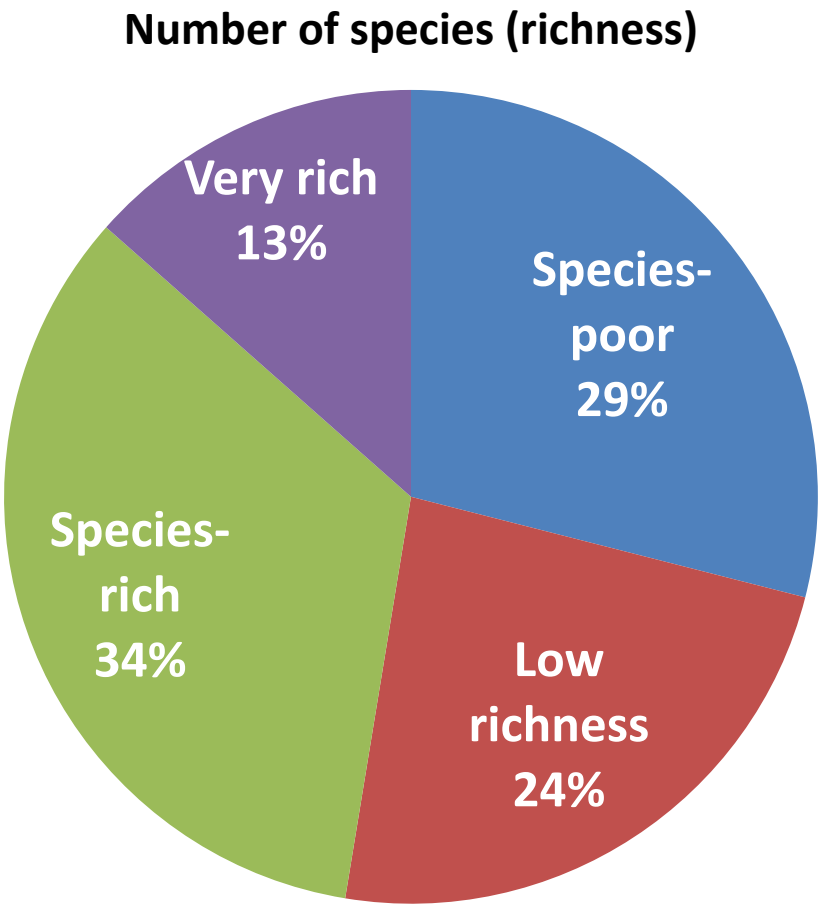


Most lakes have extensive vegetation throughout the littoral zone

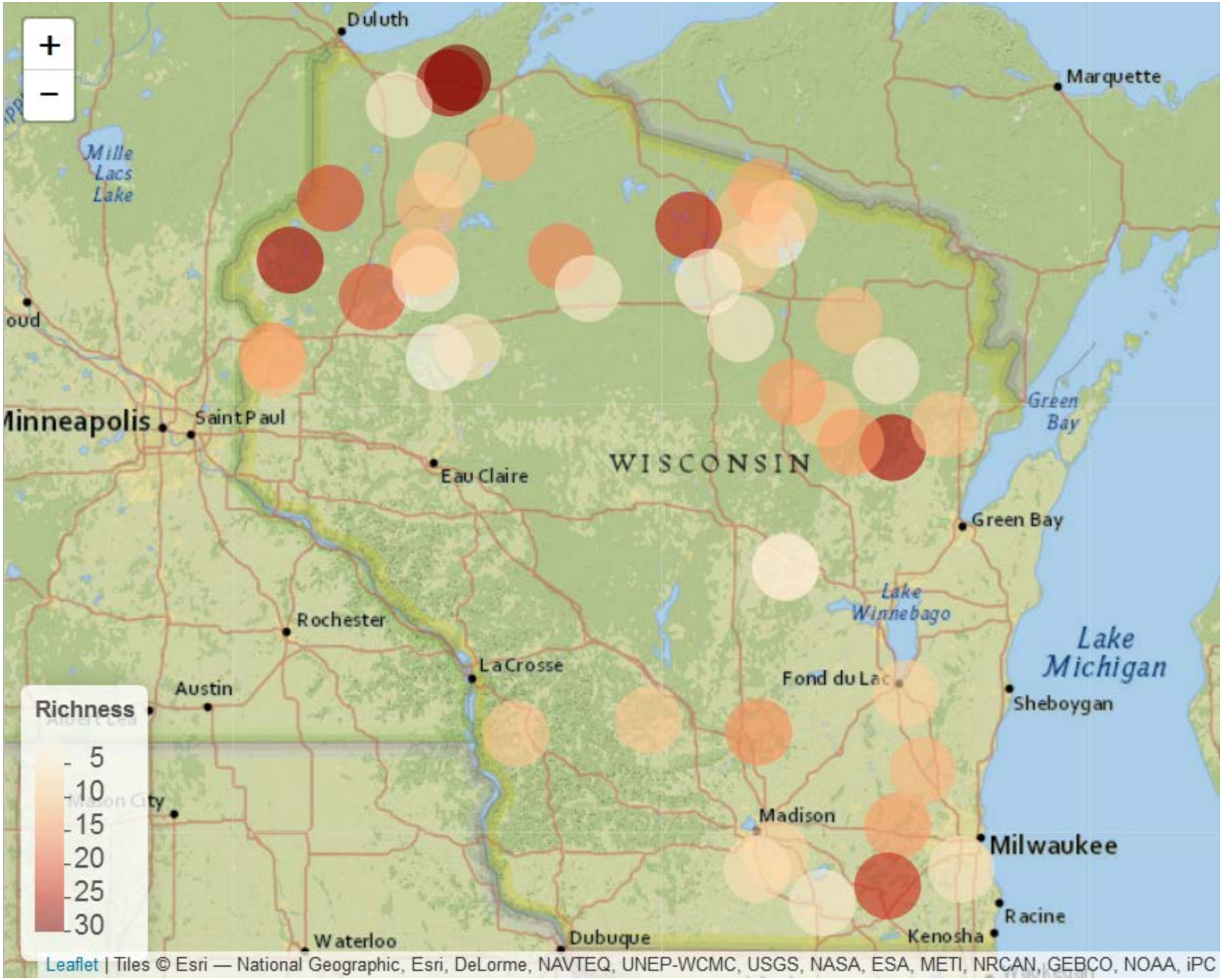


Very patchy: ≤ 20%
Patchy: 20-41%
About half: 42-59%
Mostly: 60-89%
Entirely: 90-100%

Nearly 1/3 of lakes are species-poor, 1/3 are species-rich



Poor: ≤ 5
Low: 6-10
Rich: 11-20
Very rich: >20


Duluth
Marquette
Mille Lacs Lake
oud
Minneapolis
Saint Paul
Eau Claire
WISCONSIN
Green Bay
Lake Winnebago
Rochester
La Crosse
Fond du Lac
Sheboygan
Lake Michigan
Austin
Madison
Milwaukee
Racine
Kenosha
Waterloo
Dubuque
Richness
5
10
15
20
25
30
Leaflet | Tiles © Esri — National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, iPC

Wet meadow

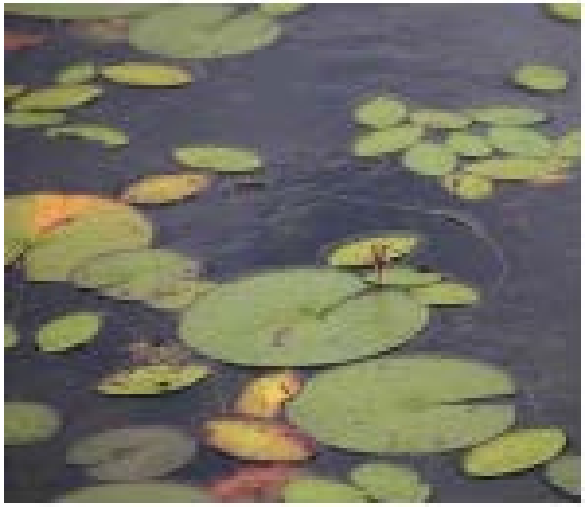
Sedge fen

Sphagnum bog

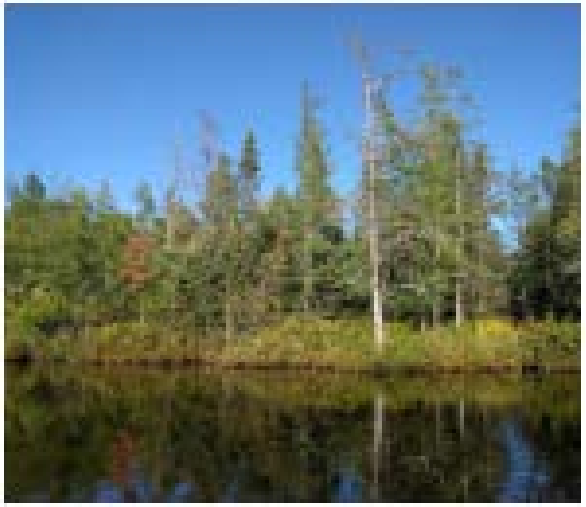
Chara-dominated

Submersed cosmopolitans

Characid/najas



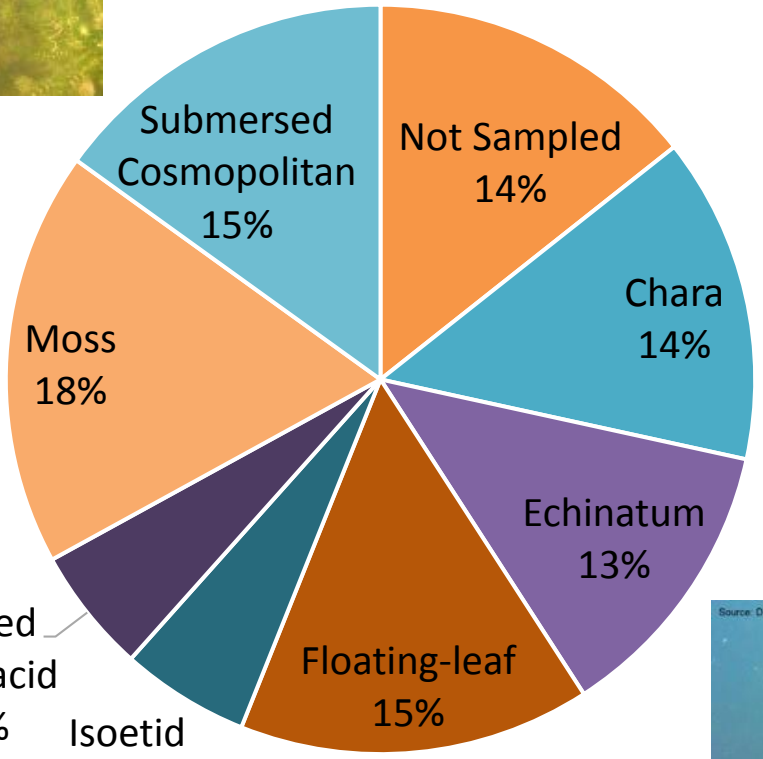
Floating-leaf meadow

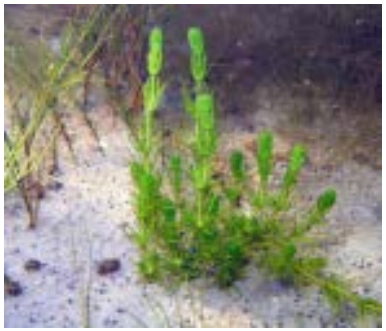


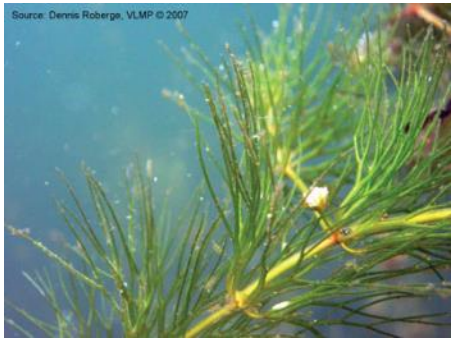
Mostly Moss

Isoetid glades

What are our plant communities like?

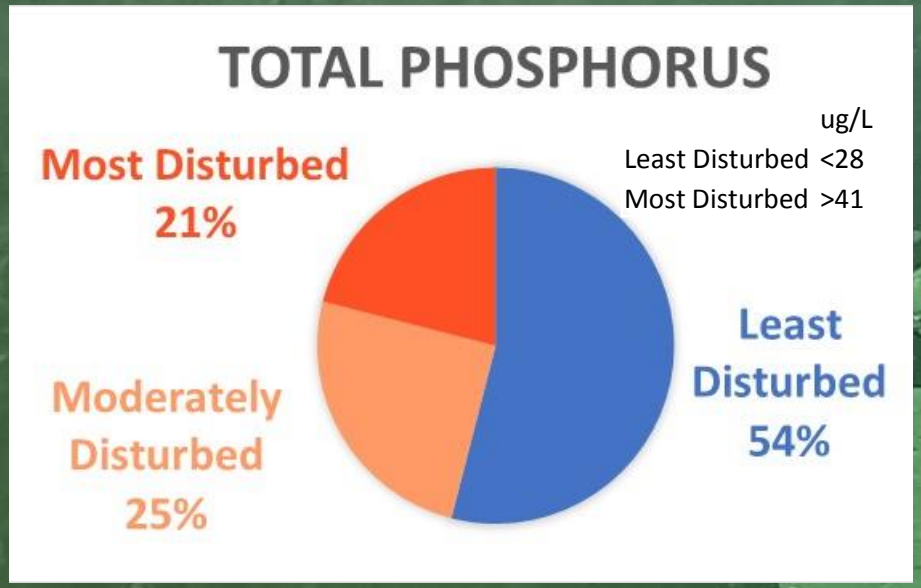


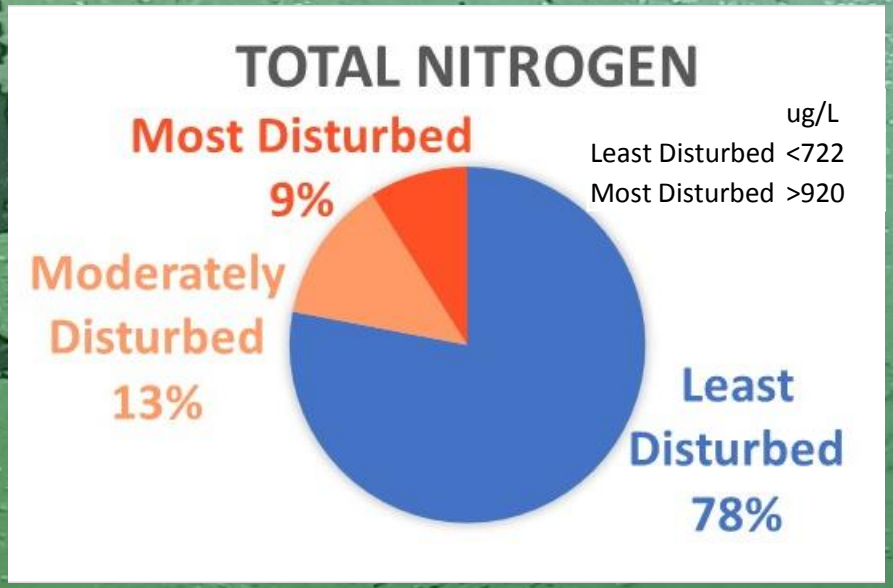




Chemical & Biological Condition of Wisconsin Lakes

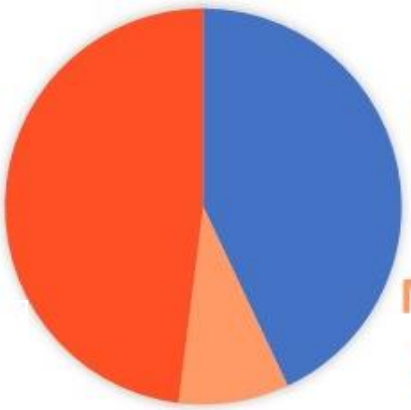
Nutrients


TOTAL PHOSPHORUS
ug/L
Least Disturbed <28
Most Disturbed >41
Most Disturbed
21%
Moderately
Disturbed
25%
Least
Disturbed
54%


TOTAL NITROGEN
ug/L
Least Disturbed <722
Most Disturbed >920
Most Disturbed
9%
Moderately
Disturbed
13%
Least
Disturbed
78%

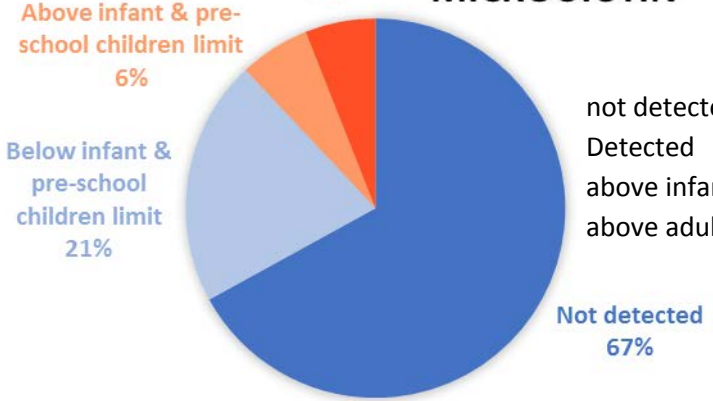
Algae & Algal Toxins

CHLOROPHYLL A



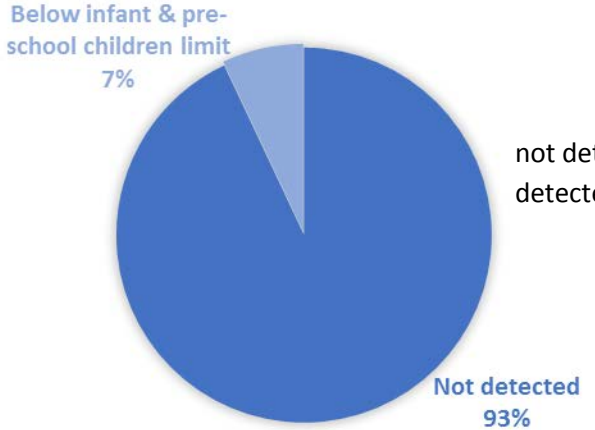
	ug/L
Least Disturbed	<6.7
Most Disturbed	>9.6

MICROCYSTIN



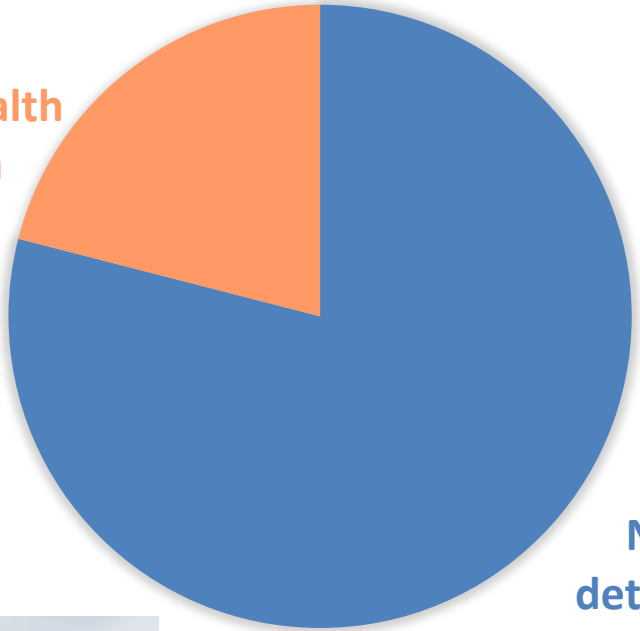
	ug/L
not detected	<0.1
Detected	<0.3
above infant	<1.6
above adult	>1.6

CYLINDROSPERMOPSIN



	ug/L
not detected	<0.04
detected	<0.7

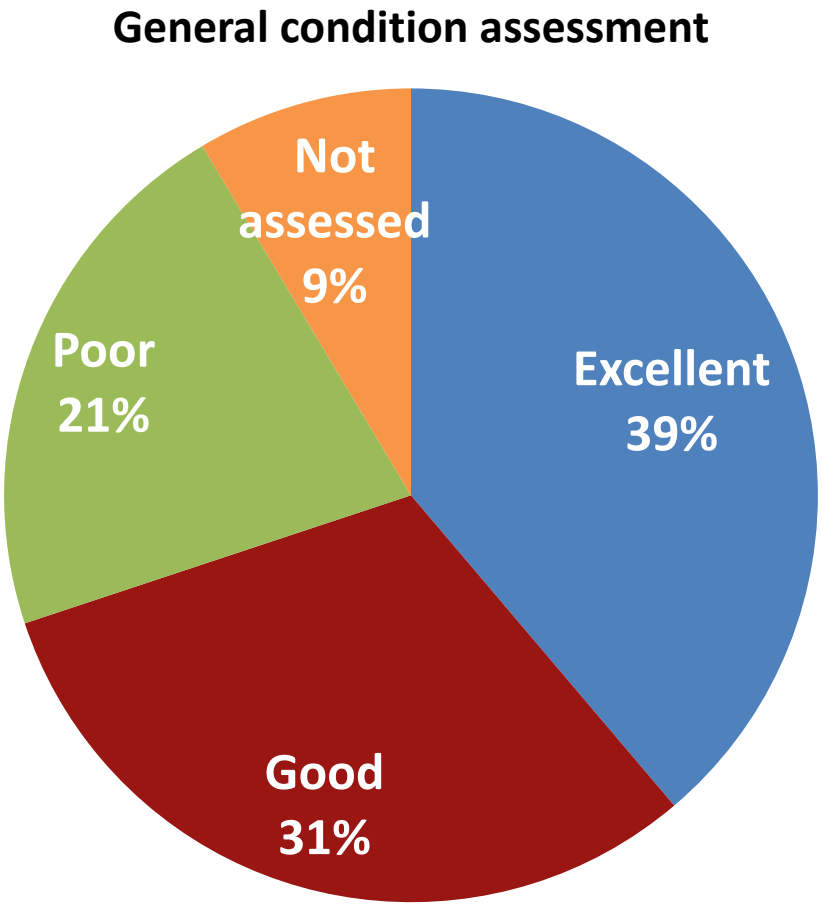
ATRAZINE



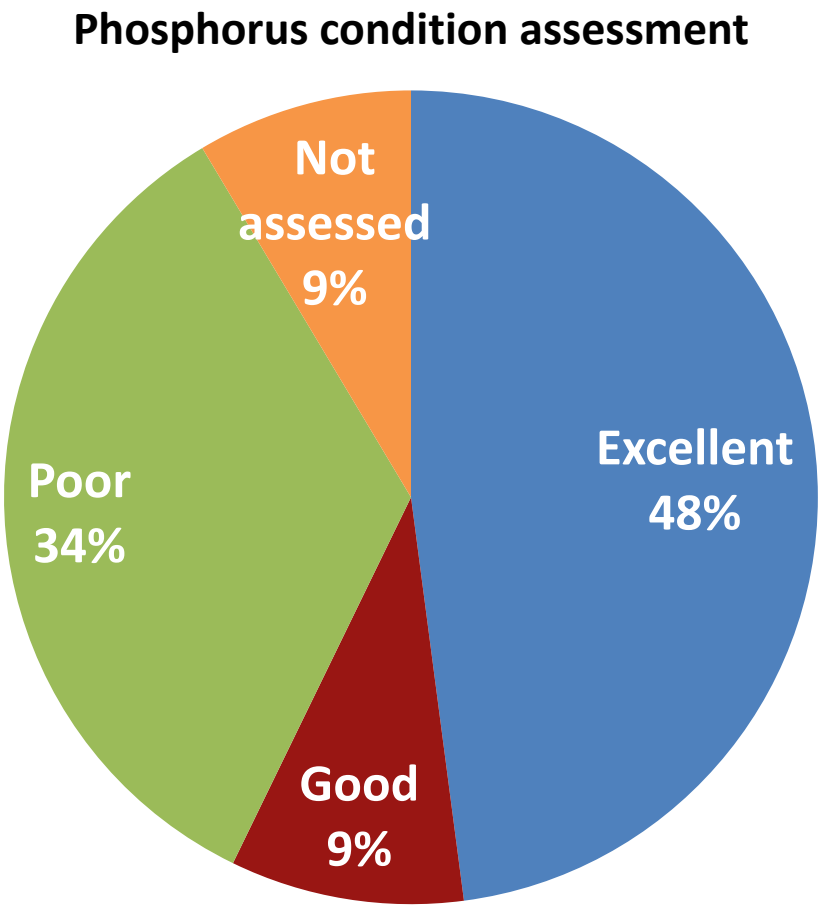
	ppb
Not detected	<0.046
Below health criteria	<0.62

Macrophytes respond to anthropogenic disturbance

Most macrophyte communities are in excellent or good condition



Many communities may be experiencing nutrient-related stress



Summary of Lake Health Indicators

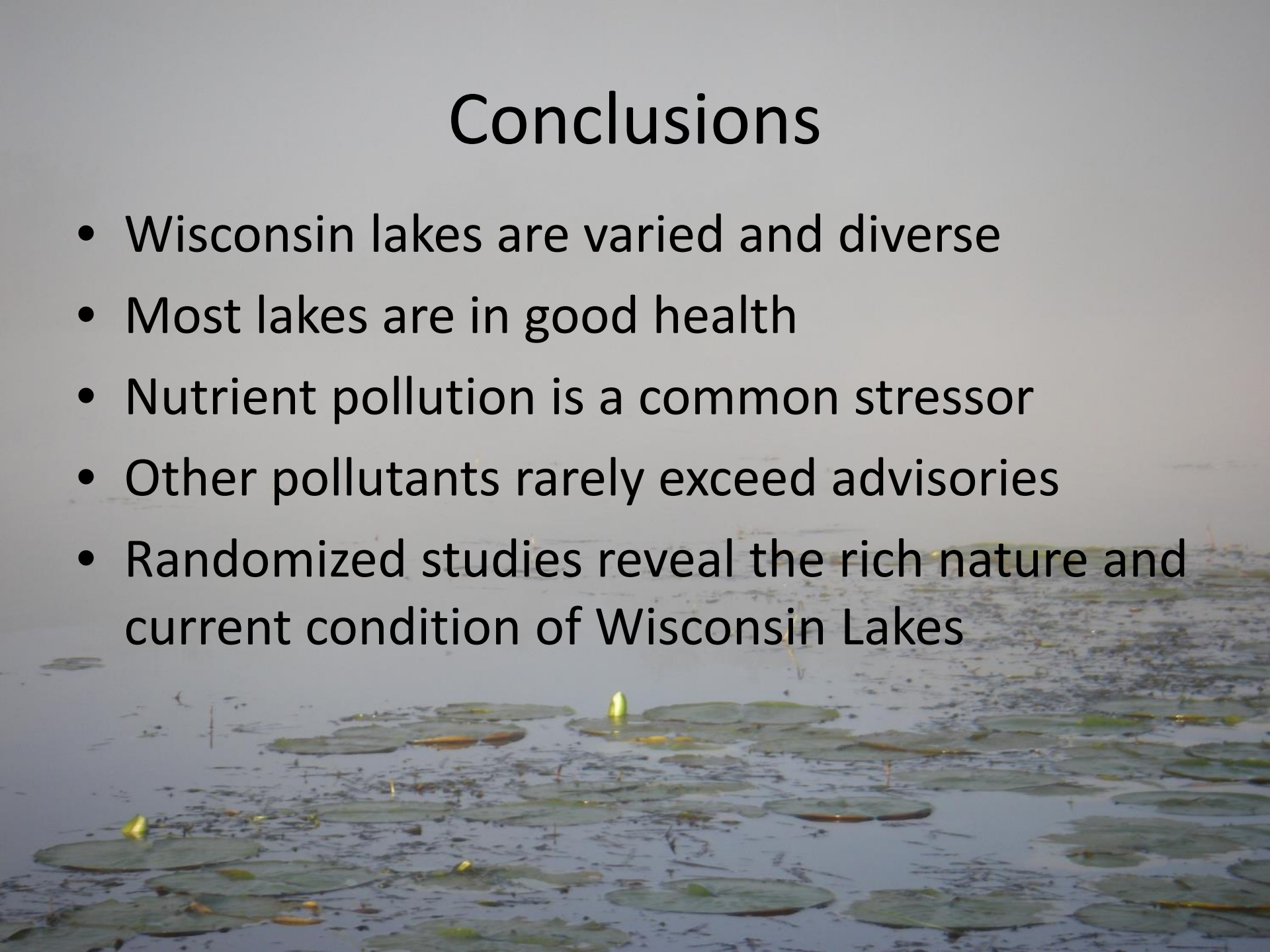
Indicator	Moderate/Healthy Lakes
Phosphorus	79%
Nitrogen	91%
Chlorophyll *a*	52%
Algal Toxins	88 - 100%
Plants: Phosphorus	66%
Plants: Disturbance	79%
Atrazine	100%

Results yet to come…

- Fish eDNA
- Dissolved gases – $C0_2$ & CH_4
- Phytoplankton
- Zooplankton
- Sediment contaminants
- Macroinvertebrates
- Lakeshore habitat
- Aquatic Invasive Species

Conclusions

- Wisconsin lakes are varied and diverse
- Most lakes are in good health
- Nutrient pollution is a common stressor
- Other pollutants rarely exceed advisories
- Randomized studies reveal the rich nature and current condition of Wisconsin Lakes



THANKS!

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EPA
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