

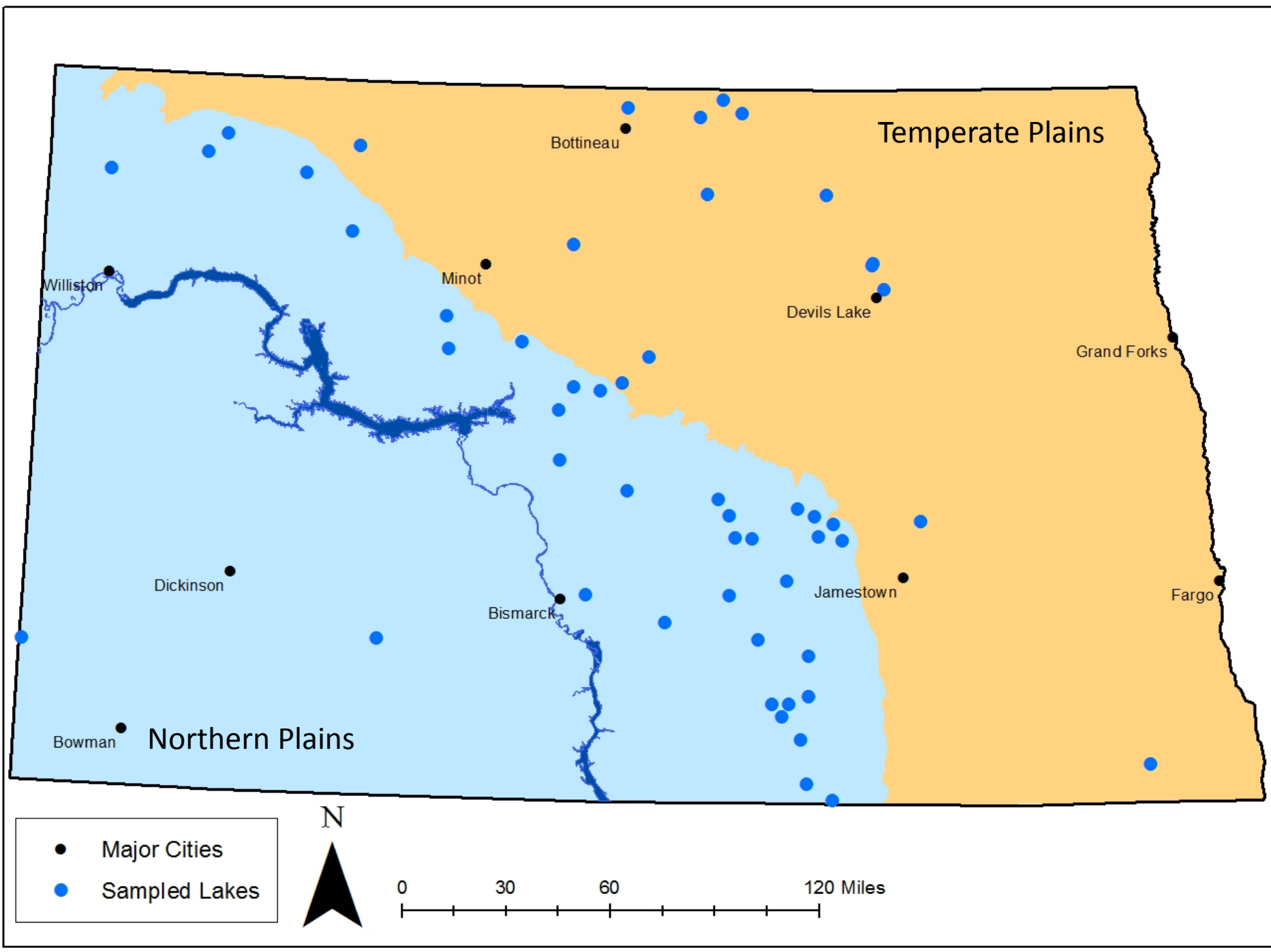
# Using the 2012 National Lakes Assessment to describe the condition of North Dakota's lakes

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ND Dept. of Health  
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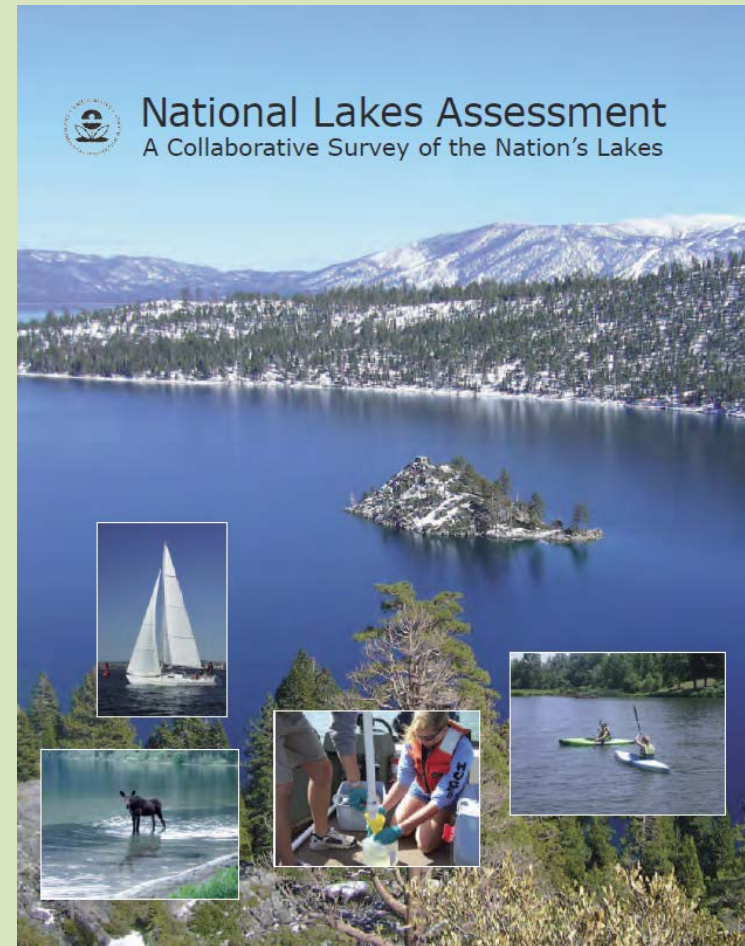
# Definition of a lake

- “A large body of water surrounded by land.”
- How the EPA defined a lake:
  - Natural or man-made
  - > 2.5 acres (10 acres for 2007 assessment)
  - At least 1 meter (3.3 feet) deep
  - At least 0.25 acres must be open water
  - This produced 68,223 lakes nationwide in 2007; > 100,000 in 2012

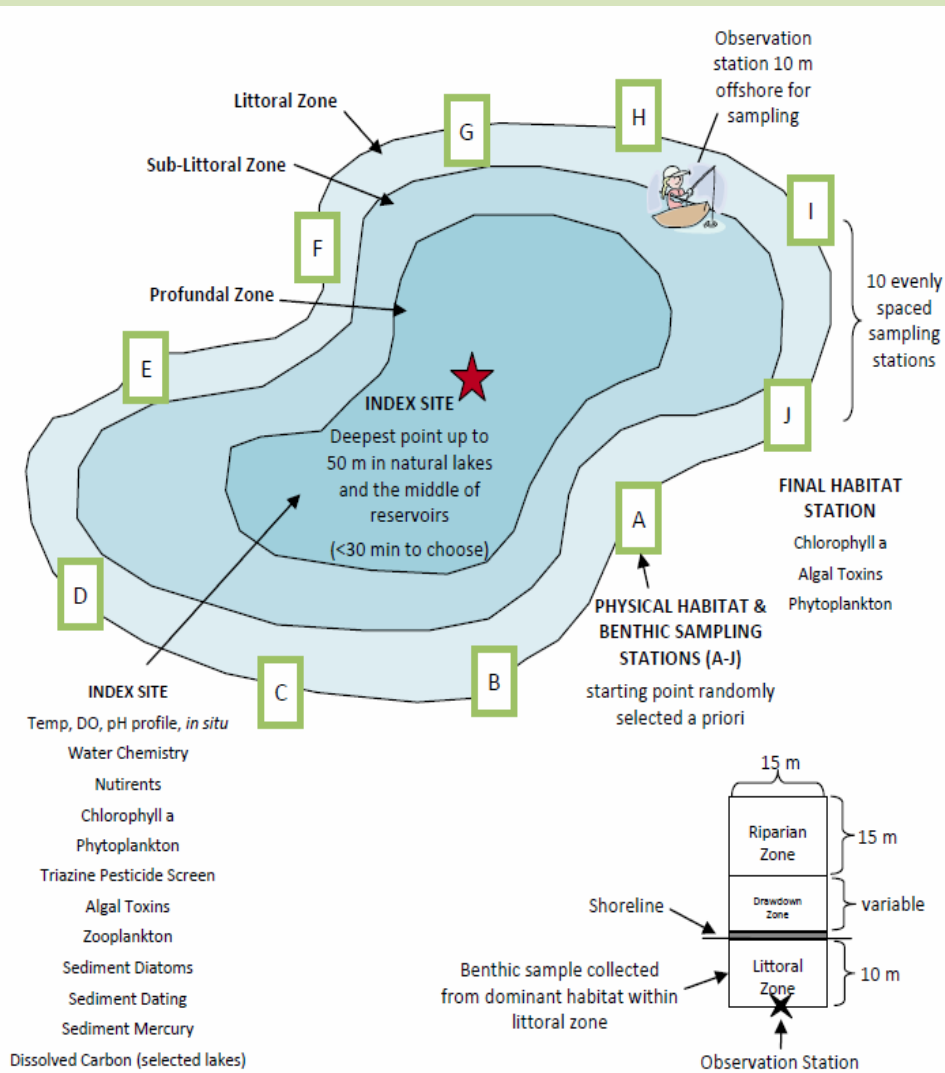


# Parameters

- Physical Habitat
  - In-lake
  - Riparian
- Chemical Condition
- Trophic State
- Sediment
- Algal Toxin Presence/Concentration
- Atrazine Presence/Concentration
- Zooplankton Community
- Phytoplankton Community
  - Cyanobacteria
- Macroinvertebrate Community



# Summary of lake activities



- Index site
- Littoral site
- Water chemistry, sediment, profile, phytoplankton, and zooplankton at index site
- Physical habitat and Benthic sampling stations
  - Physical habitat at all stations
  - Benthic sampling at all stations
  - Macrophytes at every other station

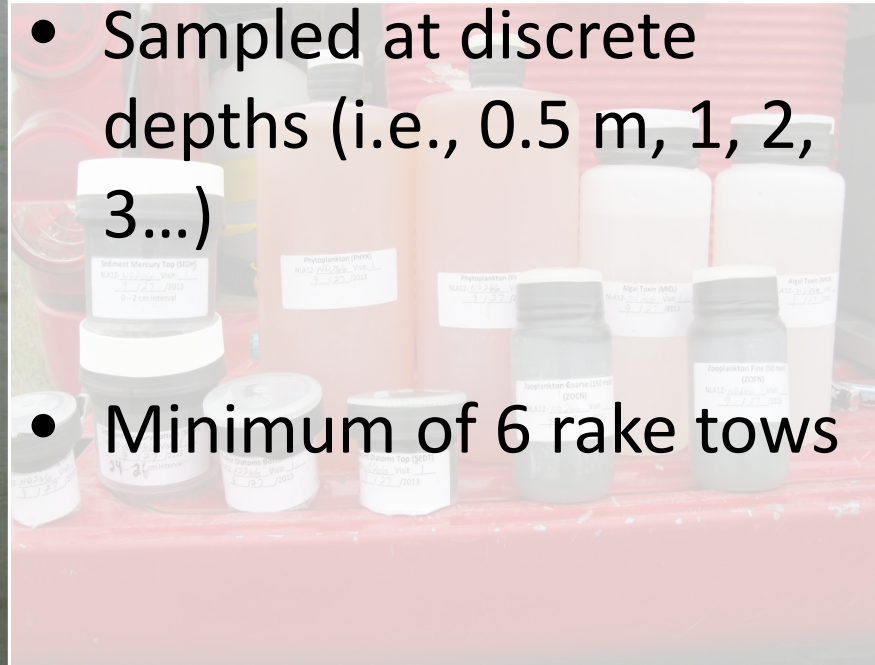
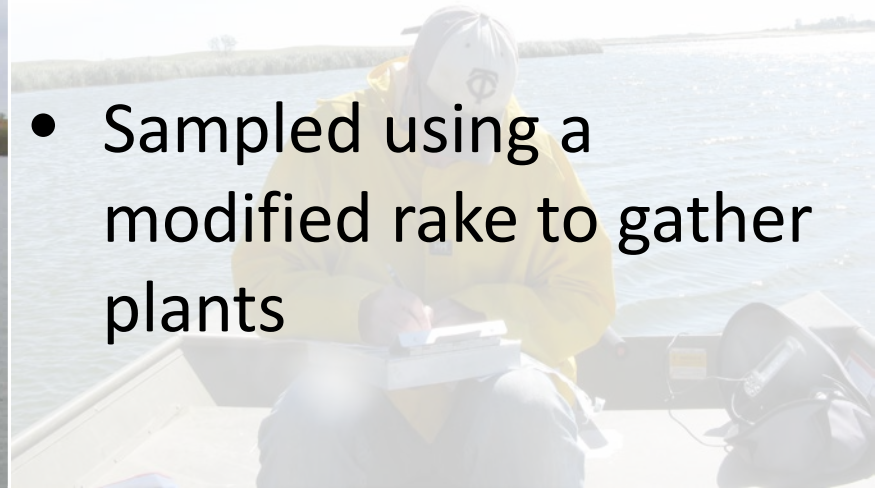


- Macrophytes assessed at 5 stations

- Sampled using a modified rake to gather plants

- Sampled at discrete depths (i.e., 0.5 m, 1, 2, 3...)

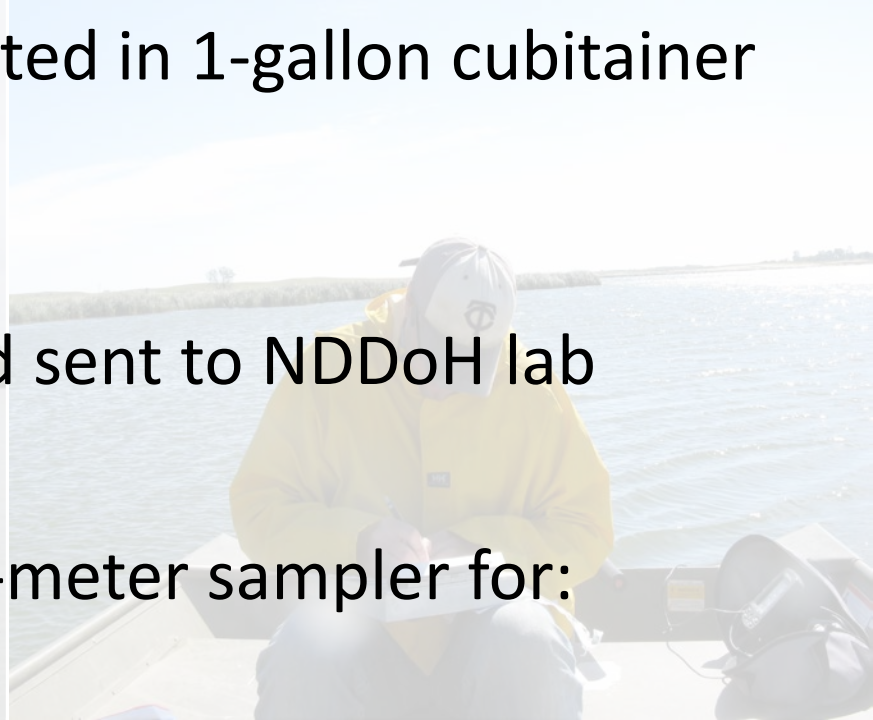
- Minimum of 6 rake tows



- Assessed riparian vegetation and disturbance using EPA forms
- Vegetative cover assessed at the canopy, understory, and ground levels
- Disturbance forms include:
  - Pasture
  - Row crop
  - Buildings
  - Commercial
  - Mining
  - Roads



- Water chemistry samples collected in 1-gallon cubitainer using 2-meter column sampler
- Duplicate samples collected and sent to NDDoH lab
- Additional sample taken with 2-meter sampler for:
  - Pesticide
  - Phytoplankton
  - Microcystin
  - Chlorophyll- $\alpha$





# Results

## National Lakes Assessment 2012

A collaborative Survey of Lakes in the United States

DRAFT  
8-27-2015

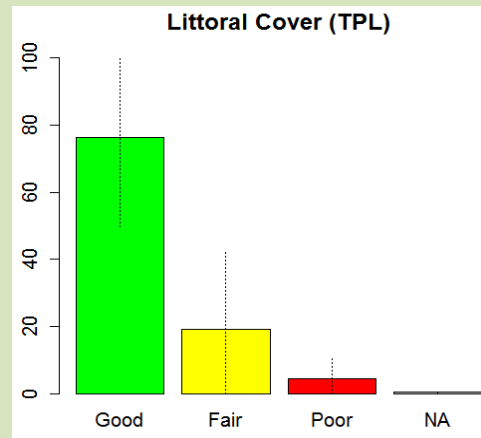
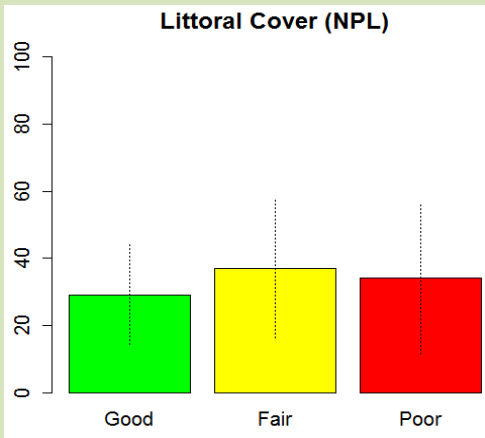
**Using the 2012 National Lakes Assessment to  
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Draft: November 2015

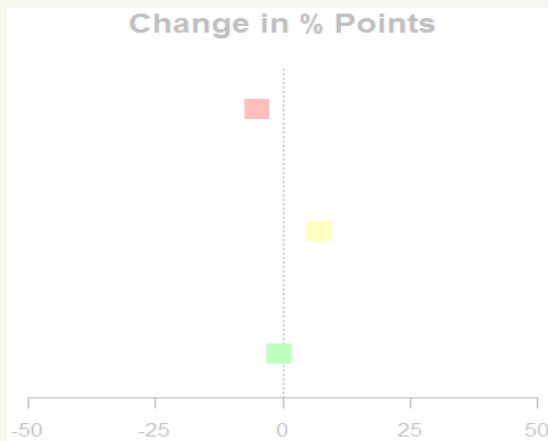
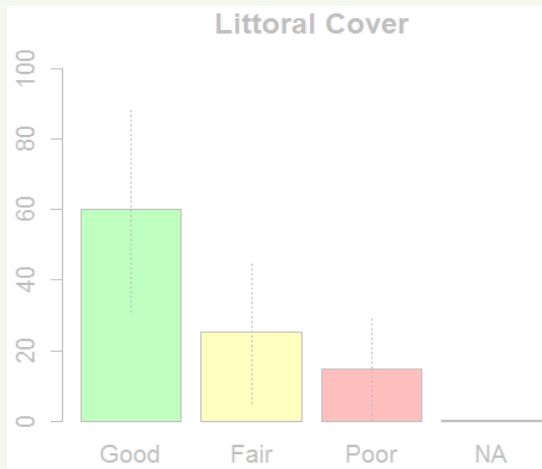
Prepared by:  
Joseph Nett  
Environmental Scientist  
North Dakota Department of Health  
Division of Water Quality  
918 E. Divide Ave, 4<sup>th</sup> Floor  
Bismarck, ND 58501-1947



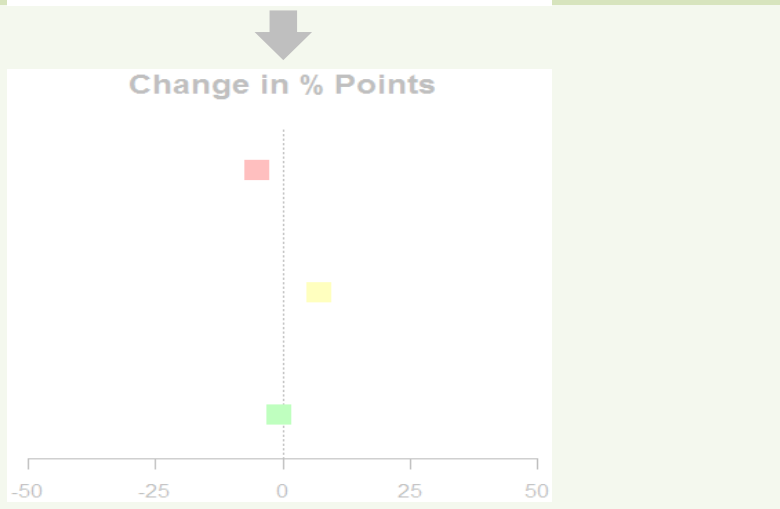
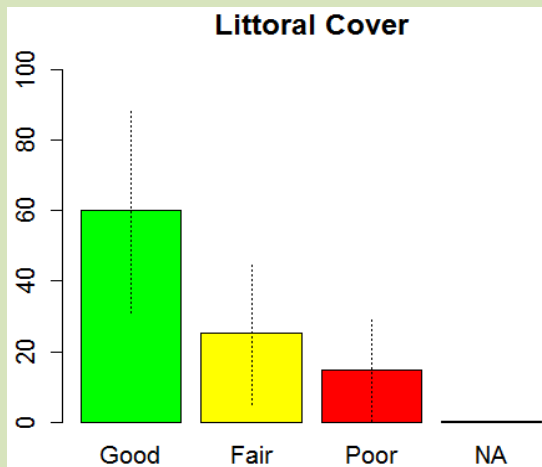
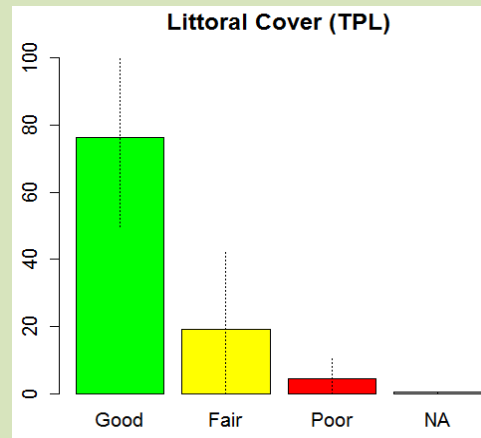
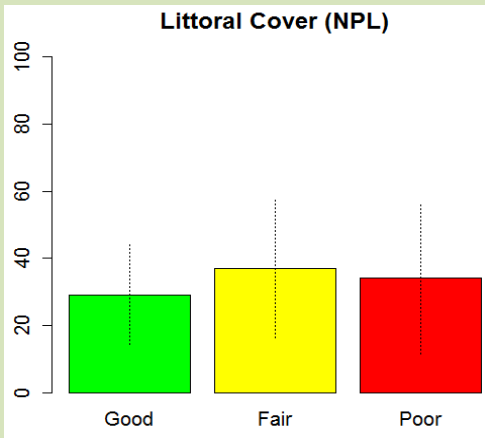
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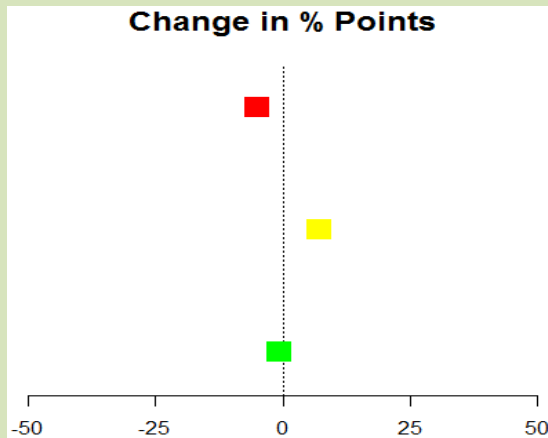
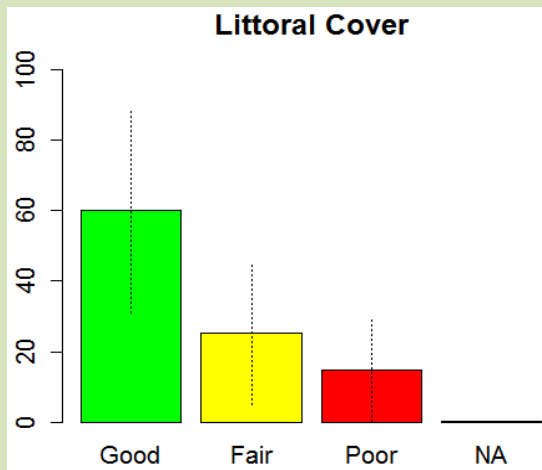
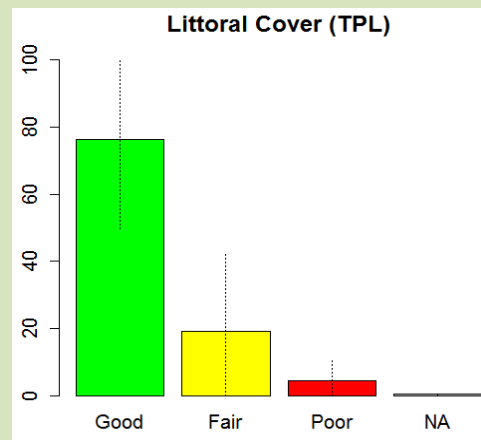
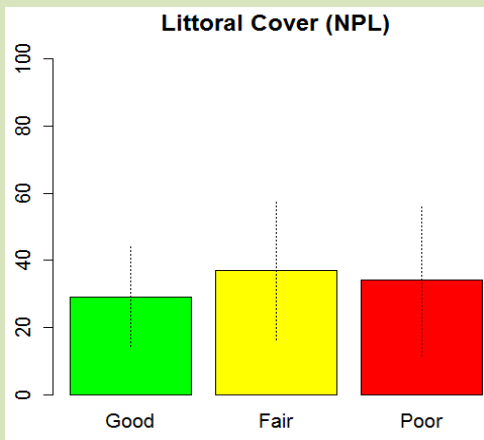
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  - Much less than 2007
- Conditions improved in TPL lakes



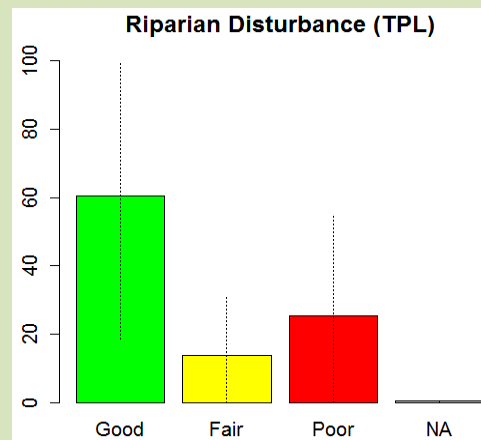
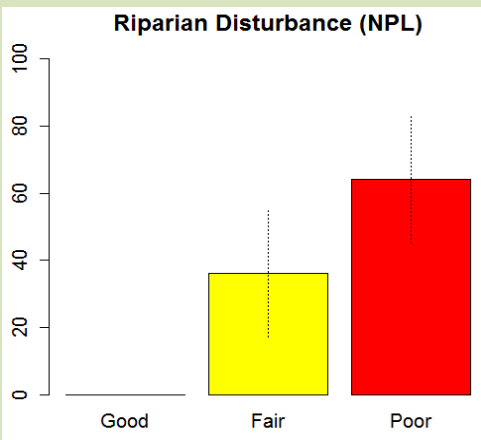
- Nearly 60% of ND lakes in good condition
- Little change since the 2007 assessment
- Overall, ND lakes in good condition for littoral cover



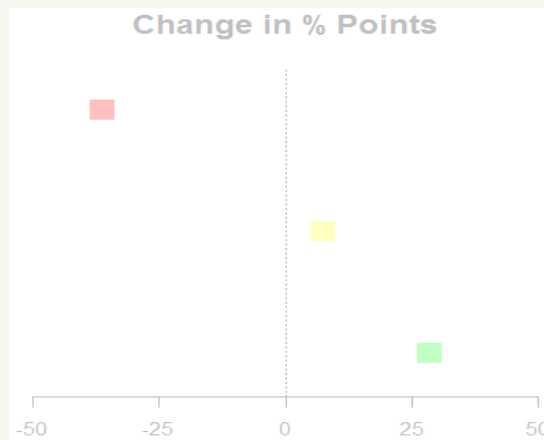
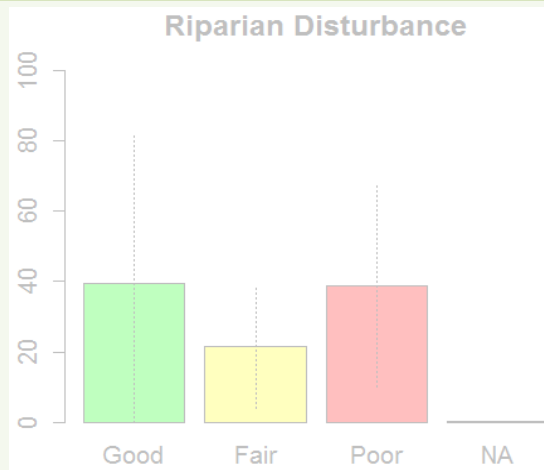
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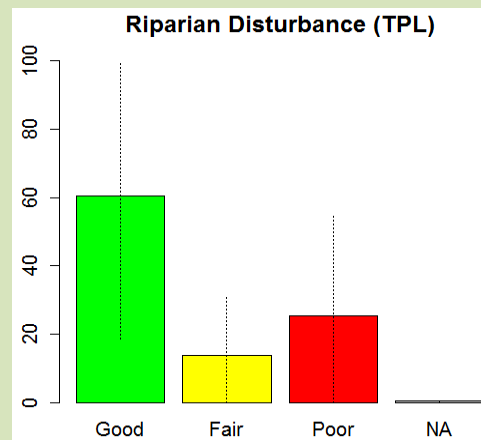
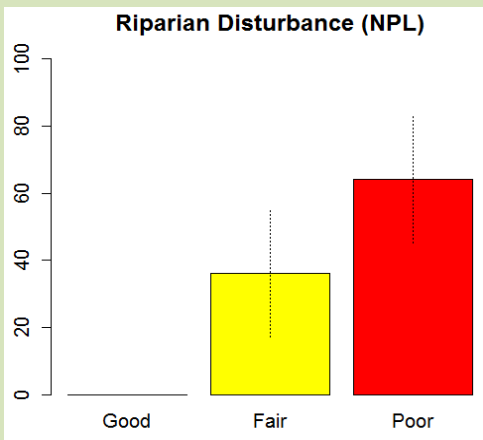
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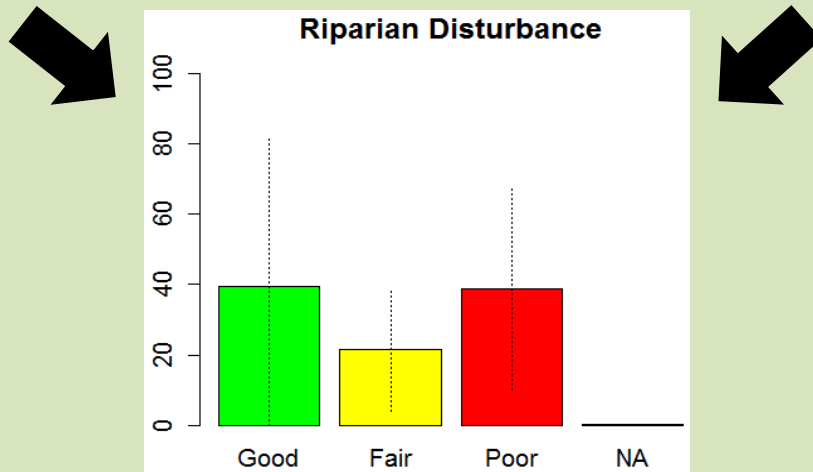
- No NPL lakes considered good
- Greater than 60% of TPL in good condition



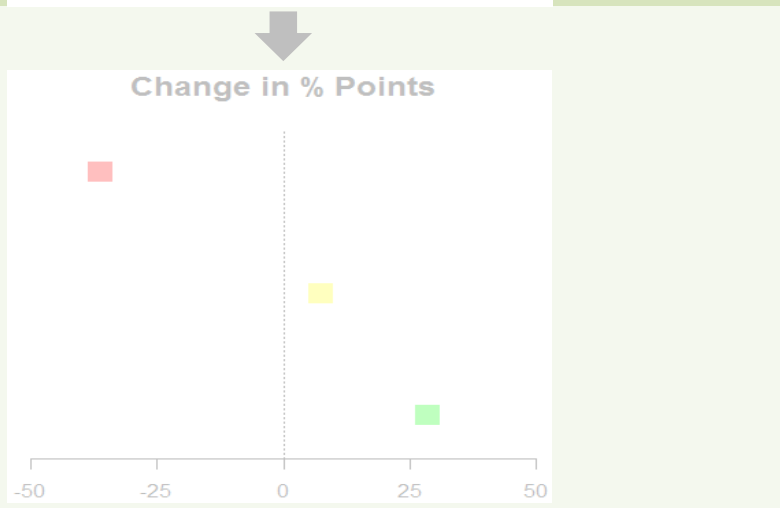
- Nearly 40% of all ND lakes in good condition for riparian disturbance
- Increased number of lakes in good condition, reflected in loss of lakes in poor condition



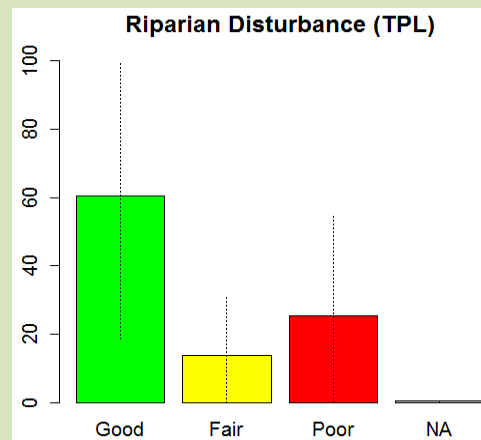
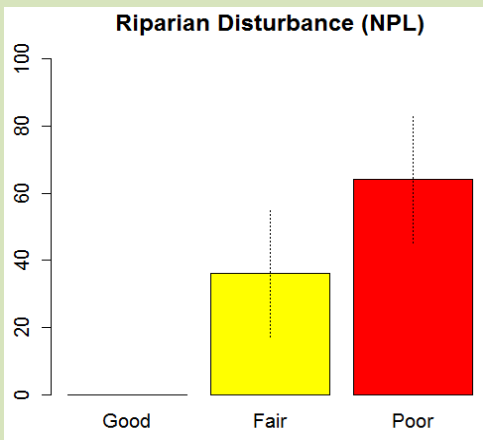
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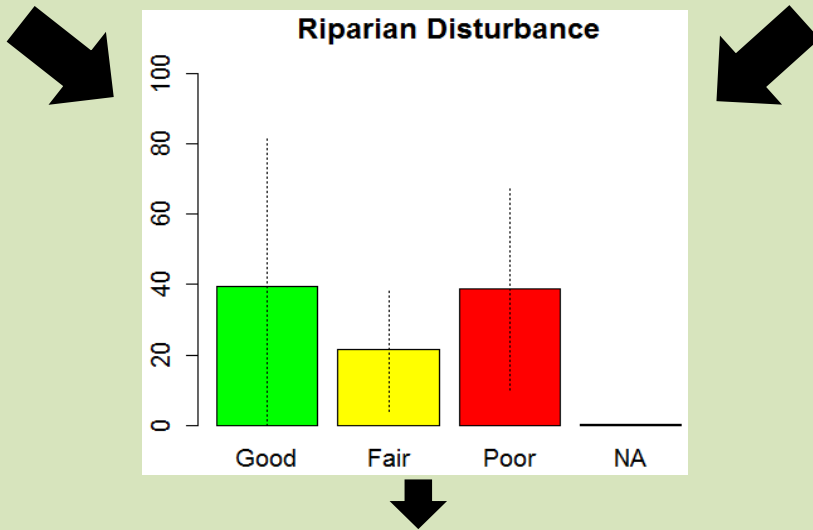
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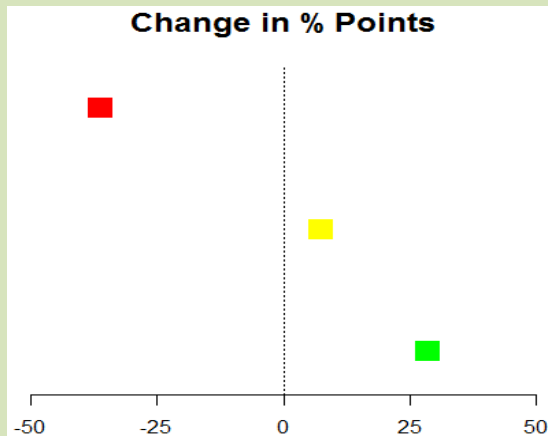
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- Increased number of lakes in good condition, reflected in loss of lakes in poor condition

# What does physical habitat condition look like?



Good

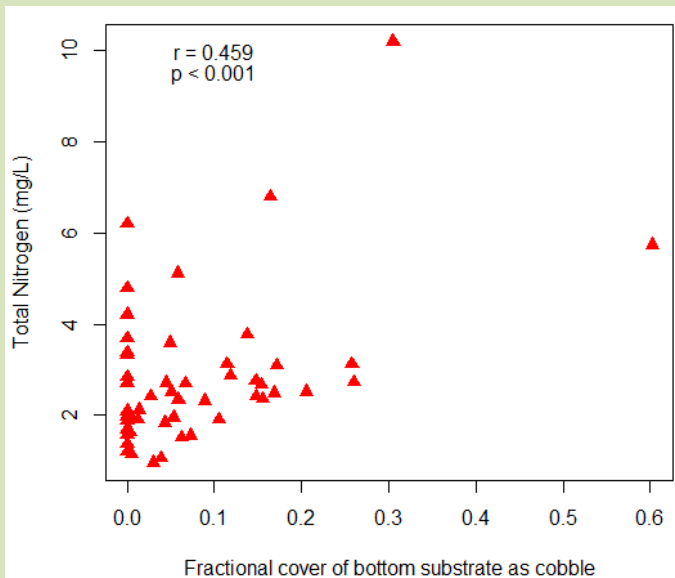
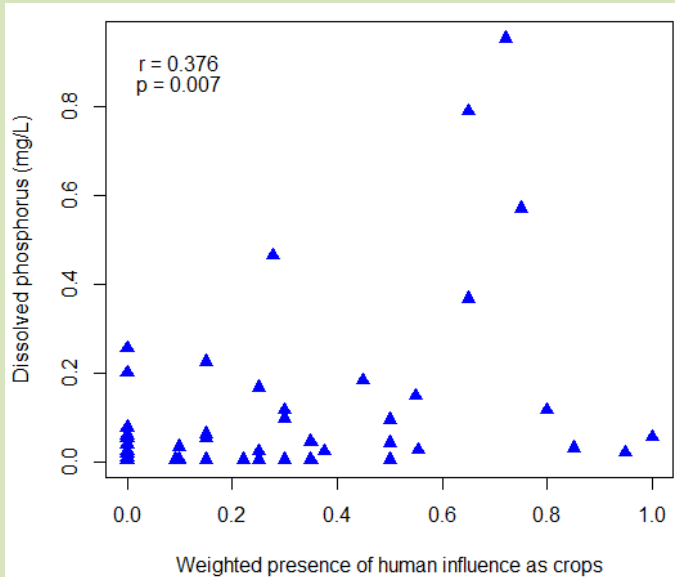
- Good:
  - Overhanging Vegetation
  - Emergent Vegetation
  - Woody Vegetation
  - Other fish cover measures
  
- Poor:
  - Exposed banks
  - No shade
  - No (or little) vegetation
  - No snags, large rocks
  - Nearshore disturbance



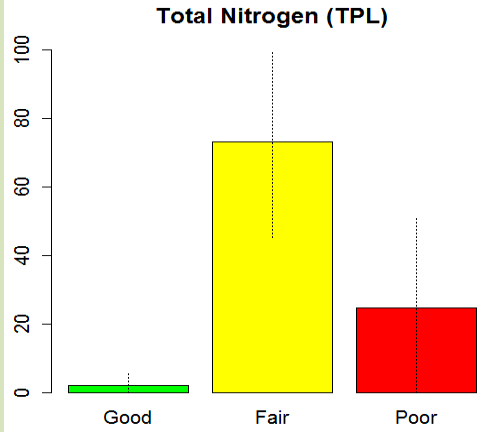
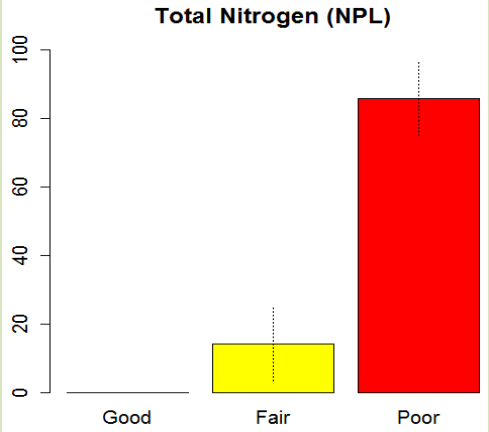
Poor



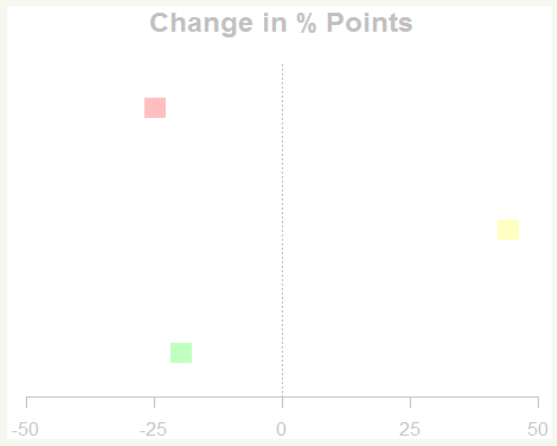
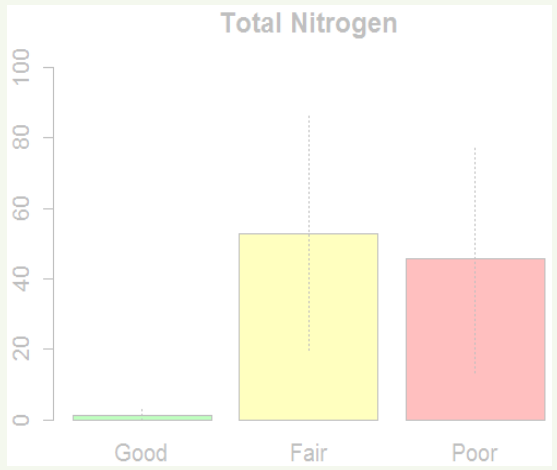
# In-lake nutrient concentrations somewhat related to riparian and littoral characteristics



- Some significant correlations
- Possibly more driven by drainage area characteristics
- Prairie pothole lakes naturally high in nutrients
- Sampling time may effect relationship between nutrients and littoral vegetation

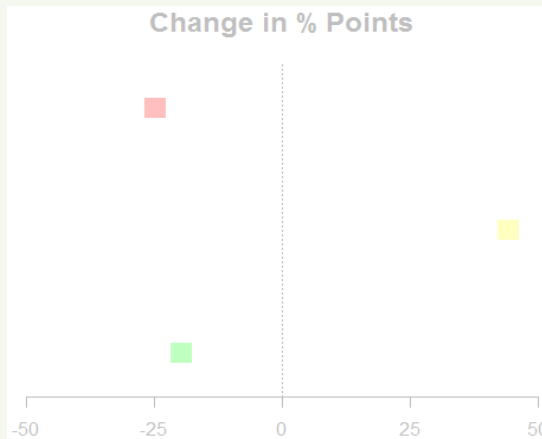
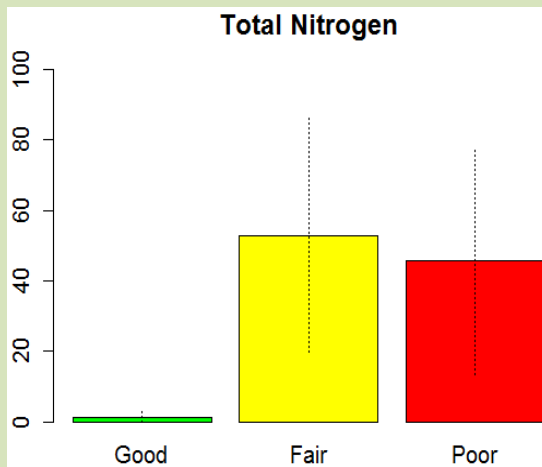
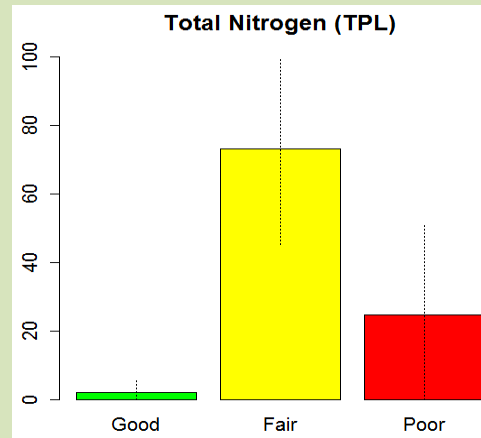
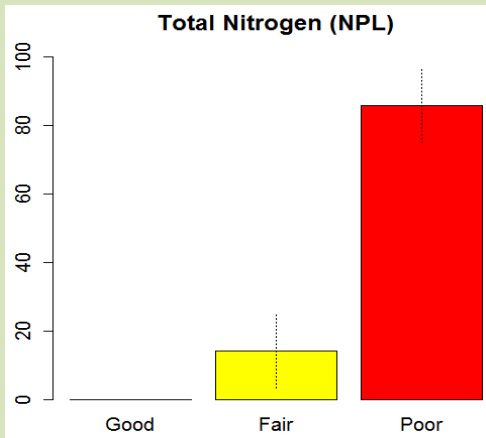


- High nitrogen concentrations accentuated in the NPL
- Improved vs 2007 concentrations

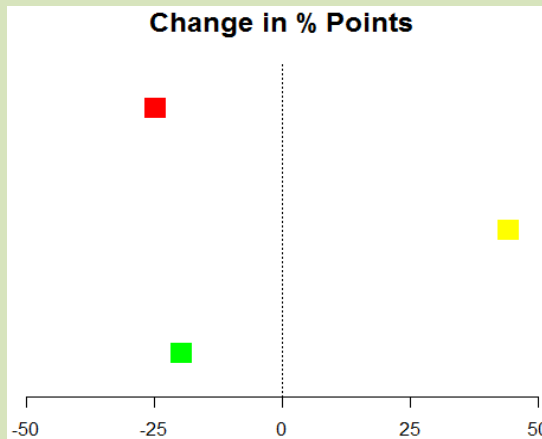
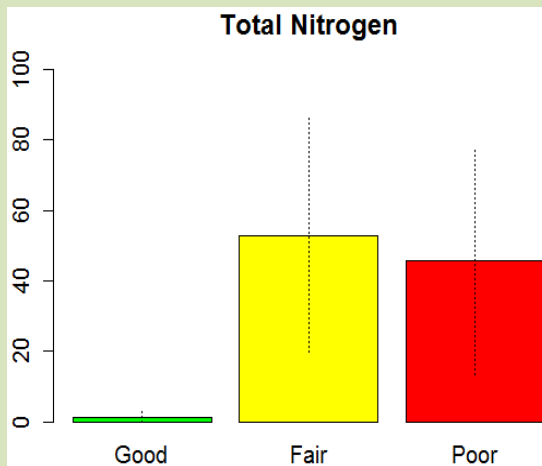
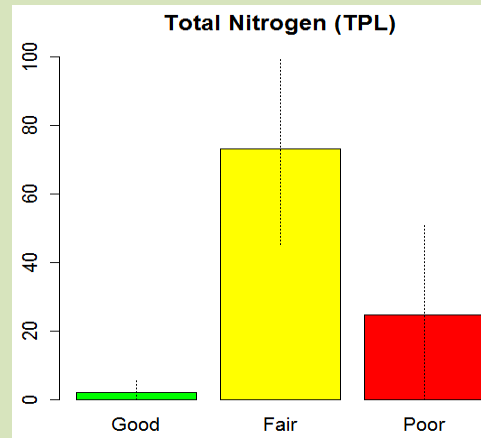
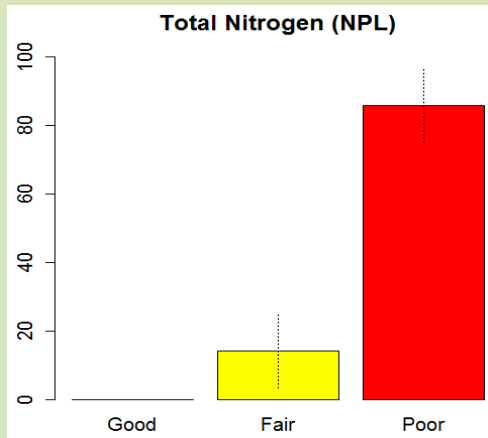


- Few lakes considered good
- 50<sup>th</sup> percentile concentration much improved in 2012 (1.62 mg/L) compared to 2007 (2.50 mg/L)

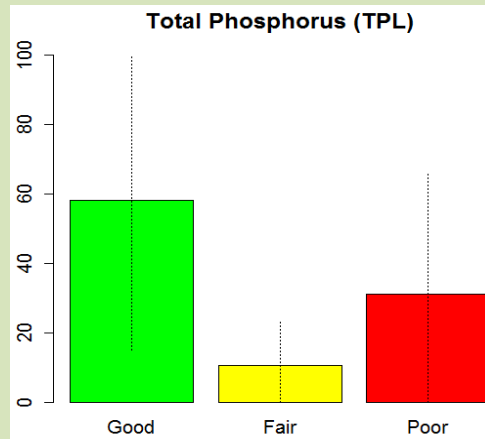
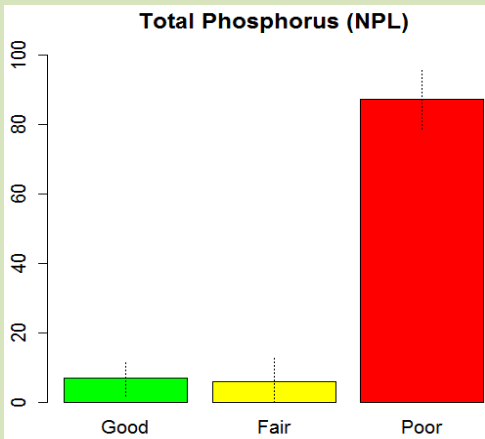
- Though not in good condition, ND lakes had a reduction in poor lakes



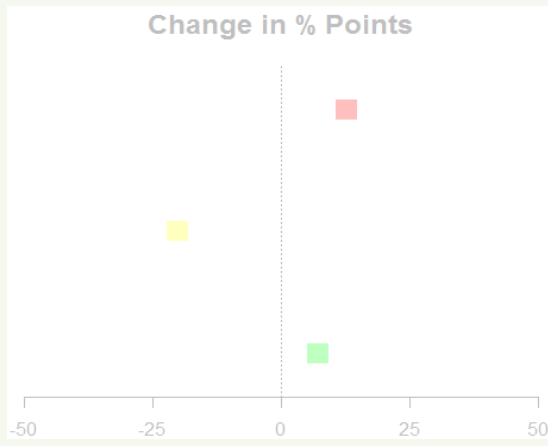
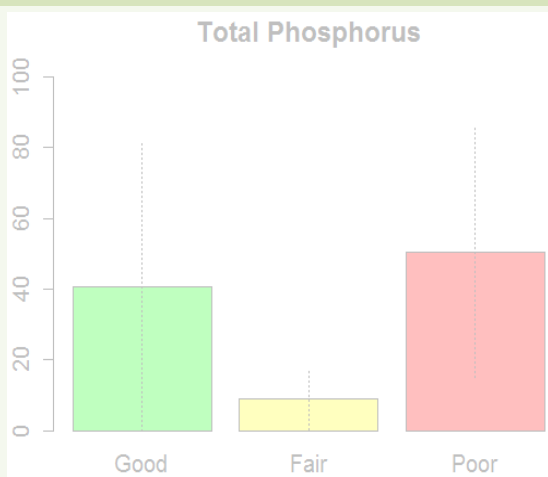
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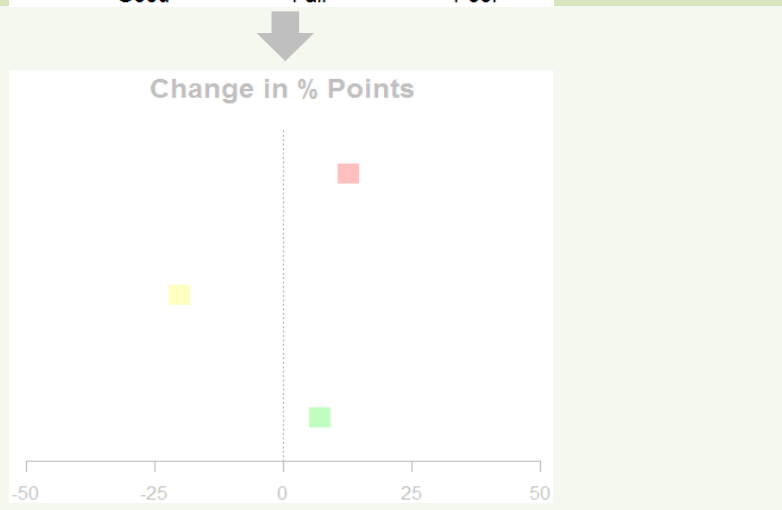
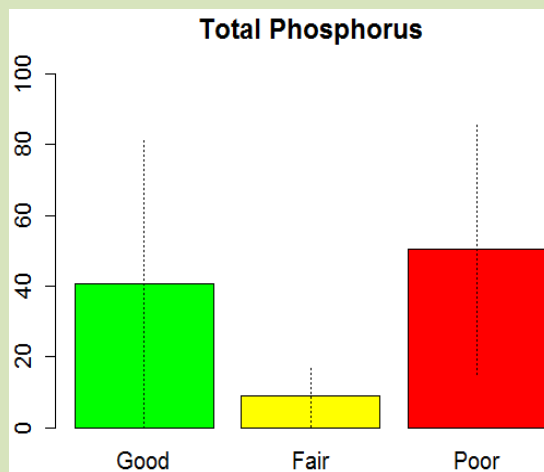
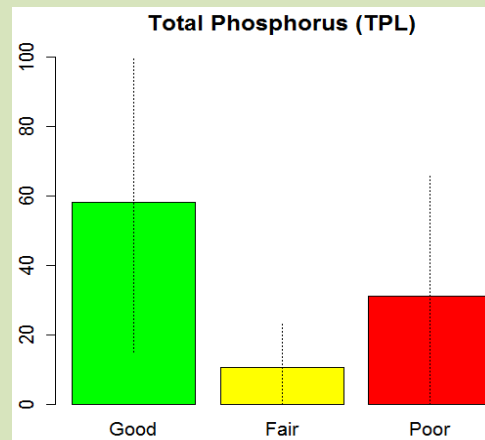
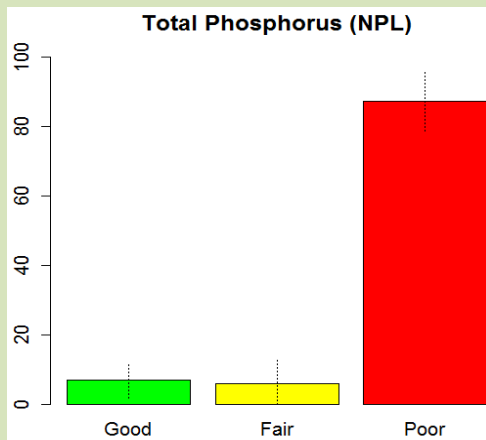
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- Improved vs 2007 concentrations
- Few lakes considered good
- 50<sup>th</sup> percentile concentration much improved in 2012 (1.62 mg/L) compared to 2007 (2.50 mg/L)
- Though not in good condition, ND lakes had a reduction in poor lakes compared to 2007 survey



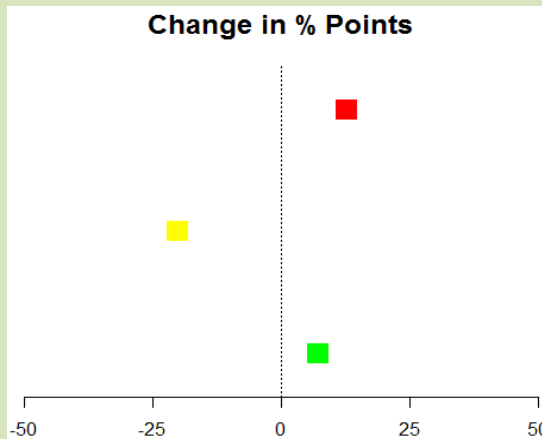
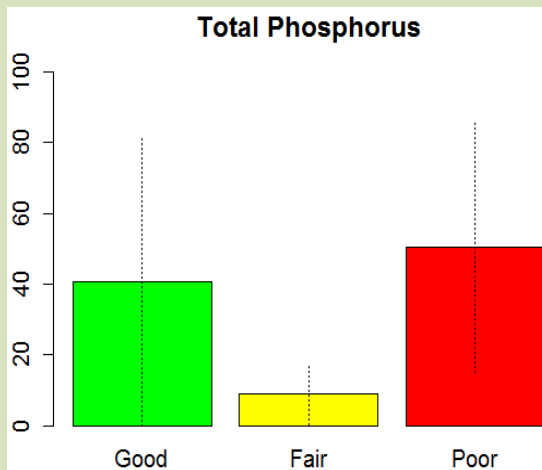
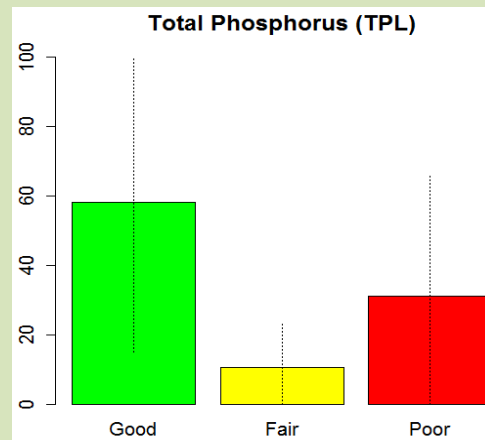
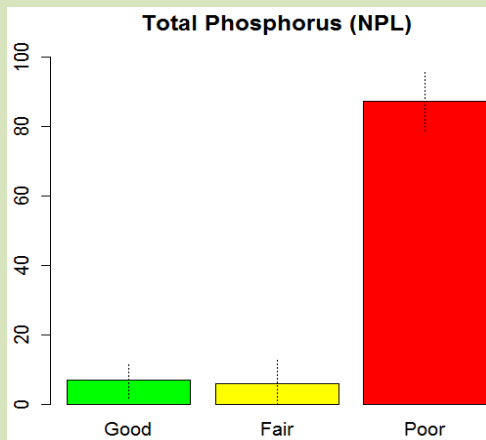
- High TP concentrations accentuated in the NPL
- Good condition in TPL



- Greater than 40% of ND lakes considered good
- 50<sup>th</sup> percentile concentration much improved in 2012 (0.09 mg/L) compared to 2007 (0.16 mg/L)
- Increase in number of lakes considered good and poor



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# What does poor nutrient condition look like?

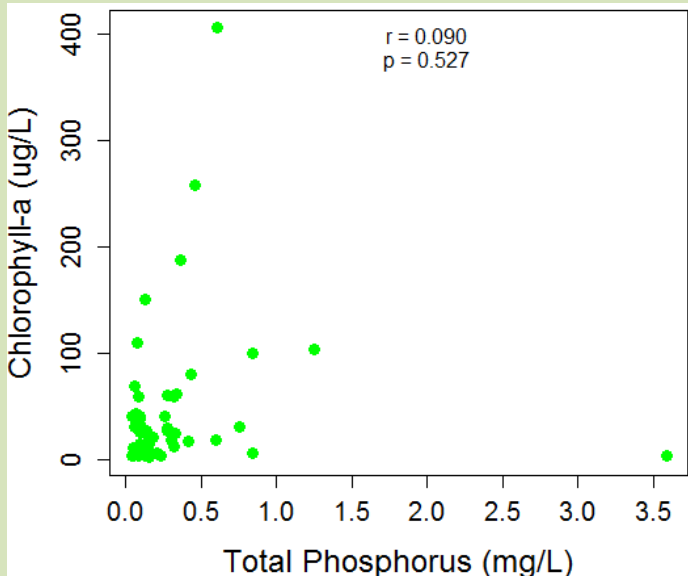
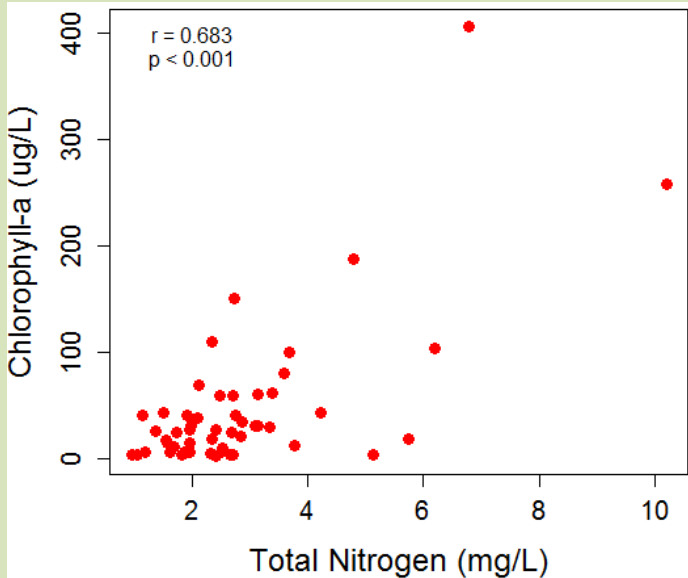


- Nuisance rooted plant growth
- Increased algal growth
- Harmful algal blooms
- Greater DO fluctuations
- Decreased biological condition

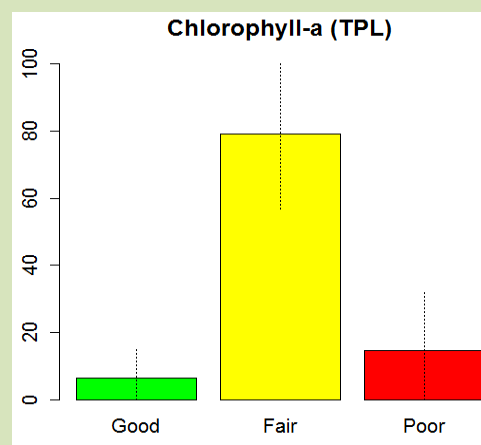
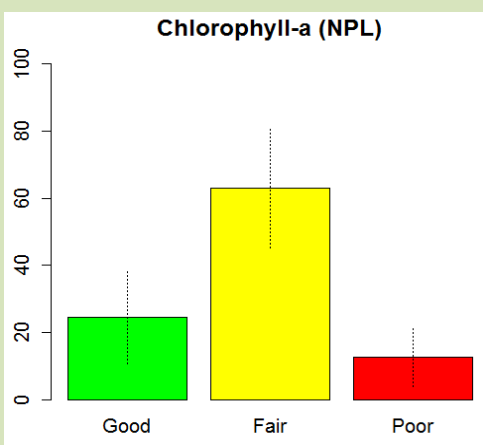




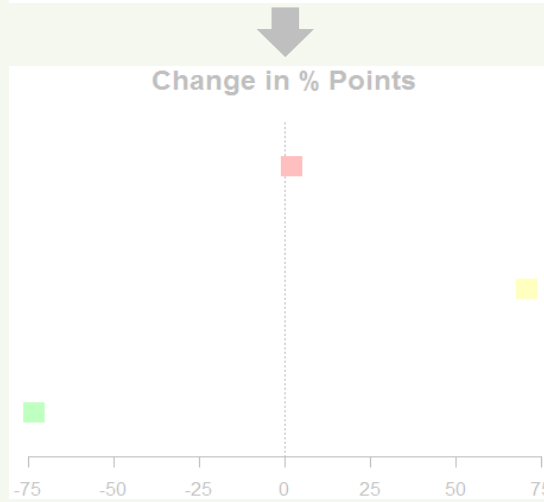
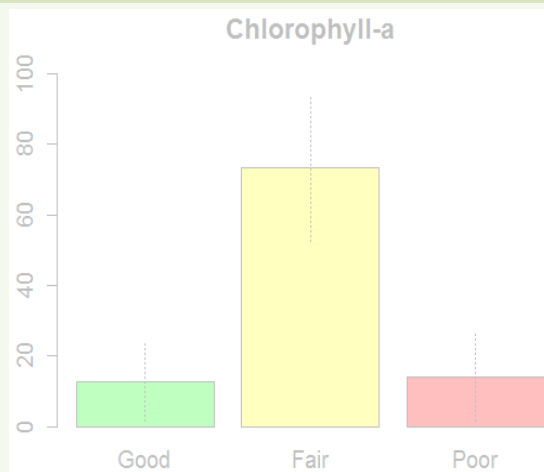
# Nitrogen concentrations strongly related to algal growth



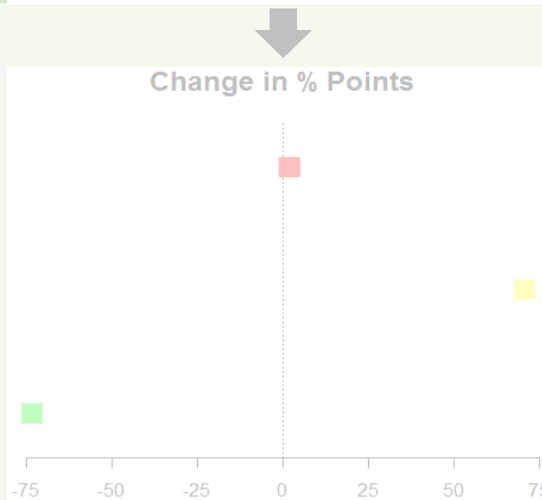
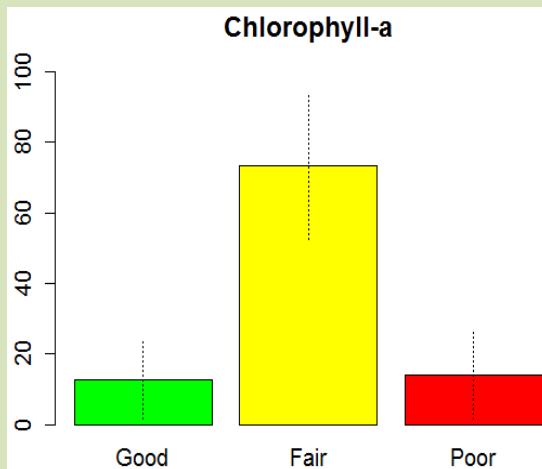
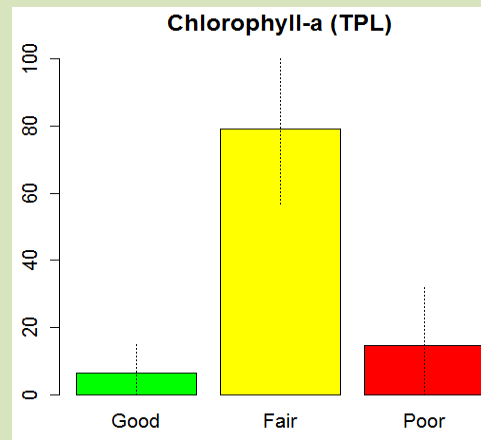
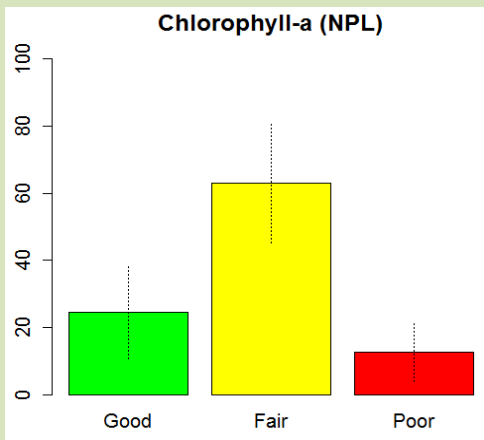
- Strong correlations with nitrogen and dissolved nitrogen
- Phosphorus (by itself) did not correlate with algal growth
- N:P may play bigger role
- Timing may be an issue



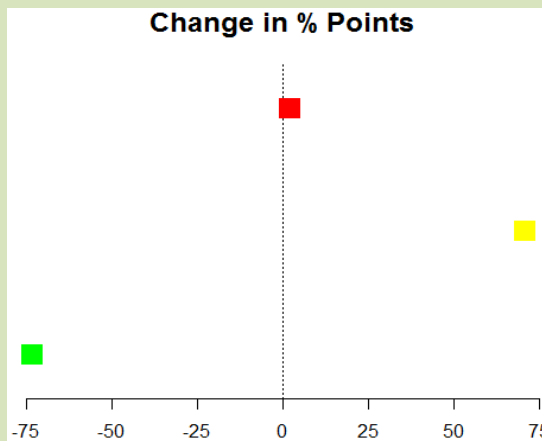
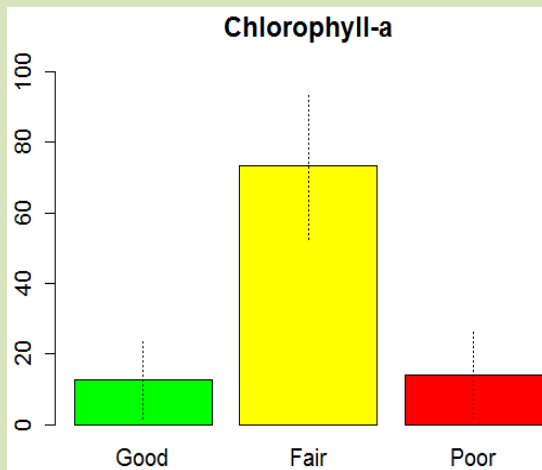
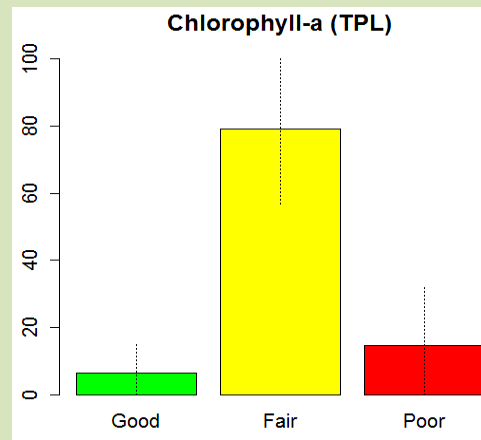
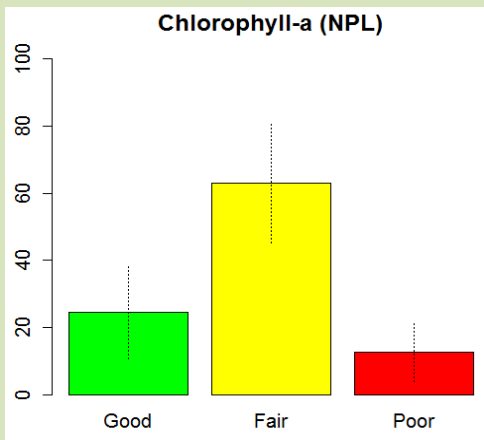
- A lot of lakes considered fair
- Much worse vs 2007 concentrations



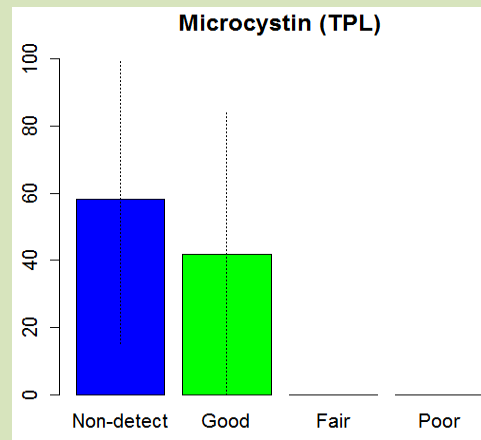
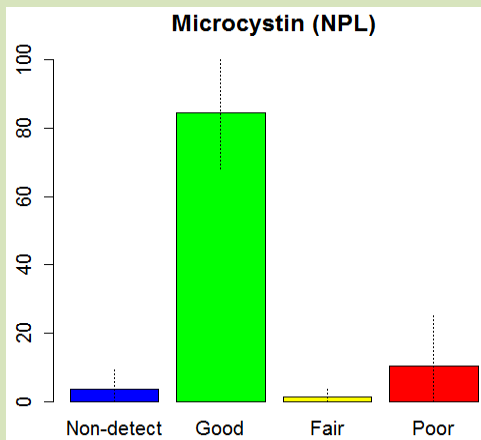
- Few lakes considered good
- 50<sup>th</sup> percentile concentration much higher in 2012 (17.17  $\mu\text{g/L}$ ) compared to 2007 (10.02  $\mu\text{g/L}$ )
- Huge swing in fair and good lakes
- Little change to lakes in poor condition



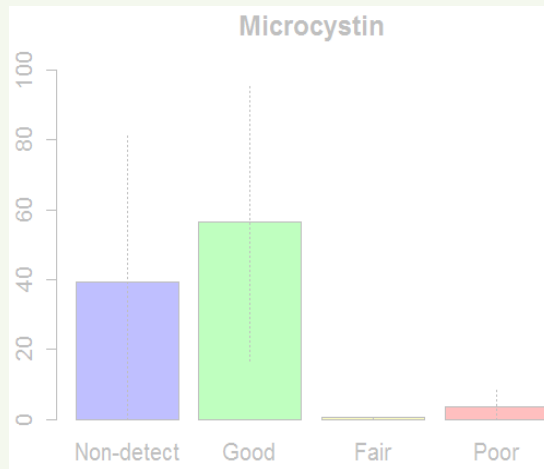
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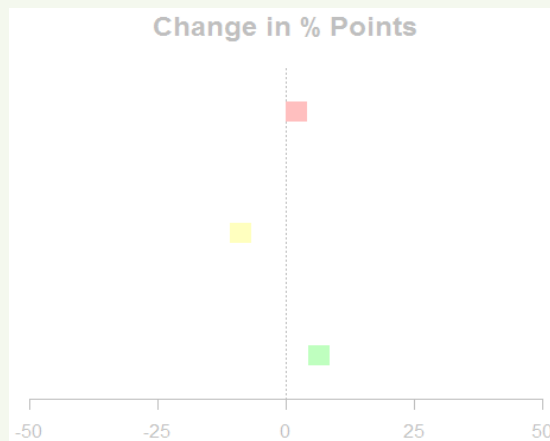
- A lot of lakes considered fair
- Much worse vs 2007 concentrations
- Few lakes considered good
- 50<sup>th</sup> percentile concentration much higher in 2012 (17.17  $\mu\text{g/L}$ ) compared to 2007 (10.02  $\mu\text{g/L}$ )
- Huge swing in fair and good lakes
- Little change to lakes in poor condition



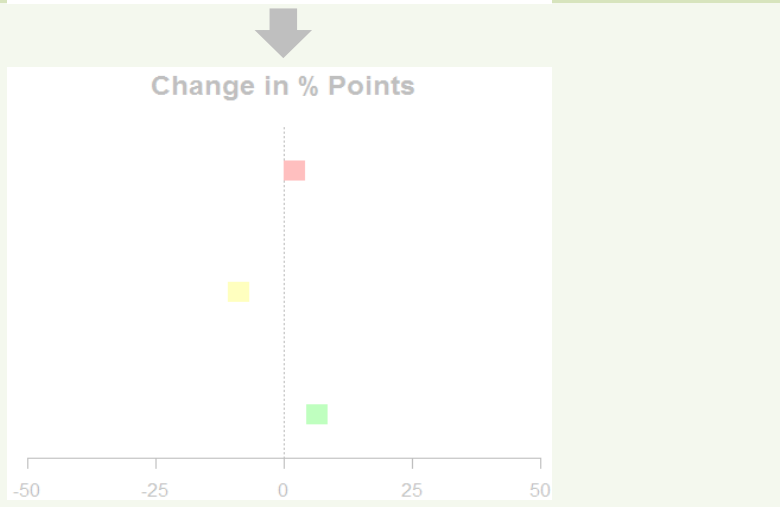
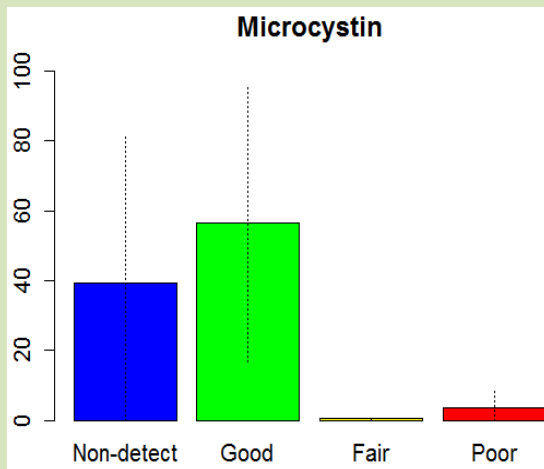
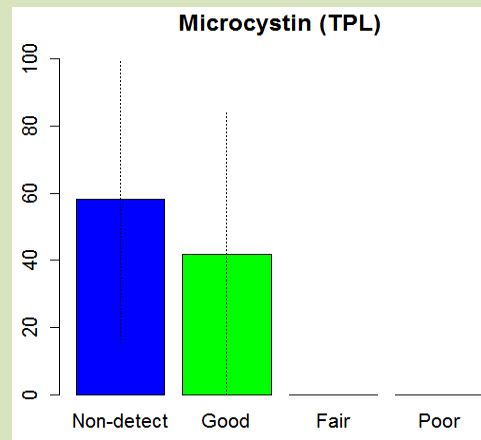
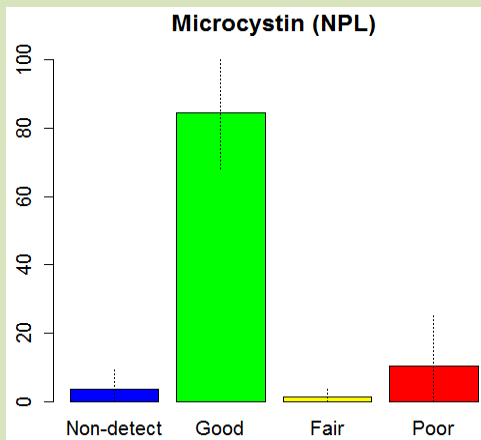
- Approximately 10% of NPL lakes in poor condition
- No concentrations > 1 µg/L in TPL



- 3.6% of ND lakes considered high risk
- Above national average



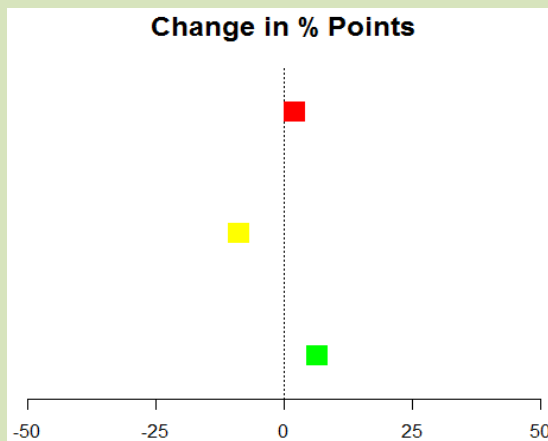
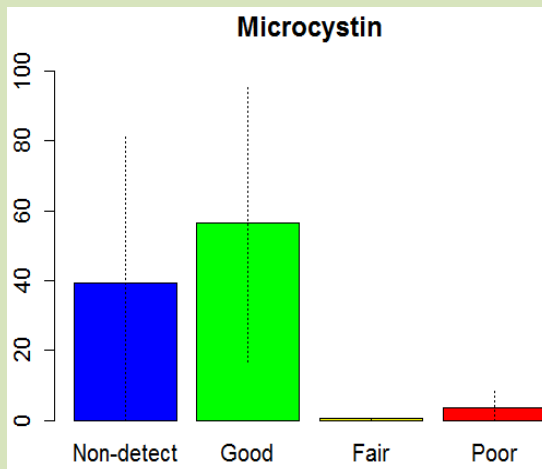
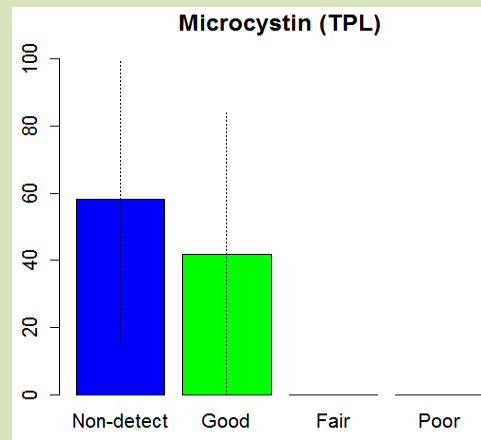
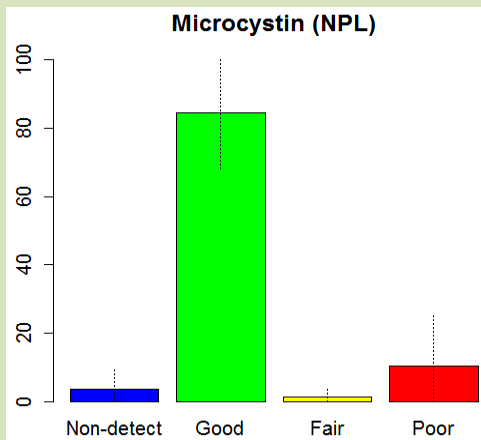
- Little change since 2007 assessment
- Potential issue with timing and location of sampling



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# Can you spot microcystin issue by looking at it?



- Things are not always as they appear
- Toxins harmful to in-lake species
- ... Also harmful to humans, livestock, pets, etc.
- Increased focus throughout country



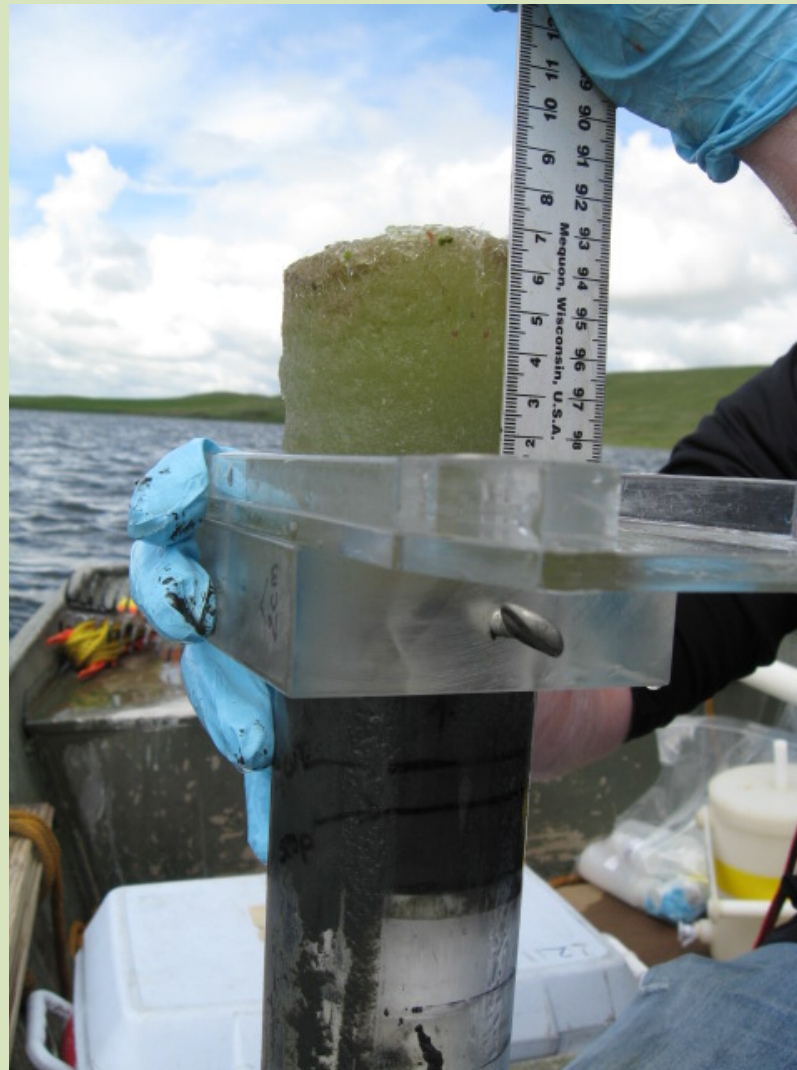


# Summary

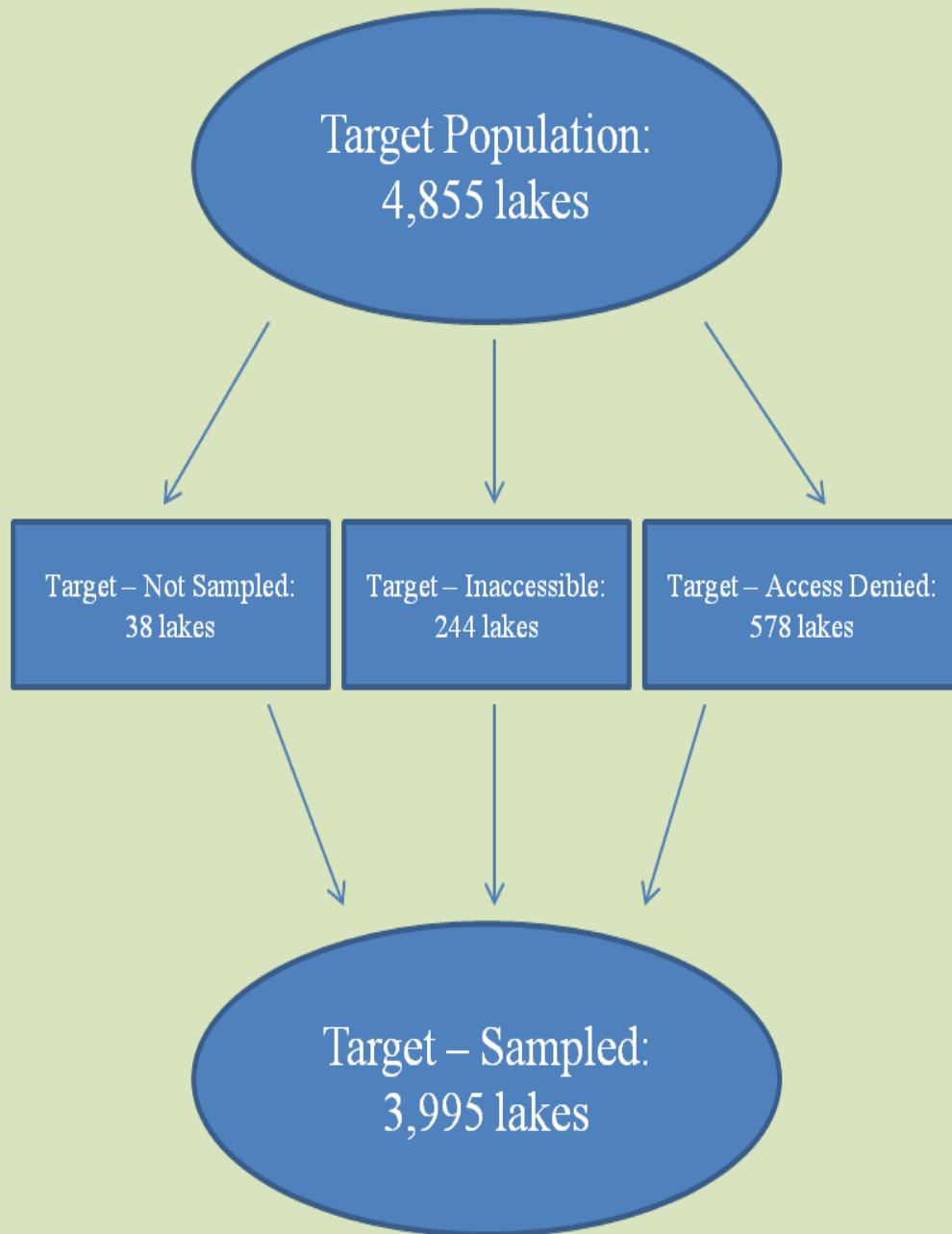
- ND lakes are relatively high in nutrients
- Good in-lake habitat, improved riparian habitat
- “Poor” scores in NPL
- Potential issue with timing



# Questions?



# Extrapolation of results



- “Weights” applied to NLA target lakes
- Weights based on:
  - Size class
  - Location
- Information from NHD
- Access denial common reason lakes “thrown out”



A grey SUV is parked on a grassy bank. The driver's side door is open, and the rear hatch is also open. The vehicle is positioned on a dirt path leading to the water's edge.

A small, dark-colored motorboat is in the water. It has a black Mercury outboard motor at the stern. The boat is partially obscured by tall, thin reeds that are leaning over the water.

A large herd of black cattle is grazing on a green hillside in the background. The cattle are scattered across the landscape, some standing and some lying down. The hillside is rolling and covered in lush green grass.

The background shows a vast, open landscape with rolling green hills under a bright blue sky with scattered white clouds. The water in the foreground is calm, reflecting the sky and the surrounding greenery.

# What does riparian cover condition look like?



Good

- Good:
  - Woody vegetation (canopy and understory)
  - Little to no nearshore impact
  - Inundated ground (i.e., nearshore wetlands)
- Poor:
  - Near-shore impacts
  - Agriculture
  - Parks
  - Cabins
  - Mining



Poor

# Blooms Like It Hot

Hans W. Paerl<sup>1</sup> and Jef Huisman<sup>2</sup>

## Harmful Cyanobacterial Blooms: Causes, Consequences, and Controls

Hans W. Paerl · Timothy G. Otten

Freshwater

*Freshwater Biology* (2015)

## Deriving nutrient targets to prevent excessive cyanobacterial densities in U.S. lakes and reservoirs

LESTER L. YUAN AND AMINA I. POLLARD

Office of Water, U.S. Environmental Protection Agency, Washington, DC, U.S.A

*Freshwater Biology* (2005) 50, 27–41

## Does high nitrogen loading prevent clear-water conditions in shallow lakes at moderately high phosphorus concentrations?

MARÍA A. GONZÁLEZ SAGRARIO,<sup>\*,†</sup> ERIK JEPPESEN,<sup>‡,§</sup> JOAN C. SØNDERGAARD,<sup>‡</sup> JENS PEDER JENSEN,<sup>‡</sup> TORBEN LAURIDSEN<sup>†</sup>

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*Lake and Reservoir Management*, 29:202–215, 2013  
ISSN: 1040-2381 print / 2151-5530 online  
DOI: 10.1080/10402381.2013.831148

## Evaluation of internal loading and water level changes: implications for phosphorus, algal production, and nuisance blooms in Kabetogama Lake, Voyageurs National Park, Minnesota

RAPID COMMUNICATION / COMMUNICATION RAPIDE

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University of Minnesota,  
St. Paul, MN 55112  
and University of Minnesota,  
Duluth, MN 55744

## Predicting Cyanobacteria dominance in lakes

John A. Downing, Susan B. Watson, and Edward McCauley