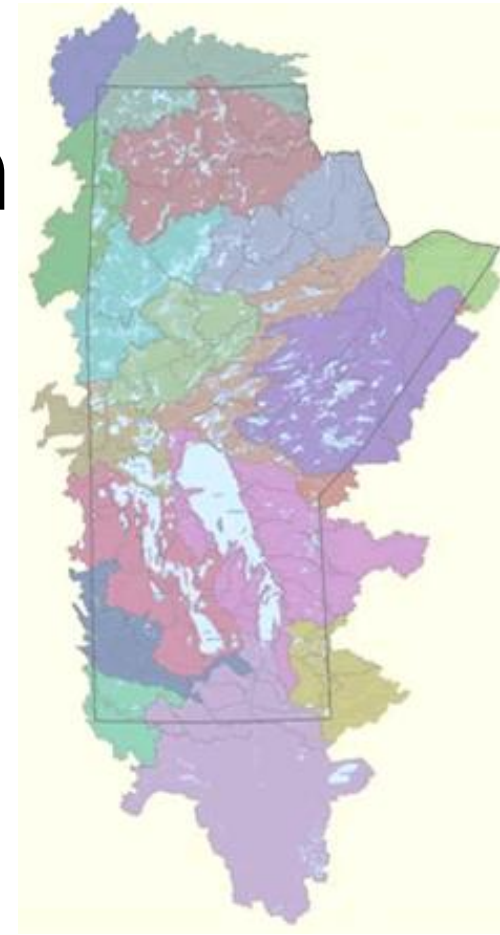


Algal Blooms in Manitoba



Contributing Factors and Management Response



Sharon Gurney Nicole Armstrong

Manitoba Conservation and Water Stewardship



Outline

- Algal blooms in Manitoba – a brief history
- Lake Winnipeg and factors influencing algal bloom development
- Algae monitoring program and beach monitoring/posting
- Manitoba's response and nutrient reductions



Algal Blooms in Manitoba

- Algal blooms are commonly reported from lakes, rivers, reservoirs and dugouts throughout the province
- Algal toxins have been found in Manitoba water supplies – 1951 to present
- Responsible for pet and livestock deaths
- Most algal blooms reported in southern Manitoba
- Highest microcystin-LR of 600 ug/L – 30 times the proposed recreational guideline of 20 ug/L and 400 times the drinking water guideline of 1.5 ug/L.



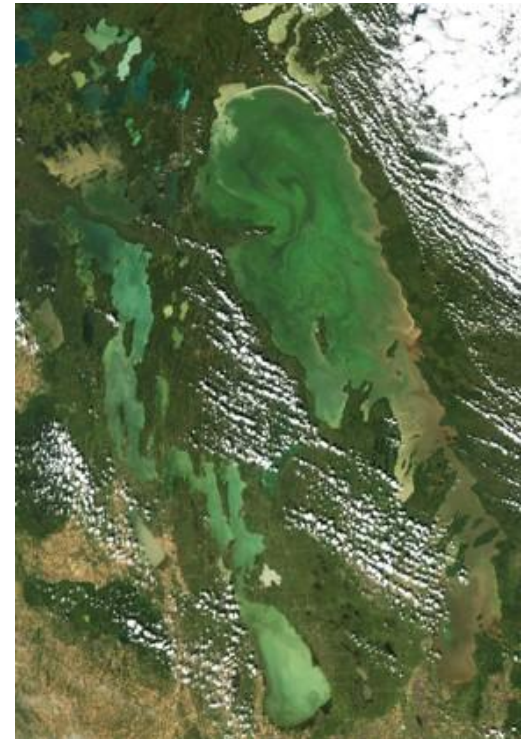
Algal Blooms in Manitoba

- Work in the 1990s on algal blooms and associated toxins in 158 waterbodies including dugouts, municipal water supplies and recreational water bodies (Jones et al. 1998)
- Routine monitoring since 1990s



Algal Blooms in Lake Winnipeg

- In late 1990s/early 2000s, noted an increase in the frequency and severity of algal blooms in Lake Winnipeg
- Large algal bloom covered 10,000 km² of north basin in 2005
- Algal toxins
- Degraded aquatic habitat - low dissolved oxygen
- Drinking water problems odour
- Clog fishing nets



Grand Beach



Photo: L. Volkart



From CBC web site

Manitoba's Algae Monitoring Program

- Adverse health effects from exposure to cyanobacteria and their toxins in recreational water is a growing concern
- The three routes of exposure include direct contact, accidental swallowing, and inhalation
- Goal: Provide timely information to the public regarding the risk of exposure to cyanobacteria and their toxins



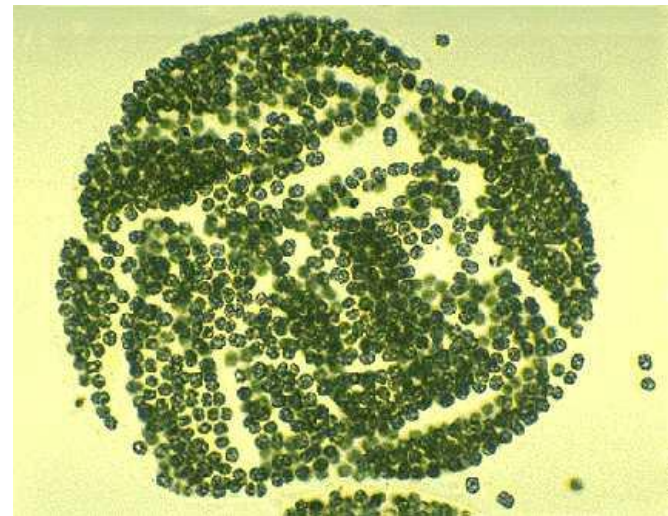
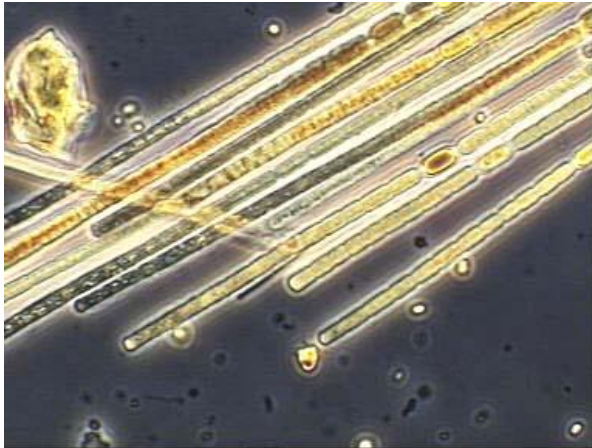
Algal Bloom Sampling Program

- Sampling components:
 - Routine sampling –samples collected at set frequency
 - Sampling when blooms are observed during monitoring for *Escherichia coli*
 - More than 60 beaches sampled across the province
 - Response to notification from regional staff, public, etc.



Algae Sampling Methods

- When algal blooms are observed, samples collected:
 - Analysis of microcystin-LR (ELISA method)
 - Density of cyanobacteria –
- Contracted laboratory – provides results in about 24 hours for a premium charge



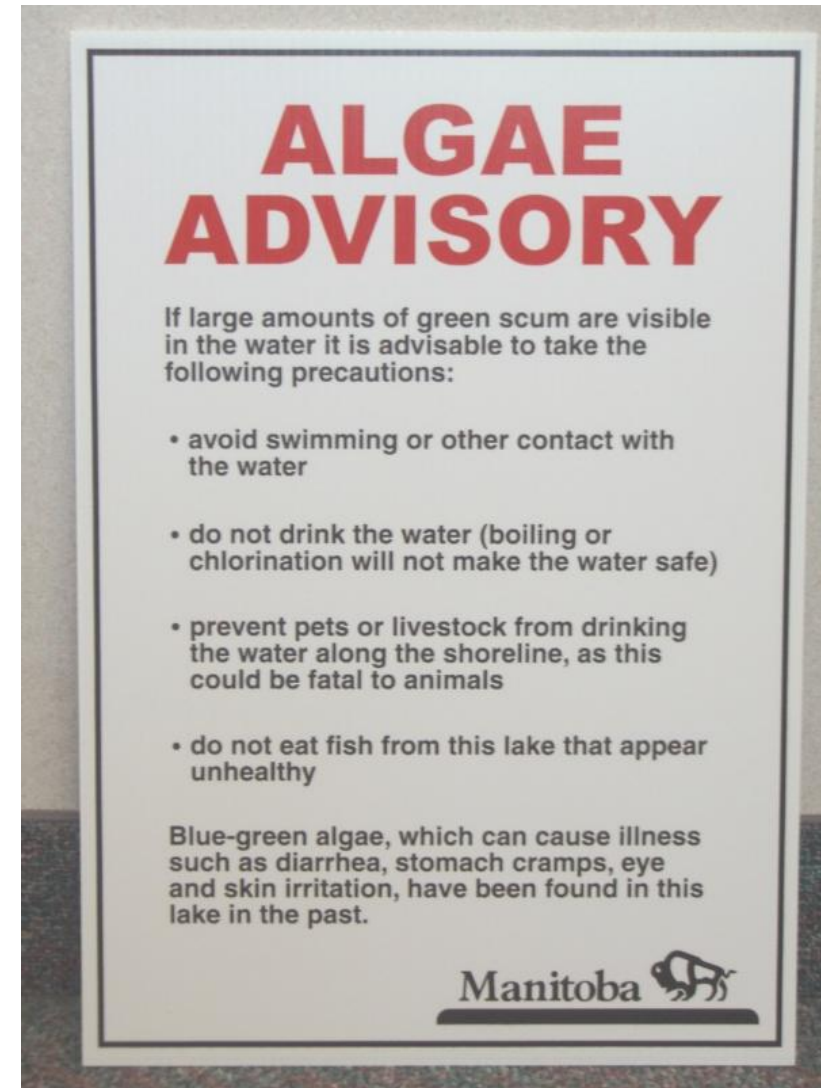
Recreational Water Quality Objectives

- In 2008, began to use draft Canadian recreational water quality objectives for microcystin-LR and cyanobacteria cell count to inform beach posting policy
- In 2011, draft Canadian recreational water quality objectives for microcystin-LR and cyanobacteria cell count were incorporated into the Manitoba Water Quality Standards, Objectives and Guidelines – enshrined into legislation on November 28, 2011

Algae	Water Quality Objectives
Microcystin-LR	20 ug/L
Cyanobacteria cell count	100,000 cells per mL

Beach Posting Policy – Level One – Algae Advisory

- First Level Advisory
 - Cyanobacteria cell count > 100,000 cells per mL
- Decision to post is with Medical Officer of Health on recommendation of Manitoba Conservation and Water Stewardship
- Sign remains posted for the recreational season



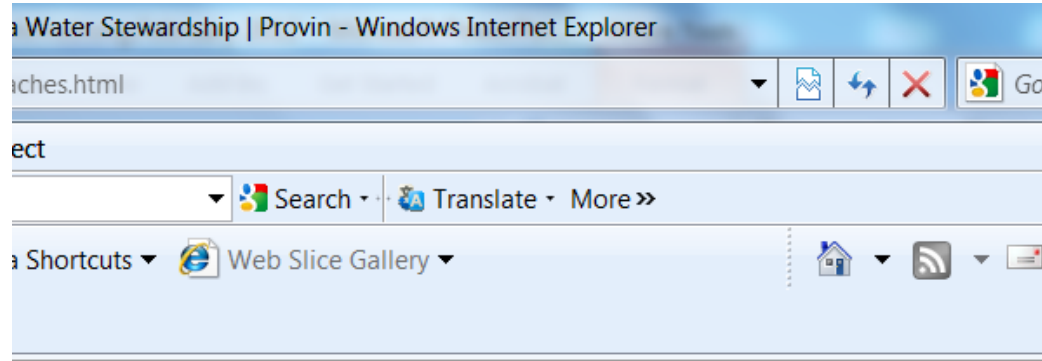
Beach Posting Policy – Level Two – Algae Toxins

- Second Level Advisory
Microcystin – LR > 20 ug/L
- Decision to post is with
Medical Officer of Health on
recommendation of
Manitoba Conservation and
Water Stewardship
- Sign remains posted until
concentration returns to
below 20 ug/L



Public Notification

- Signage at beaches
- Web site posting
- www.manitoba.ca/beaches
- Weekly news release – Friday – with beach conditions during recreational season



[Algae advisory signs](#) let swimmers know that blue-green algae or cyanobacteria have been observed this season. If large amounts of green scum are visible in the water it is advisable to take the following precautions:

- Avoid swimming or other contact with the water.
- Do not drink the water (boiling or chlorination will not make the water safe).
- Prevent pets or livestock from drinking the water along the shoreline, as this could be fatal to animals.
- Do not eat fish that appear unhealthy.

[Algae toxin signs](#) let swimmers know that blue-green algae or cyanobacteria toxins have been observed at this beach and that drinking, swimming or other contact with the water is not recommended.

Advisory Signs are Posted at the Following Beaches

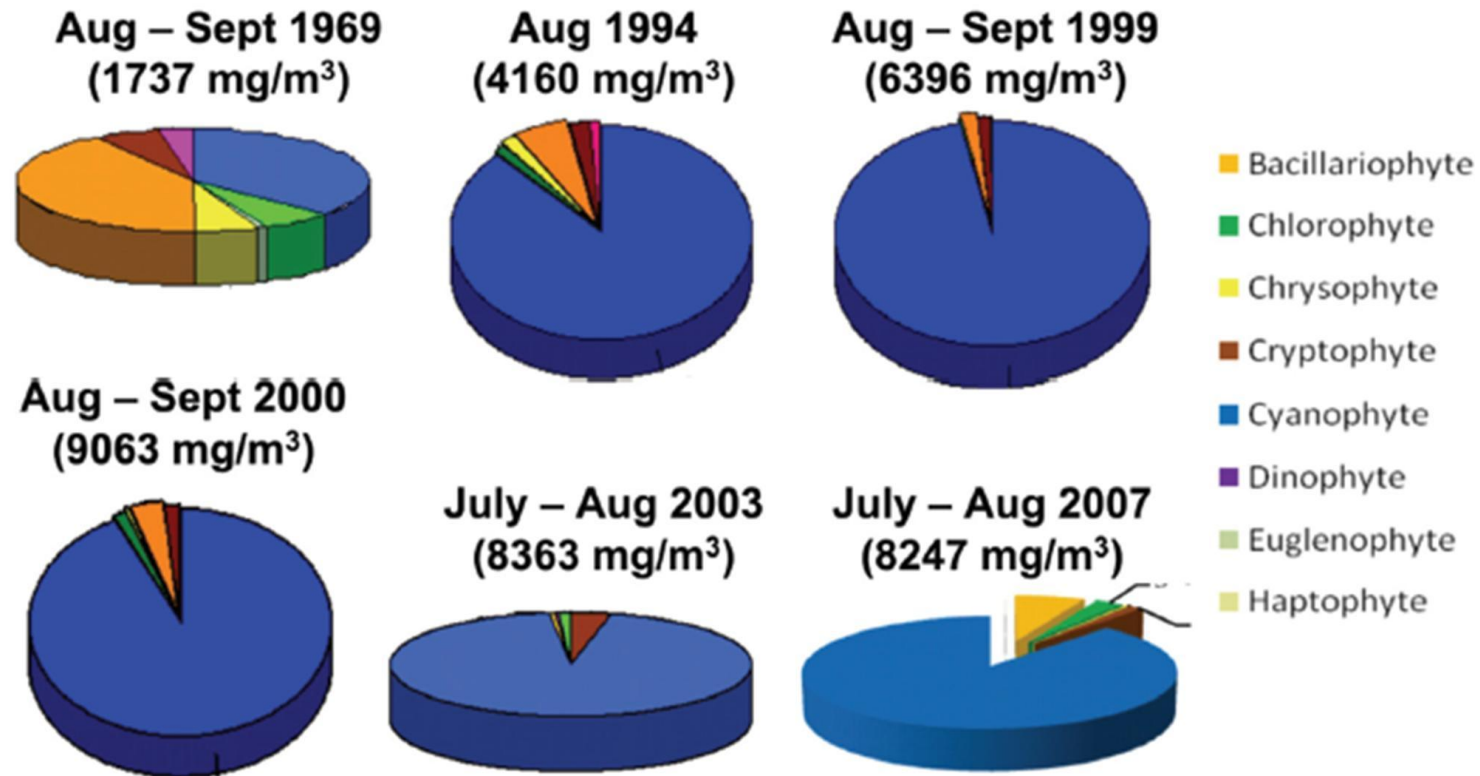
Beaches	Advisory Sign
Falcon Lake	Algae Advisory
Matlock Beach	Lake Winnipeg Advisory
Patricia Beach	Lake Winnipeg Advisory
Sandy Hook Beach	Lake Winnipeg Advisory

Follow up and Public Education

- Re-sampling for level one and level two algae advisories
- Contact with responsible authority (municipality, provincial park staff, etc.), regional staff, Medical Officer of Health
- Ongoing work with cottage associations, concerned citizens, etc. on awareness, causes of algal blooms, action to reduce nutrient loading



Changes in Algal Biomass and Composition



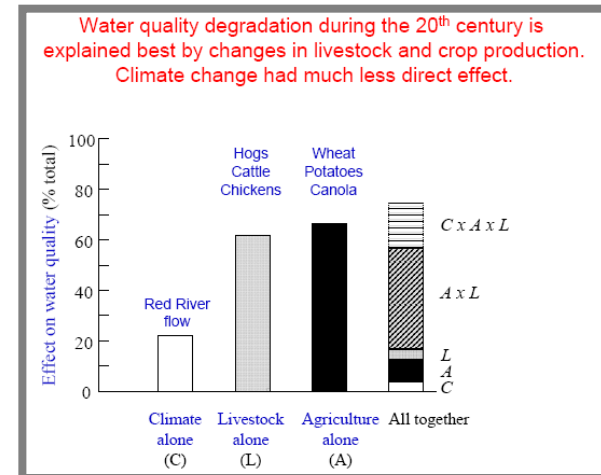
Paleolimnological Evidence

- Paleolimnological work by Dr. Peter Leavitt, Canada Research Chair from the University of Regina
- Used paleolimnological techniques to reconstruct historical changes in nutrient influx, algal production, and phytoplankton composition (1800s to present)
- Quantified the magnitude and timing of cultural eutrophication to establish benchmarks for improving water quality



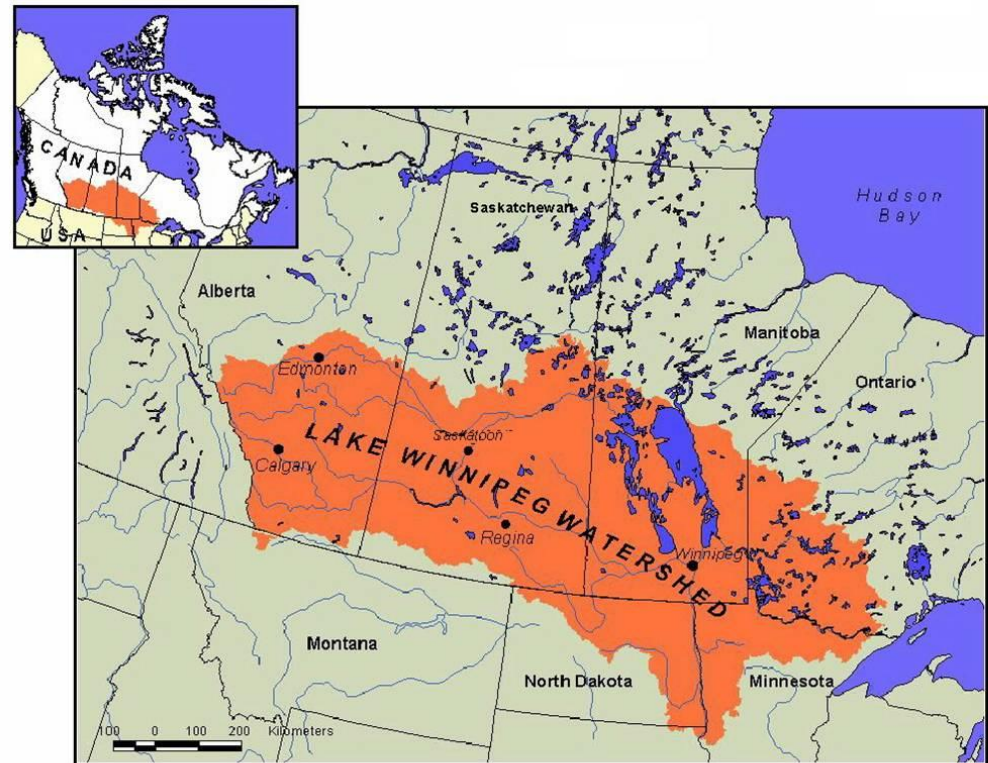
Study Conclusions

- Water quality degraded mainly by changes in crop and animal production
- Historically Lake Winnipeg was moderately productive (15 – 20 ug/L P)
- Algal abundance increased 300 - 500 % since 1900, but nitrogen fixing cyanobacteria increased about 1000 % since 1990
- Nutrients must be reduced by about 50 % to eliminate major blooms
- At “tipping point” and danger of moving to a toxic algae dominated system.



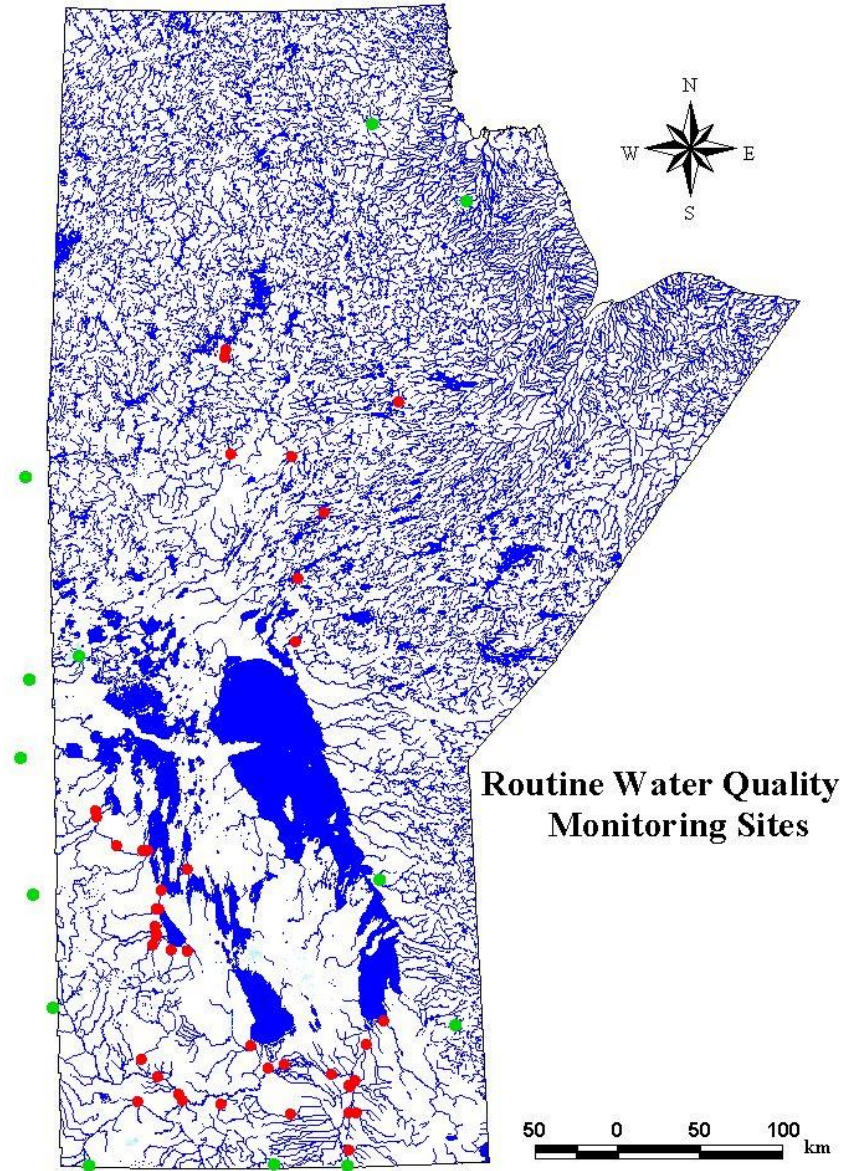
Nutrients are Contributed Across a Large, Multi-jurisdictional Watershed

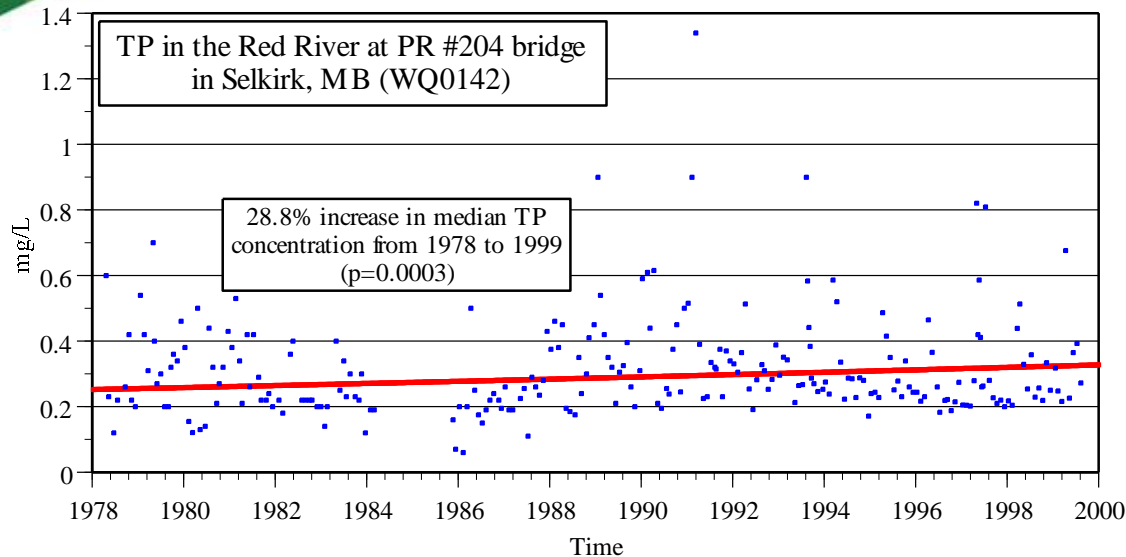
- Manitoba receives water from several upstream jurisdictions
- 1 million square kilometre watershed
- Four provinces and four US states
- Need for Interprovincial and international cooperation



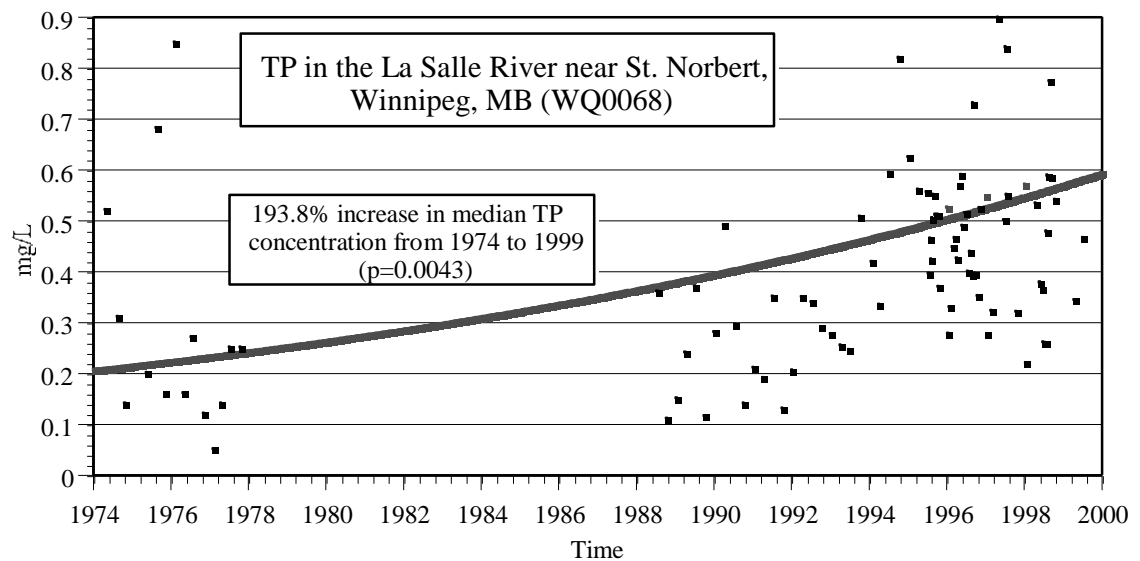
Nutrients are Increasing

- 30 years of monitoring water quality indicated that concentrations of nutrients are increasing in many rivers and streams across the province (Jones and Armstrong 2001, WQ Trends)
- As much as 200 % in some rivers and streams

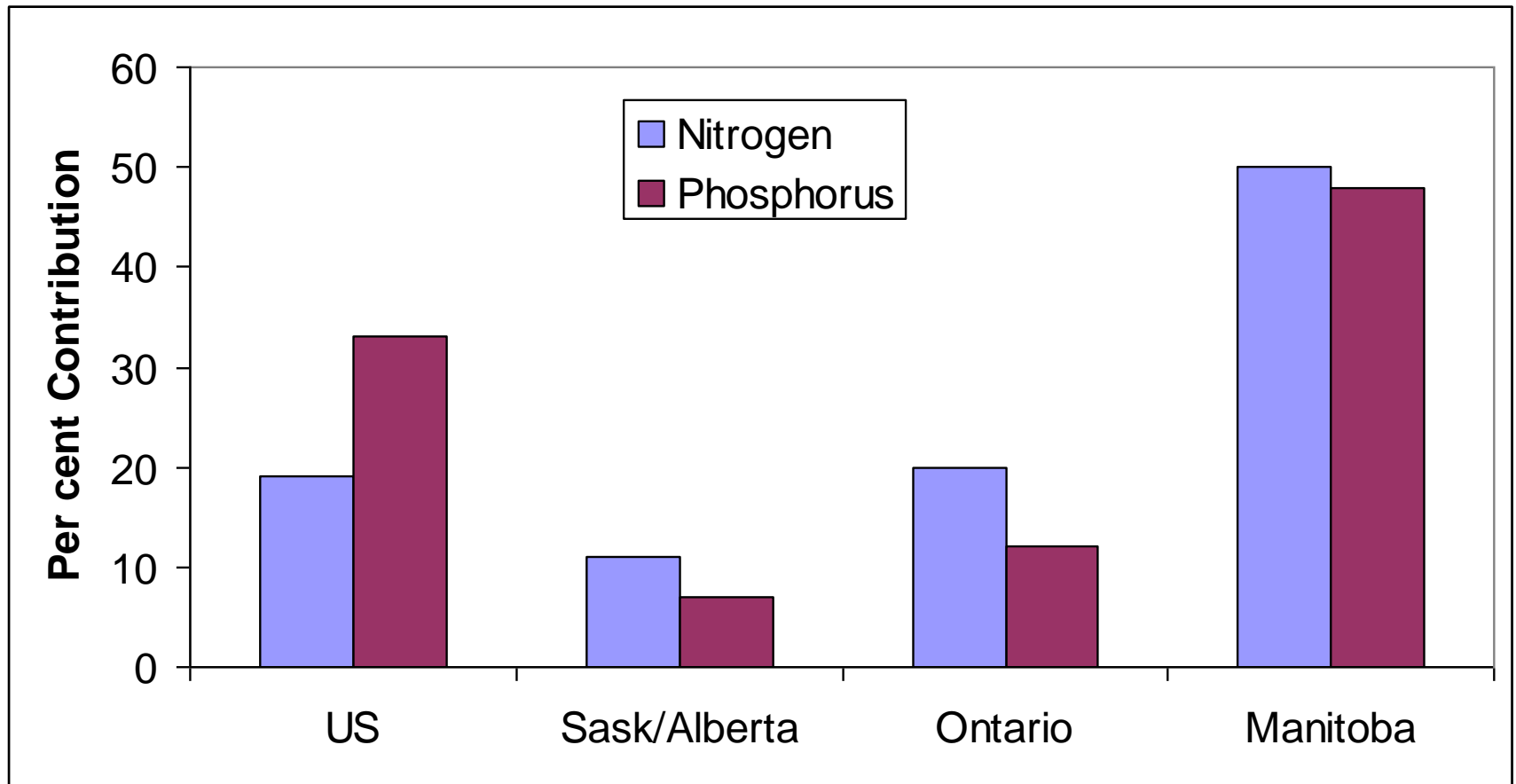




Nitrogen and Phosphorus are increasing



Nutrient Loads to Lake Winnipeg (1994 to 2007)



Many Sources of Nutrients

- Many, small sources of nutrients
- Nutrients contributed by:
 - Municipal and industrial wastewater systems
 - Runoff from land – agricultural, golf courses, park lands
 - Atmospheric deposition
 - Release from soils and vegetation, and leaching from rocks
- Activities on the landscape are accelerating nutrient runoff to waterways – wetland drainage, removal of riparian buffers



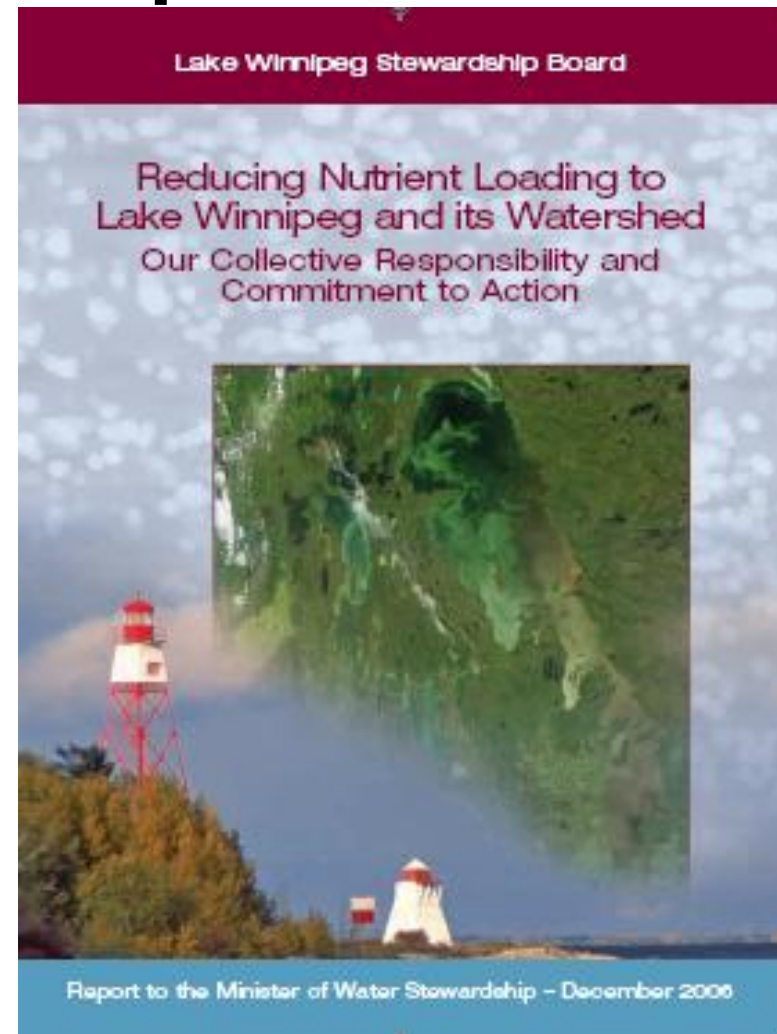
Action to Reduce Nutrient Loading

- 2003: Lake Winnipeg Action Plan: A commitment to reduce nitrogen and phosphorus loads to Lake Winnipeg by 10 %.
- 2011: Commitments to reduce phosphorus concentrations in the lake by 50 %



Lake Winnipeg Stewardship Board

- 2003: Established a Lake Winnipeg Stewardship Board to assist in identifying actions to achieve the commitments in the Lake Winnipeg Action Plan
- Stakeholders including First Nations communities, fishers, farmers, industry, municipal governments, non-government organizations, researchers
- 135 recommendations in 38 areas



Action Underway to Reduce Nutrients

- Legislation:
 - nutrient standards for municipal and industrial wastewater dischargers
 - limits on the application of nutrients to land (manure, inorganic fertilizer, cosmetic phosphorus fertilizer, wastewater sludge)
 - phosphorus in detergents
 - onsite wastewater management
 - Save Lake Winnipeg Act – wetlands, agricultural activities, wastewater treatment plant upgrades
- Incentives:
 - Riparian tax credits
 - Wetland restoration incentive program

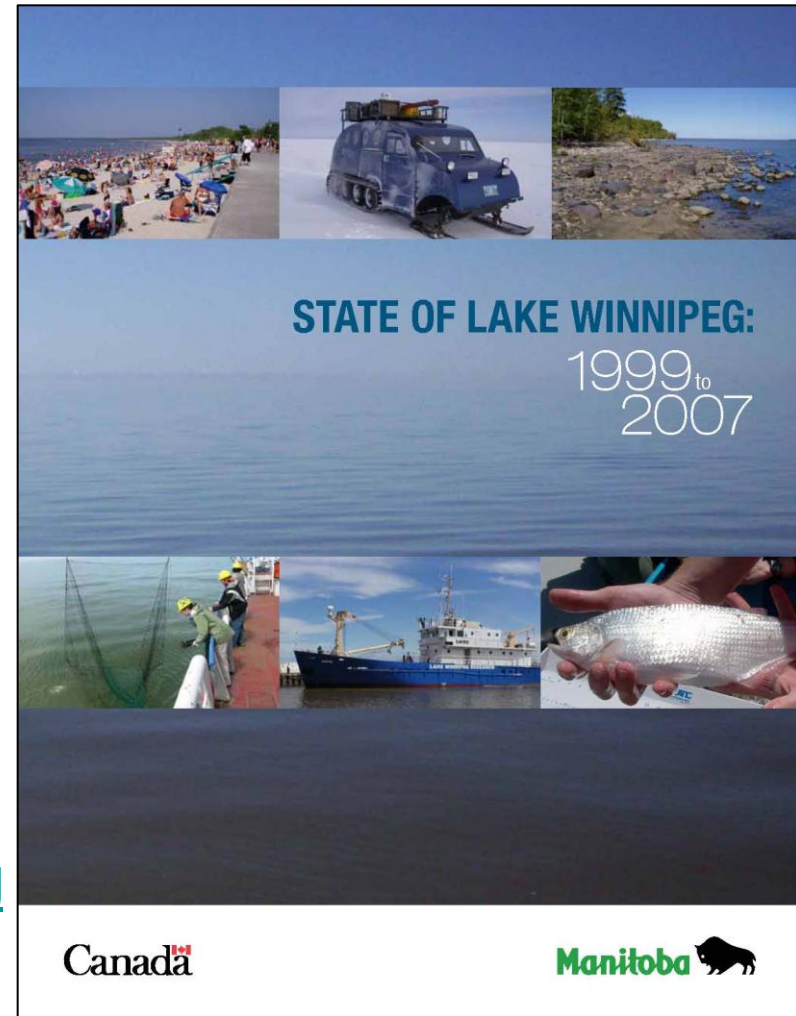
Action Underway to Reduce Nutrients

- Education:
 - Soil testing and nutrient management planning for producers
 - Lake Friendly Products Campaign
www.lakefriendly.ca
 - Water Quality Handbook
 - Lake Winnipeg curriculum for Manitoba students
- Research:
 - Grants and support to research programs
 - Watershed Research Chair
 - In-house work on Lake Winnipeg



State of Lake Winnipeg Report

- Manitoba Water Stewardship and Environment Canada lead the preparation of a status report on information collected on Lake Winnipeg between 1999 and 2007 – published in July 2011
- Describes physical, chemical and biological conditions in Lake Winnipeg
- www.manitoba.ca/lakewinnipeg

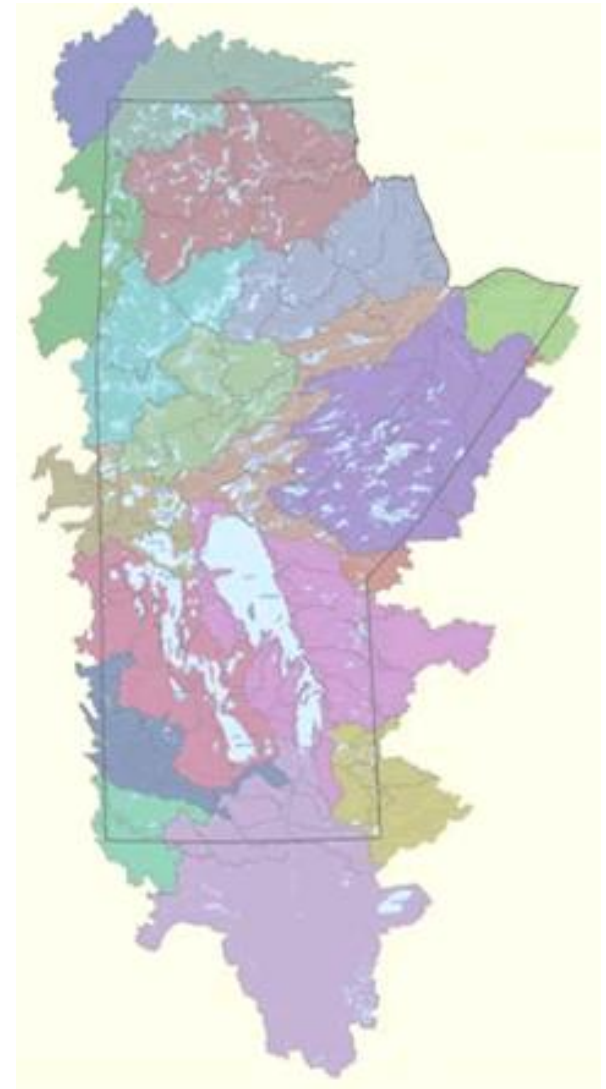


Engaging Other Governments

- International Governments
 - E.g. Work through the International Red River Board (International Joint Commission) to develop a nutrient management strategy for the Red River.
- Federal Government
 - Announced the Action Plan for Clean Water - included \$18 million for Lake Winnipeg over five years
 - Canada-Manitoba Memorandum of Understanding on Lake Winnipeg
- Provincial Governments
 - Prairie Provinces Water Board and nutrient objective development
- Local Governments
 - Watershed Planning, South Basin Mayors and Reeves and Lake Friendly Products Campaign

Next Steps and Ongoing Work

- Continue work with upstream jurisdictions and Manitobans to reverse the increasing concentrations of nitrogen and phosphorus in waterways across Manitoba including Lake Winnipeg
- Develop long-term ecologically relevant nutrient objectives for Lake Winnipeg and other waterbodies throughout Manitoba



Contact Information

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