



Muskrat Lake Symposium

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Ministry of the Environment
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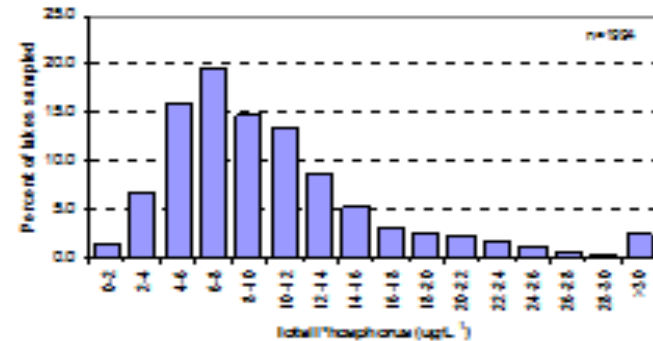
Summary of Presentation

- Overview of the importance of Ontario lakes and water quality
- Role of phosphorus and dissolved oxygen
- Muskrat Lake conditions
- Sources of phosphorus to Muskrat Lake
- Blue-green algae and toxins
- Next steps

Water quality in Ontario



- 200,000+ lakes
- majority on Precambrian (Canadian) Shield
- soft-water, acidic, nutrient-poor



The economic value of clean water in Ontario

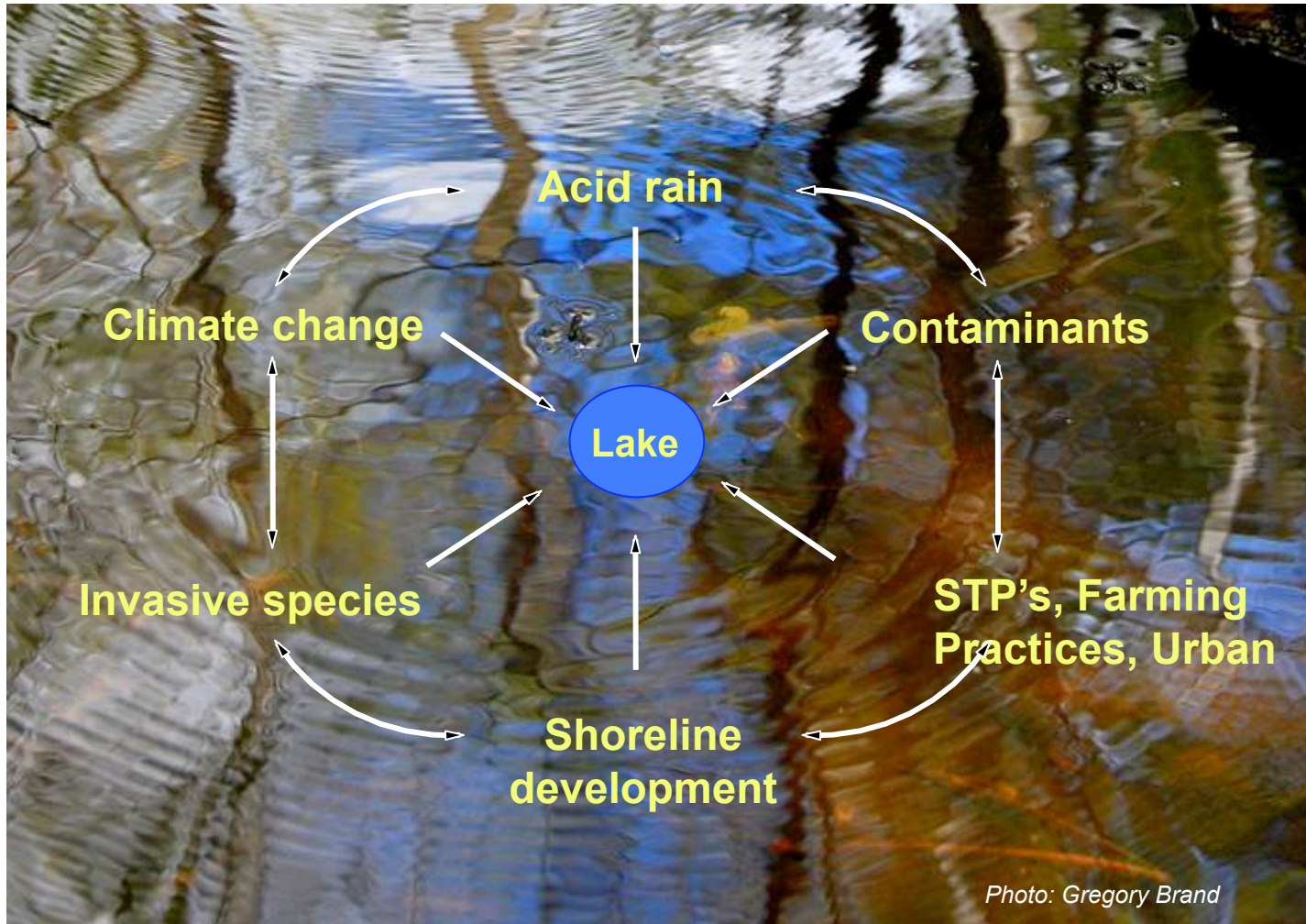
- ~2 million adult anglers per year
- \$1.2 billion in fishing gear, boats, etc.
- \$1.7 billion in activities related to fishing
- \$1 billion annually on recreational boating
- commercial fisheries (~\$42.5 million)
- water-related tourism (~\$5.5 billion)
- property values are maintained



Photo: Gregory Brand

(Lakeshore Capacity Assessment Handbook- May 2010)

Threats to water quality of inland lakes



Phosphorus- the link



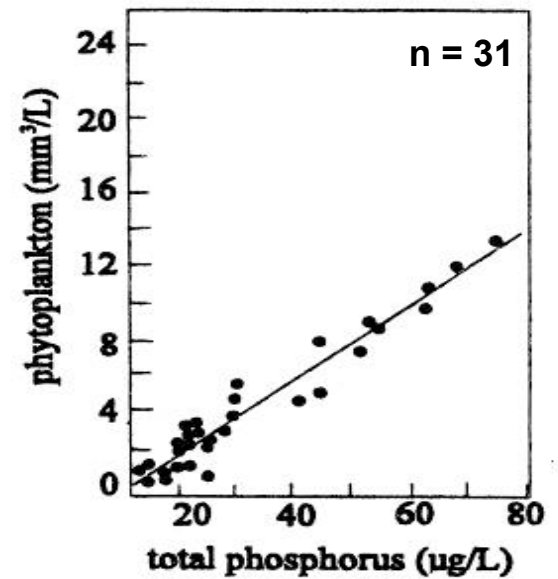
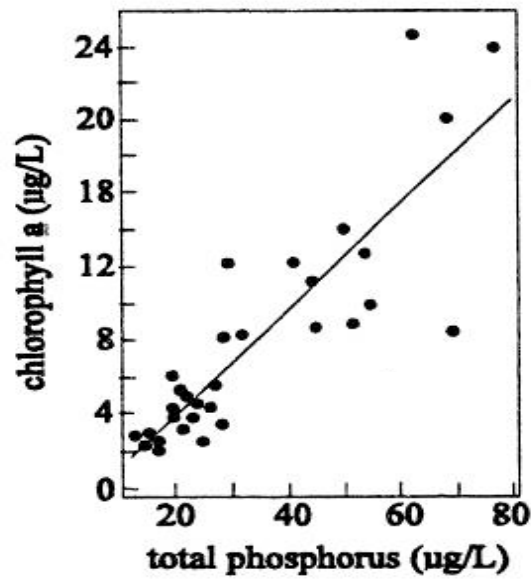
Phosphorus



Algae blooms
Photo: Kathryn Hargan

Nutrient enrichment is the primary water quality concern for most of Ontario's inland lakes.

The importance of phosphorus → algae



Muskrat Lake

- Lies in the Ottawa River drainage basin
- Muskrat Lake – surface area of 1,202 ha
- Maximum depth of 64 metres
- Total watershed area 511 km²
- Turnover time 1.6 years – low flushing rate
- Source of drinking water for Cobden

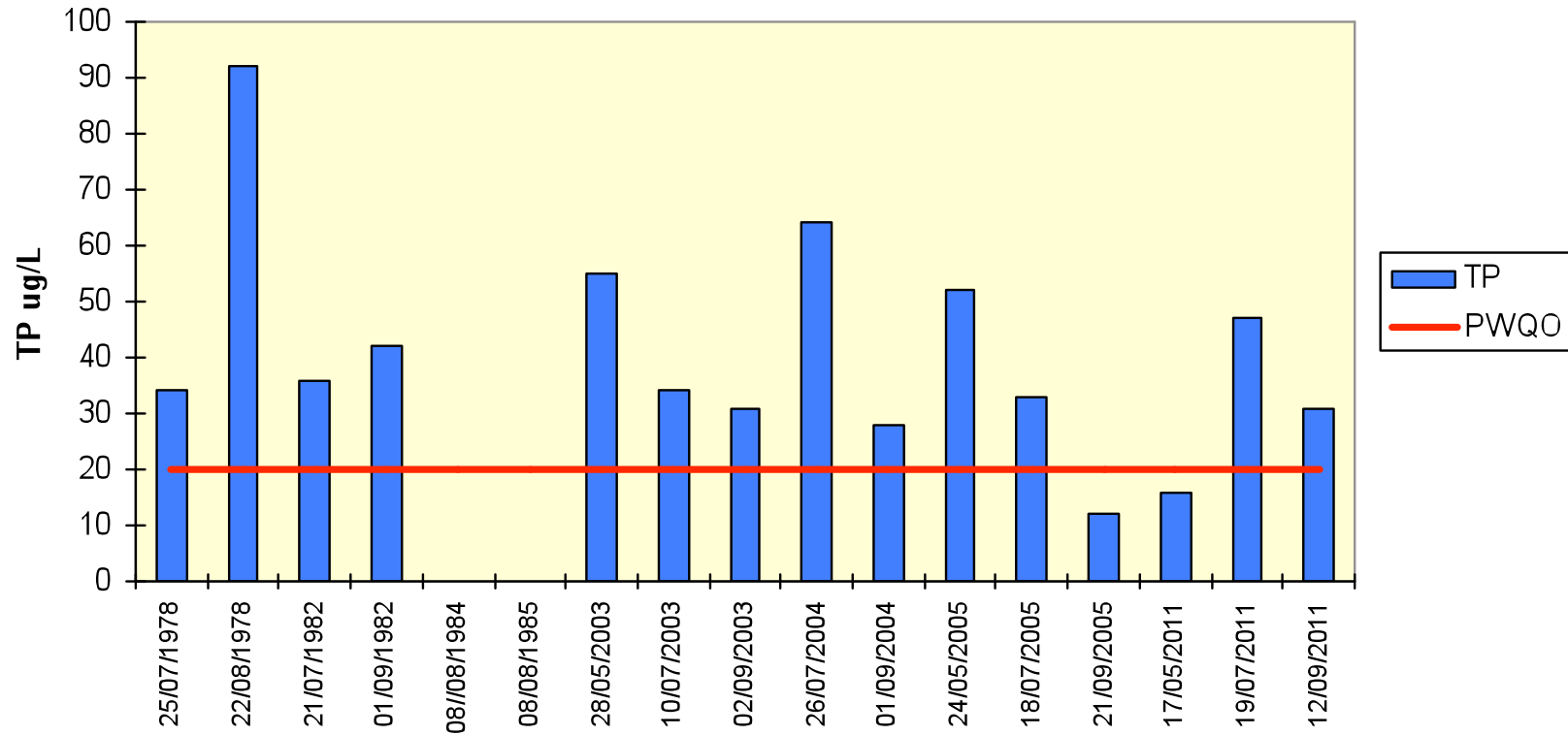
Muskrat Lake

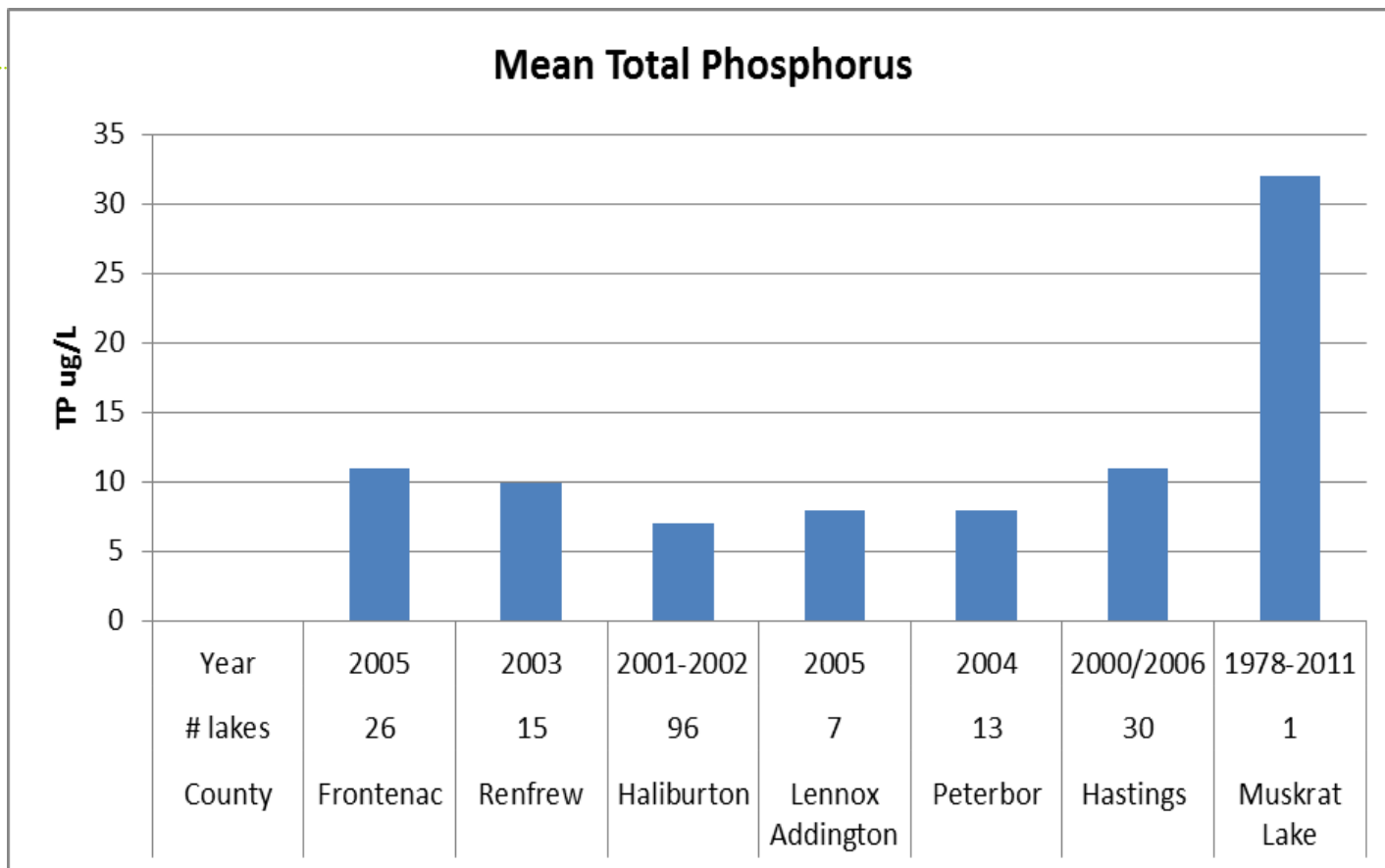
MOE Involvement:

- Muskrat Lake has been sampled numerous times over the last 40 years.
- Lake Trout Lakes Program
- Recent water quality surveys in 2003, 2004, 2005, 2007 and 2011.
- Sampling includes nitrogen series, phosphorus, calcium, magnesium and many other parameters; dissolved oxygen and temperature profiles; algal identification during blooms.
- Lake Partner Program (volunteers)
- Supported Algonquin College and their work on Muskrat Lake.
- Worked closely with MNR on lake management issues.



Total Phosphorus Concentrations in Muskrat Lake





DEGRADATION OF LAKE QUALITY

- Activities and land use practices on watershed = Increased levels of phosphorus
- Promotes algae and aquatic plant growth.
- In extreme cases results in algae blooms
- Organic matter settles, decomposes and consumes oxygen
- Reduces amount of dissolved oxygen for fish



Algal blooms:

- 1) Reduced water clarity**
- 2) Loss of deep-water oxygen**
- 3) Taste and odour**
- 4) Toxins**

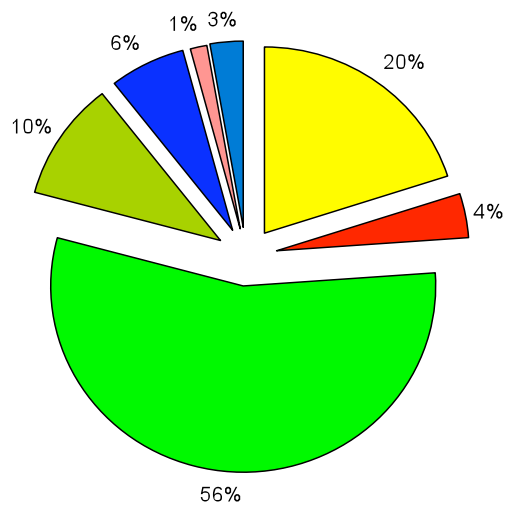


SOURCES OF PHOSPHORUS

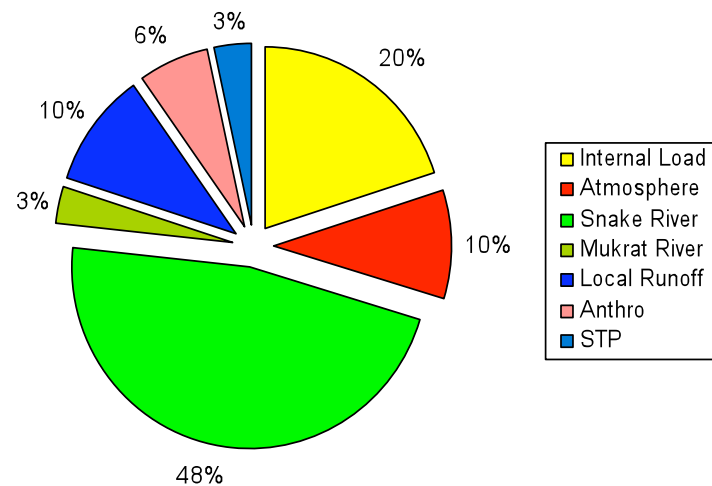
- Found naturally in all aquatic ecosystems
- Surface runoff
- Atmospheric deposition
- Sediments of lakes
- Upstream lakes
- Agricultural land uses
- Urban inputs
- Shoreline development

Muskrat Lake Phosphorus Budget

MOE - 2005 Preliminary Nutrient Budget



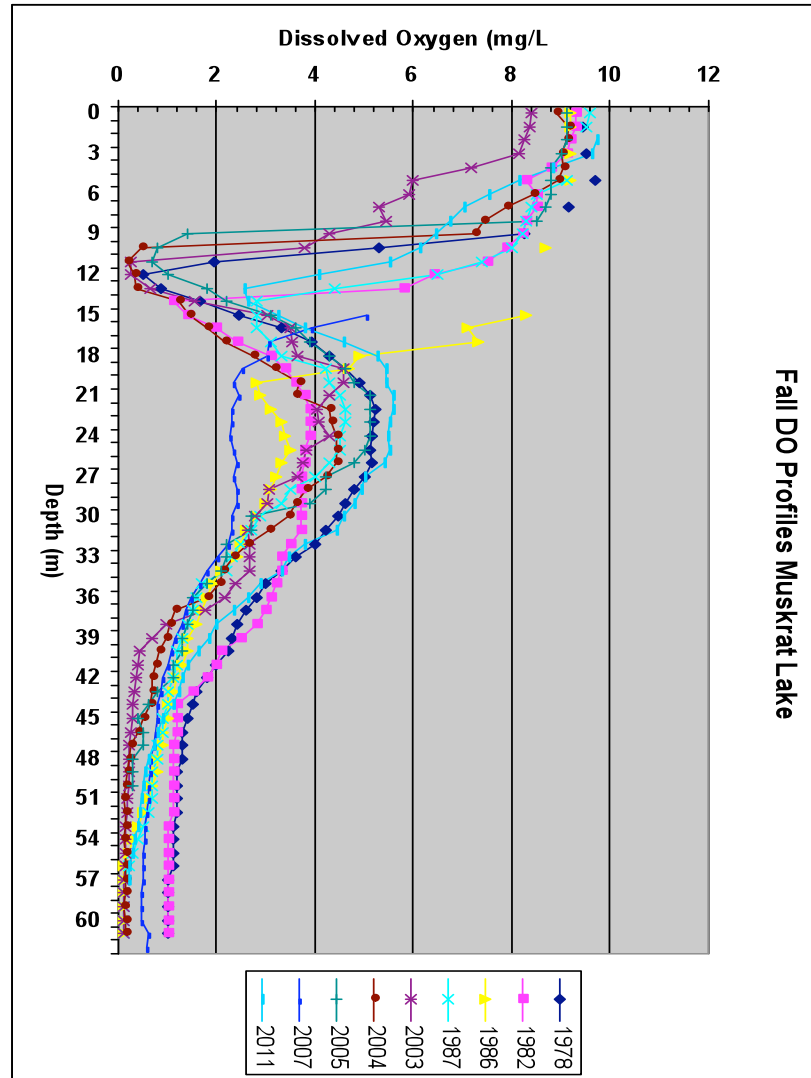
MOE Lakeshore Capacity Model



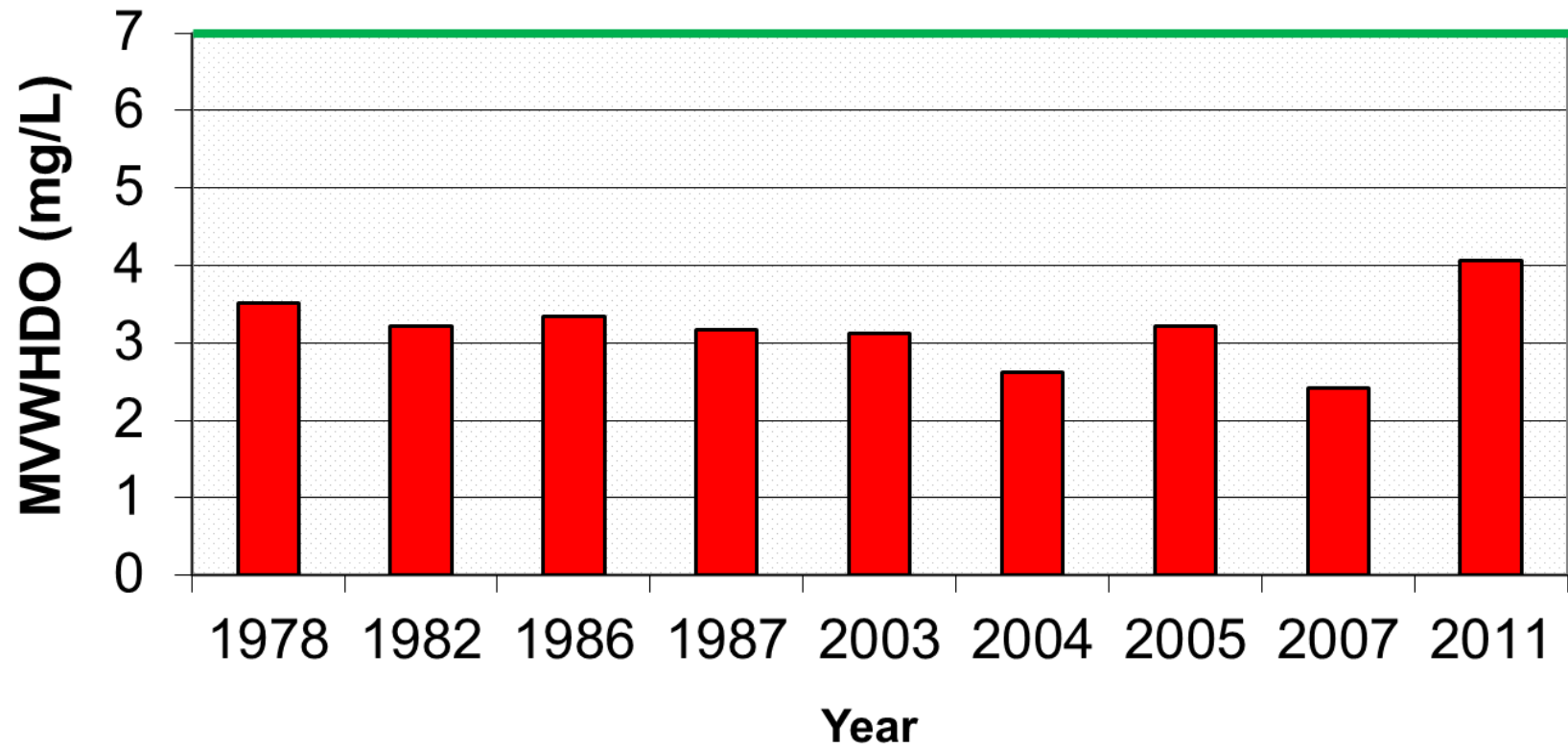
Source: Cobden Source Water Study, AECOM (2009)

Muskrat Lake Oxygen Levels

- Dissolved oxygen concentrations measured through water column
- Profiles going back 30 plus years
- Deep water oxygen consistently low
- Release sediment bound phosphorus
- Lake Trout Lakes – target is 7 mg/L dissolved oxygen
- If < 7 mg/L lake is considered at-capacity
- Even if not managed for lake trout, Muskrat Lake still at-capacity (simply too much phosphorus)



MVWHDO in Muskrat Lake



Muskrat Lake

- Water quality problem in Muskrat Lake is driven primarily by excess nutrients (zebra mussels complicate matters).
- Reduction of external loads is key to improving water quality. Secondary benefit is higher dissolved oxygen.
- There are techniques to reduce internal loading but they are expensive, and require external loads to be reduced.
- May see immediate response to loading reductions, but significant water quality improvements will take decades.

Summary

- Phosphorus concentrations in Muskrat Lake are very high (exceed PWQO)
- Dissolved oxygen concentrations are low
- High risk for blue green algal blooms and toxins
- Snake River watershed and internal loading are main sources
- Improvements to water quality can occur
- Need for comprehensive watershed phosphorus reduction strategy

