

# Lake Superior



State of Lake Superior  
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Environment Canada

# State of Lake Superior

- Outline
- Watershed and land use
- Biological integrity issues
- Indicator update
- Emerging issues
- Binational Program and the Lakewide Management Plan
- Acknowledgements

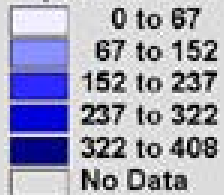


# Lake Superior Watershed

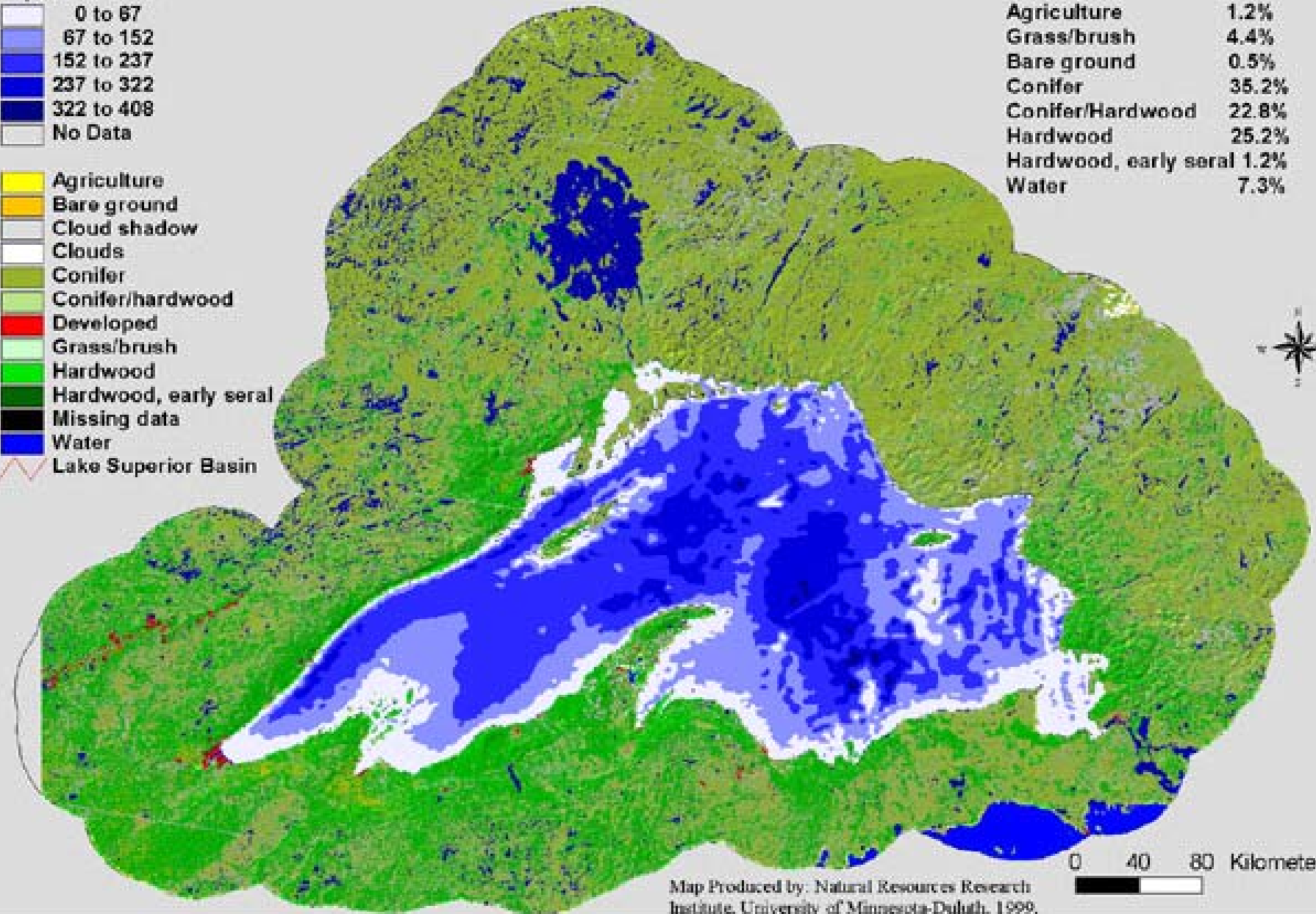


# Lake Superior Landuse and Bathymetry

Depth in meters



Developed	0.3%
Agriculture	1.2%
Grass/brush	4.4%
Bare ground	0.5%
Conifer	35.2%
Conifer/Hardwood	22.8%
Hardwood	25.2%
Hardwood, early seral	1.2%
Water	7.3%



Map Produced by: Natural Resources Research Institute, University of Minnesota-Duluth, 1999.

# Biological Integrity Issues

- Endangered species
- Non-native species
- Habitat fragmentation
- Chemical impacts

# Endangered Species

- Fourteen Lake Superior species are listed nationally by Canada and the U.S. as endangered (3), threatened (6) or vulnerable (5)
- 400 species in the basin listed by provincial or state jurisdictions as endangered, threatened or of special concern.
  - Nearly 300 of these are plants.

# Non-Native Species

- Wetland plants
- Aquatic plants
- Terrestrial plants
- Aquatic species

# purple loosestrife



photo credit: Karen Holland , US Environmental Protection Agency, Saginaw Bay Lake Huron



# Eurasian water milfoil

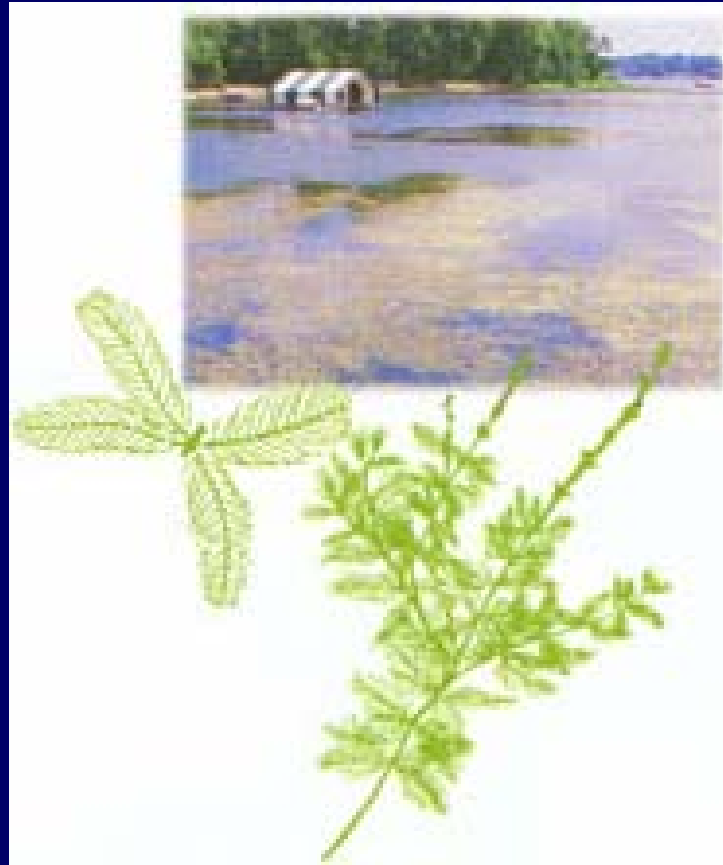


photo credit: a field guide to aquatic exotic plants and animals, Minnesota Sea Grant

# leafy spurge



photo credit: Ontario Ministry of Agriculture and Food

# garlic mustard



photo credit: Theodore G. Scott, Virginia Native Plant Society.

# buckthorn



photo credit: Ontario Ministry of Agriculture and Food

# non-native honey suckle



photo credit: Penn State - College of Agricultural Sciences, School of Forest Resources



# knapweed



Photo by Gaetan Mercier, 1996

# sea lamprey

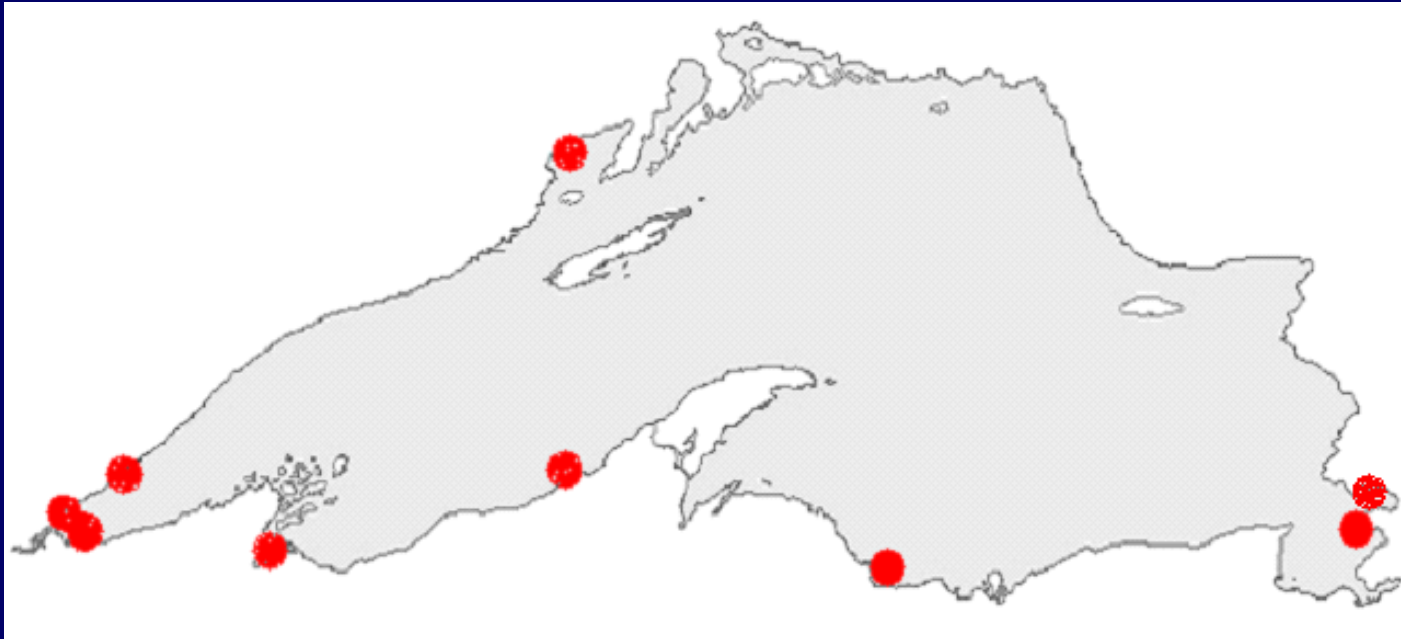


photo credit: Great Lakes Sea Grant Network Exotic Species Graphics Library

# rainbow smelt



# zebra mussel (*Dreissena polymorpha*)



- Harbors and sheltered bays

round goby (*Neogobius melanostomus*)

tubenose goby (*Proterorhinus marmoratus*)



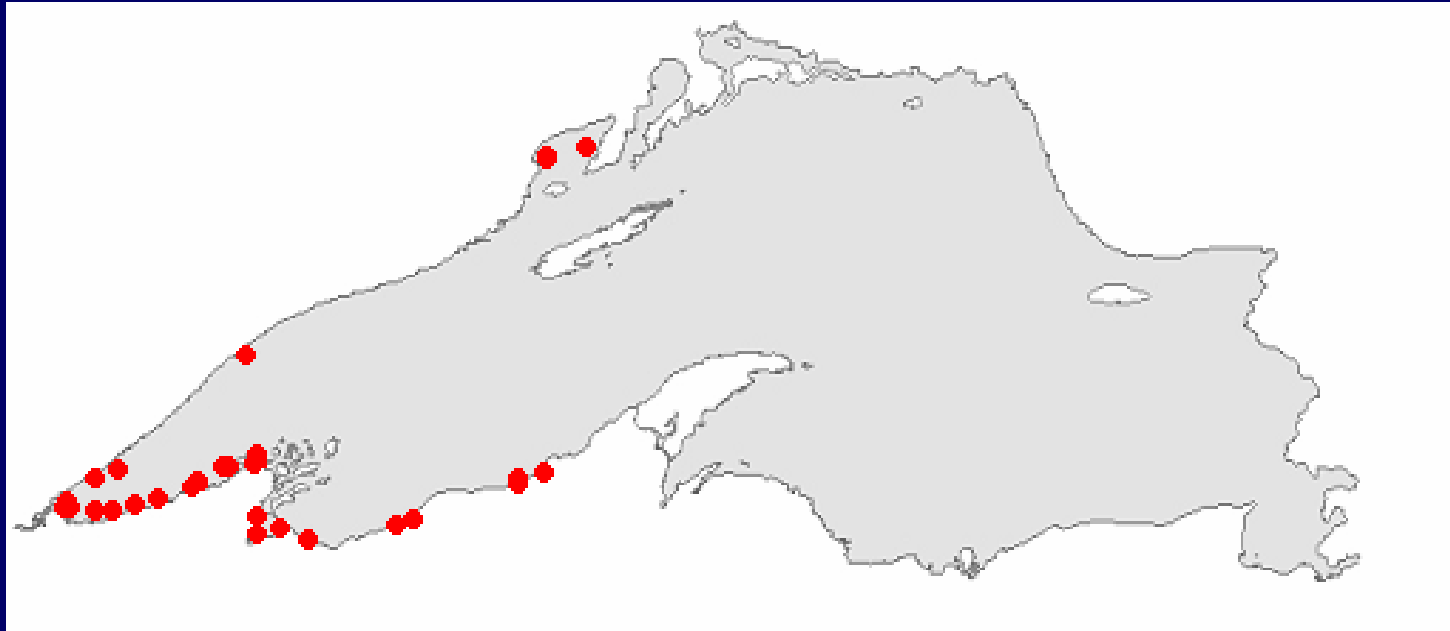
round goby



tubenose goby

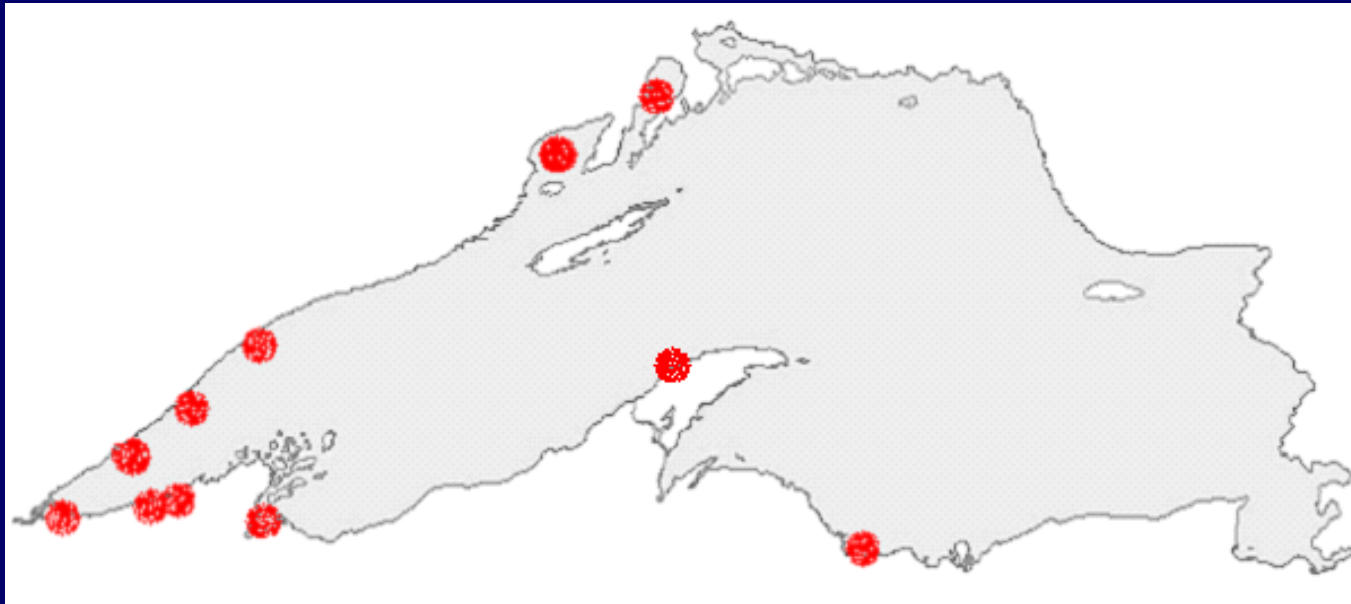


# ruffe (*Gymnocephalus cernuus*)



Lake Superior – west half  
Lake Huron – at Alpena, MI

# threespine stickleback (*Gasterosteus aculeatus*)



- Marquette Harbor
- Black Bay
- MN, WI, MI tributary estuaries

## Non-Native Species (2)

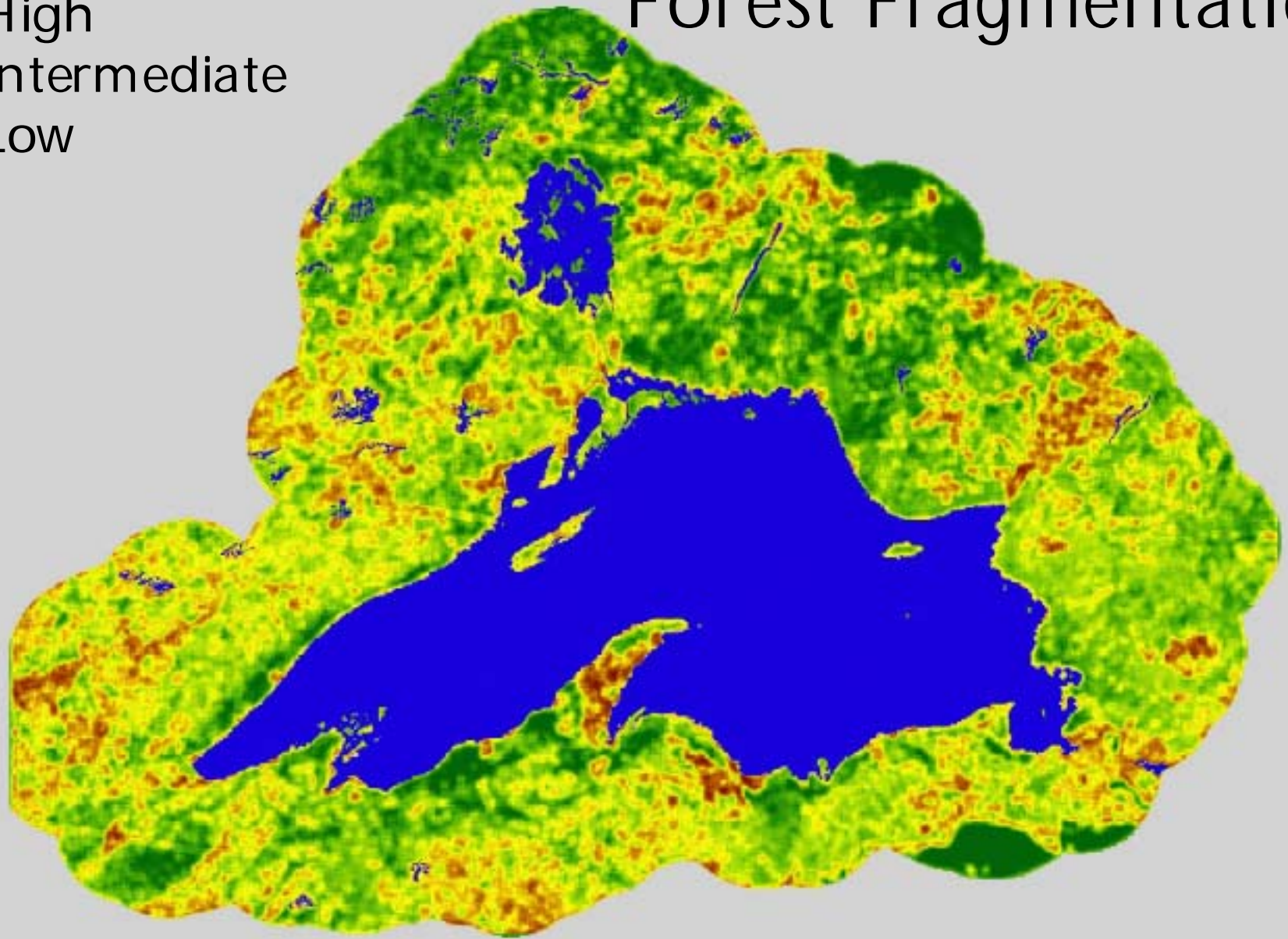
- Like Extinction, introduction is forever
  - persistent biological pollution
  - still uncertain of all possible associated impacts
- Need to integrate the results of biological indicators
  - requires a multi-disciplinary; multi-jurisdictional response
  - focused, systematic monitoring

# Habitat Fragmentation and Alteration

- Need to address changing landscape patterns in terrestrial systems
- Build an understanding of physical processes and historic dynamics
  - then begin to understand natural thresholds

# Forest Fragmentation

- High
- Intermediate
- Low





# Chemical Contaminants

- Chemical contaminants impact Biological Integrity in Lake Superior in many ways: e.g.
  - Individual Species
  - Habitat
  - Human Health

# Chemical Contaminants (2)

- Possible impacts include:
  - changes to predator/prey relationship
  - gaps in form and function in the ecosystem
  - reduced reproductive capacity
- While Status and Trend indicators are important, there is a need to link indicators to decision making

# Chemical Contaminants (3)

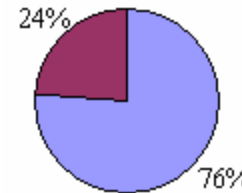
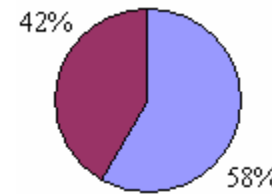
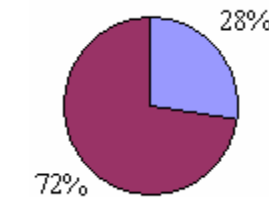
- Need remediation and source reduction activity
- Expand monitoring programs for sources and ecosystem (e.g. track mercury emissions from coal fired power plants as well as heavy metal contamination in western Lake Superior)

# Lake Superior Public Attitude - Household Trash Burning

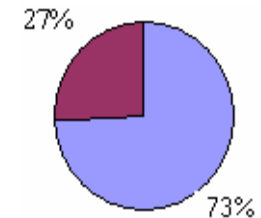
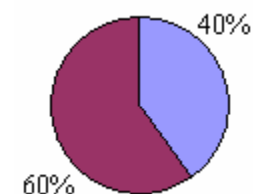
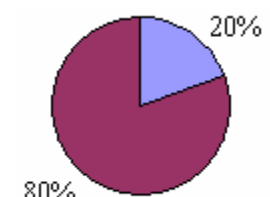
## 2000-2001 Survey Questions

1. Do you burn household garbage?
2. Do you know someone else who does?
3. Would you stop burning if you knew that burning garbage had significant negative effects on the environment and human health?

**Minnesota/Wisconsin**



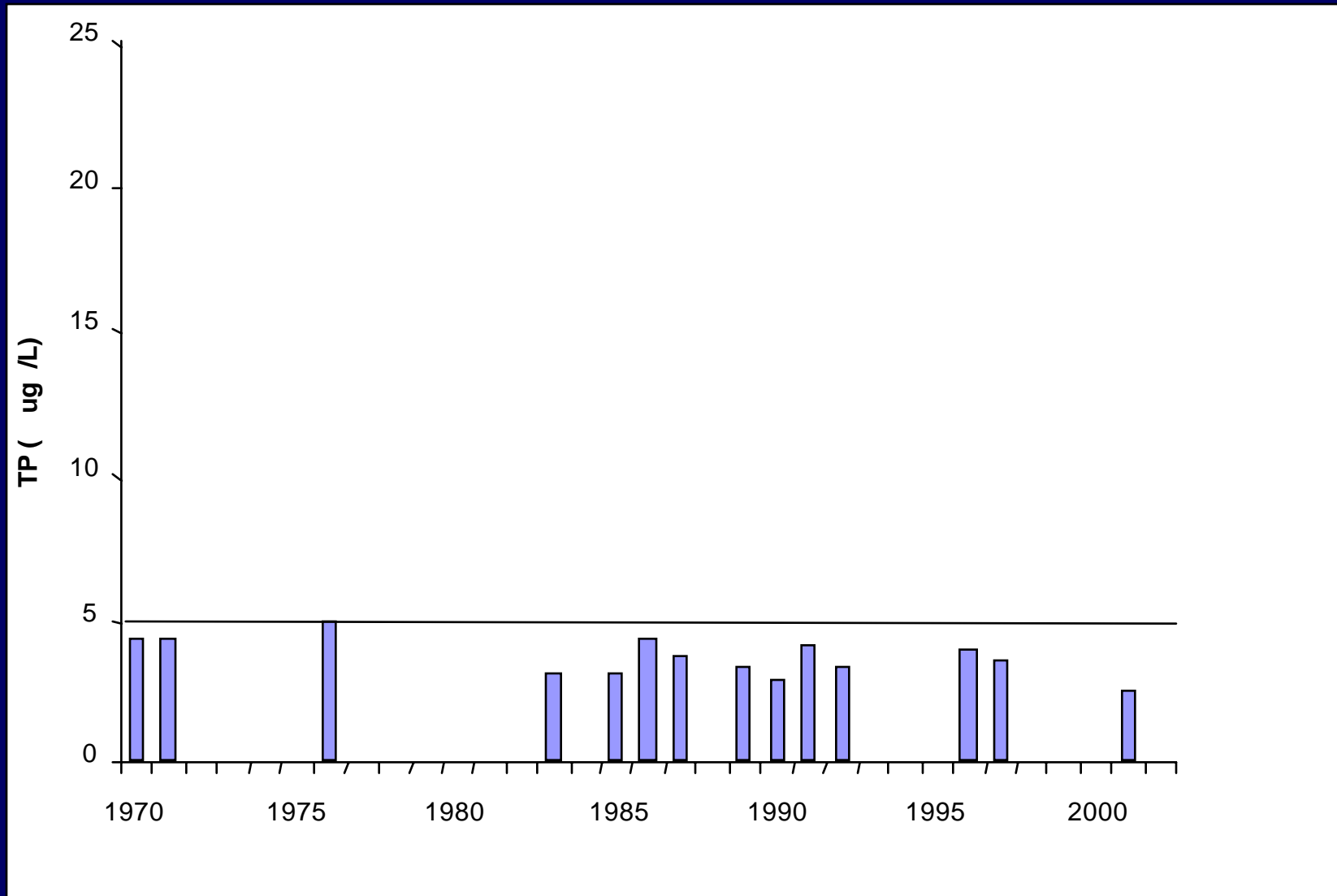
**Ontario**



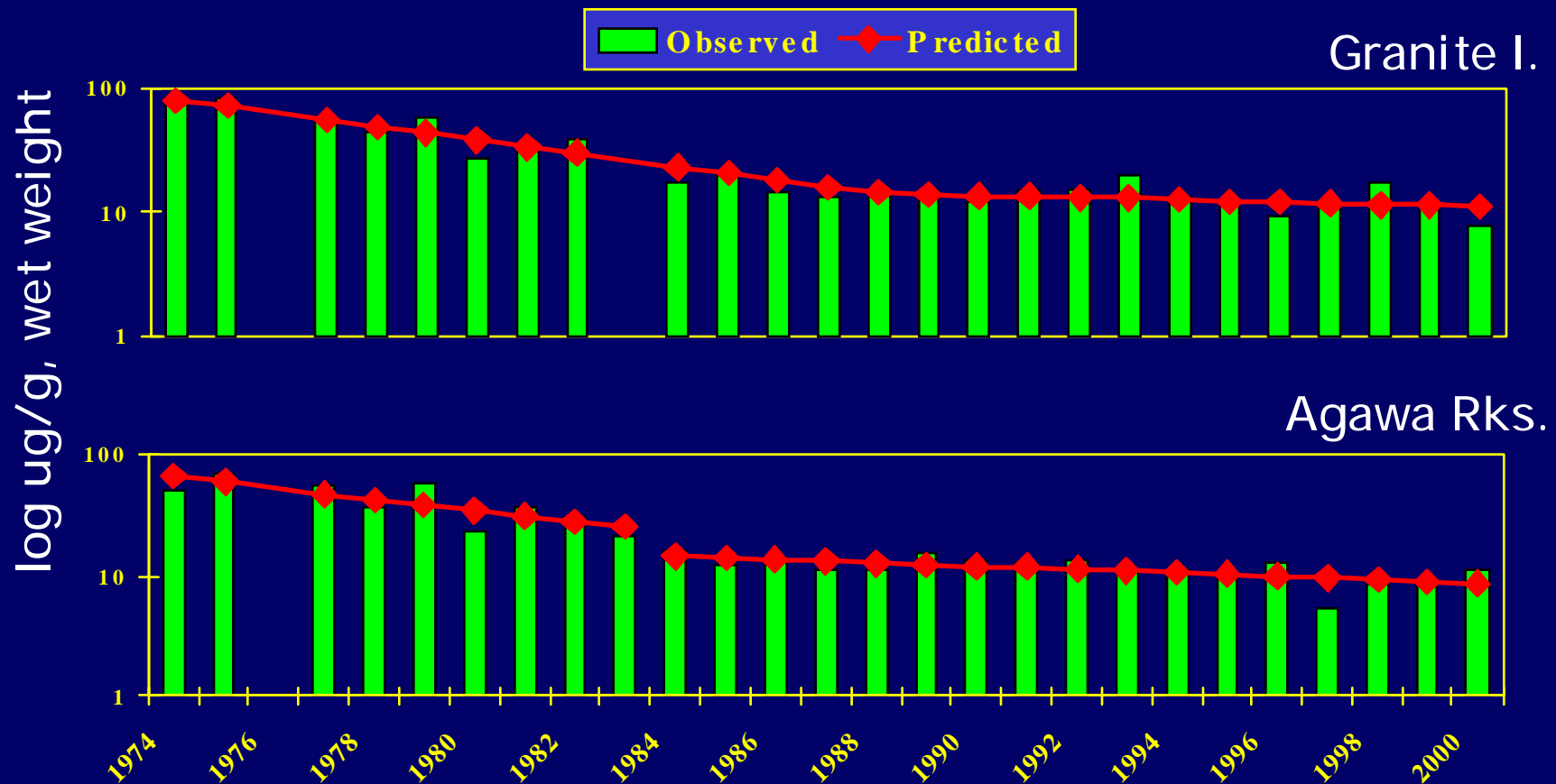
# Indicator Update

- Land and Land Use Indicators
  - Urban Density
  - Economic Prosperity
- Nearshore & Open Water Indicators
  - Phosphorus Concentrations and Loadings
  - Contaminants in Colonial Nesting Waterbirds

# Average Phosphorus Concentrations in Lake Superior



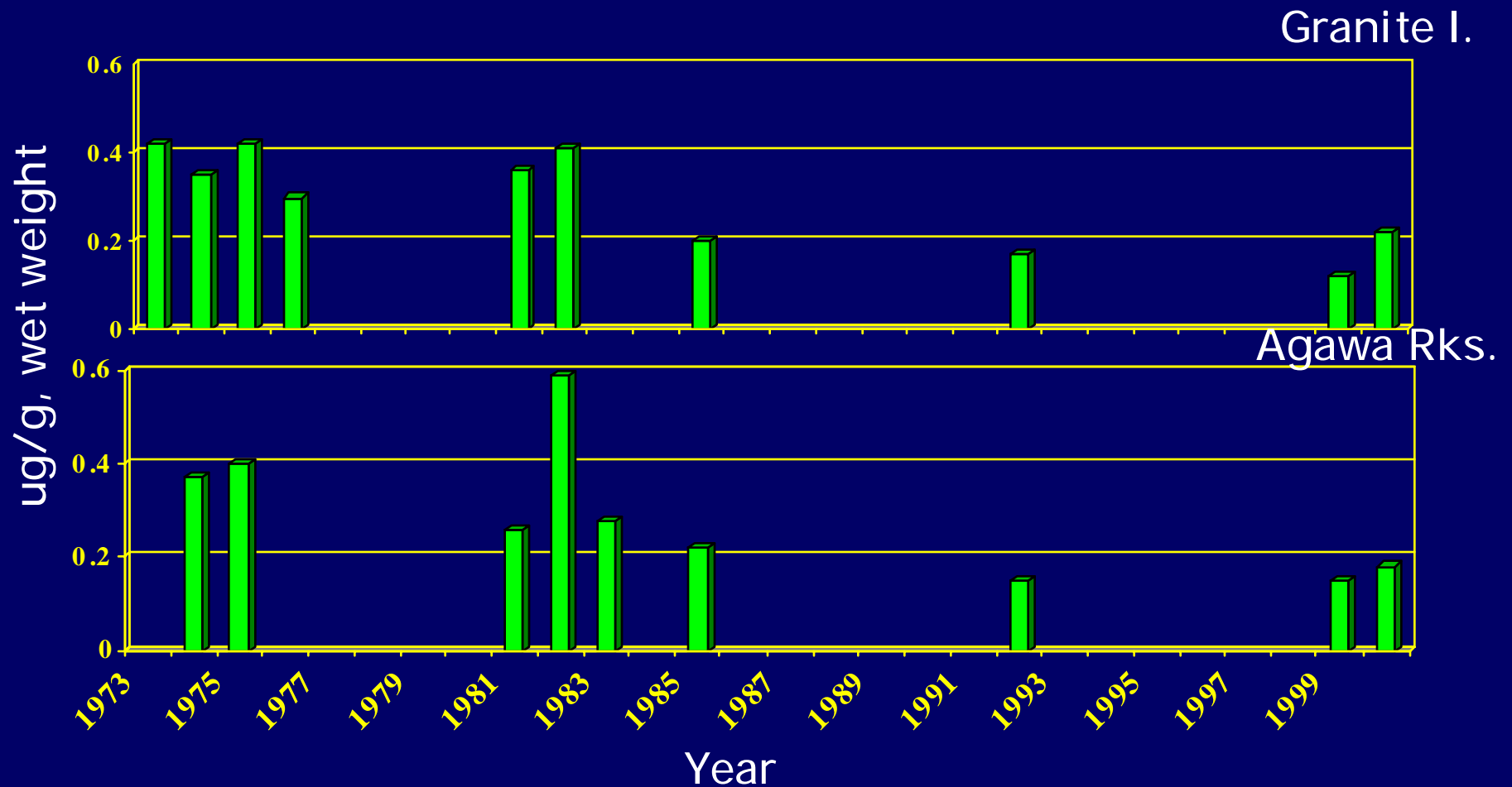
# PCBs in Herring Gull eggs – Lake Superior, 1974 - 2000.



DATA SOURCES: Environment Canada, D.V. Weseloh



# Mercury in Herring Gull eggs - Lake Superior, 1973-2000.



DATA SOURCES: Environment Canada, D.V. Weseloh

# Emerging Issues

- Global issues:
  - global warming - water levels, temperature, increased contaminant cycling
  - ozone depletion, greater UV exposure to organisms and increased phototoxicity of PAH compounds
- Regional/basin issues:
  - increased # of non-native species caused by increased shipping/ballast water exchange
  - PBDEs, Pharmaceuticals and Endocrine disrupting substances, HPCs, PFOs, Diphenyl Ethers, Plasticizers
  - water export

# Lake Superior Binational Program

- Habitat restoration and the development of broad ecosystem goals
- A continuing decrease in concentrations of nine critical pollutants; met year 2000 goal of reducing mercury emissions by 60%
- Almost complete restoration of the lake trout population
- Mercury collection and recycling
- reports available online at:  
<http://www.epa.gov/glnpo/lakesuperior/>

# Acknowledgements

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Lake Superior Binational Program