GLNPO Monitoring Programs

Lake Ontario Contaminant Monitoring & Research Workshop

March 27-28, 2007

Cooperative Monitoring Achievements

Early stages of cooperative monitoring

- 2001 and 2002 – Lake Erie work
- 2002 and 2003 - LOADS and LOLA

Recent cooperative monitoring efforts

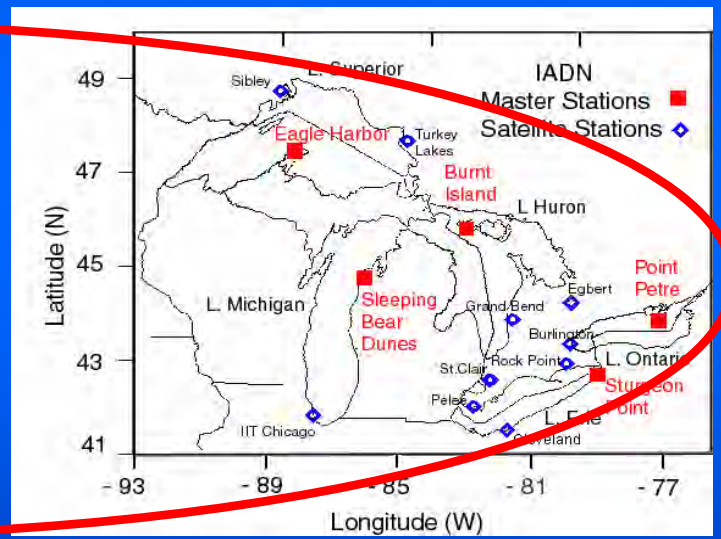
- Lake Erie DO surveys
- Lake Michigan Mass Balance redux
- Lake Superior supplemental work
  - Tributaries and add'l atmospheric contaminants
  - Inter-laboratory comparison
- Lake Huron
  - Lower food web

Nutrients

- Total Phosphorus
- Total Dissolved Phosphorus
- Nitrite + Nitrate
- Soluble Reactive Silica
- Particulate C,N,P

Contaminants

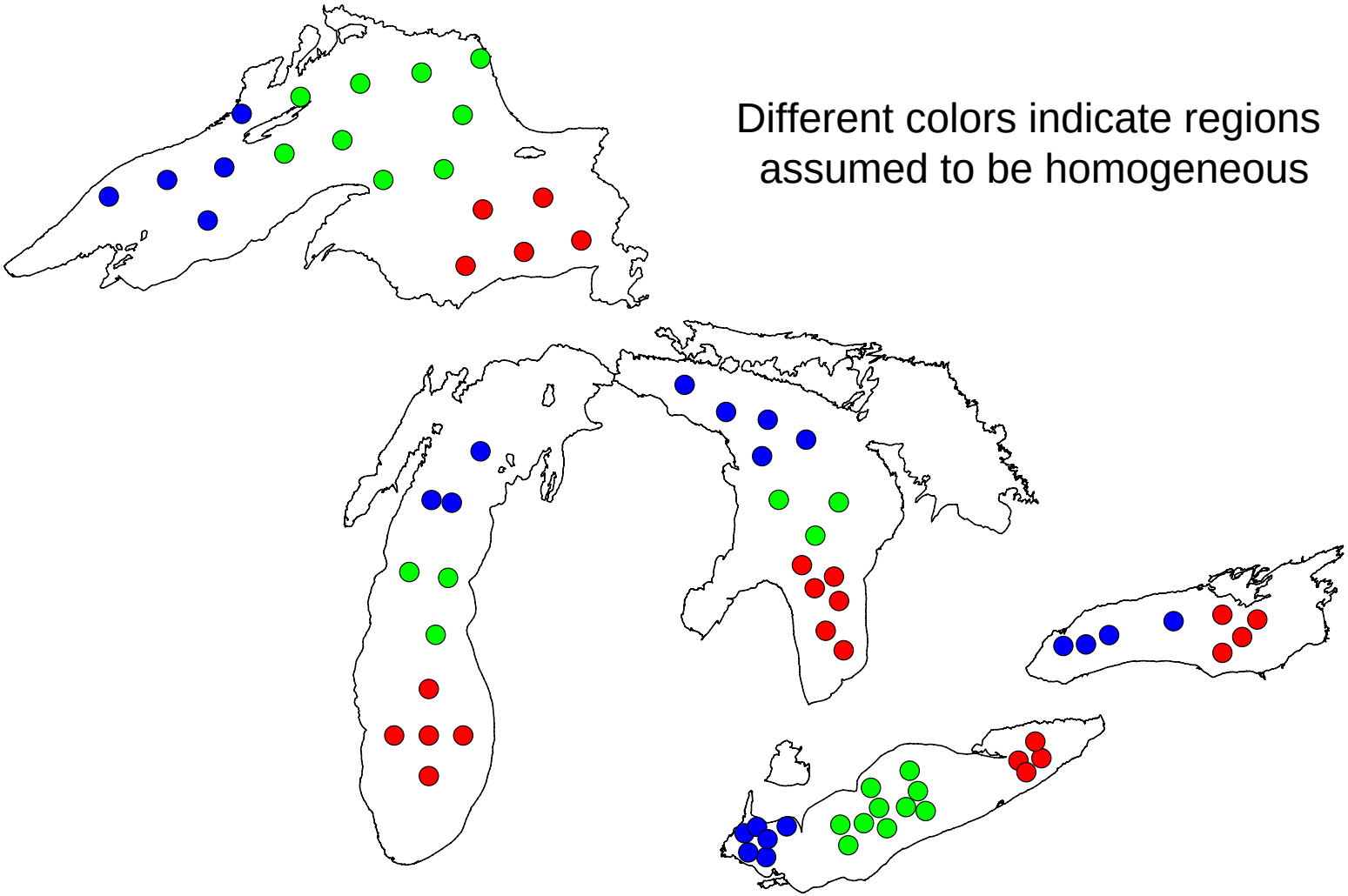
- Air (IADN)
- Open Water
- Fish Tissue



Biological Indicators Program

- Phytoplankton
- Zooplankton
- Benthic Invertebrates

GLNPO Sampling Stations



Different colors indicate regions assumed to be homogeneous

Water Quality

Nutrients

- Total Phosphorus
- Total Dissolved Phosphorus
- Nitrite + Nitrate
- Soluble Reactive Silica
- Particulate C,N,P

Conventionals –

- pH, turbidity, alkalinity, specific conductance

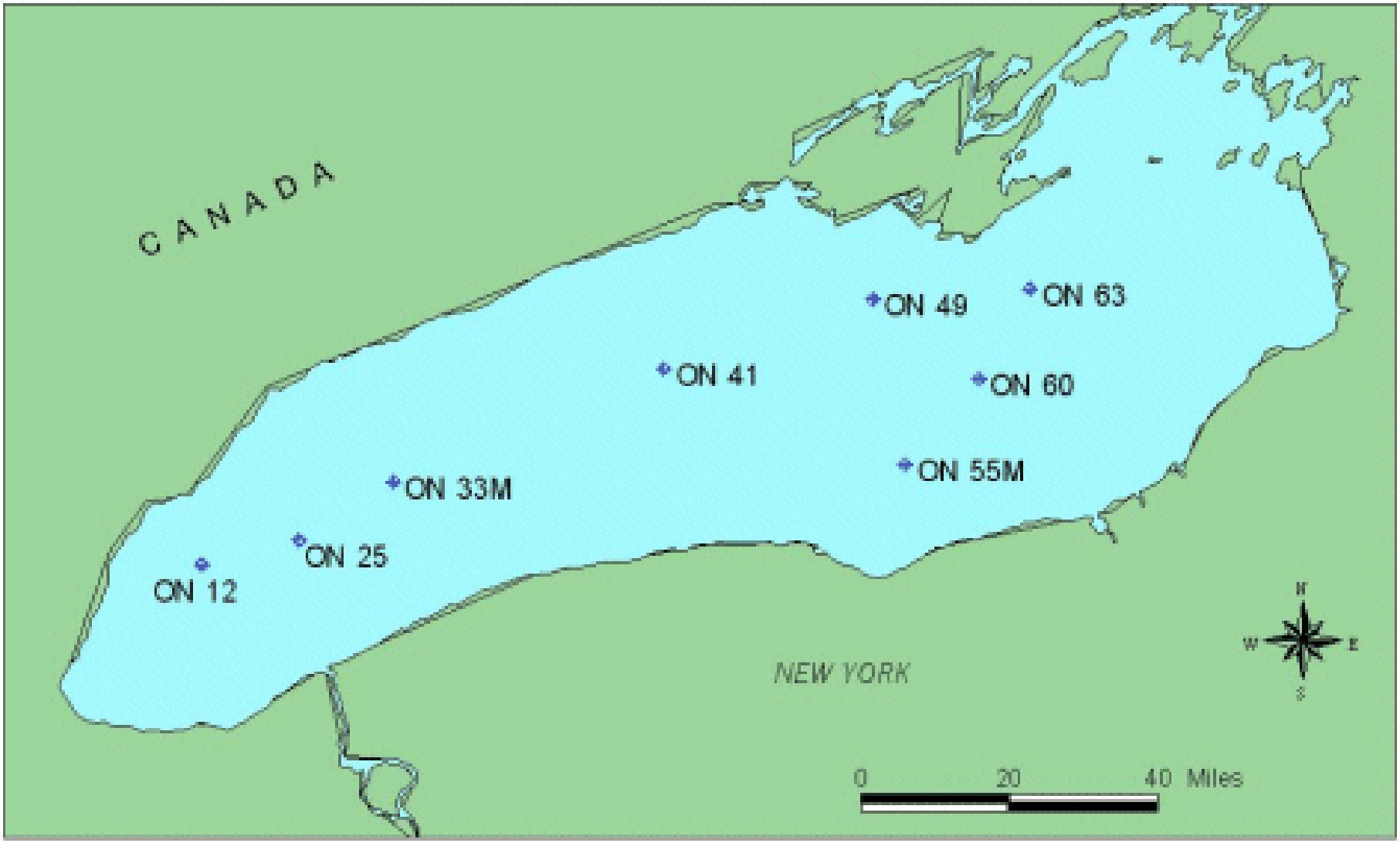
GLNPO Biology Program Measures

- BenthosCommunity Composition
  - Community Composition
  - Size Structure of Community
- Phytoplankton
  - Community Composition, Biomass
  - Deep Chlorophyll Maximum
  - Historical Communities
- Crustacean Zooplankton
  - Community Composition
  - Size Structure of Community

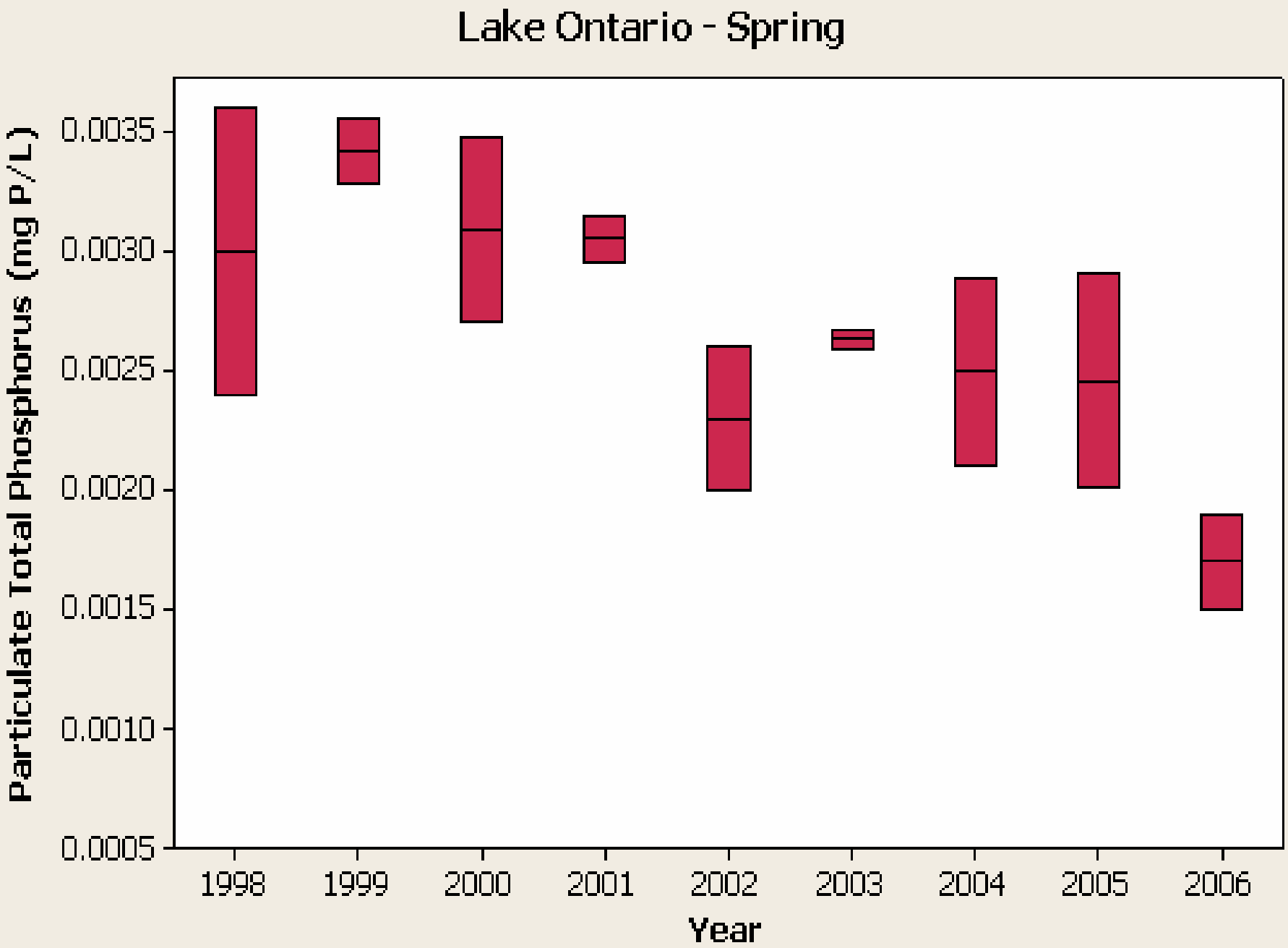
Great Lakes National Program Office

EPA

Lake Ontario Sampling Stations
Spring Survey

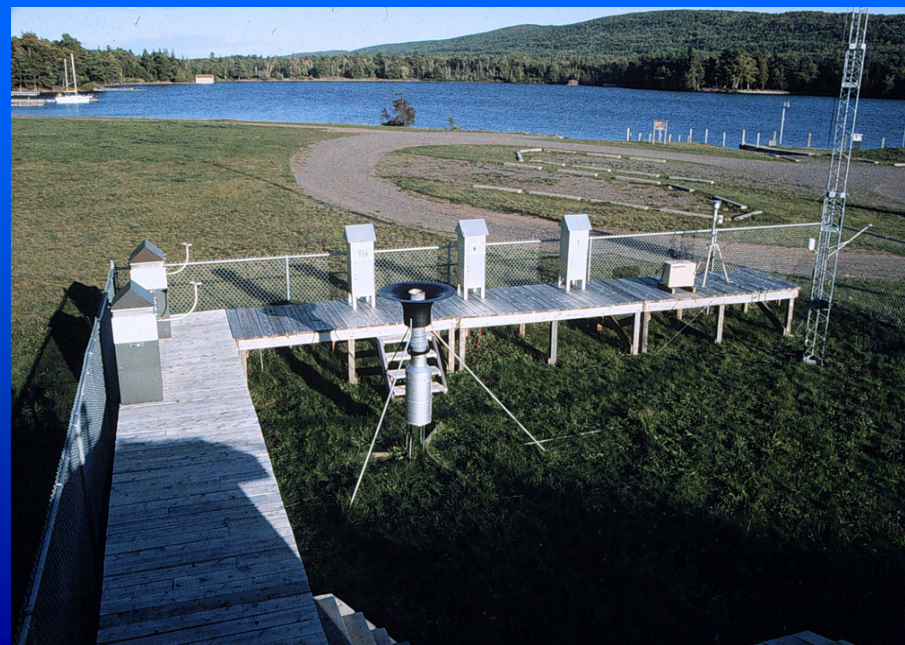


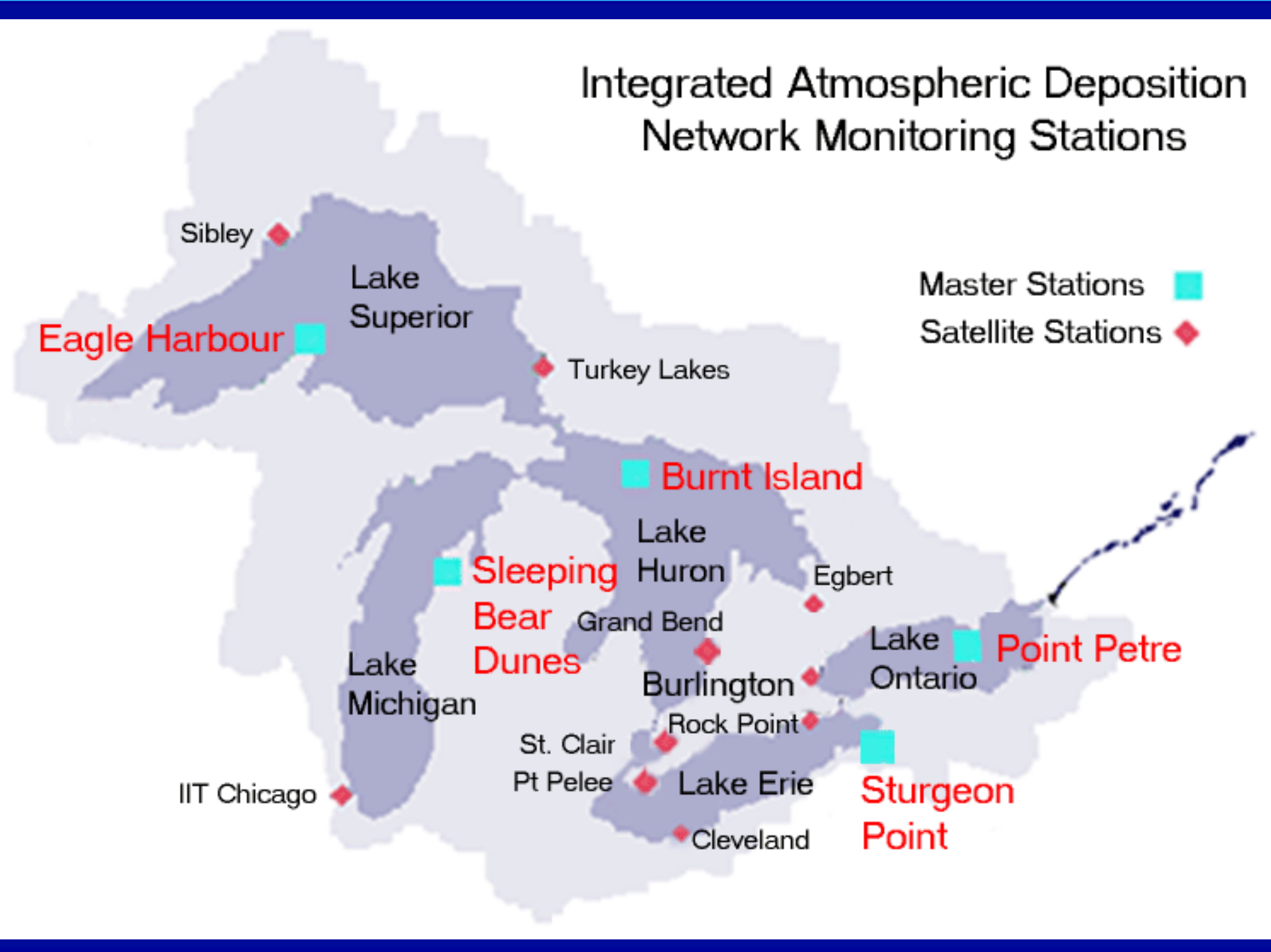
Open Water Stations


Lake Ontario - Spring
Particulate Total Phosphorus (mg P/L)
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year

The Integrated Atmospheric Deposition Network (IADN)

- Annex 15 of the Great Lakes Water Quality Agreement; 1990 Clean Air Act Amendments
- Measure PBT chemicals in air and precipitation
- Gas, particles, precipitation concentrations; meteorological parameters
- Examine concentration trends, calculate loadings
- In operation since 1990
- Partnership: U.S. EPA, U.S. grantee (IU), Environment Canada (MSC, OR-EHD)

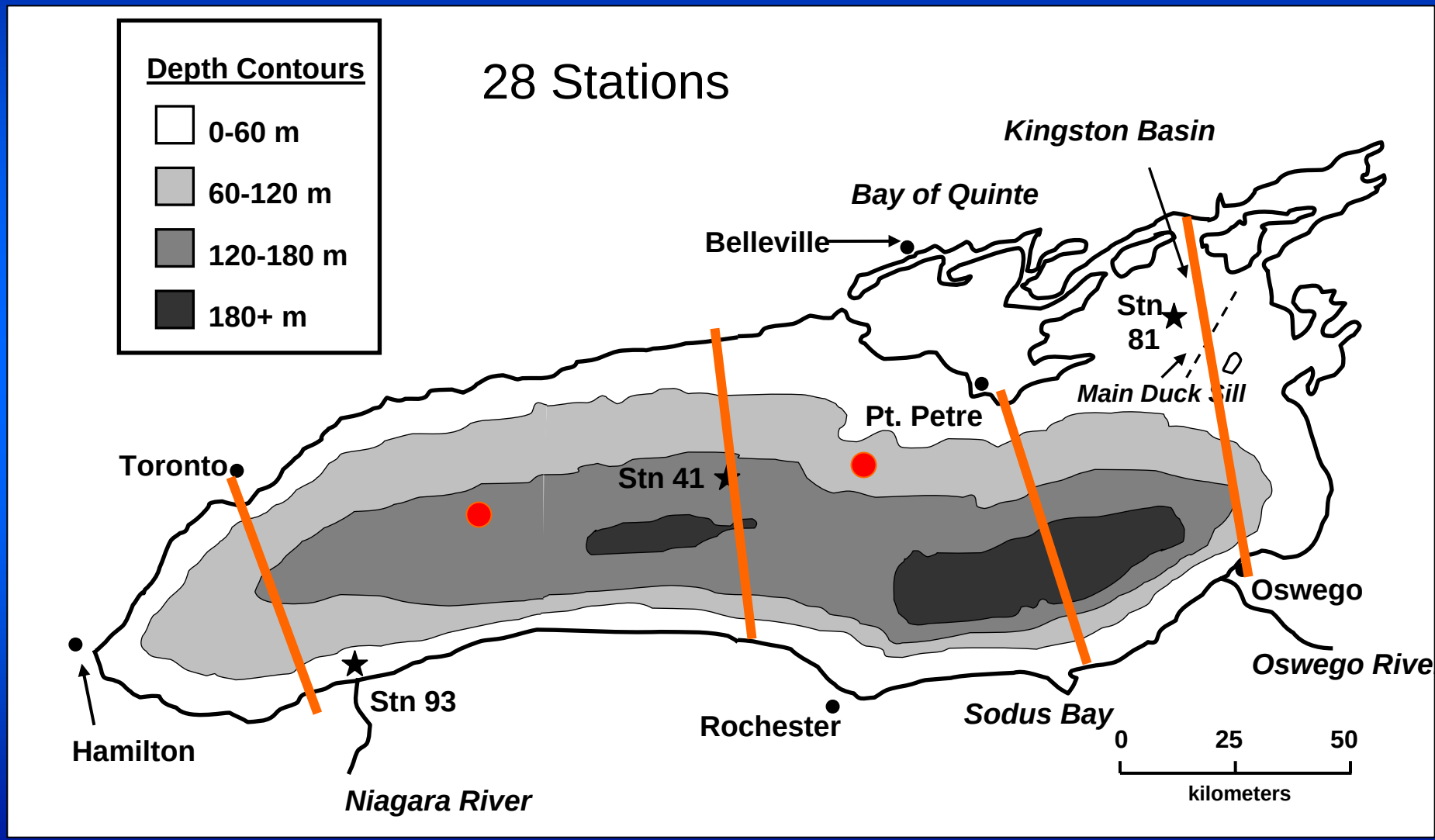



Integrated Atmospheric Deposition
Network Monitoring Stations
Master Stations
Satellite Stations
Sibley
Lake
Superior
Eagle Harbour
Turkey Lakes
Burnt Island
Lake
Huron
Sleeping
Bear
Dunes
Egbert
Grand Bend
Lake
Michigan
Lake
Ontario
Point Petre
Burlington
Rock Point
St. Clair
Pt Pelee
Lake Erie
Sturgeon
Point
IIT Chicago
Cleveland

Lake Ontario Lower Aquatic Foodweb (LOLA) Key Questions

- What is the current status of native benthic and zooplankton communities?
- What is the current status of mysid populations?
- How do the results of this study compare with similar studies conducted before the arrival of zebra mussels?
- What changes have occurred in nearshore waters <50 m deep where zebra and quagga mussels impacts are greatest?
- Can traditional zooplankton assessments be improved by the use of new remote sensing technologies?

LOLA 2003 Transect Locations (28 Stations)



LOLA Partners

- *Lake Ontario Lakewide Management Plan (NY DEC, OMOE, EPA R2, EC)*
- *Great Lakes Fishery Commission Lake Committee (NY DEC, OMOE)*
- *Department of Fisheries & Oceans Canada*
- *National Oceanic & Atmospheric Administration*
- *Cornell University*
- *U.S. EPA Great Lakes National Program Office*
- *U.S. EPA Office of Research & Development, Duluth*
- *University of Toronto*
- *State Univ. of New York, ESF*

Thank you!

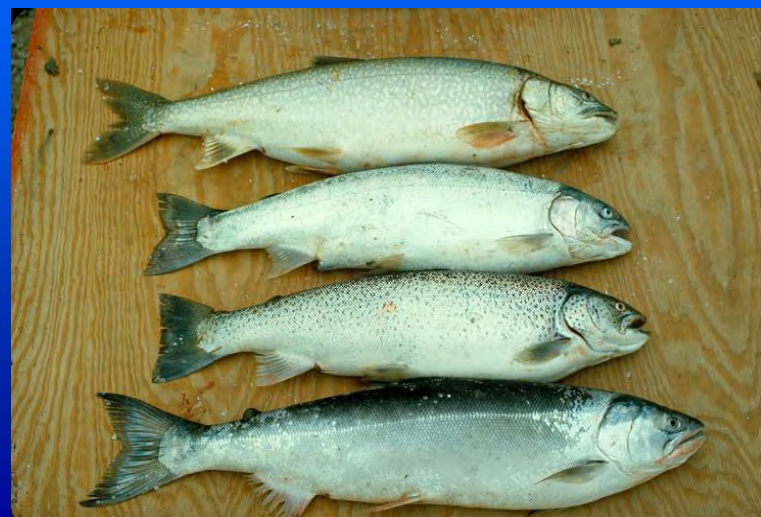
Great Lakes Fish Monitoring Program (GLFMP)

Open Lake Trends Monitoring

- Monitor contaminant trends in the open waters of the Great Lakes (using fish as indicators)
- Assess the overall effects of toxics on fish and fish-consuming wildlife
- Whole lake trout

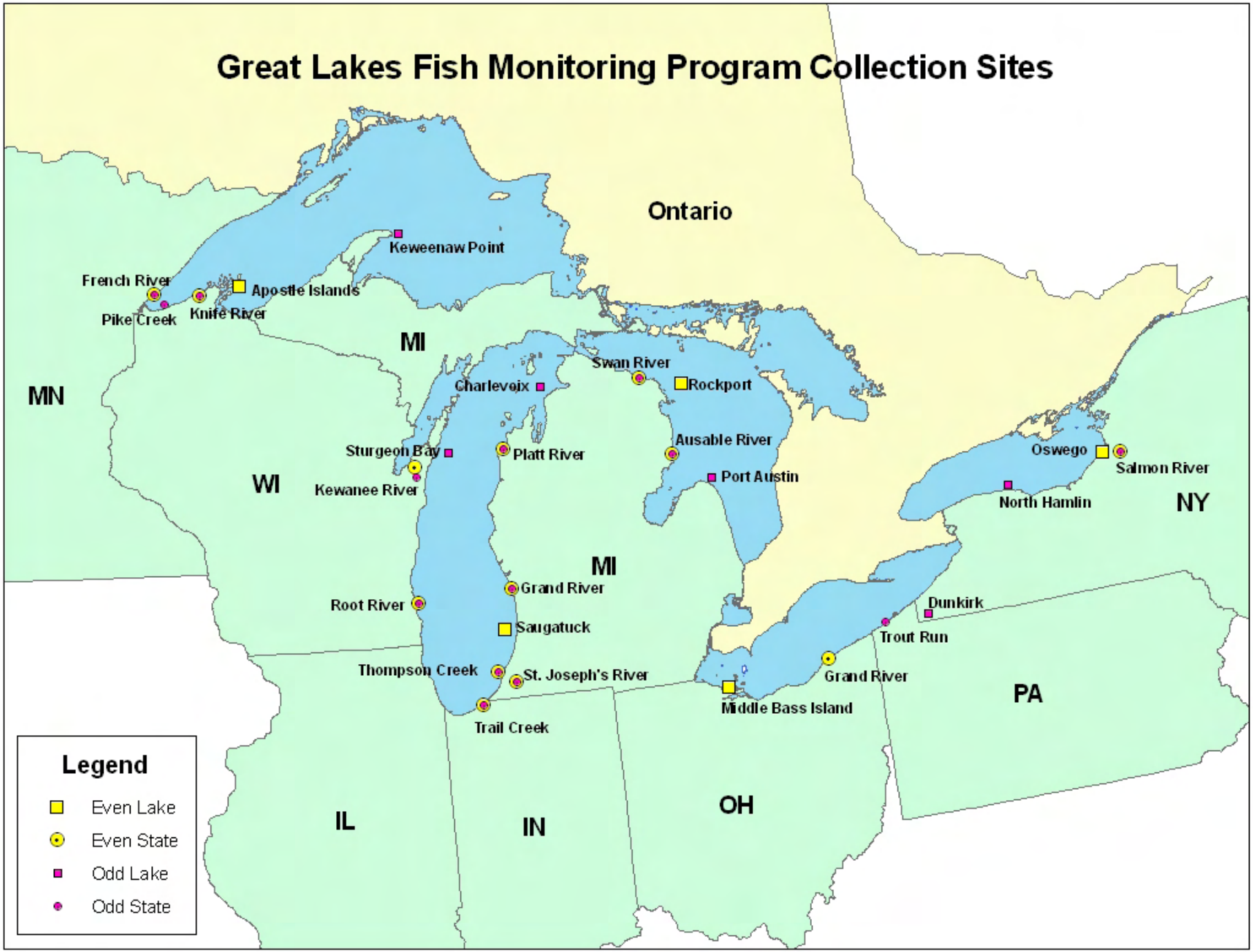
Game Fish Fillet Program

- Monitor potential human exposure to contaminants through consumption of popular sport species
- Salmon fillets



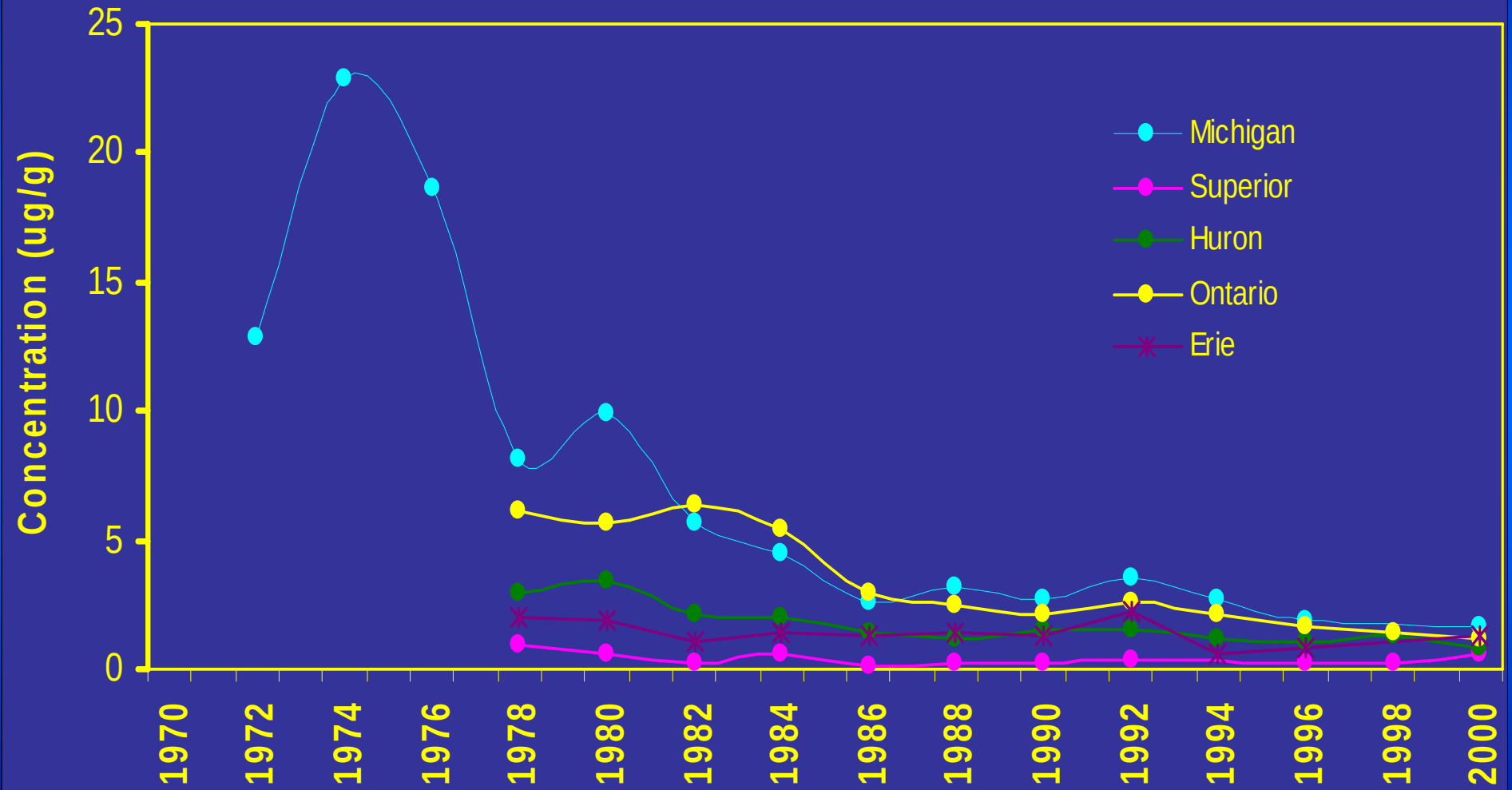
GLFMP Contaminant List

- PCB congeners
- Hexachlorobenzene
- Pentachlorobenzene
- Octachlorostyrene
- alpha BHC
- Lindane
- Aldrin
- Dieldrin
- Heptachlor epoxide-b
- Heptachlor epoxide-a
- Cis-chlordane
- Trans- chlordane
- Oxychlordane
- Cis- nonachlor
- Trans- nonachlor
- pp, op-DDT
- pp, op-DDE
- pp, op-DDD
- Endrin
- Mirex
- Toxaphene& homologs
  - **PCDD/Fs**
  - **PBDEs**
  - **PBB-153**
  - **PCNs**
  - **Hg**
- Fraction lipid
- *PFOS*
- *TBBPA*
- *SCCPs*
- *APEs*
- *chlorothalonil*


Great Lakes Fish Monitoring Program Collection Sites
Ontario
Keweenaw Point
French River
Apostle Islands
Pike Creek
Knife River
MI
MN
Swan River
Charlevoix
Rockport
Ausable River
Sturgeon Bay
Platt River
Oswego
Salmon River
WI
Kewanee River
Port Austin
North Hamlin
NY
MI
Grand River
Root River
Dunkirk
Saugatuck
Trout Run
Thompson Creek
St. Joseph's River
Grand River
PA
Middle Bass Island
Trail Creek
Legend
Even Lake
Even State
Odd Lake
Odd State
IL
IN
OH

PCBs in Great Lake Top Predator Whole Fish

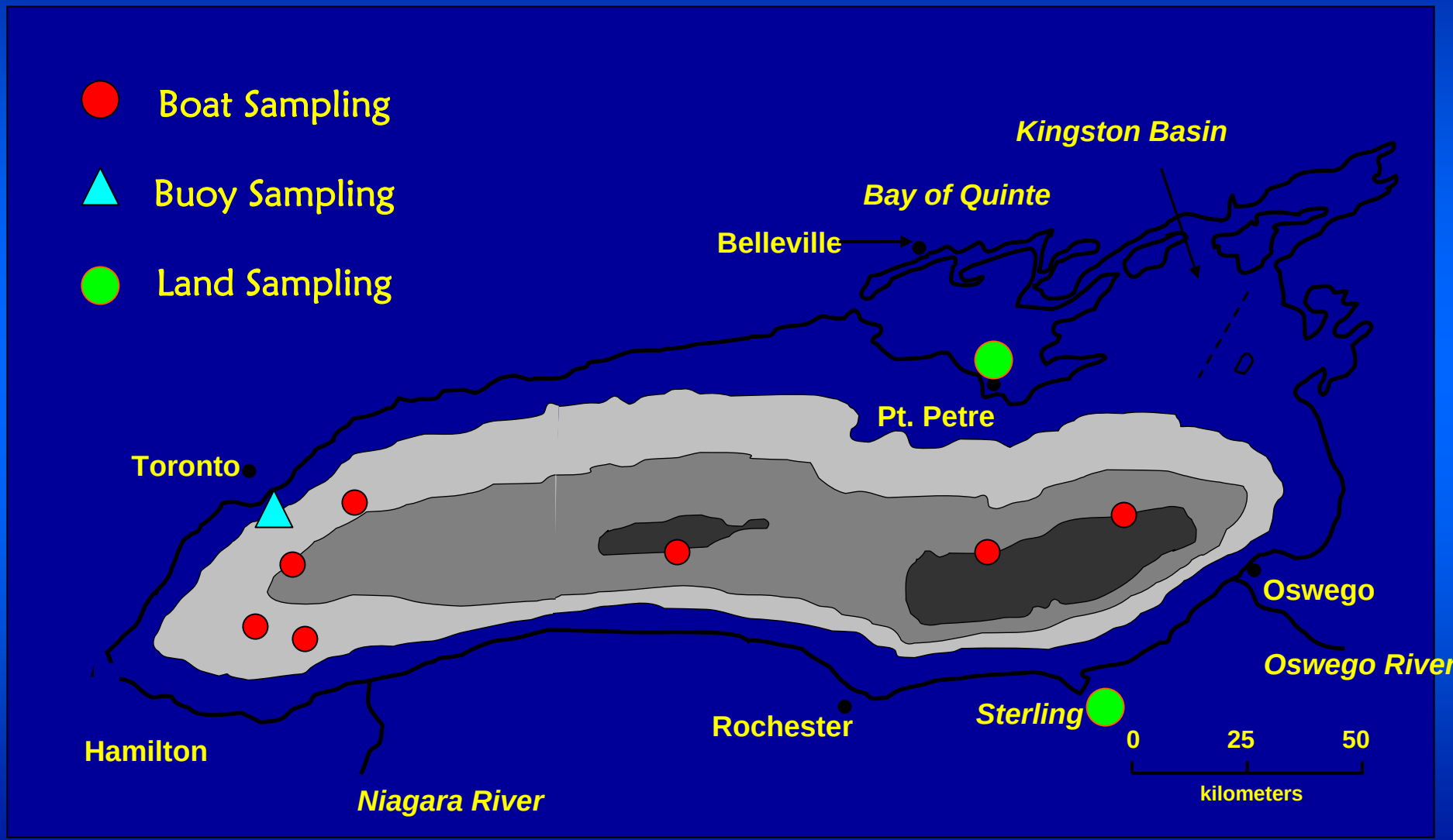
Walleye in Lake Erie



LOADS Project Design

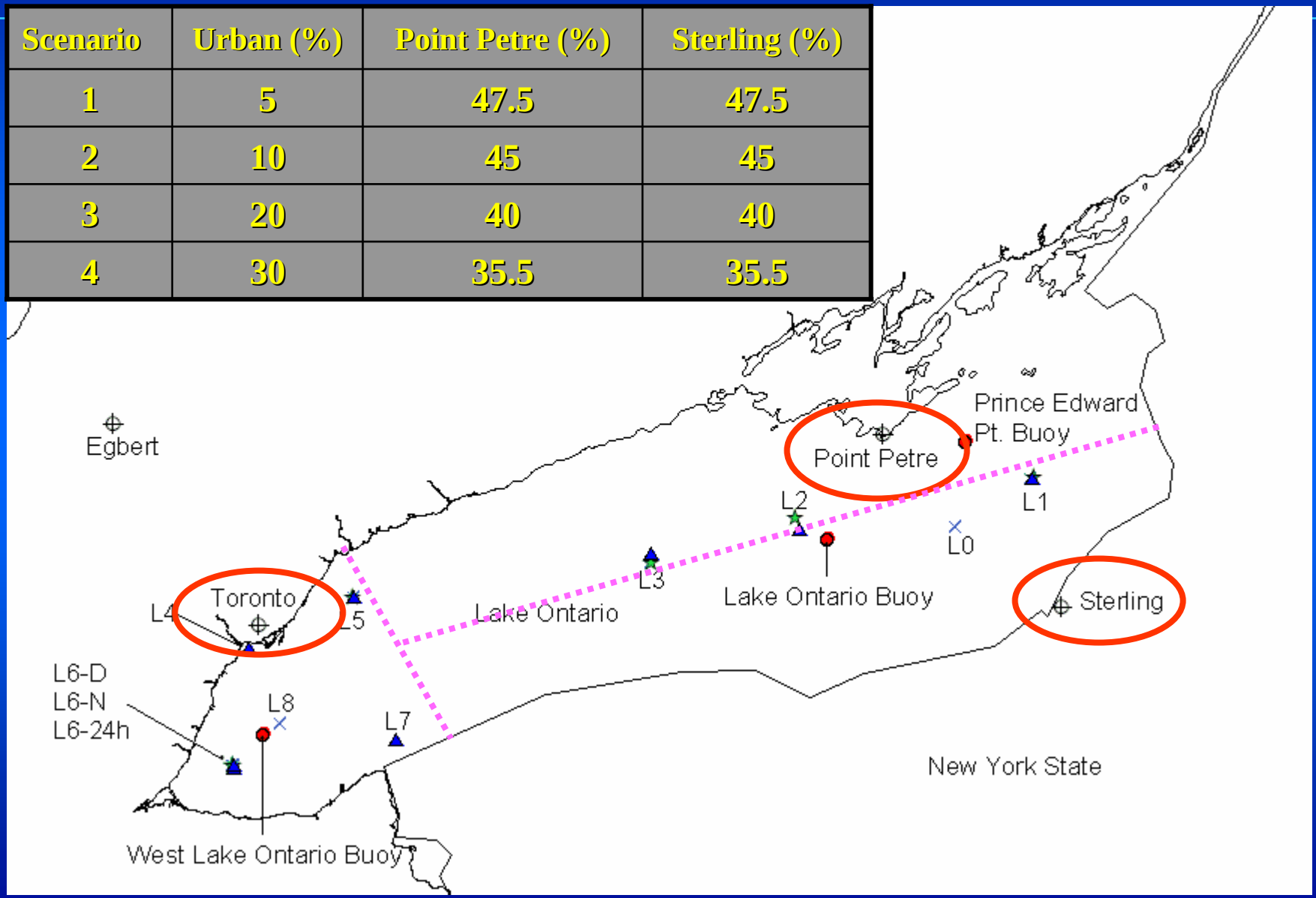
- Lake-based air/water sampling
  - Water column, gas-phase, precipitation, and dry dep
  - Lake Guardian cruises 4/02, 9/02, 7/03
  - LIMNOS cruise summer 2002
  - EC buoy
- Land-based air sampling
  - Sterling, NY
  - Pt Petre, Ontario
  - Other NY sites
  - Rochester, NY – 2004 (Hg)

LOADS Sampling Locations



Scenarios

Scenario	Urban (%)	Point Petre (%)	Sterling (%)
1	5	47.5	47.5
2	10	45	45
3	20	40	40
4	30	35.5	35.5



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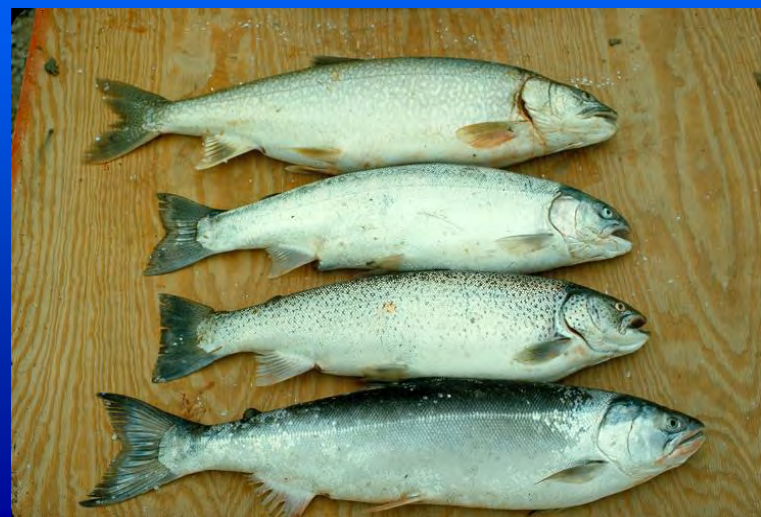

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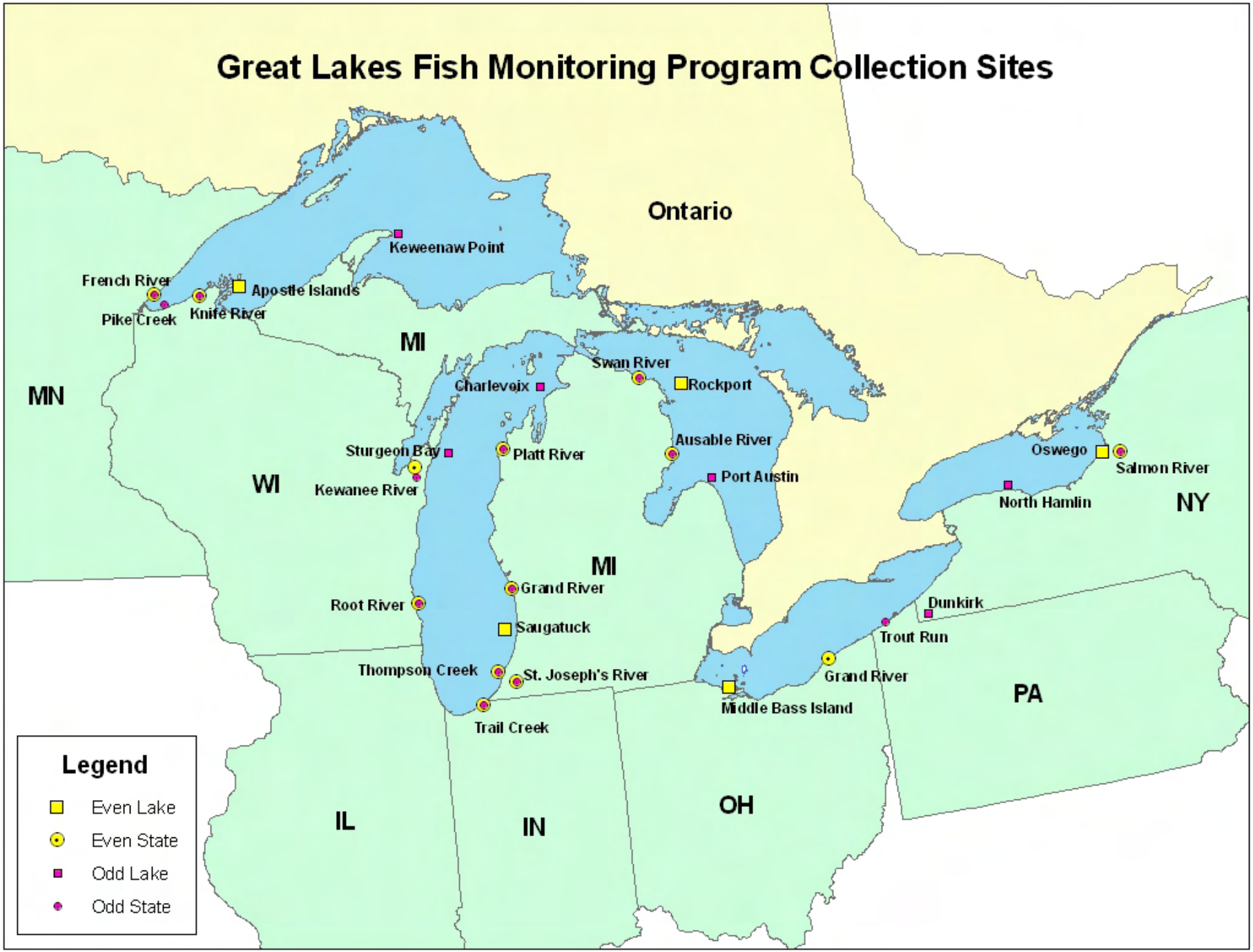
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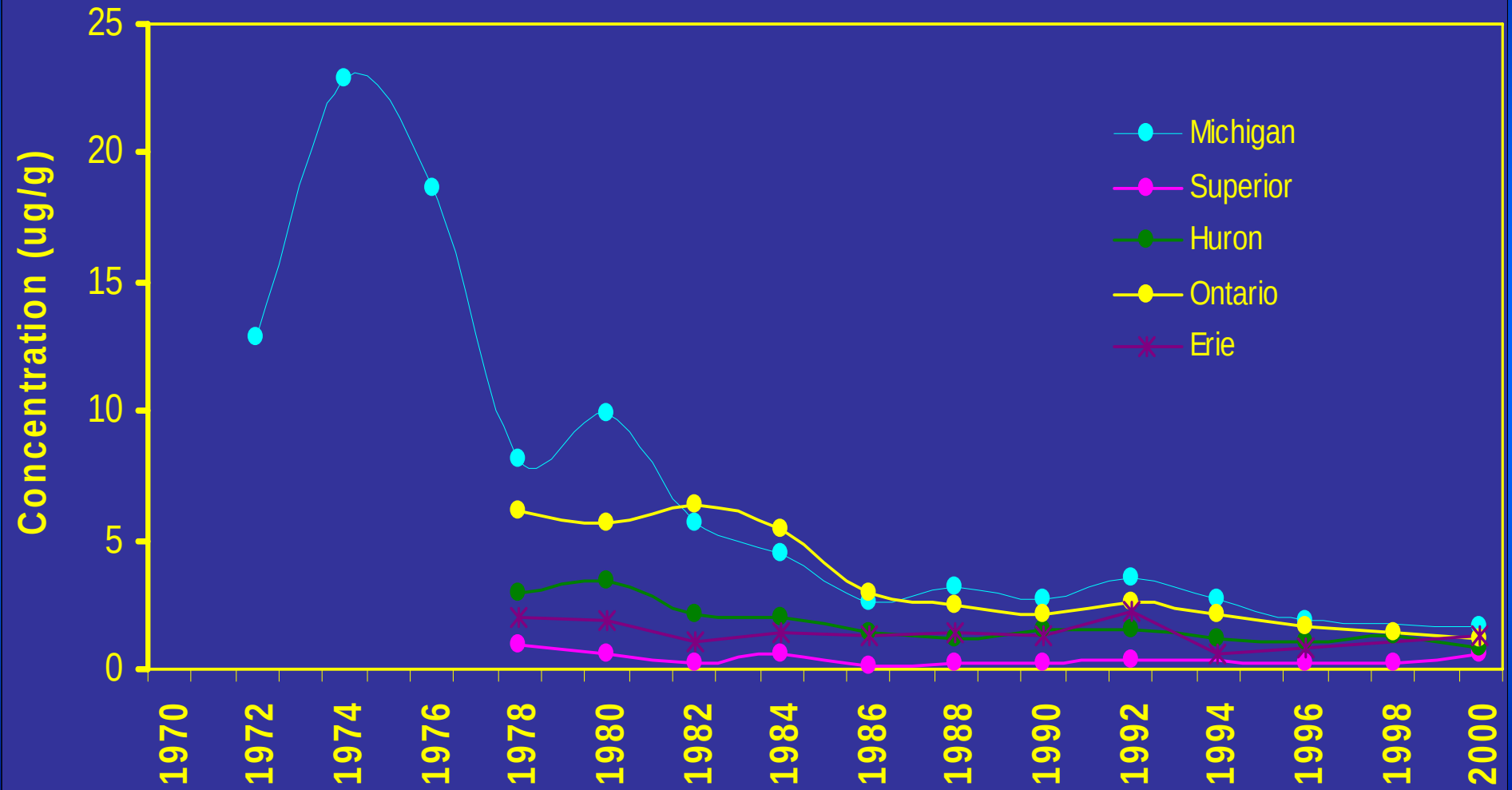
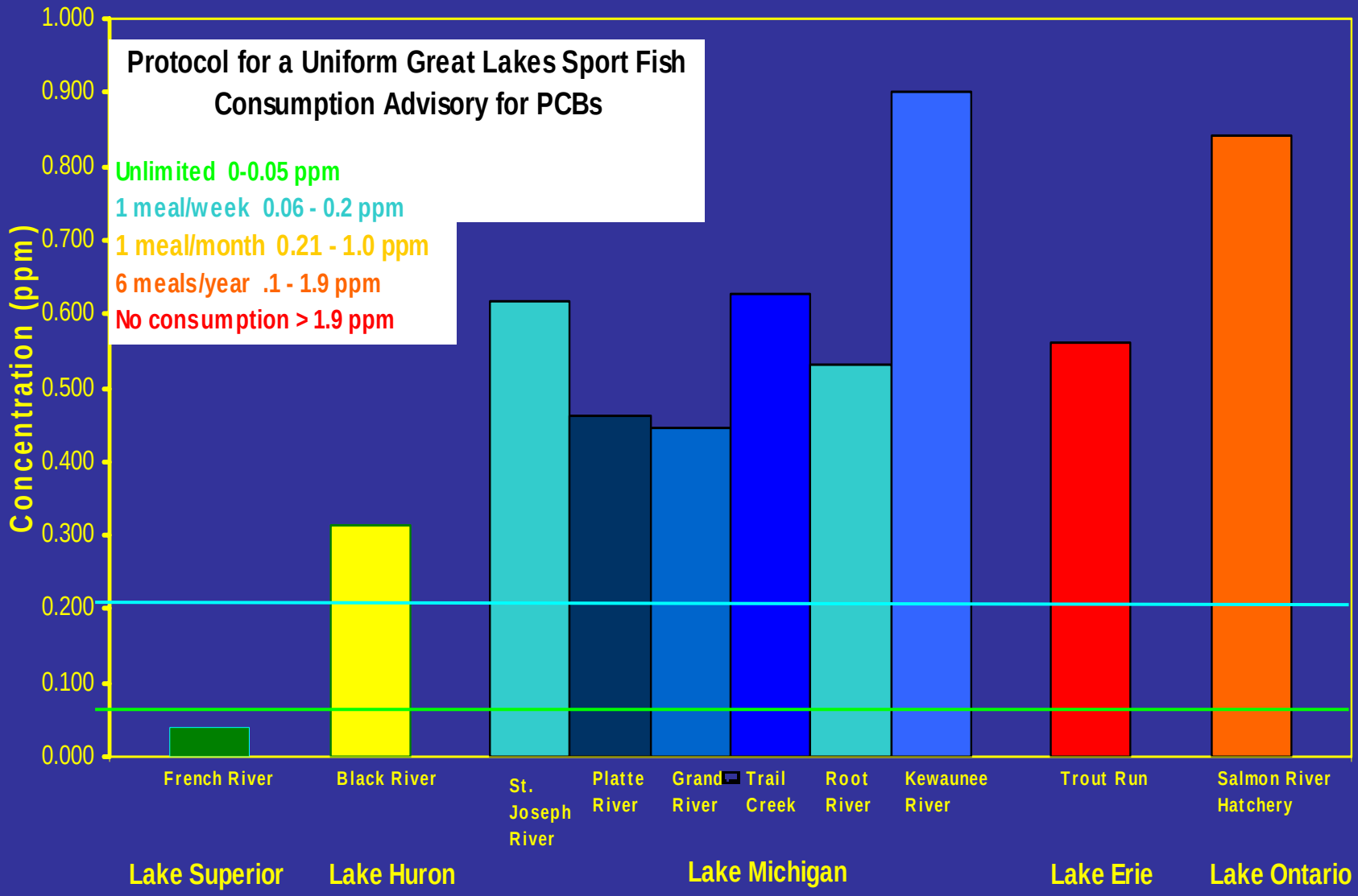
Sturgeon Bay
Platt River
Oswego
Salmon River
WI
Kewanee River
Port Austin
North Hamlin
NY
MI
Grand River
Root River
Dunkirk
Saugatuck
Trout Run
Thompson Creek
St. Joseph's River
Grand River
PA
Middle Bass Island
Trail Creek
Legend
Even Lake
Even State
Odd Lake
Odd State
IL
IN
OH

PCBs in Great Lake Top Predator Whole Fish

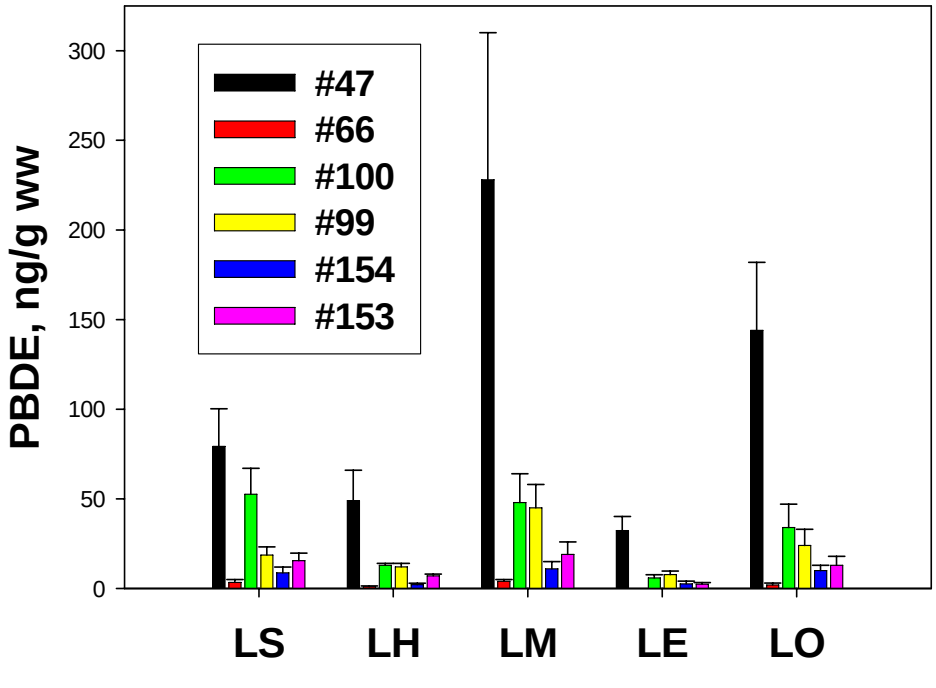
Walleye in Lake Erie



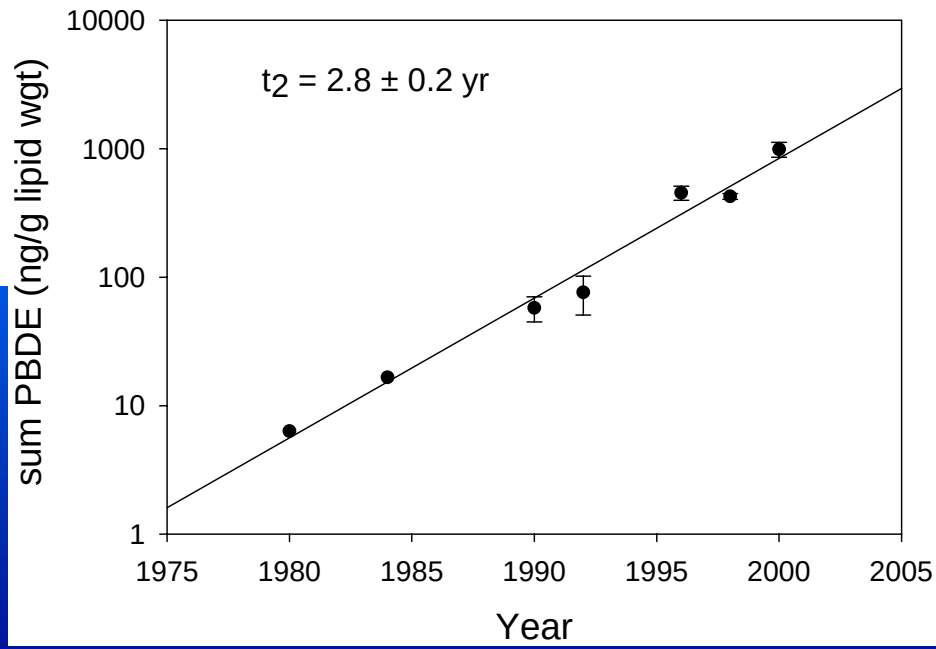
PCBs in Site Specific Great Lakes Coho
2002



PBDEs in Lake Trout



Source: 2000 data – Elizabeth Murphy, GLNPO



Source: Zhu and Hites, *ES&T* (38) 2004.

Thank you!

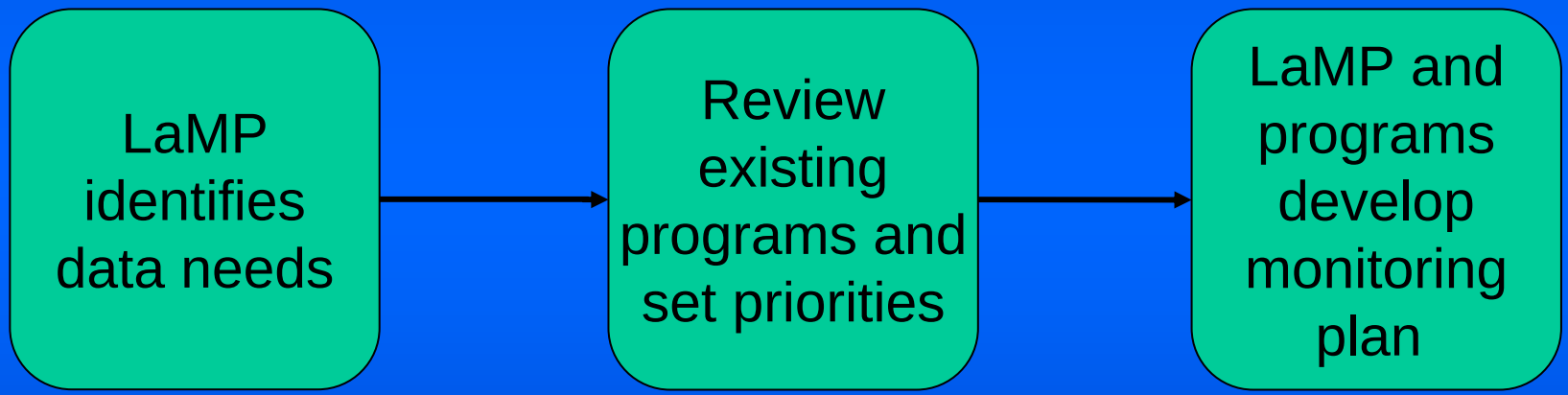
Cooperative Monitoring Initiative

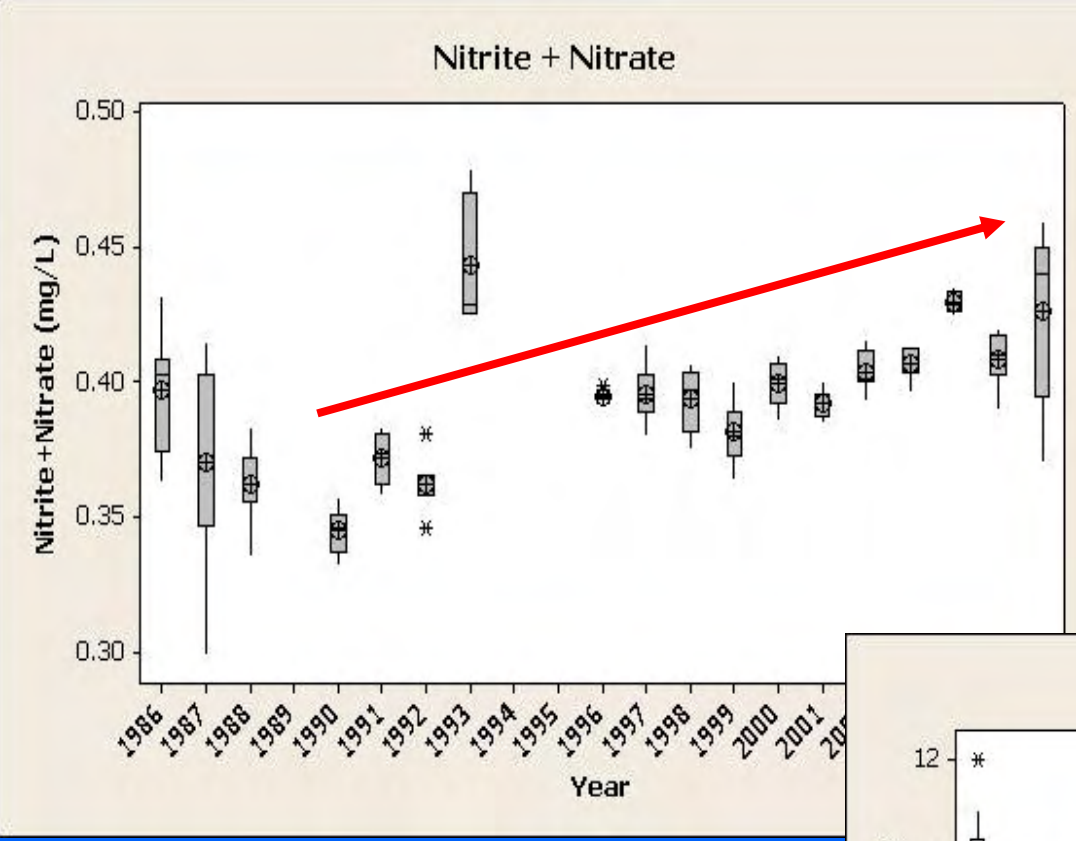
Cooperative Monitoring Initiative Schedule:

Canadian Research Vessel Limnos, and the U.S. Research Vessel Lake Guardian

- 2003 - Lake Ontario
- 2004 - Lake Erie
- 2005 - Lake Superior (Canada), Lake Michigan (US)
- 2006 - Lake Superior – Joint
- 2007 - Lake Huron
- 2008 - Lake Ontario
- 2009 - Lake Erie

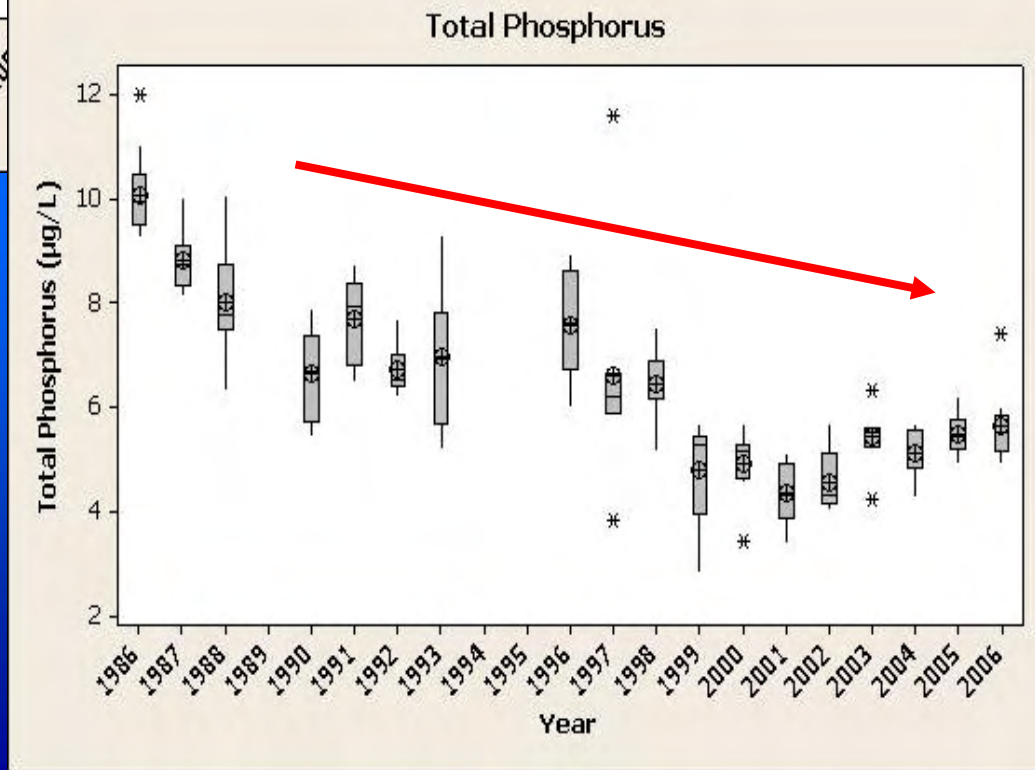
Cooperative Monitoring Process



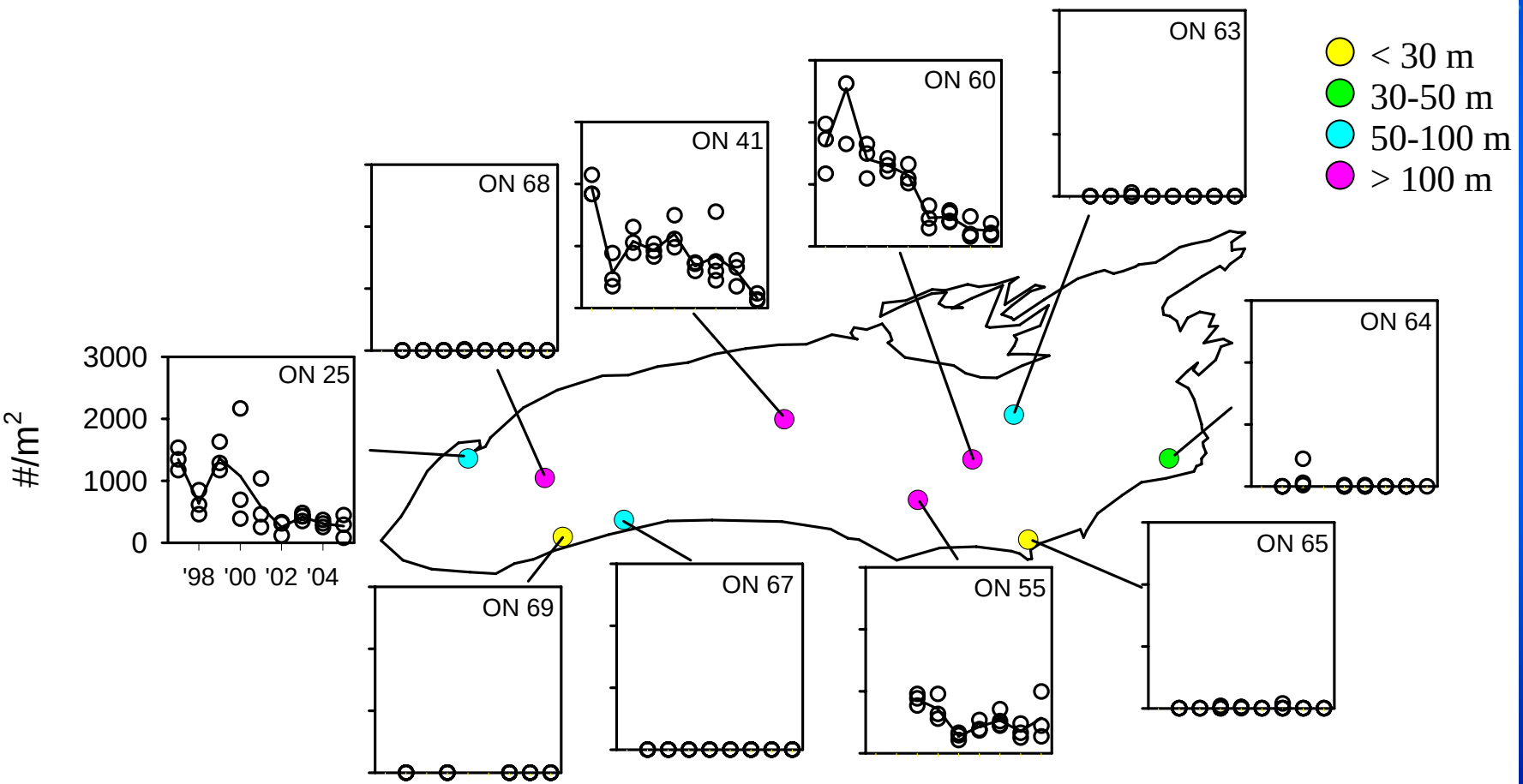


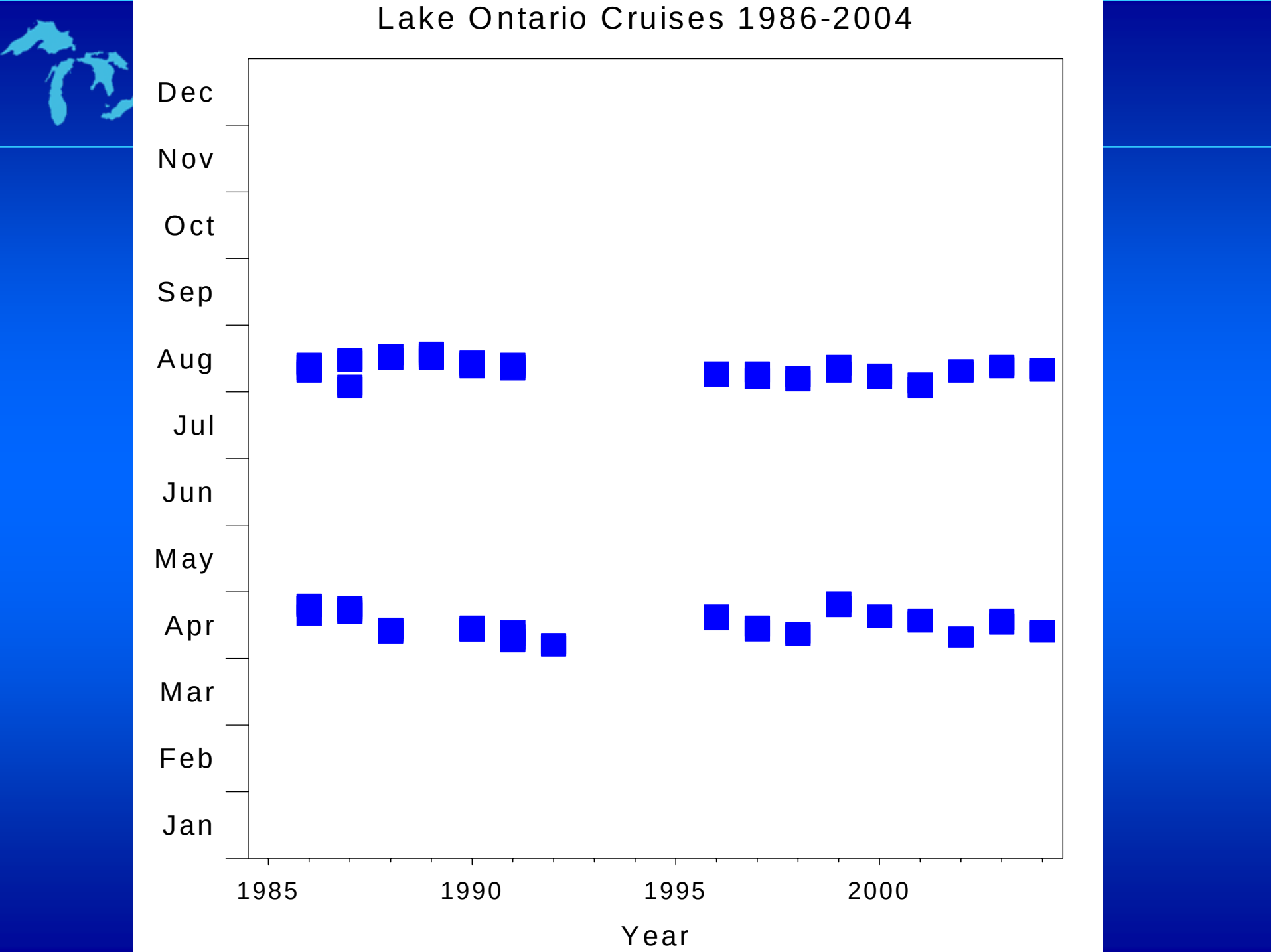
Nitrite + Nitrate increasing…

While TP decreasing, but…

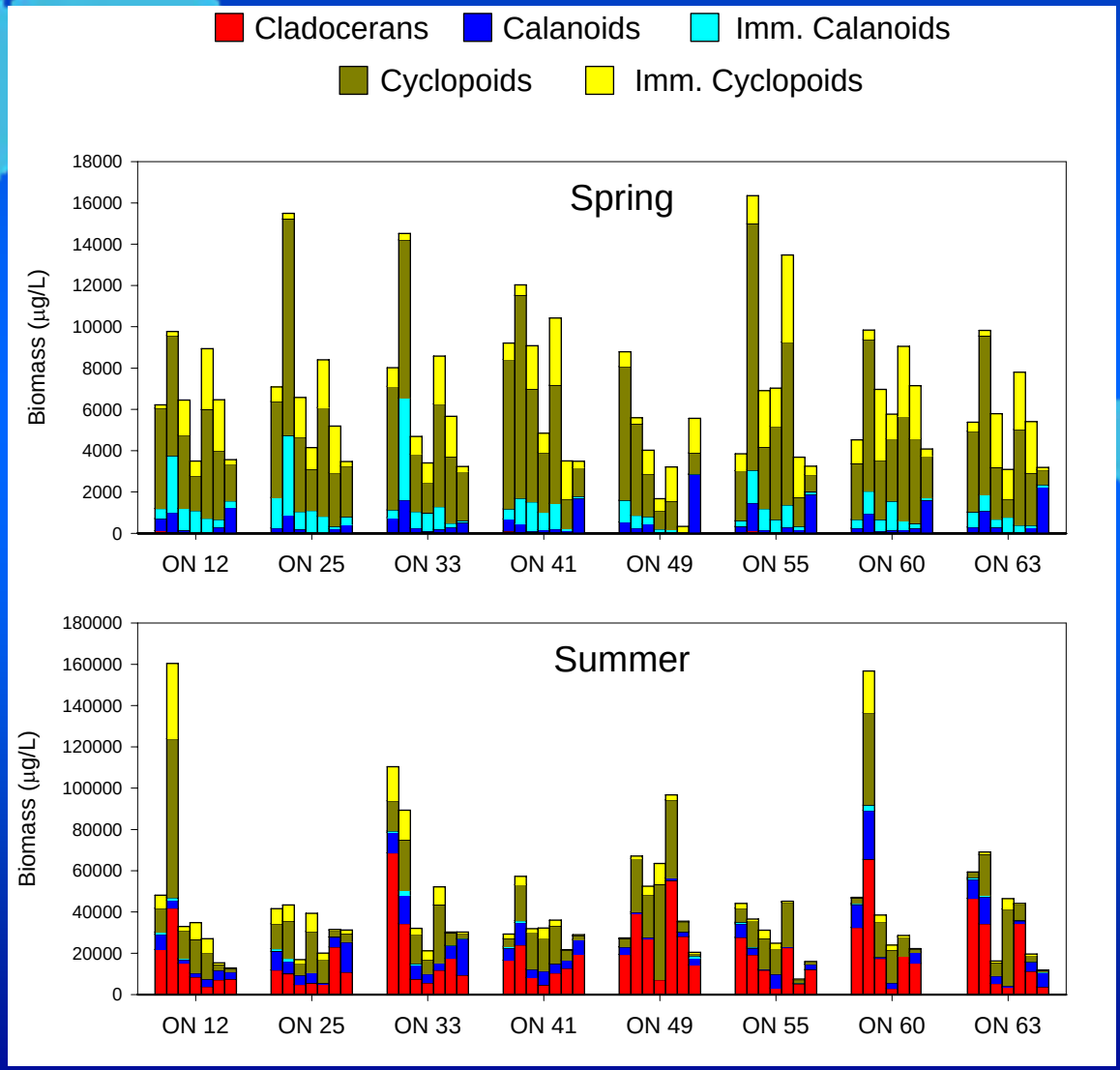


Diporeia Abundances in Lake Ontario, 1997-2005



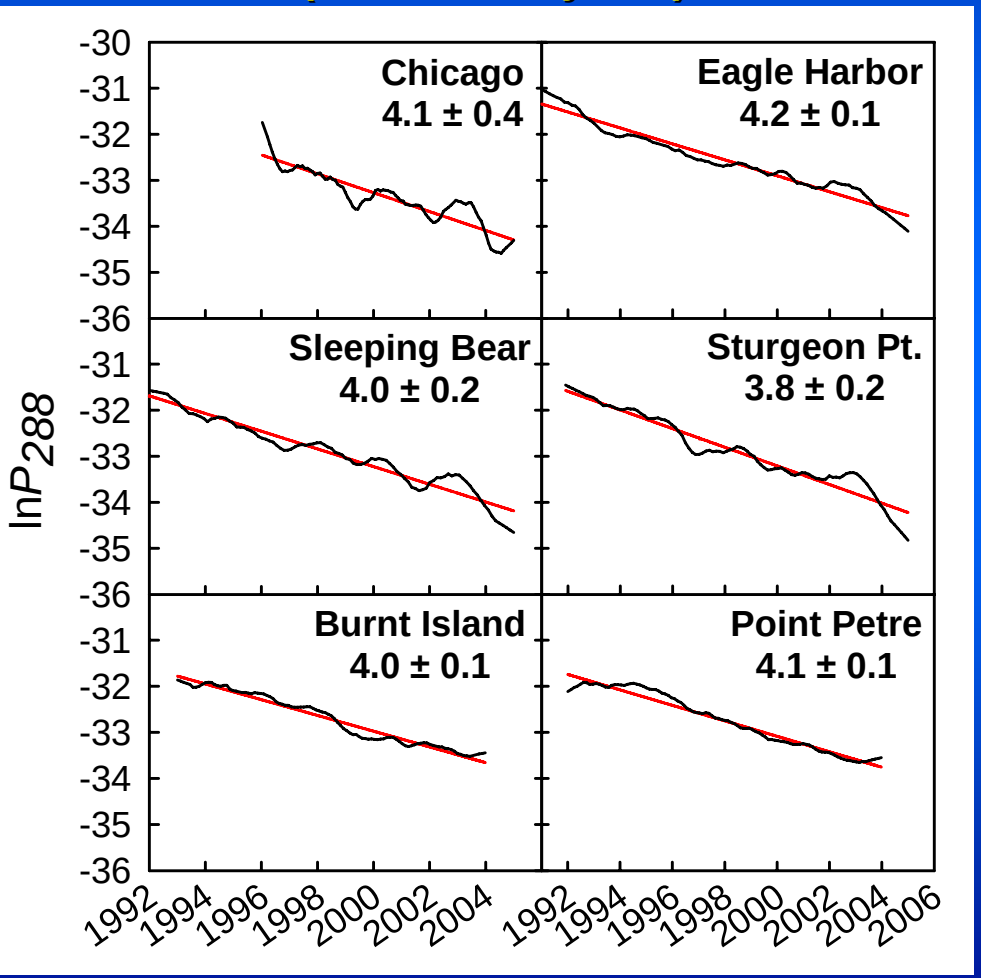

Lake Ontario Cruises 1986-2004
Dec
Nov
Oct
Sep
Aug
Jul
Jun
May
Apr
Mar
Feb
Jan
1985
1990
1995
2000
Year

Zooplankton Biomass in Lake Ontario 1998-1999, 2001-2005

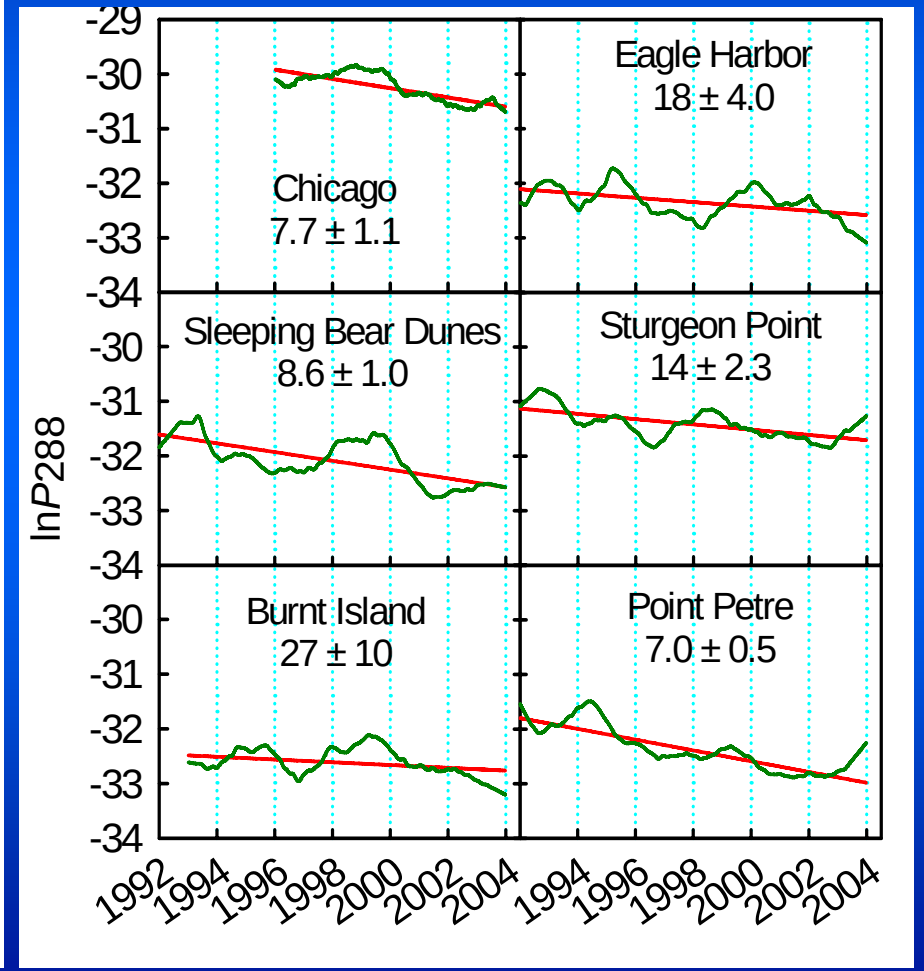


Levels of banned organochlorine pesticides are generally decreasing…….

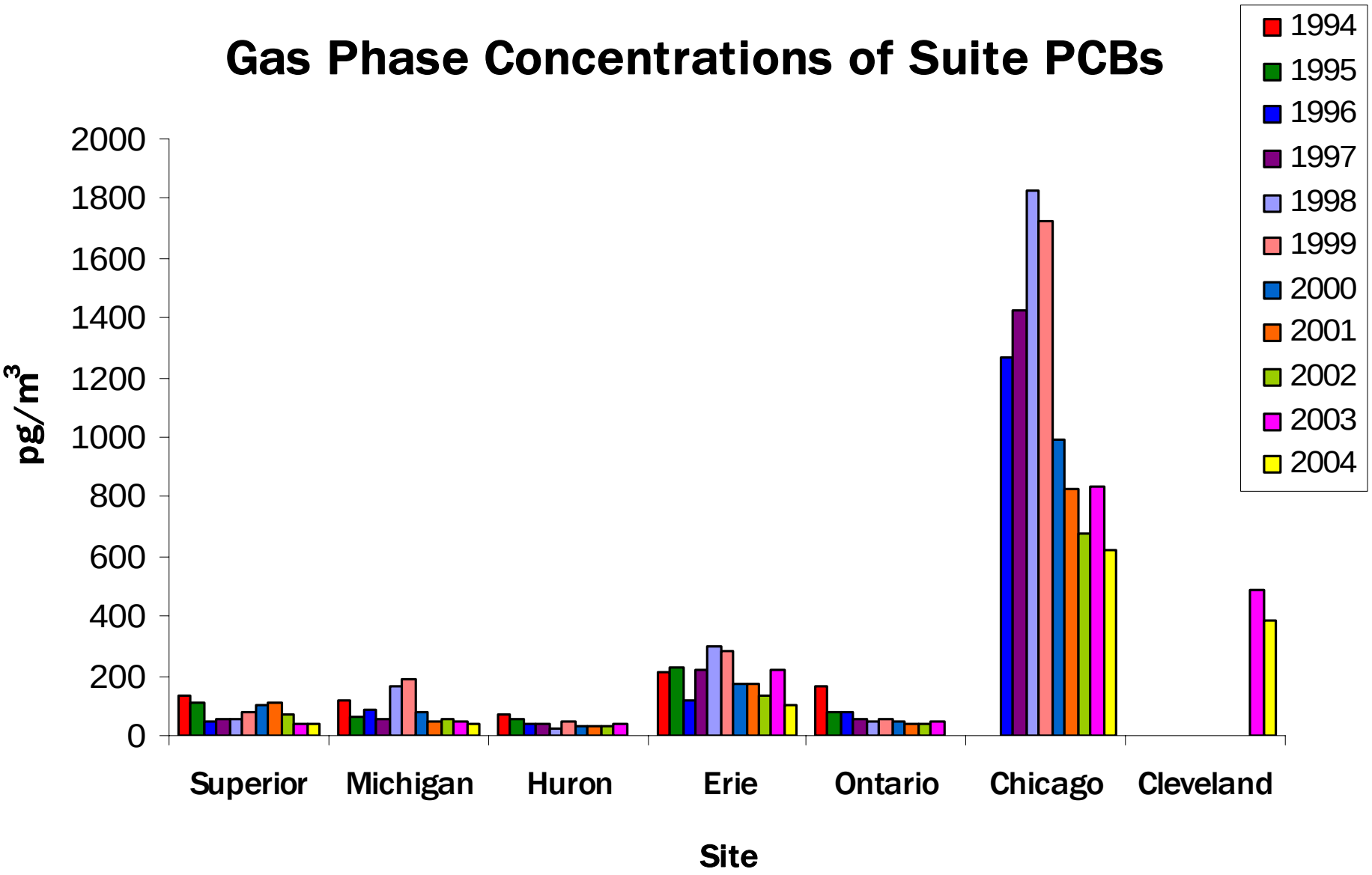
a-HCH in the gas phase (half-lives in years)



PCBs in the gas phase (half-lives in years)



Ron Hites, Indiana University


Gas Phase Concentrations of Suite PCBs
2000
1800
1600
1400
1200
1000
800
600
400
200
0
pg/m3
Superior
Michigan
Huron
Erie
Ontario
Chicago
Cleveland
Site
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004

Atmospheric Loadings Trends