Contaminants in Fish from the St. Clair River/Lake Corridor

Trends and current status

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Symposium: St. Clair River Area of Concern

June 7, 2012

Ontario

St. Clair corridor

- Contaminated fish identified in 1968-69
- Commercial fish ban
- Recognized as an AOC in 1985
- Point sources:
  - Petroleum refineries and chemical plants
  - Upper 10 km of the St. Clair River

Photo credit: Wayne Windjack

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St. Clair corridor

Several remedial actions have taken place

- Closure of chlor-alkali plant in early 1970s
- Upgrades to industrial and municipal facilities
- Dredging (1996, 2002-2004)

Recent RAP report:

- Conditions have improved
- Problems remain, including impaired “Beneficial Uses” (e.g. restrictions on fish and wildlife consumption)

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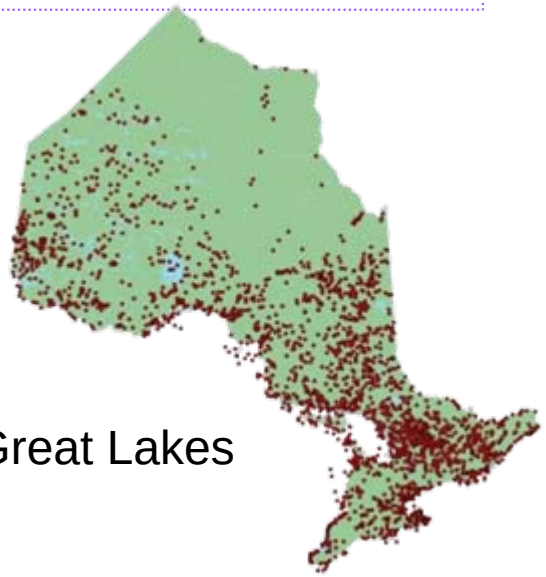
Sport Fish Contaminant Monitoring Program



Monitors contaminants

- in sport fish & juvenile fish
- Since 1970s
- Various contaminants
- ~1950 locations across Ontario and Canadian Great Lakes
- Partnership with Ministry of Natural Resources

Assesses health risk

- Partnership with Food Directorate Health Canada (Tolerable Daily Intakes)
- Develop fish advisories based on most restrictive contaminant

Communicates risk to stakeholders

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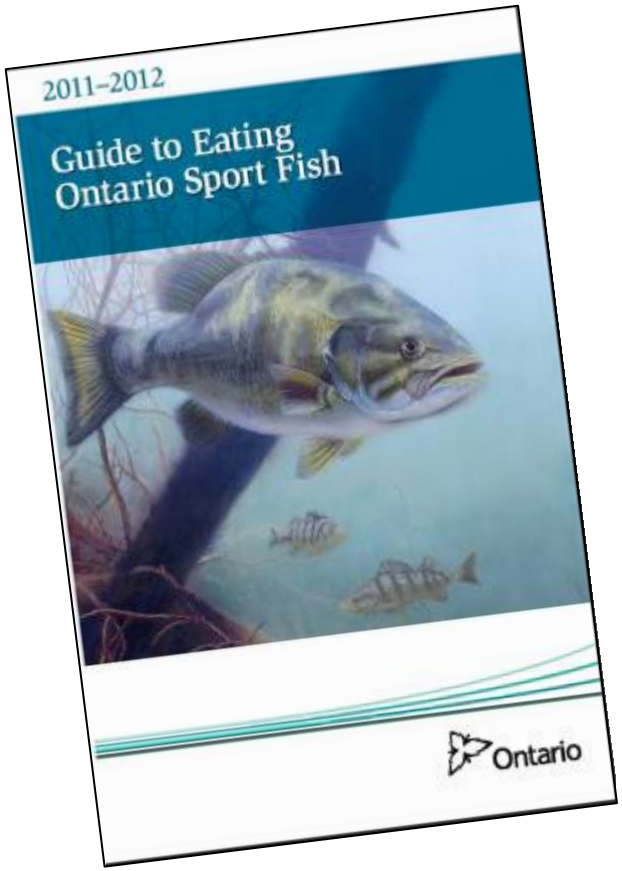
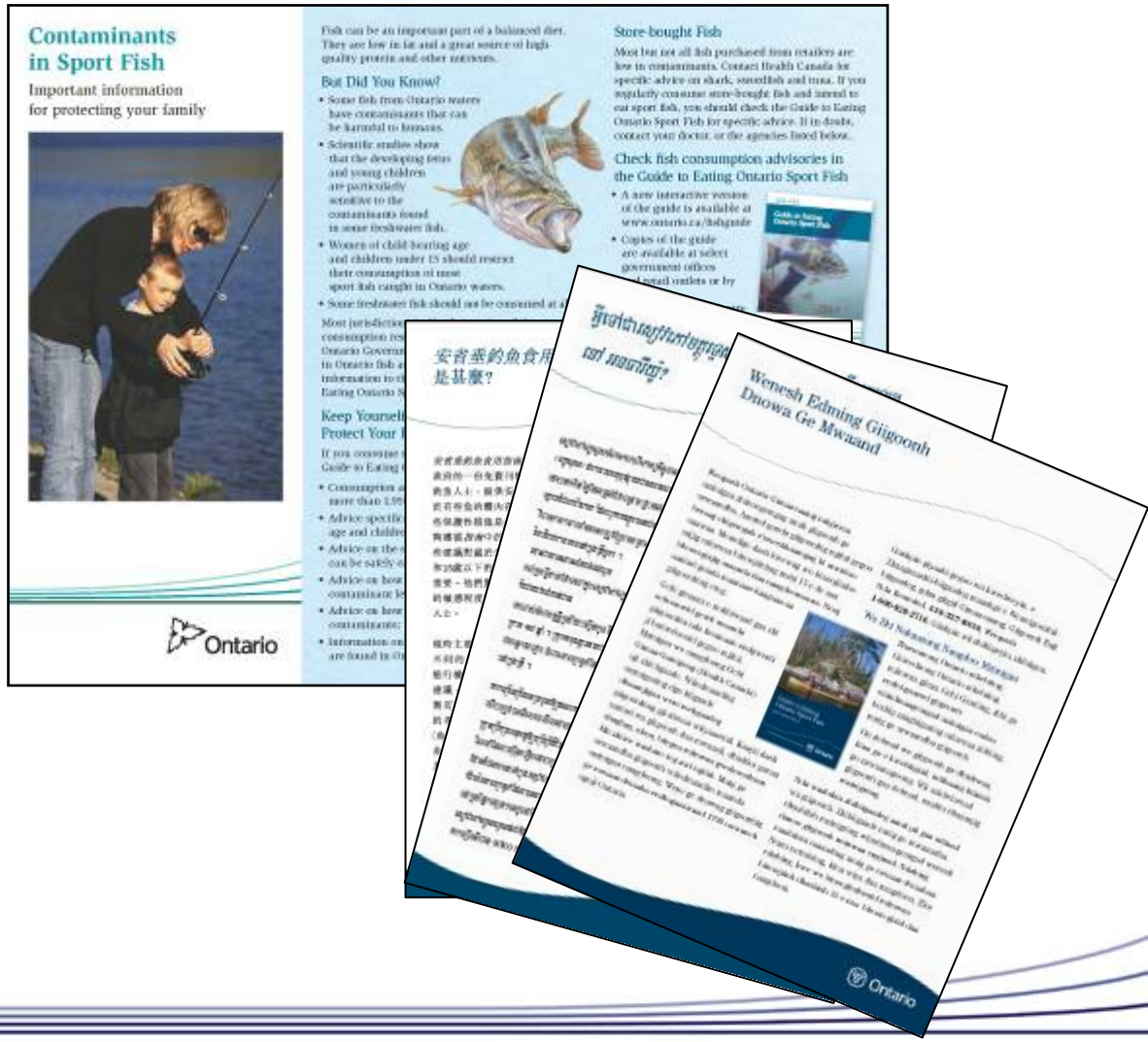
Guide to Eating Ontario Sport Fish

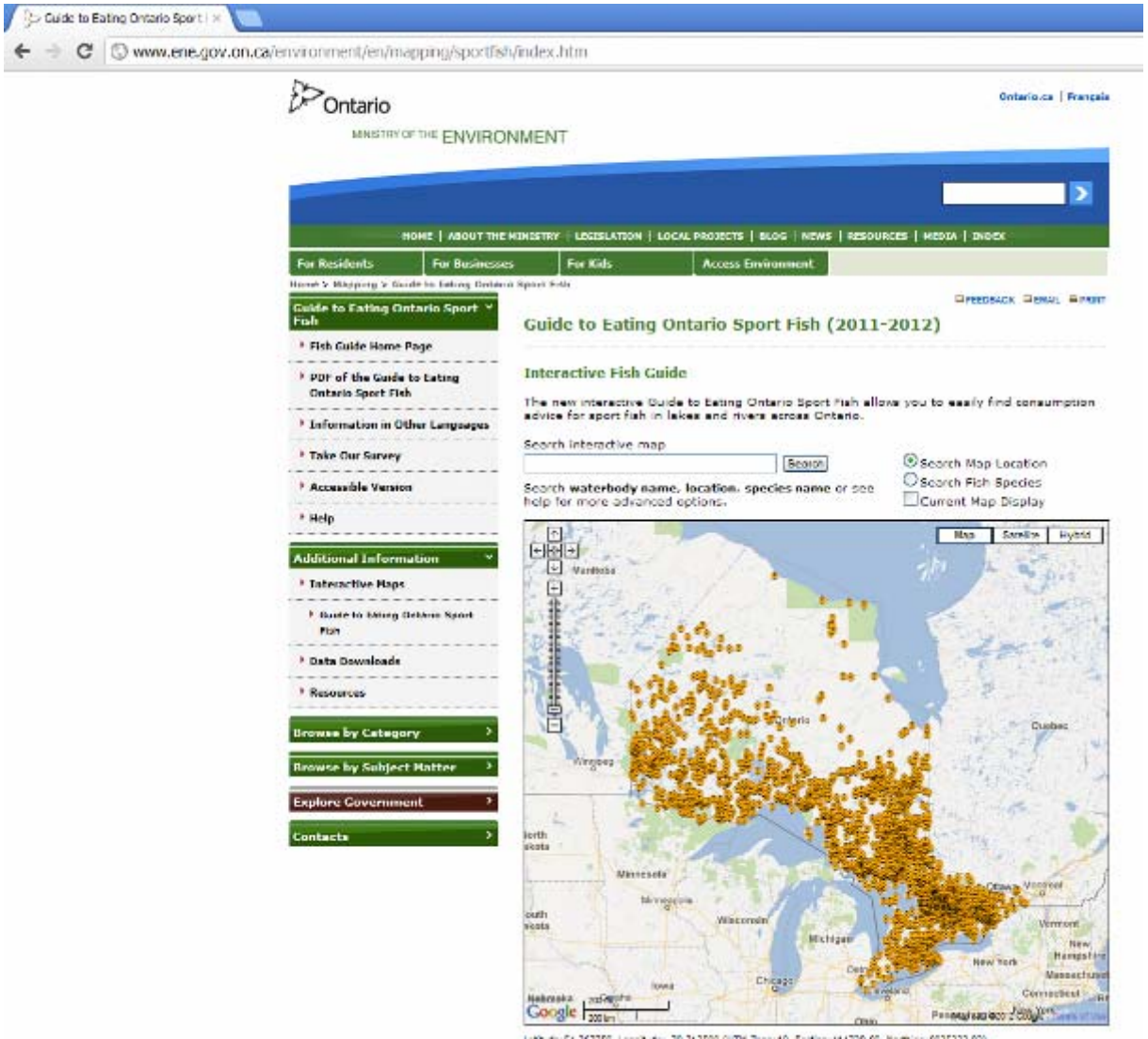
www.ontario.ca/fishguide





www.ontario.ca/fishguide

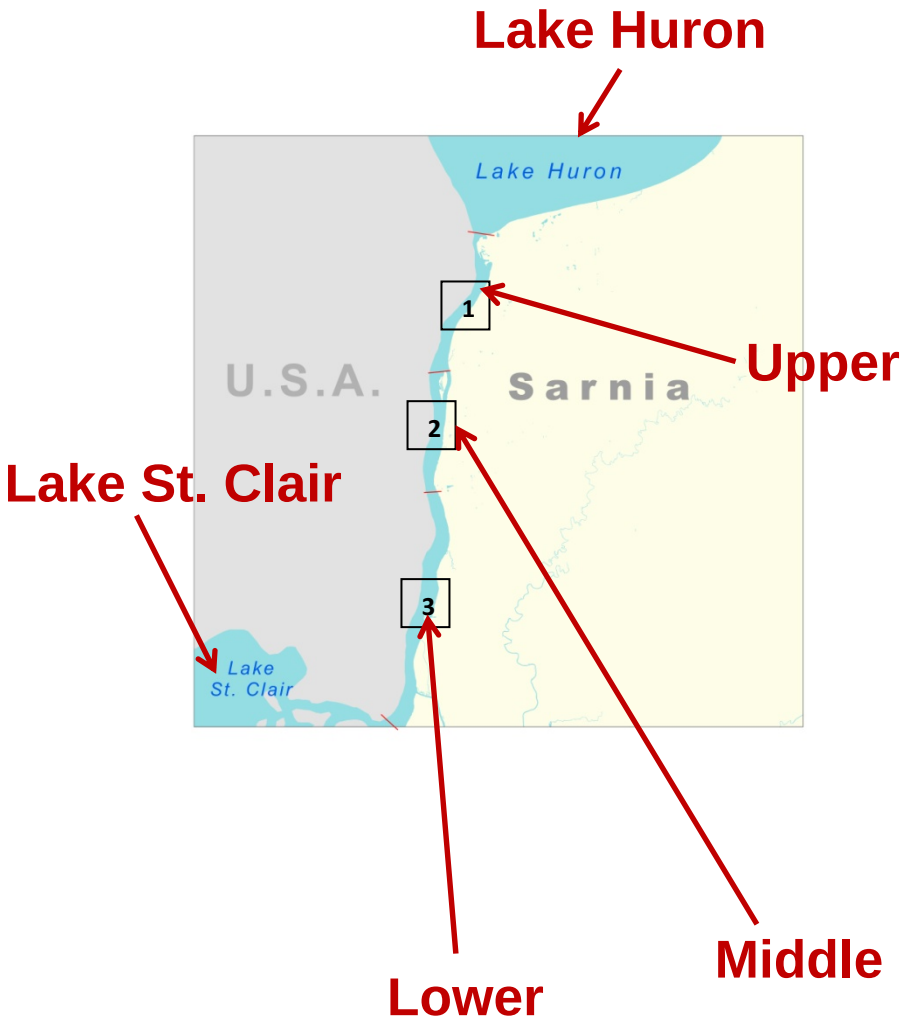
Online portal developed (March 2011) to disseminate the advisories

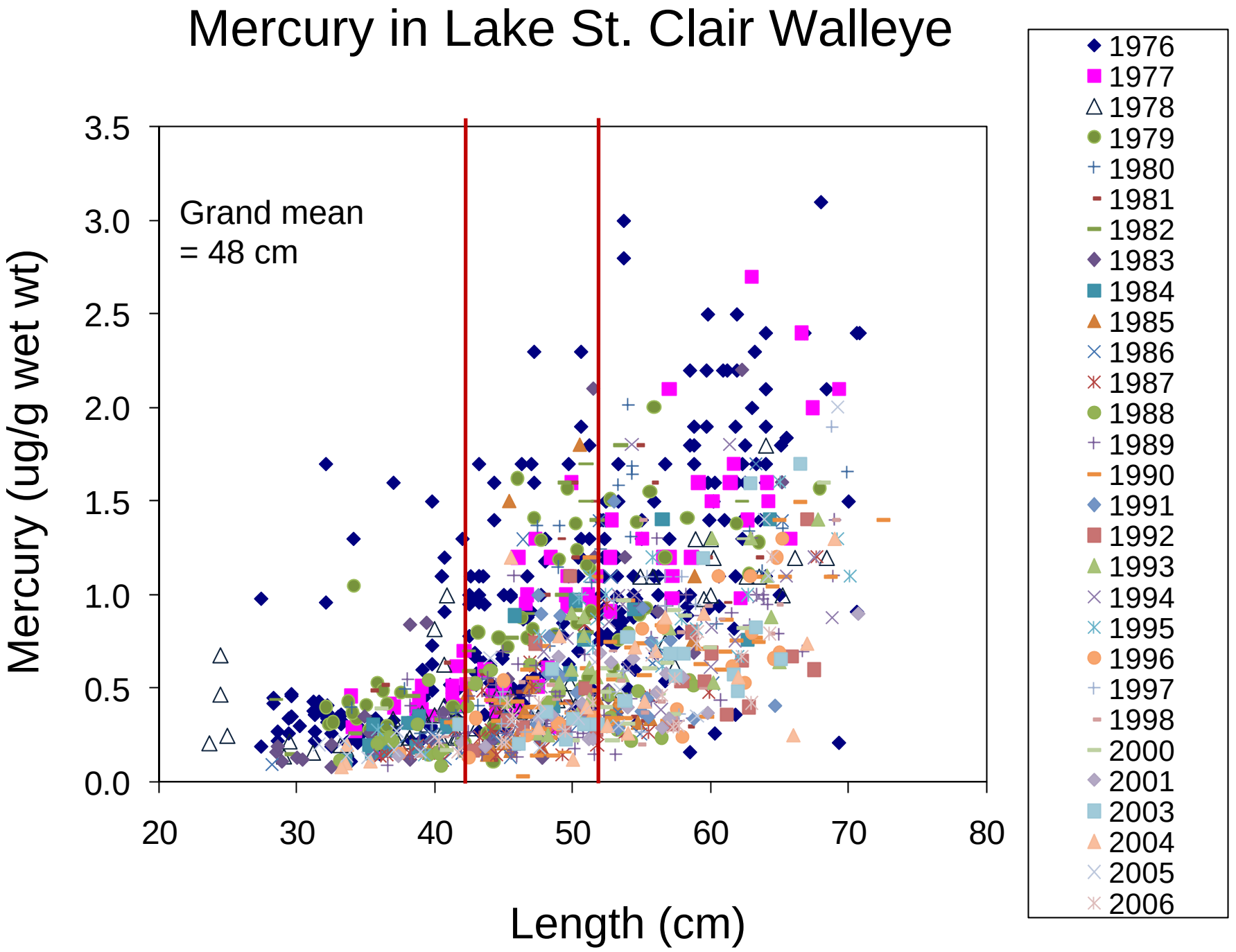


Methods

- Fish collected by the MOE and MNR
- Sport fish:
  - 3 blocks in St. Clair River + Lake St. Clair
  - Skinless, boneless dorsal fillet analyzed
- Temporal trends:

  Focused on:
  - total-PCB, Hg, OCS, HCB, and total-DDT
  - **Lake St. Clair sport fish**
  - ND values treated as dl/2




Mercury in Lake St. Clair Walleye
Grand mean
= 48 cm
Mercury (ug/g wet wt)
Length (cm)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
20
30
40
50
60
70
80
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
2000
2001
2003
2004
2005
2006

Comparison to consumption guidelines

- Fish considered: walleye, yellow perch, and carp
- Guidelines: those used in Sport Fish Guide
- All major chemicals considered:
  - Hg, total-PCB, OCS, HCB, total-DDT, mirex, photomirex, toxaphene, chlordane, PCDD/F, DL-PCB
- All lengths considered; St. Clair River/Lake fish included
- Analysis performed on data from 1999 onwards
  - Assumed to represent current conditions
  - No changing trends during time period

Results:
Temporal trends

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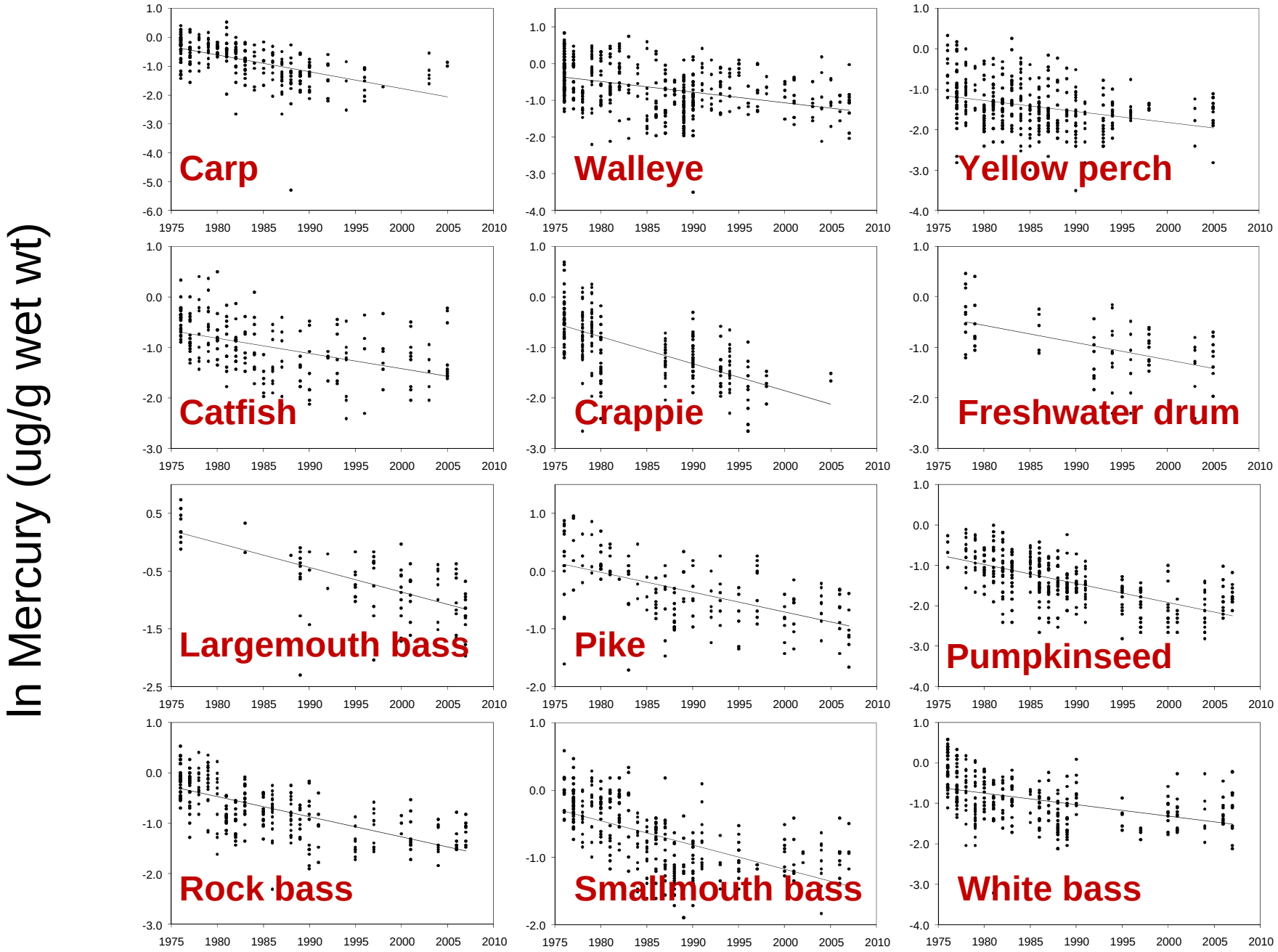
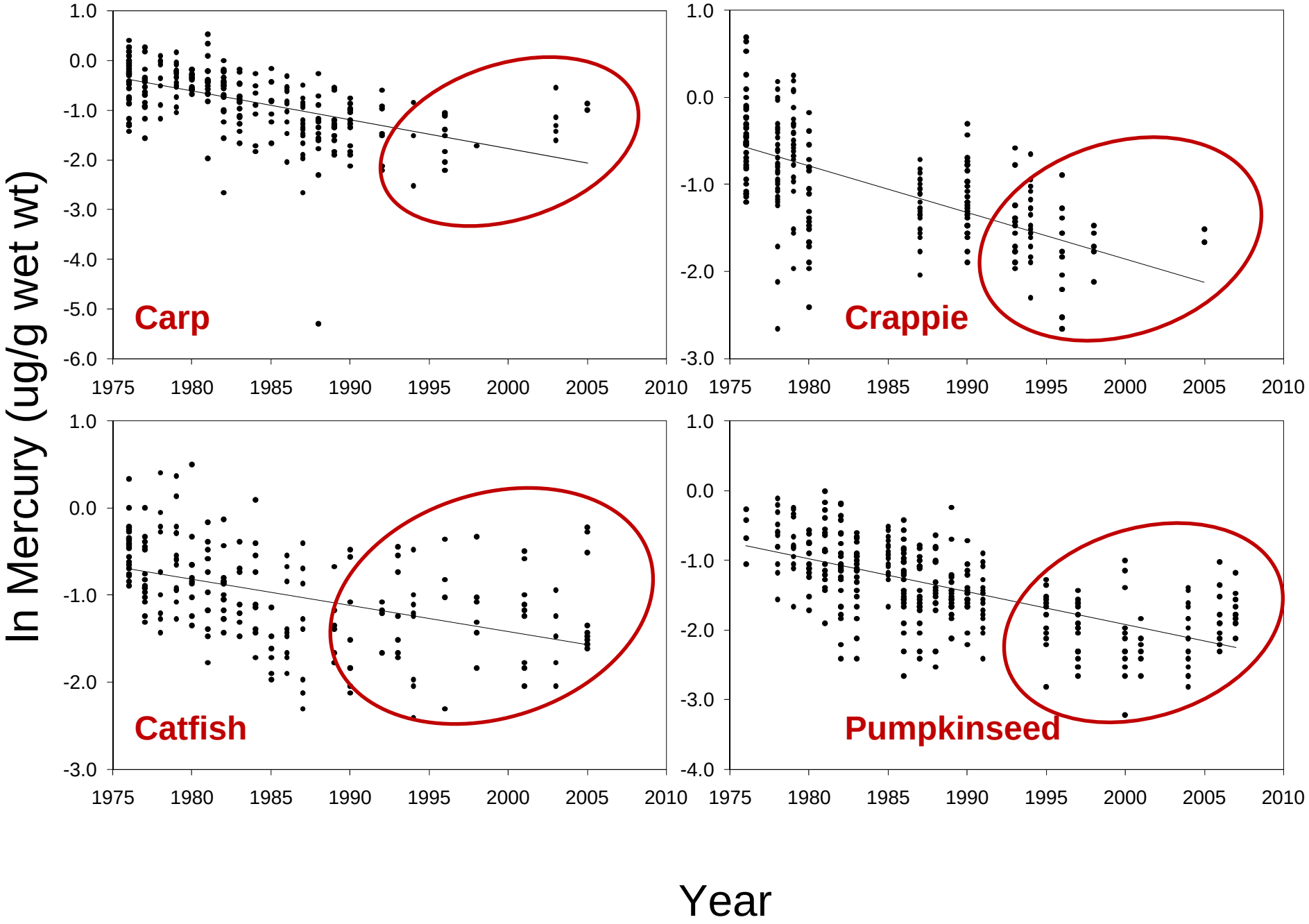
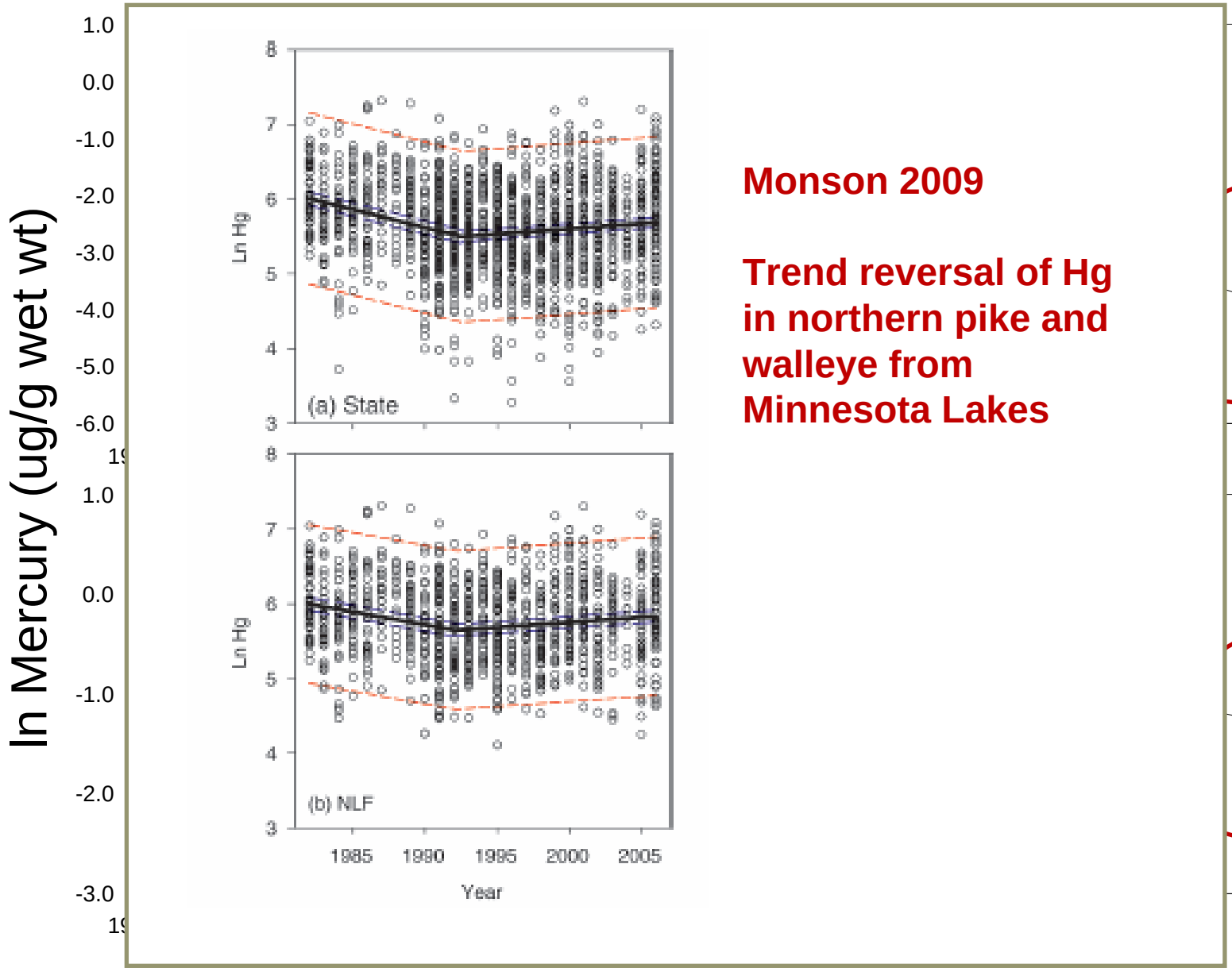
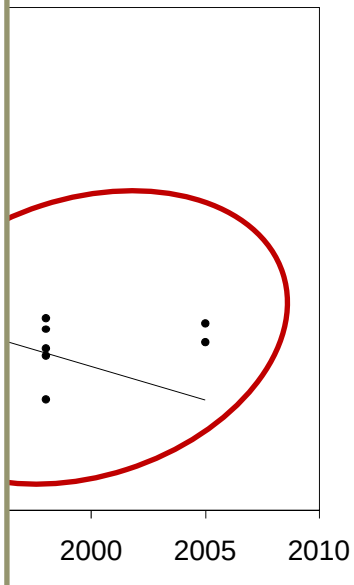

ln Mercury (ug/g wet wt)
Carp
Walleye
Yellow perch
Catfish
Crappie
Freshwater drum
Largemouth bass
Pike
Pumpkinseed
Rock bass
Smallmouth bass
White bass
Year

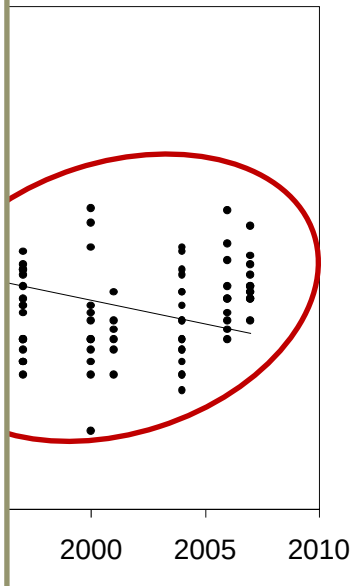

ln Mercury (ug/g wet wt)
Year
Carp
Crappie
Catfish
Pumpkinseed
1.0
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
1975
1980
1985
1990
1995
2000
2005
2010



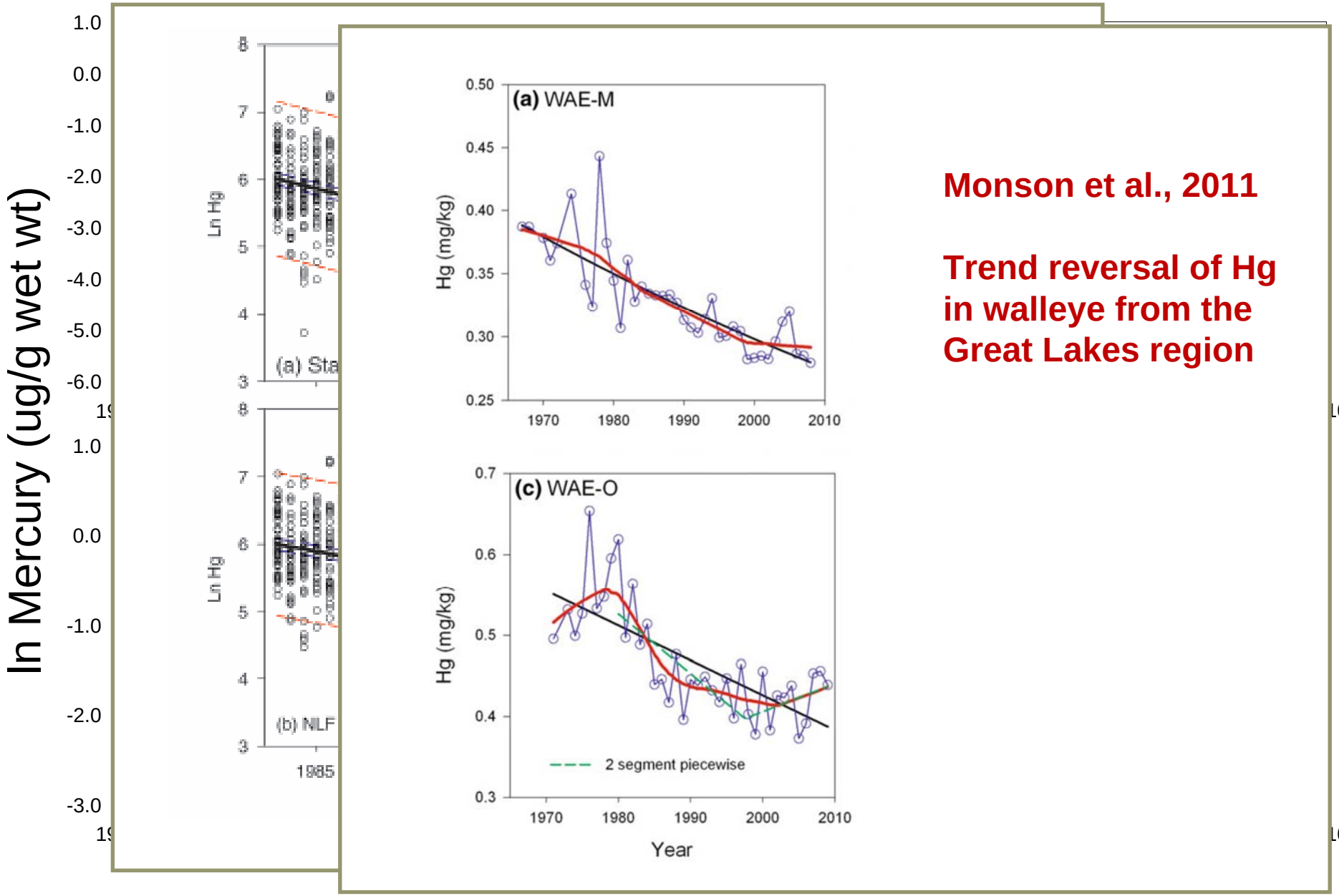
Monson 2009

Trend reversal of Hg in northern pike and walleye from Minnesota Lakes





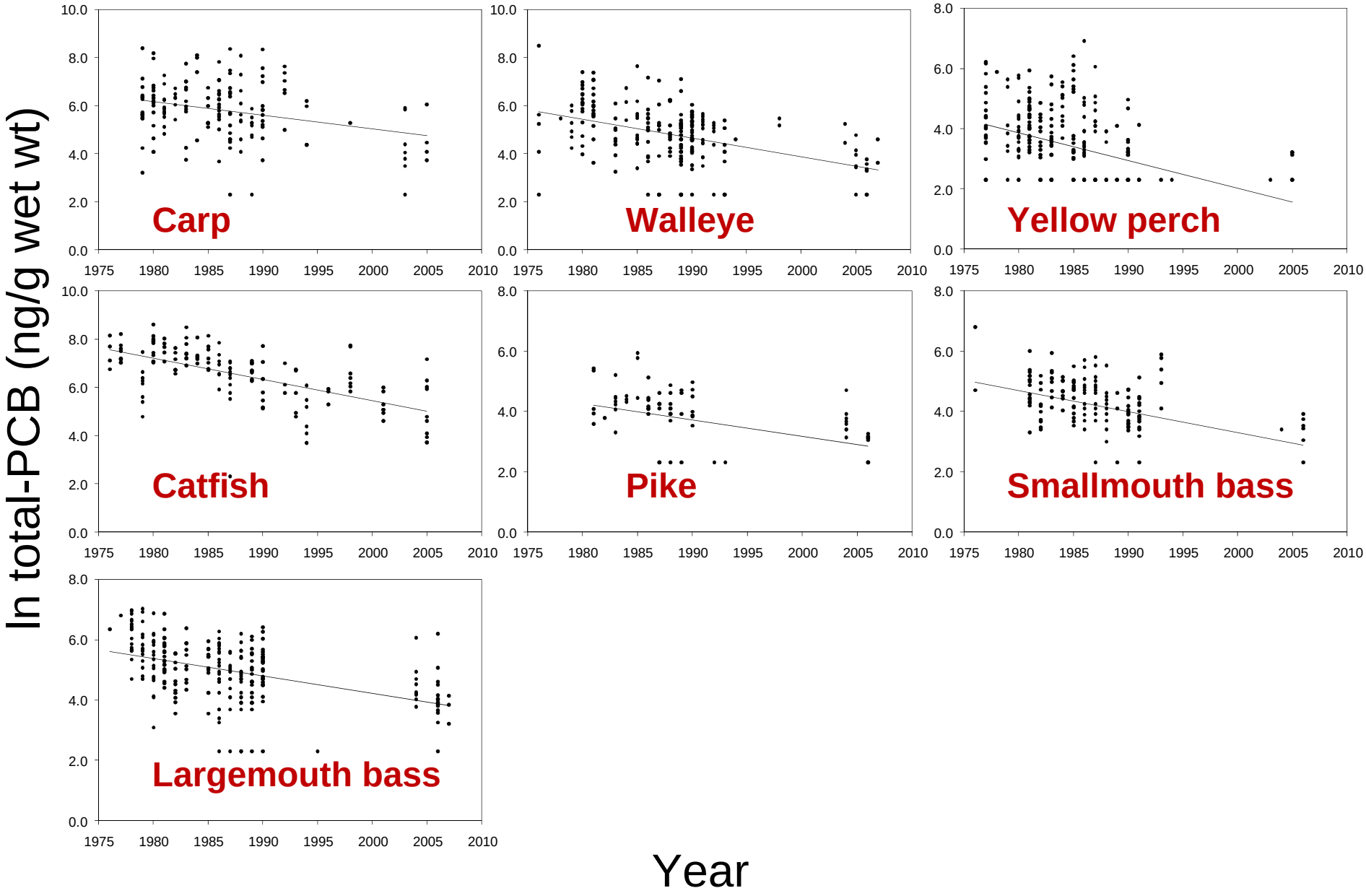
Year



Monson et al., 2011

Trend reversal of Hg in walleye from the Great Lakes region

Total-PCB


ln total-PCB (ng/g wet wt)
Carp
Walleye
Yellow perch
Catfish
Pike
Smallmouth bass
Largemouth bass
Year

Contaminant pattern hypotheses?

- Initial rapid declines
  - Control of point source contamination
  - Hg: Chlor-alkali plant closure in early 1970s
  - PCBs and DDT: production banned in 1970s
  - PCB discharges restricted in Sarnia area
  - OCS: Phase-out by chlorine industry in 1970s
- Slowing of rate of decrease since the mid-1980s/mid-1990s
  - Relative importance:
    - ↓point source
    - ↑ sediment and atmosphere
  - Changes to food web processes

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Results:
Comparison to consumption guidelines

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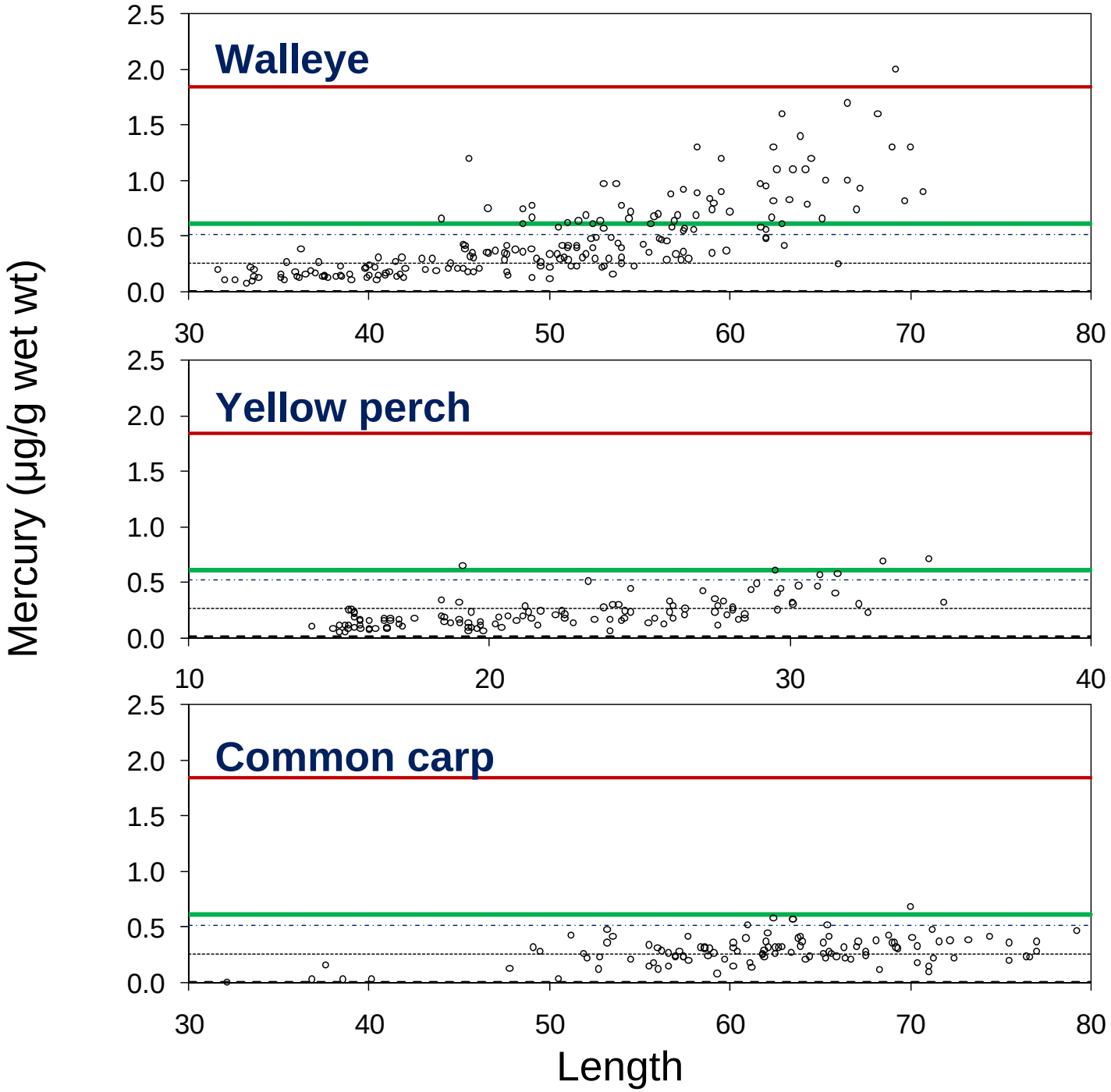
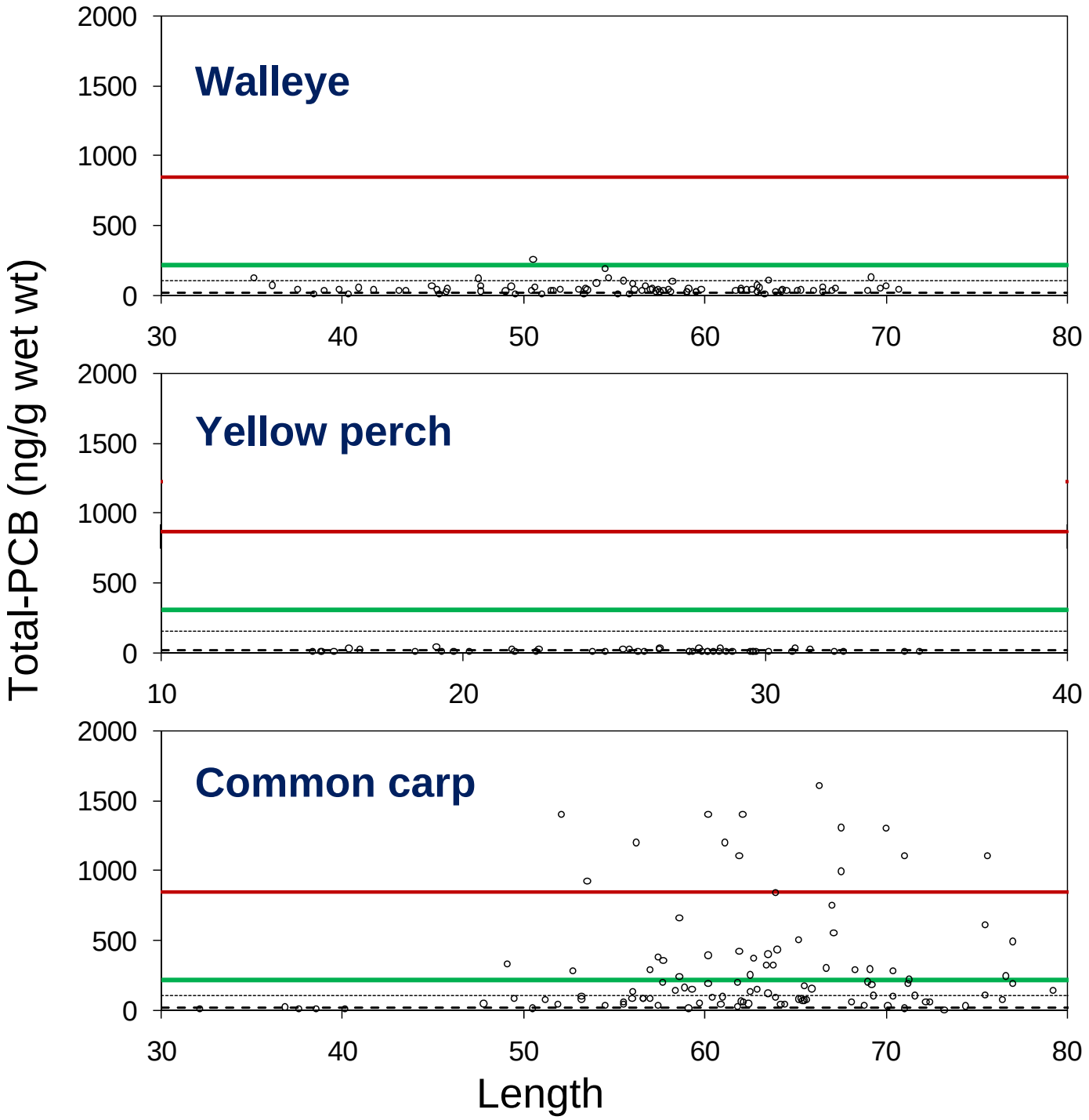
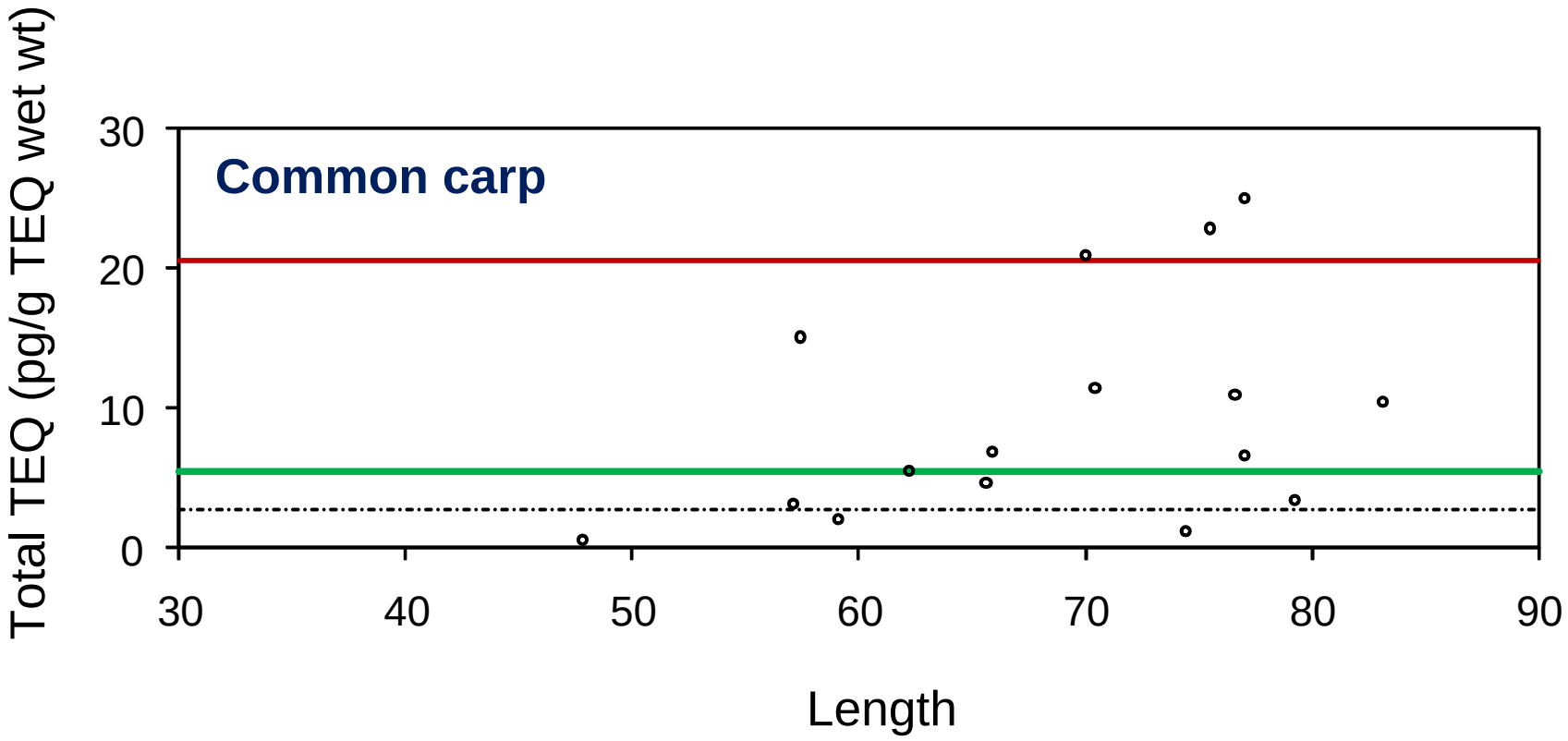
Hg


Walleye
Yellow perch
Common carp
Mercury (µg/g wet wt)
Length
2.5
2.0
1.5
1.0
0.5
0.0
30
40
50
60
70
80
10
20
30
40

PCB


Walleye
Yellow perch
Common carp
Total-PCB (ng/g wet wt)
Length
2000
1500
1000
500
0
30
40
50
60
70
80
10
20
30
40

PCDD/F and DL-PCB



Fish Consumption Advisories

- Compared current advisories from 3 blocks in St. Clair River, Lake St. Clair and lower Lake Huron
- Categorized restrictions as:
  - Unrestricted (8 meals/mo)
  - Partial restriction (4,2,1 meals/mo)
  - Complete restriction (0 meals/mo)
- Comparison of overlapping size ranges of common species only

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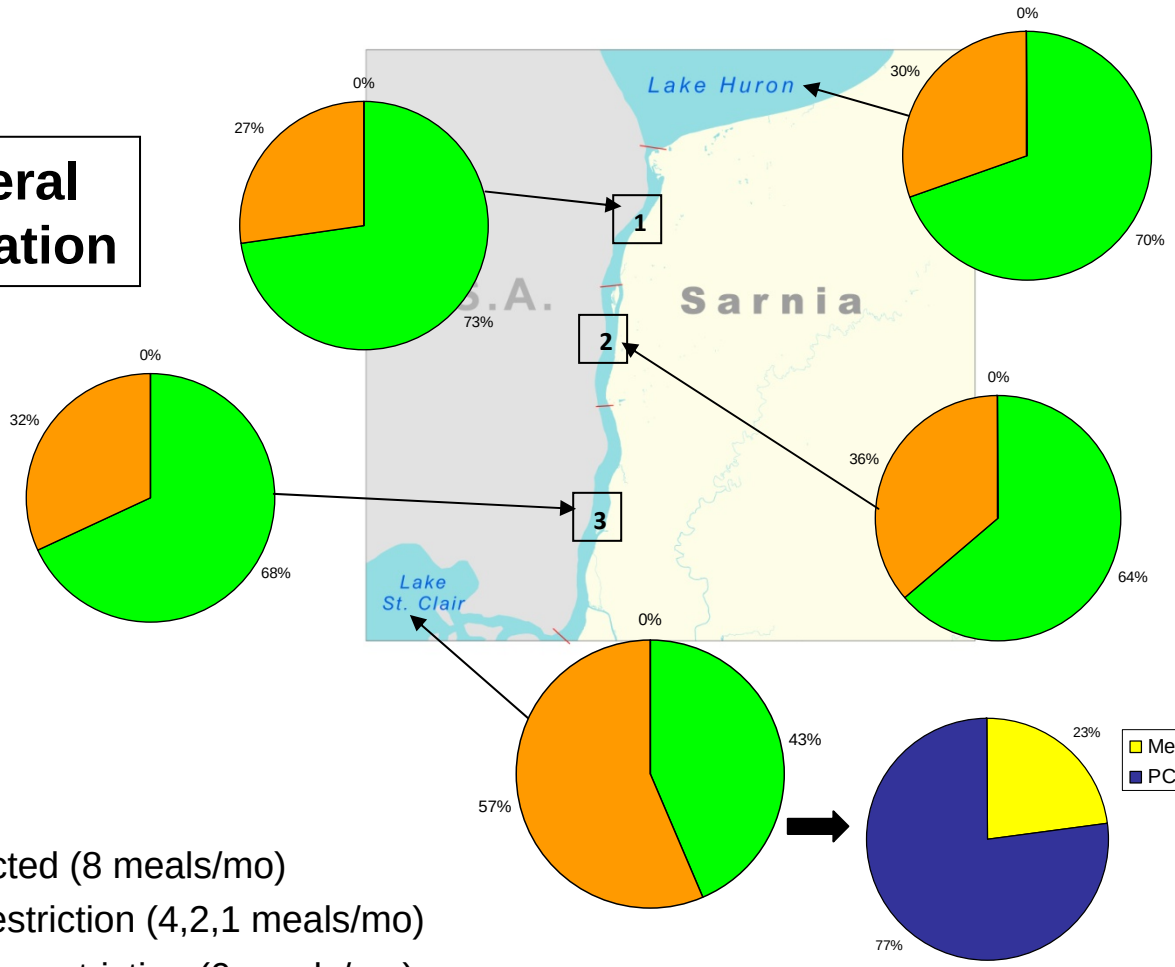
Fish Consumption Advisories - Spatial

General Population



Species compared

Carp (45-75cm)

Freshwater Drum (35-45cm)

Walleye (25-55cm)

White Sucker (25-45cm)

Yellow Perch (15-35cm)

PCBs generally cause all restrictions

- Unrestricted (8 meals/mo)
- Partial restriction (4,2,1 meals/mo)
- Complete restriction (0 meals/mo)

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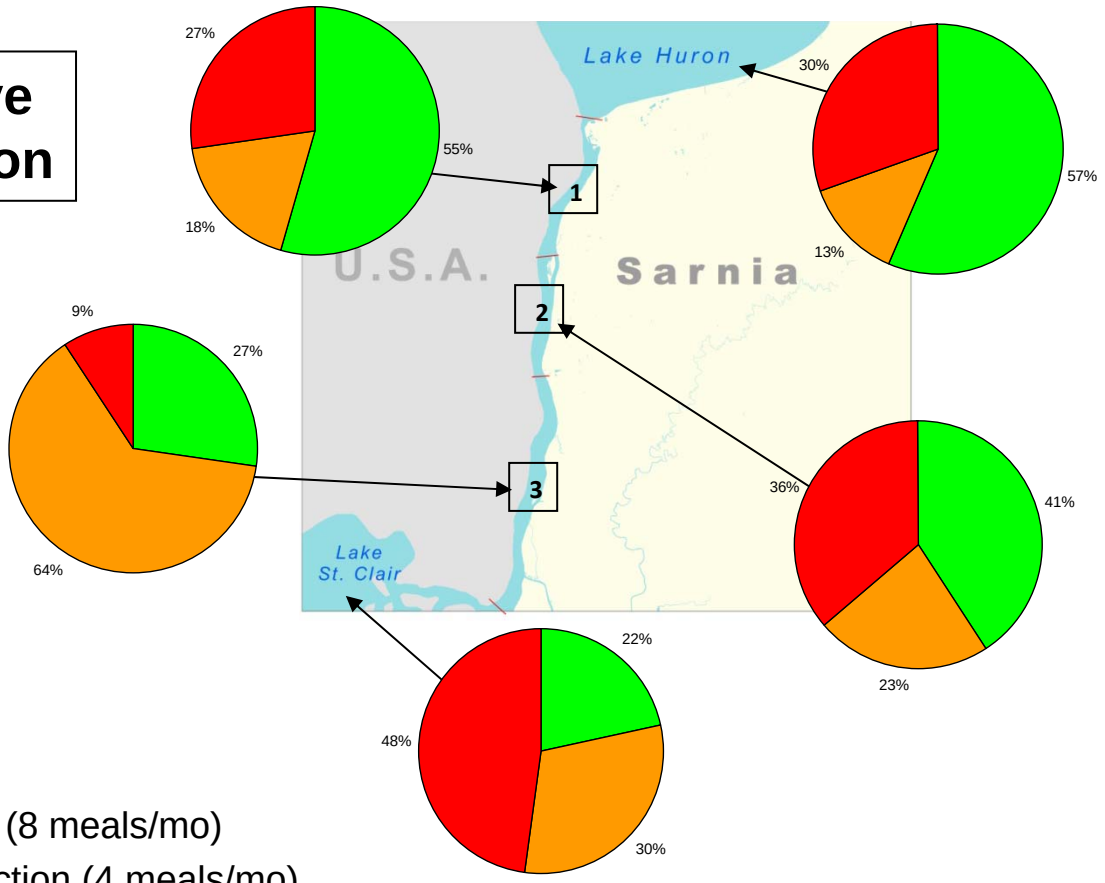
Fish Consumption Advisories - Spatial

Sensitive Population



Species compared

Carp **(45-75cm)**

Freshwater Drum **(35-45cm)**

Walleye **(25-55cm)**

White Sucker **(25-45cm)**

Yellow Perch **(15-35cm)**

- Unrestricted (8 meals/mo)
- Partial restriction (4 meals/mo)
- Complete restriction (0 meals/mo)

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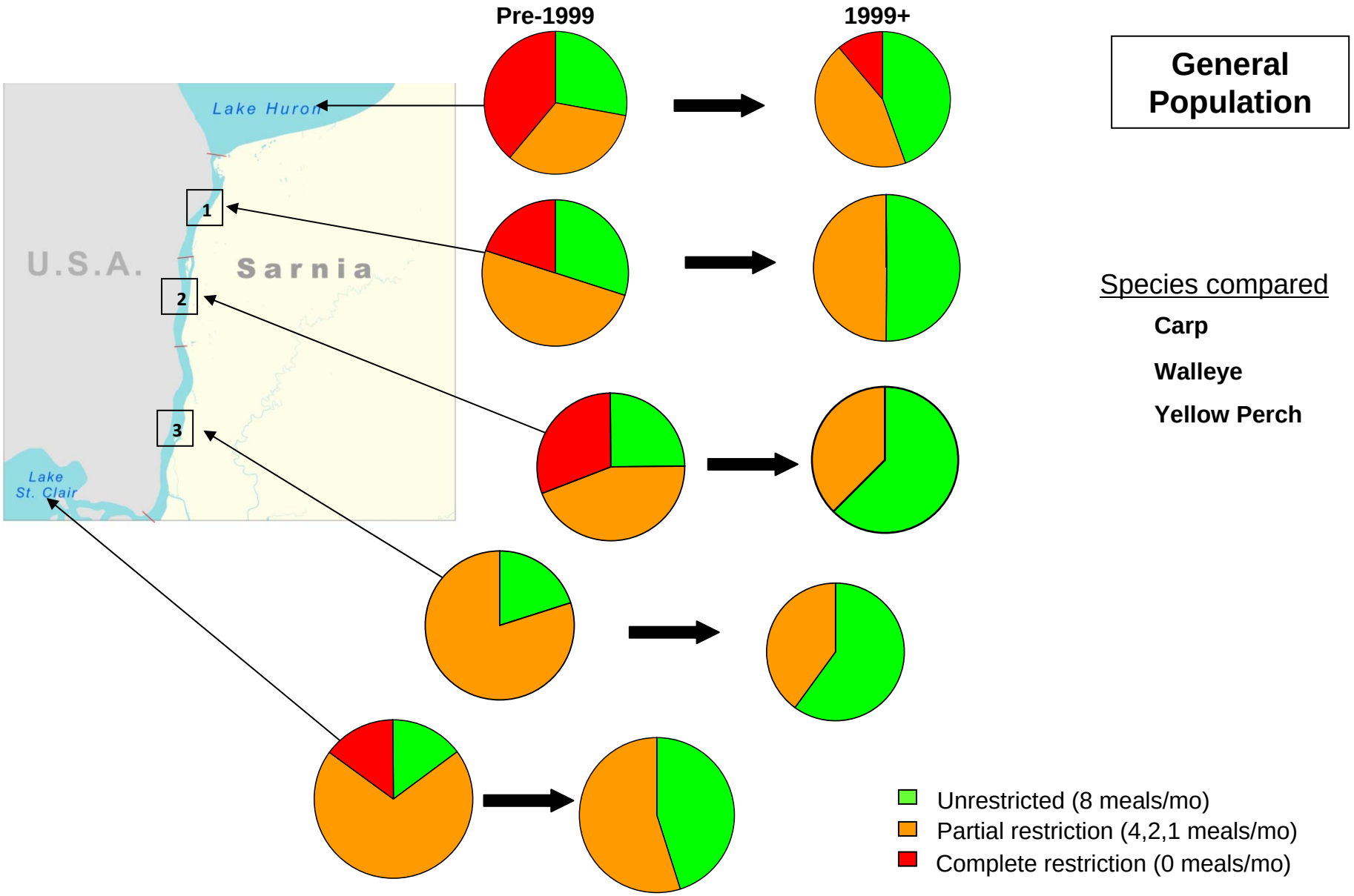
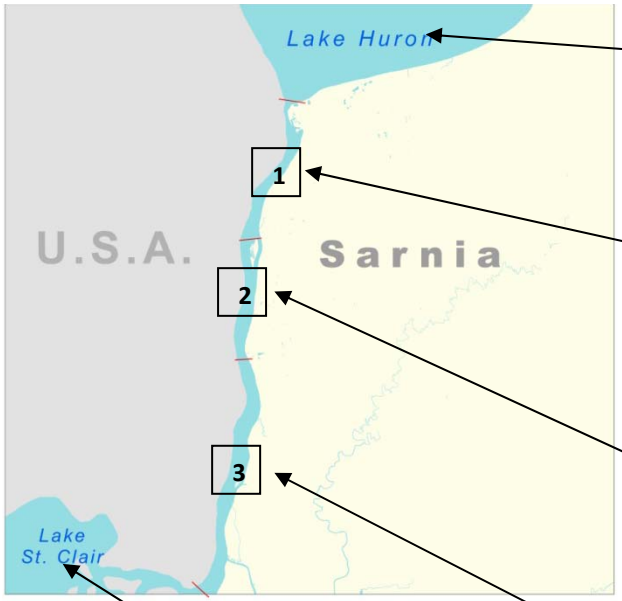
Fish Consumption Advisories – Temporal



Fish Consumption Advisories – Temporal



Pre-1999 1999+

Sensitive Population

Species compared

Carp

Walleye

Yellow Perch

Unrestricted (8 meals/mo)
Partial restriction (4 meals/mo)
Complete restriction (0 meals/mo)

Conclusions

- ↓ PCBs, Hg, OCS, HCB, and DDT
- 1970s – 1990s
  - Sources: industry along St. Clair River
- 1980s/1990s onwards
  - Concentrations stabilized
  - Sources: Atmospheric and sediment
- Hg trend reversal in some species; further monitoring necessary

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Conclusions

- Mercury and PCBs still pose a risk to human fish consumers
- Larger sized walleye and carp are a problem
- Given that rate of decline is slowing, natural recovery may be slow
- Decreases in fish tissue concentrations have improved consumption restrictions over time
- More thorough assessment needed to determine if BUI “restored”
- Challenge: ecosystem changes (Hg); appropriate reference area

Acknowledgements

- Lisa Richman (OMOE)
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- Staff at the Laboratory Services Branch (OMOE)

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