Contaminant trends in Lake Erie fish and possible impact of invasive species

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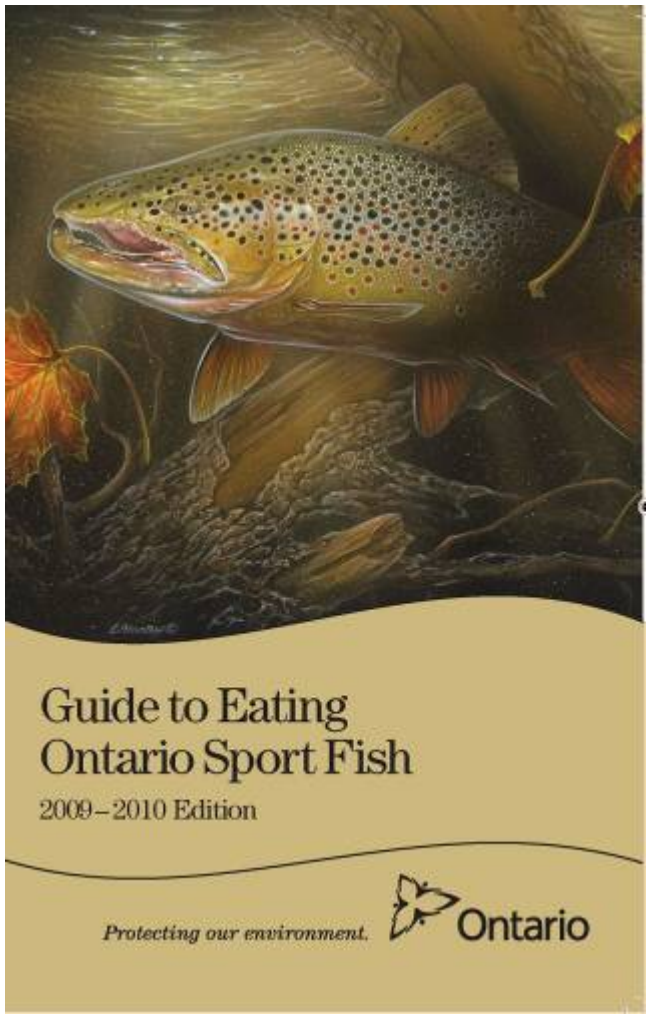
Ontario Ministry of the Environment

OMOE - Sport Fish Contaminant Monitoring Program (SFCMP)

- Monitors contaminants
  - in Sport fish & Juvenile fish
  - Since 1970s
  - Various contaminants (eg, PCBs, dioxins, Hg, pesticides)
  - >1850 locations across Ontario and Canadian Great Lakes
- Assesses health risk
  - Partnership with Health Canada
  - Develop fish advisories based on most restrictive contaminant
- Communicates risk to public

Fish consumption advisories



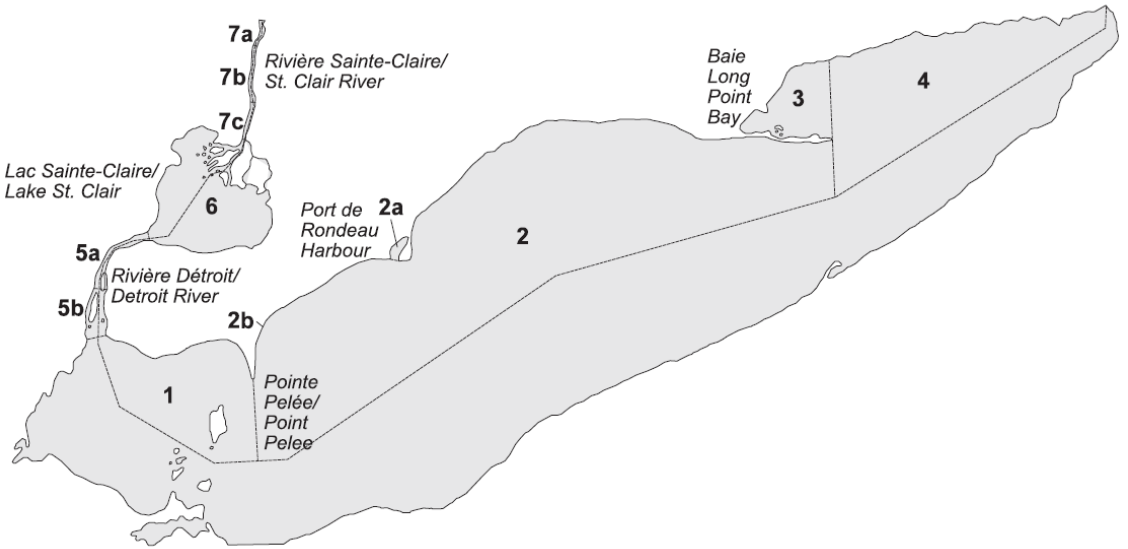
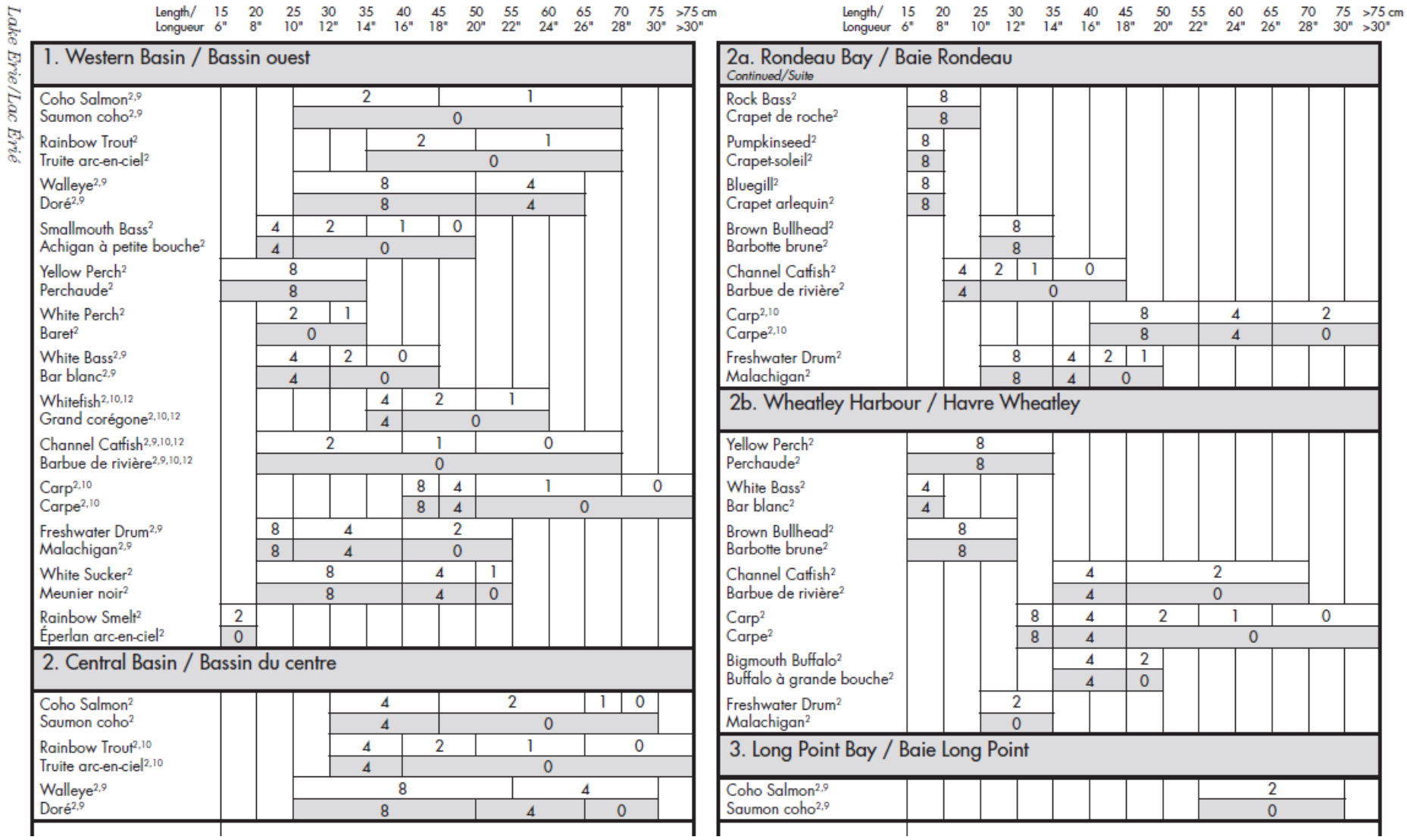
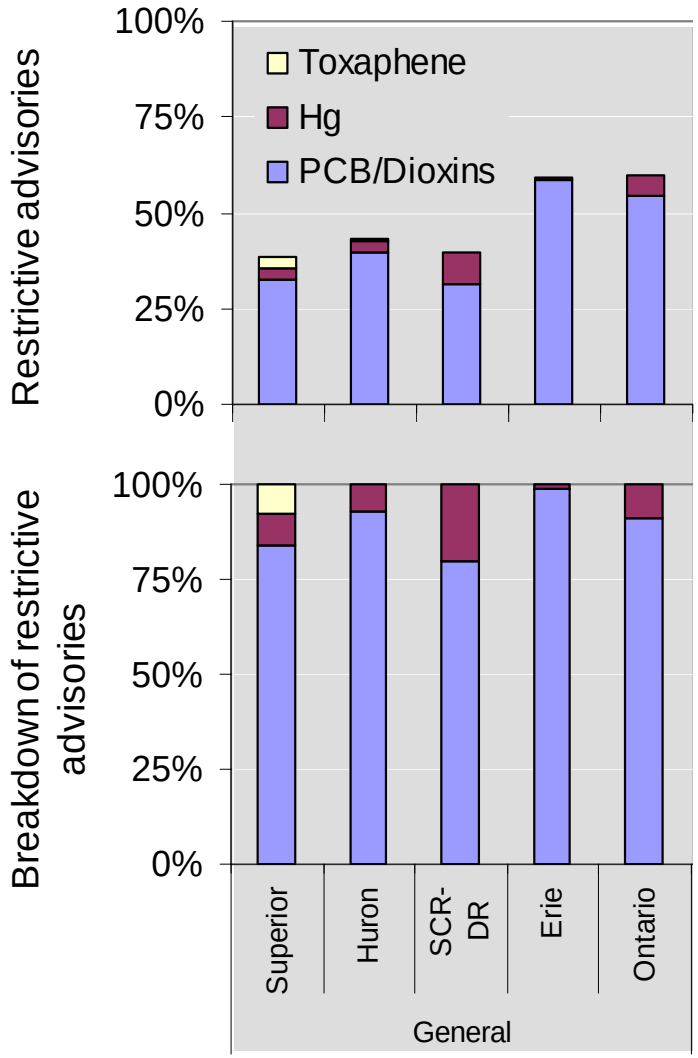


Illustration of restrictions advised for Lake Erie fish consumption due to contaminants



Chemical contaminants in fish

Analysis of fish consumption advisories



Lk Erie:

Restrictions are among the highest in the Great Lakes

PCB is major contaminant causing restrictions

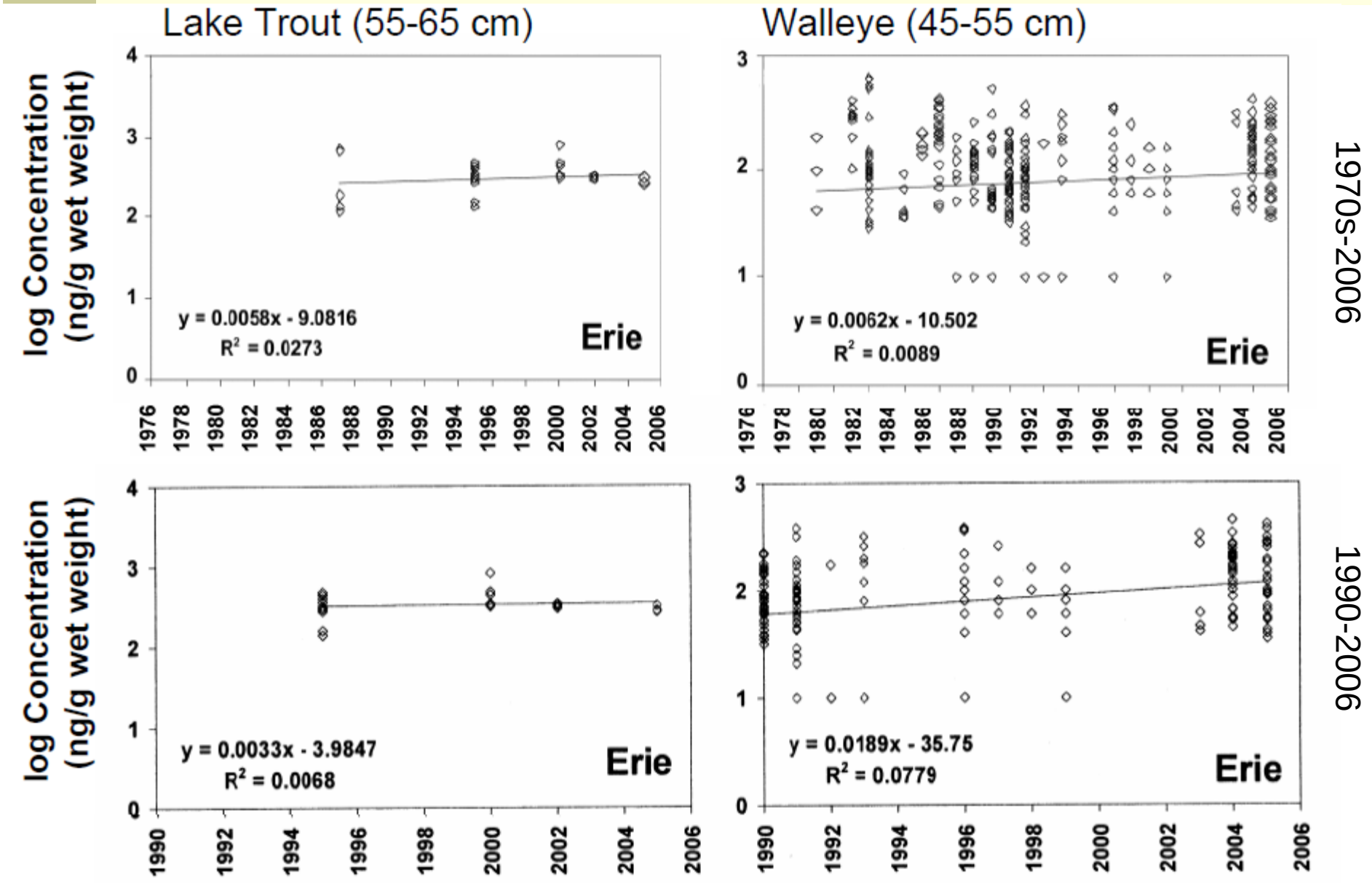
PCB trends

Lake trout

Walleye

PCB trends (fish-fillet, OMOE)

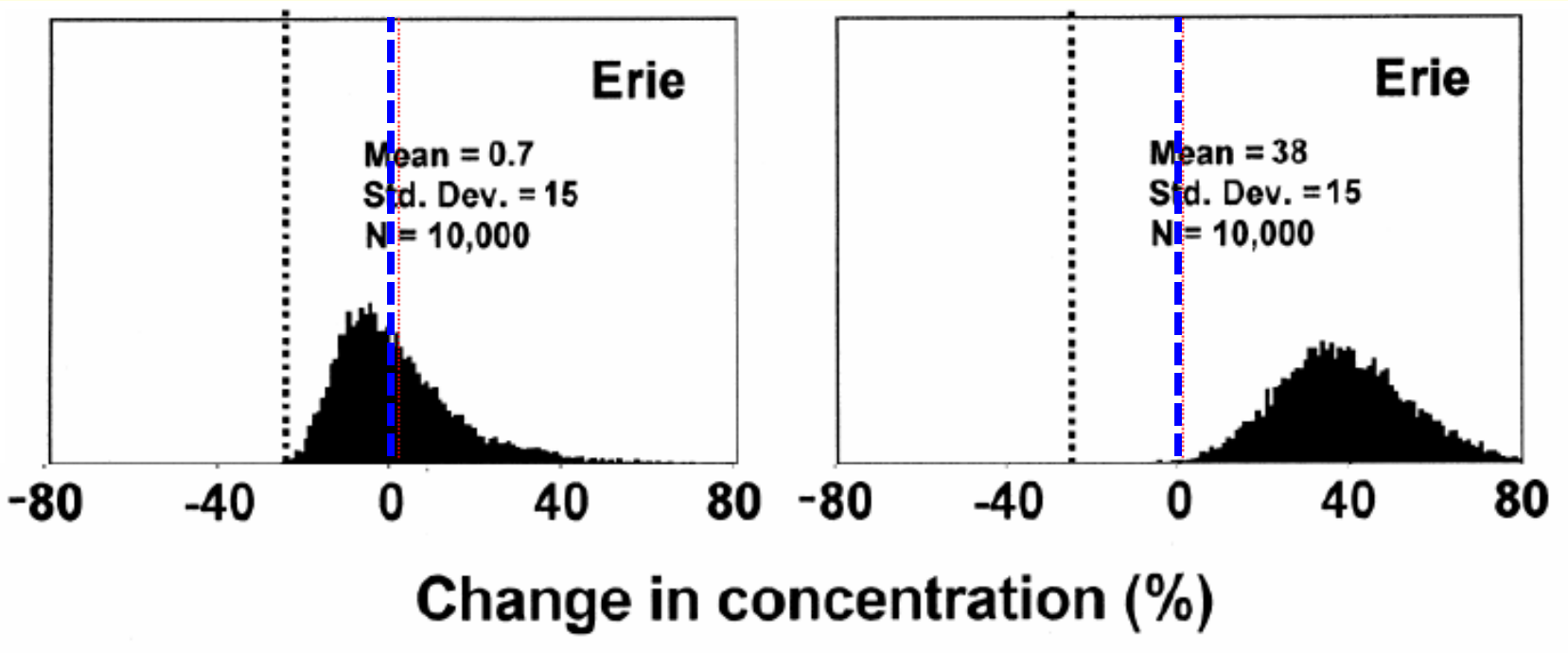
Bhavsar et al. 2007 JGLR



PCB conc. change (2000-2007)
based on 1990-2006 trend analysis

55-65cm Lake trout

45-55cm Walleye

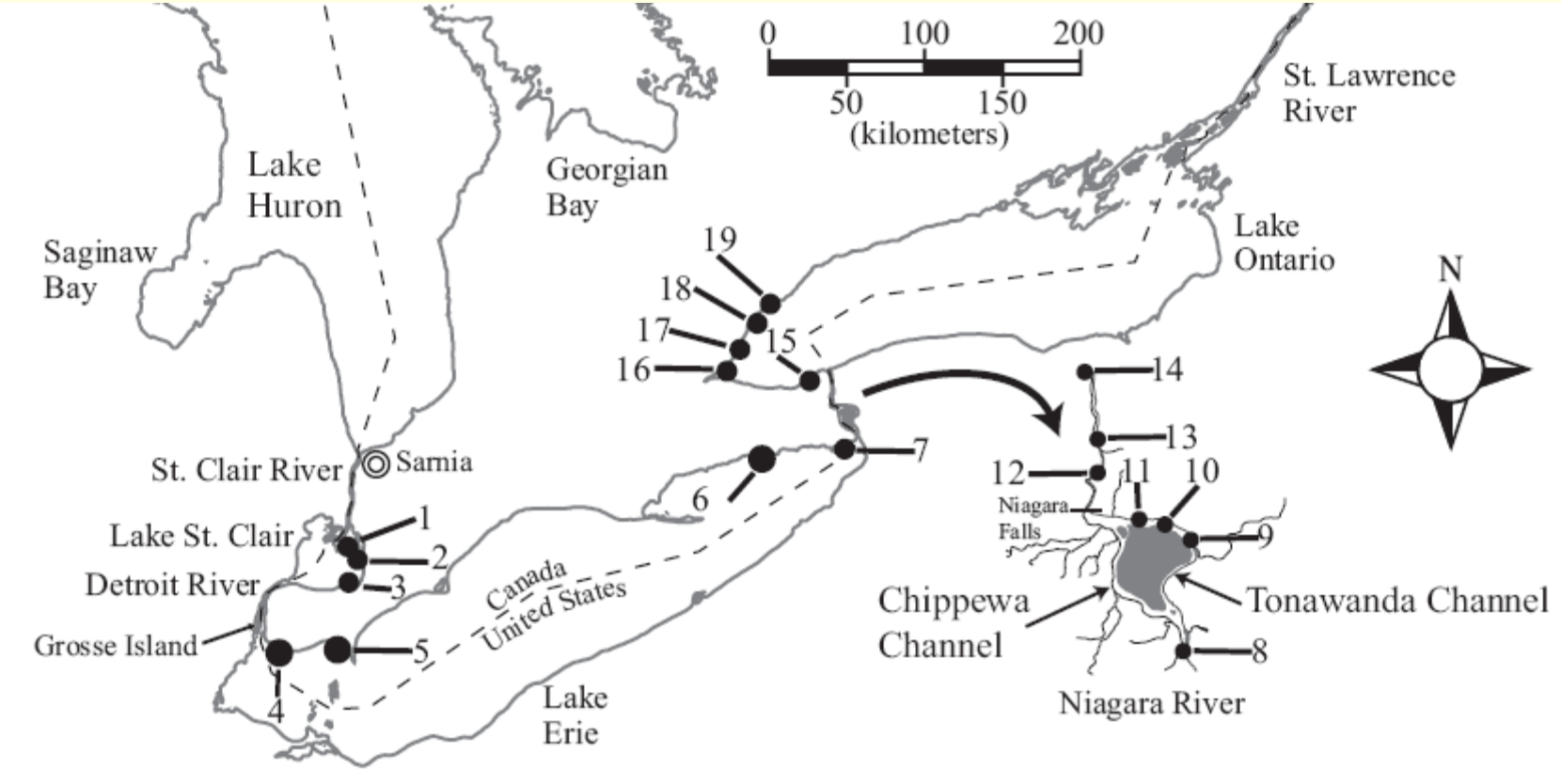


Bhavsar et al. 2007 J. Great Lakes Res. 33:592-605

PCB trends

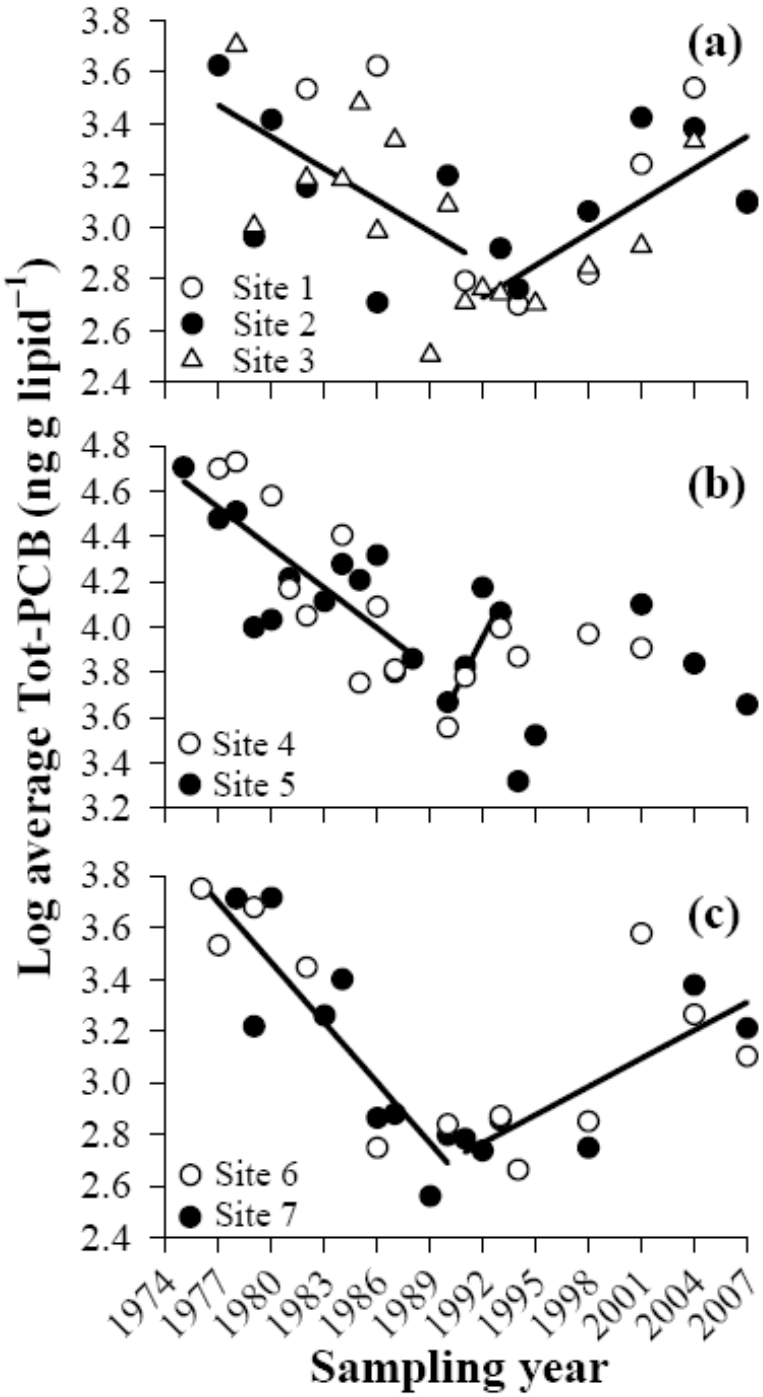
Spottail shiner (forage fish)

Forage fish (sampling locations, OMOE)



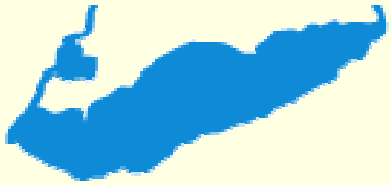
Forage fish (spottail shiner), PCB trends (OMOE)

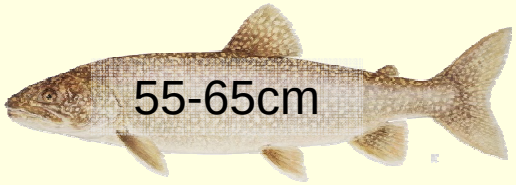
French et al., In prep



Hg trends

Bhavsar et al. 2010, ES&T online

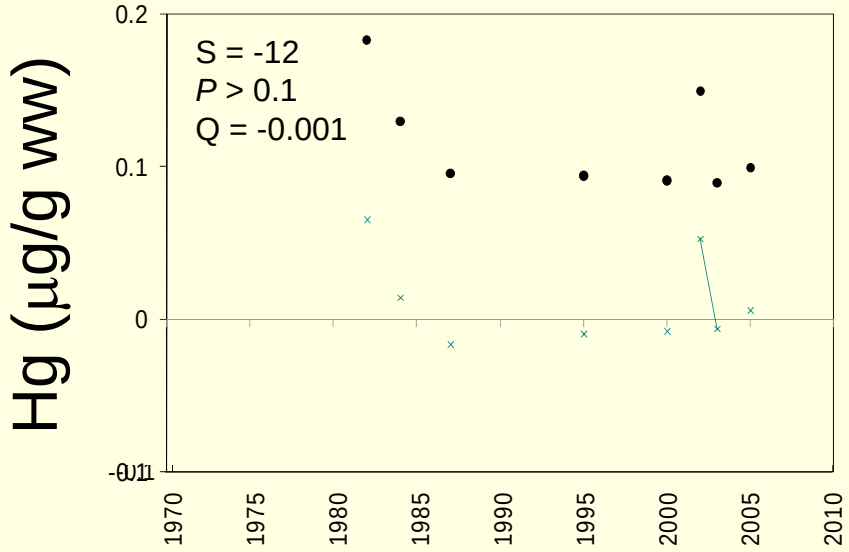




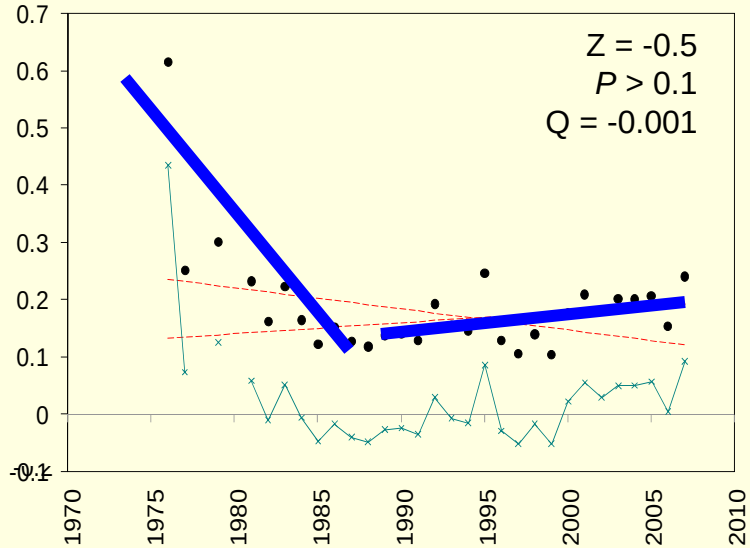
1970s-2007
Fillet, OMOE

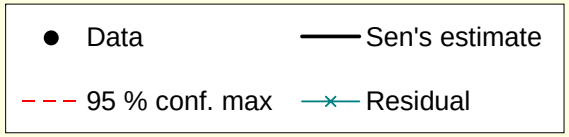
Hg trend: Erie, fish-fillet (OMOE)

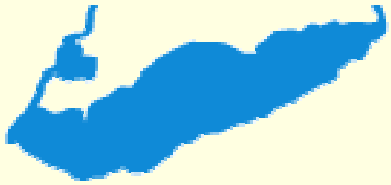
55-65cm Lake trout

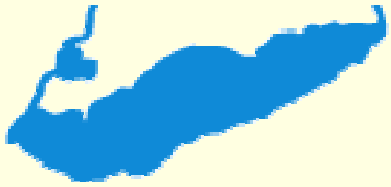


45-55cm Walleye





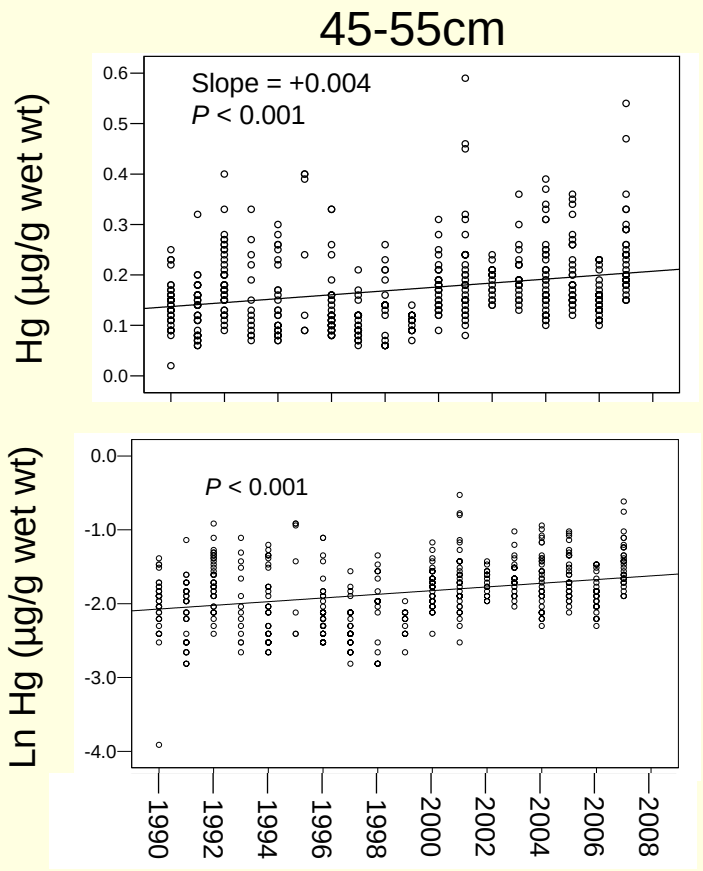


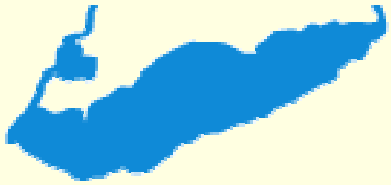


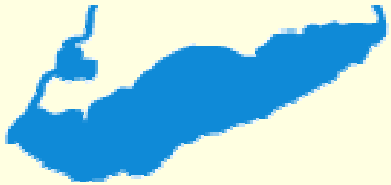
1970s-2007
Fillet, OMOE

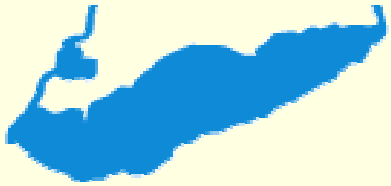
1990-2007
Fillet, OMOE

Hg trend: Erie, walleye-fillet (OMOE)







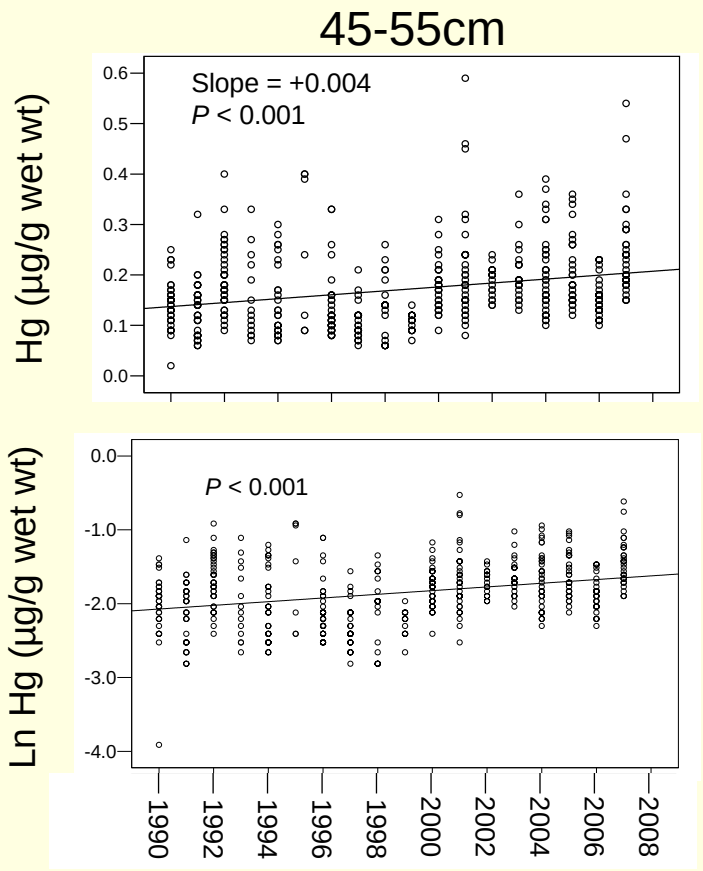


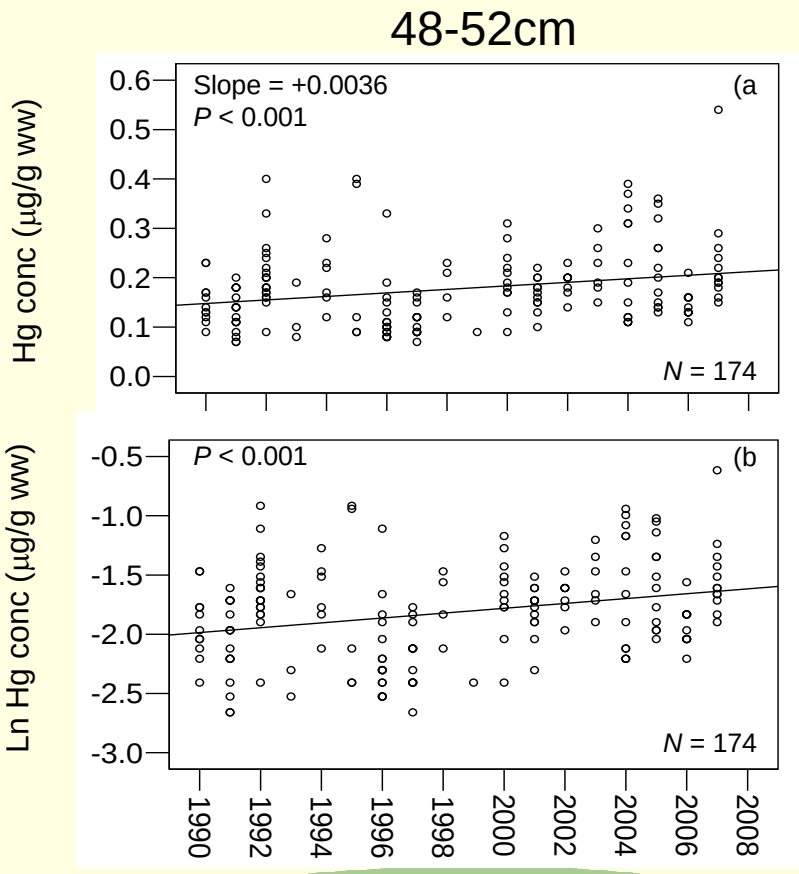
1970s-2007
Fillet, OMOE

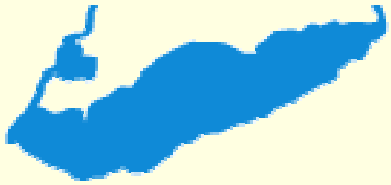
1990-2007
Fillet, OMOE

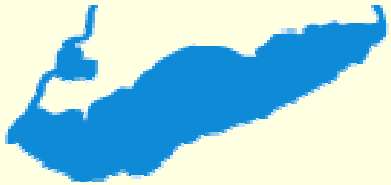
1990-2007
Fillet, OMOE

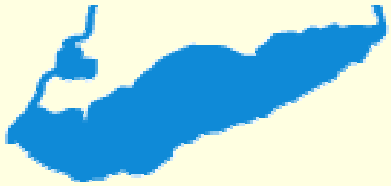
Hg trend: Erie, walleye-fillet (OMOE)

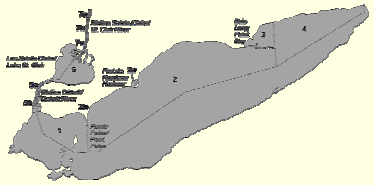












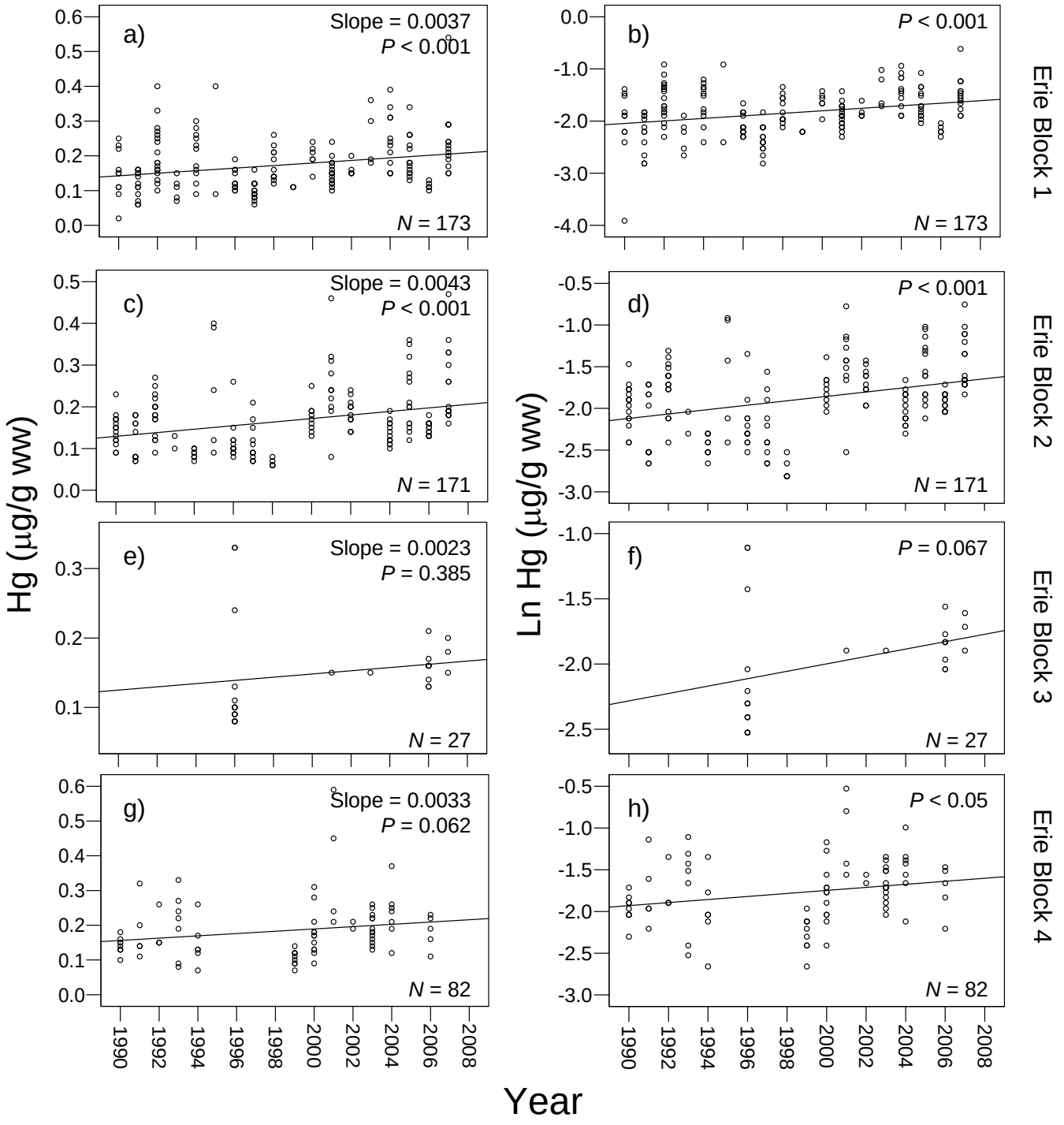
1970s-2007
Fillet, OMOE

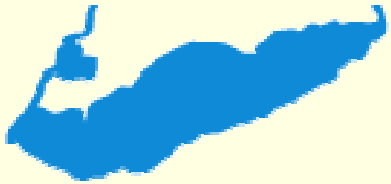
1990-2007
Fillet, OMOE

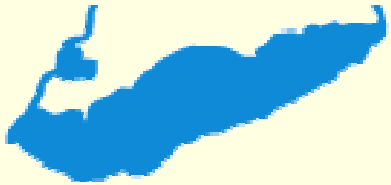
1990-2007
Fillet, OMOE

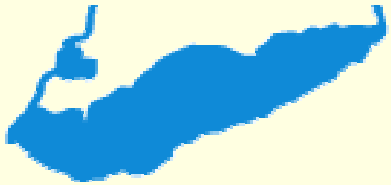
1990-2007
Fillet, OMOE

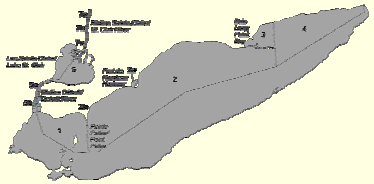
45-55cm walleye-fillet (OMOE)

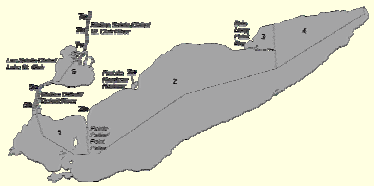












1970s-2007
Fillet, OMOE

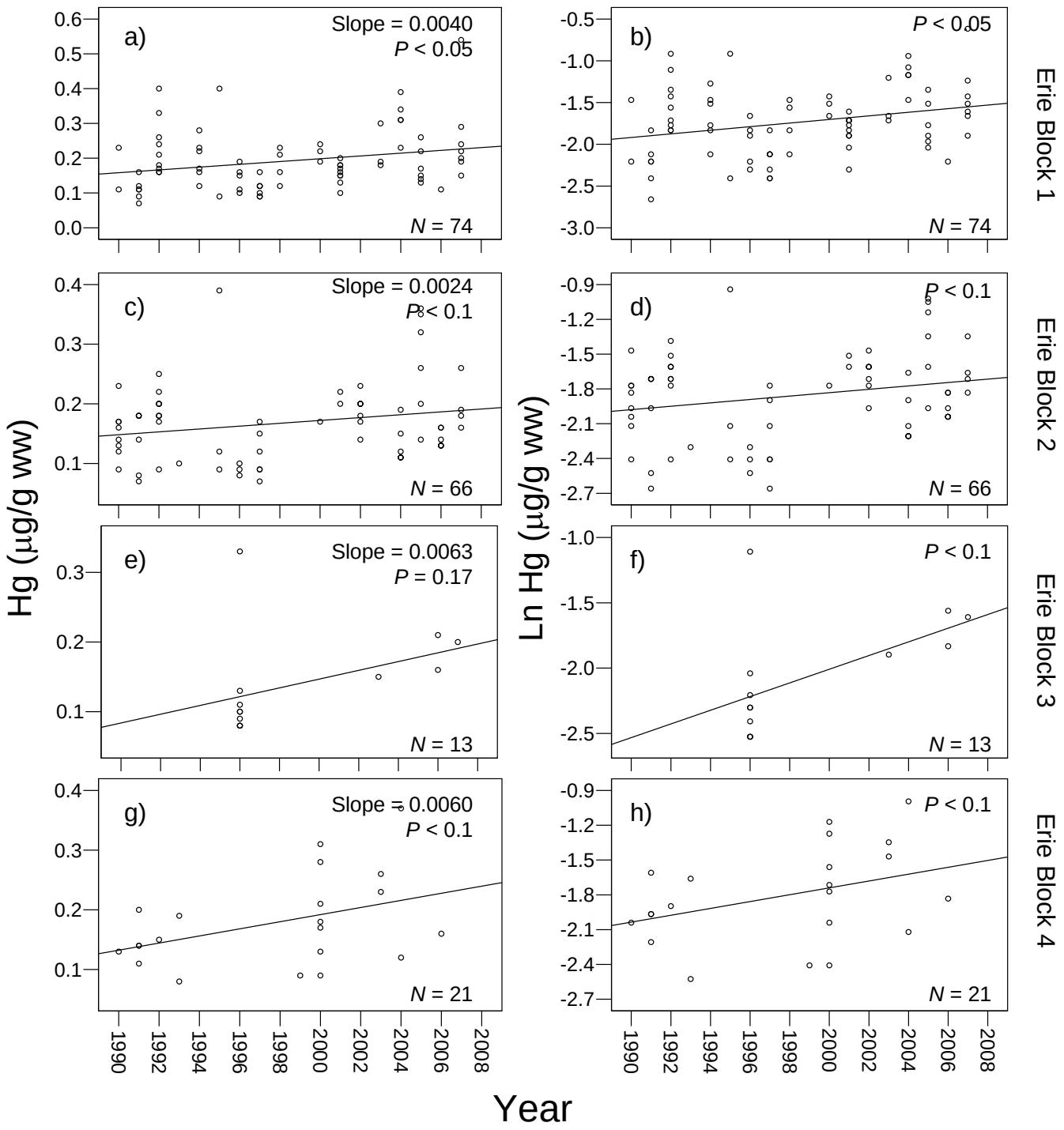
1990-2007
Fillet, OMOE

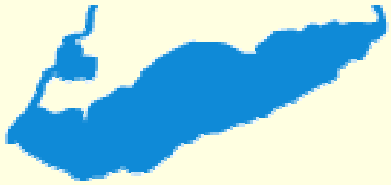
1990-2007
Fillet, OMOE

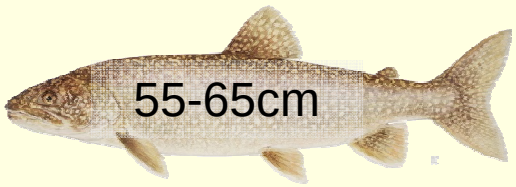
1990-2007
Fillet, OMOE

1990-2007
Fillet, OMOE

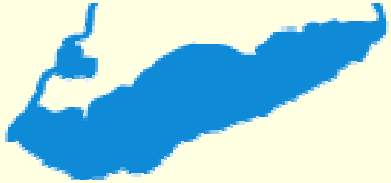
48-52cm walleye-fillet (OMOE)



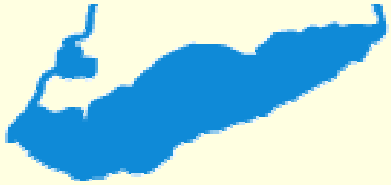




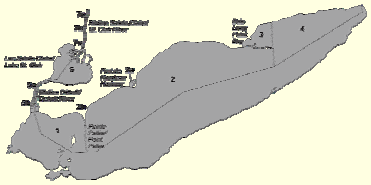
1970s-2007
Fillet, OMOE



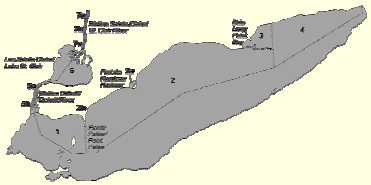
1990-2007
Fillet, OMOE



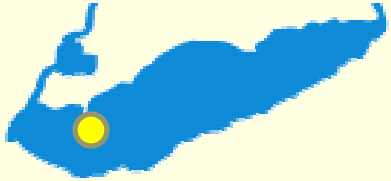
1990-2007
Fillet, OMOE



1990-2007
Fillet, OMOE



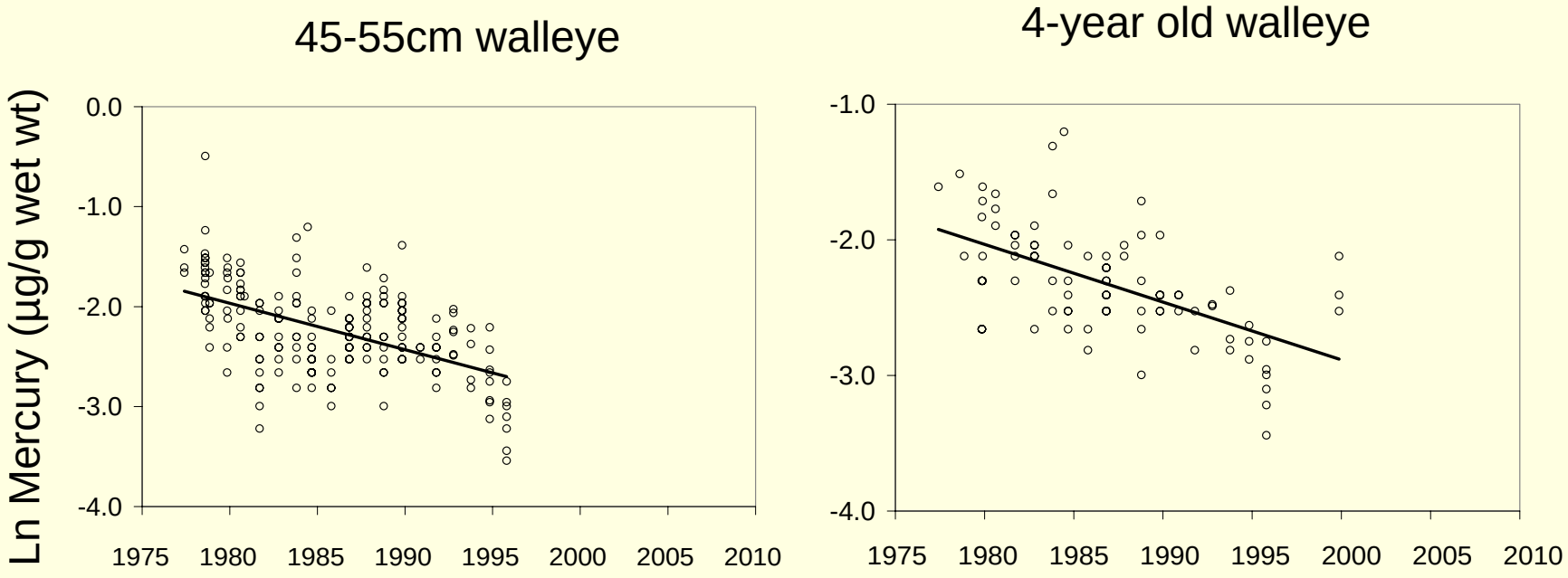
1990-2007
Fillet, OMOE

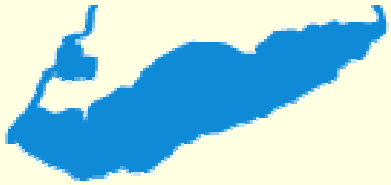


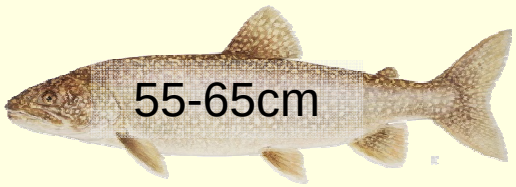
1970s-2000
Whole fish, EC

Hg trend: Erie, whole-fish (Envi Canada)

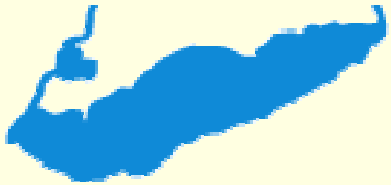
Pelee Island (*P<0.001*)



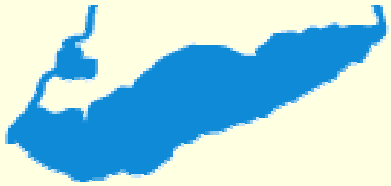




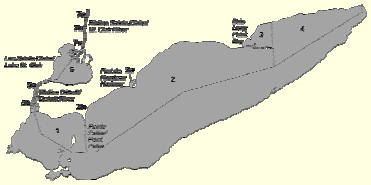
1970s-2007
Fillet, OMOE



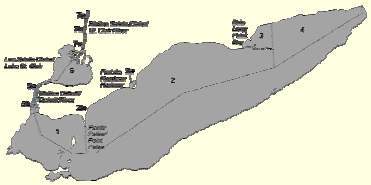
1990-2007
Fillet, OMOE



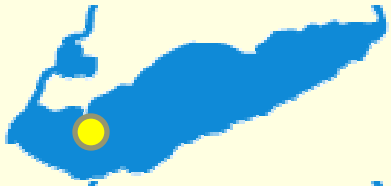
1990-2007
Fillet, OMOE



1990-2007
Fillet, OMOE



1990-2007
Fillet, OMOE

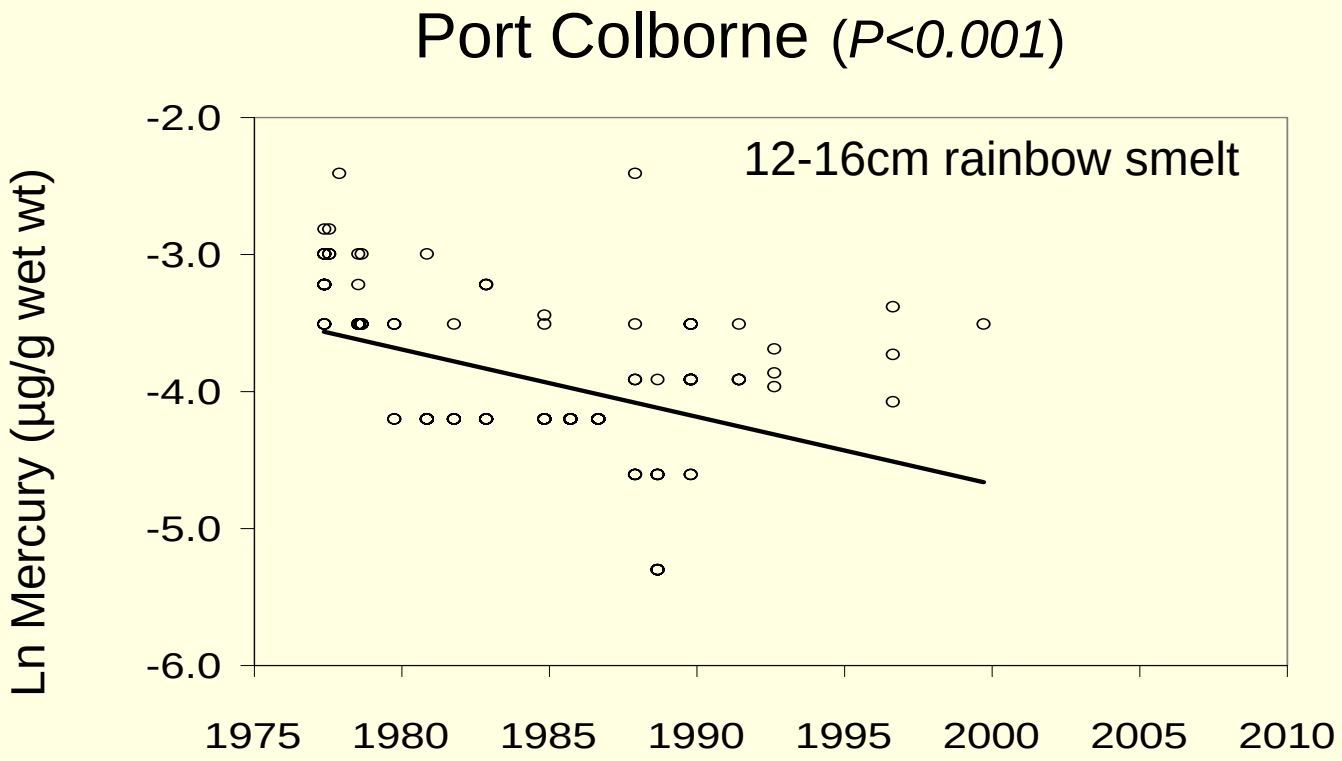


1970s-2000
Whole fish, EC

12-16cm

1970s-2000
Whole fish, EC

Hg trend: Erie, whole-fish (Envi Canada)



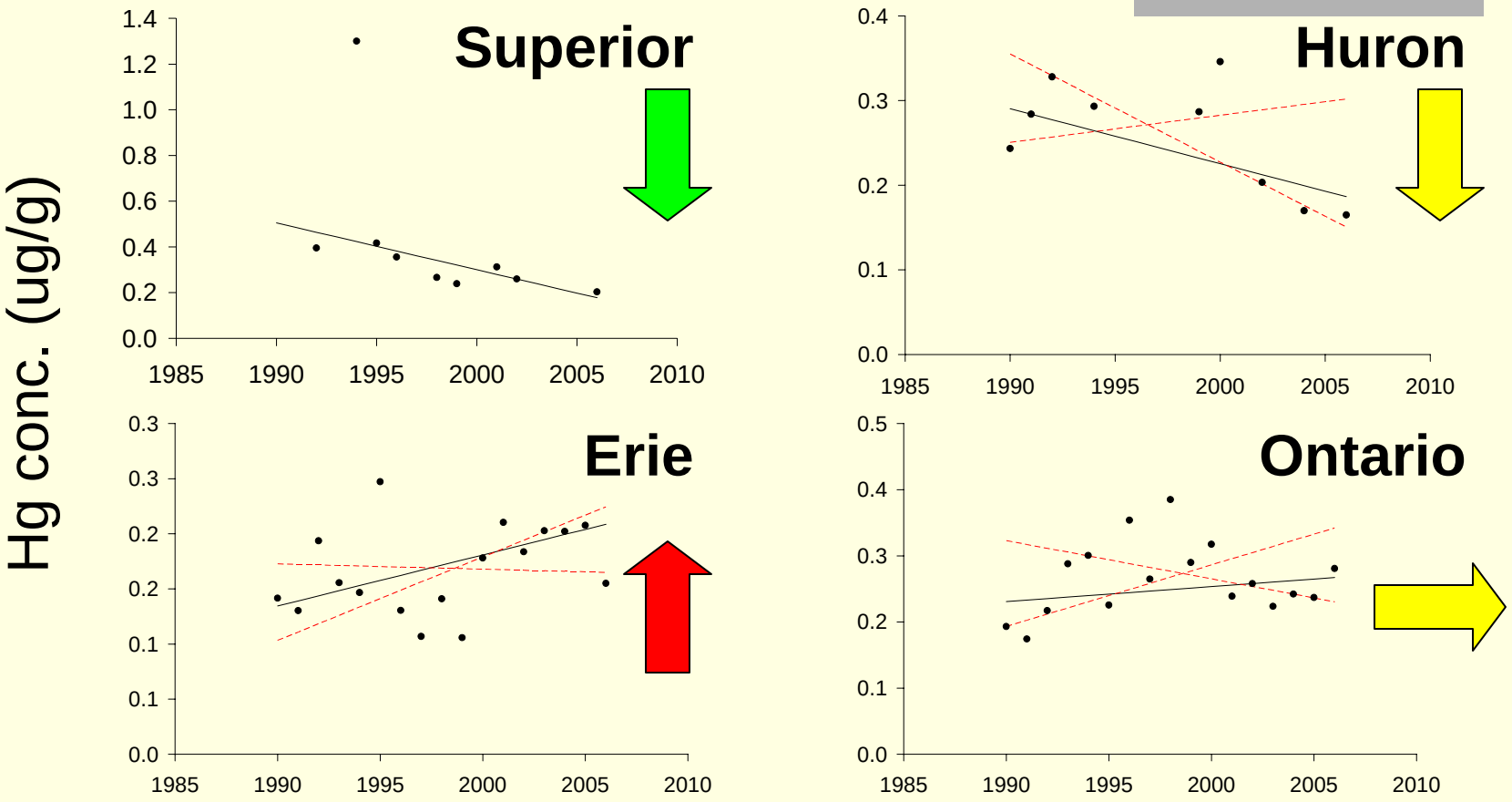
Hg Trends

Canadian Great Lakes

Walleye

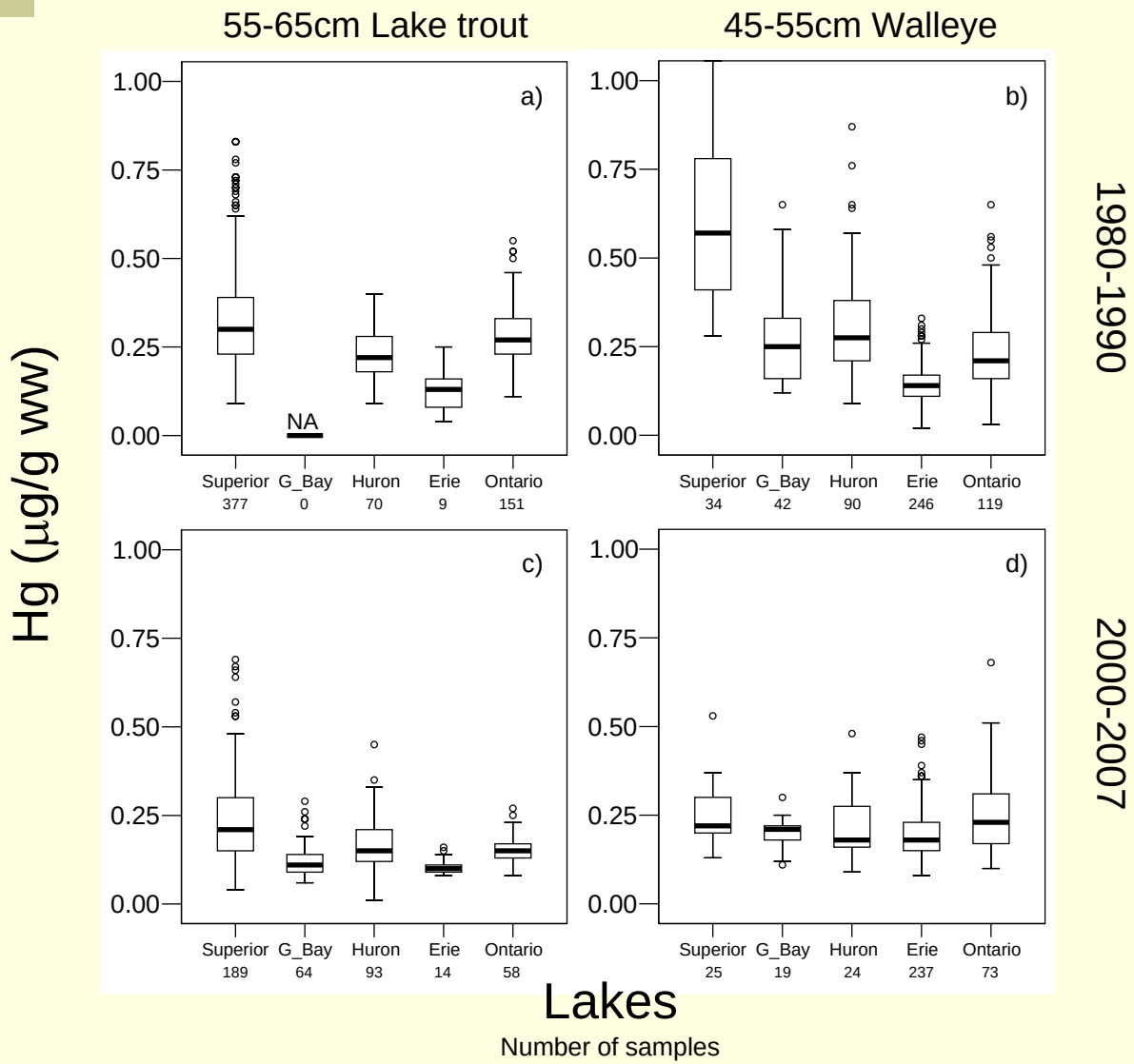
Walleye, 45-55 cm, 1990-2007 OMOE data

Bhavsar et al. 2010, ES&T online



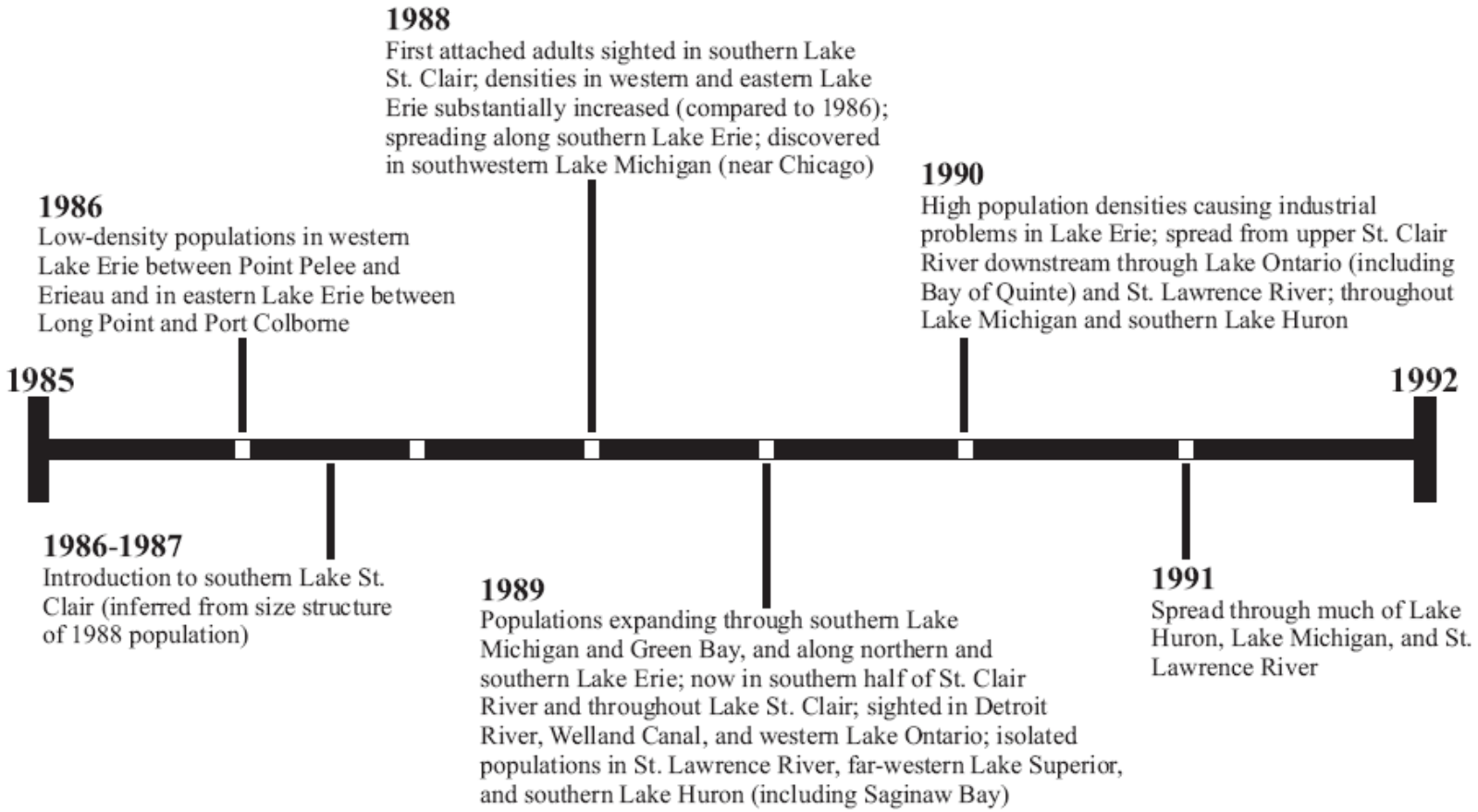
Hg: Great Lakes fish, spatial diff.

Bhavsar et al. 2010, ES&T online



Lk Erie fish generally lowest Hg

Invasion history of zebra mussels in the Great Lakes (1985–1992)



Literature support

Environ. Sci. Technol. **1998**, *32*, 3862−3867

Projected Changes to the Trophodynamics of PCBs in the Western Lake Erie Ecosystem Attributed to the Presence of Zebra Mussels (*Dreissena polymorpha*)

HEATHER A. MORRISON,*,† FRANK A. P. C. GOBAS,‡ RODICA LAZAR,† D. MICHAEL WHITTLE,§ AND G. DOUGLAS HAFFNER†

results of this study are relevant to Lake Erie resource managers that are concerned about the potential of zebra mussels to alter PCB congener dynamics in the western basin.

Introduction

The effects of the zebra mussel (*Dreissena polymorpha*) on the dynamics of polychlorinated biphenyls (PCBs) in the western basin of Lake Erie are an important environmental concern (*1*). This concern exists because PCBs are persistent and hazardous chemicals that are prevalent in the basin, and changes in the transfer pathways of these contaminants

J. Great Lakes Res. 33:46–61
Internat. Assoc. Great Lakes Res., 2007

How Non-native Species in Lake Erie Influence Trophic Transfer of Mercury and Lead to Top Predators

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Department of Evolution, Ecology and Organismal Biology
The Ohio State University

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journal homepage: www.elsevier.com/locate/jglr

Note

Polybrominated diphenyl ethers (PBDEs) in Lake Michigan forage fish

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Lake Michigan
Fish
Diporeia
Toxic substances

ABSTRACT

Polybrominated diphenyl ethers (PBDEs) were analyzed in 88 forage fish samples collected from Lake Michigan in 1995 and in 2002/2003. Lipid-normalized total PBDE concentrations ranged from 149 to 1094 ng/g. Total PBDEs in alewife and deepwater sculpin did not change significantly from 1995 to 2002/2003, while the levels in bloater chub and the slimy sculpin decreased. BDE-47 was the most abundant congener in the fish. All of the forage fish were depleted in BDE-99 relative to what would be expected based on the congener composition of the commercial formulation in use. The deepwater sculpins were particularly lacking in BDE-99. Changes in the food web brought about by the dramatic decline of Diporeia abundance (due to the invasion of zebra and quagga mussels) may have affected the levels of PBDEs in some of the forage fish.

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Conclusions

- Analyzed PCB and Hg trends using OMOE & EC data
- 1970s-2007 trend: mostly declining
- PCB in Erie: High levels, ↑ conc trend
- Hg in Erie: Low levels, ↑ conc trend
- Change in PCB & Hg conc trend coincide with invasions of dreissenid mussels and round goby

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