

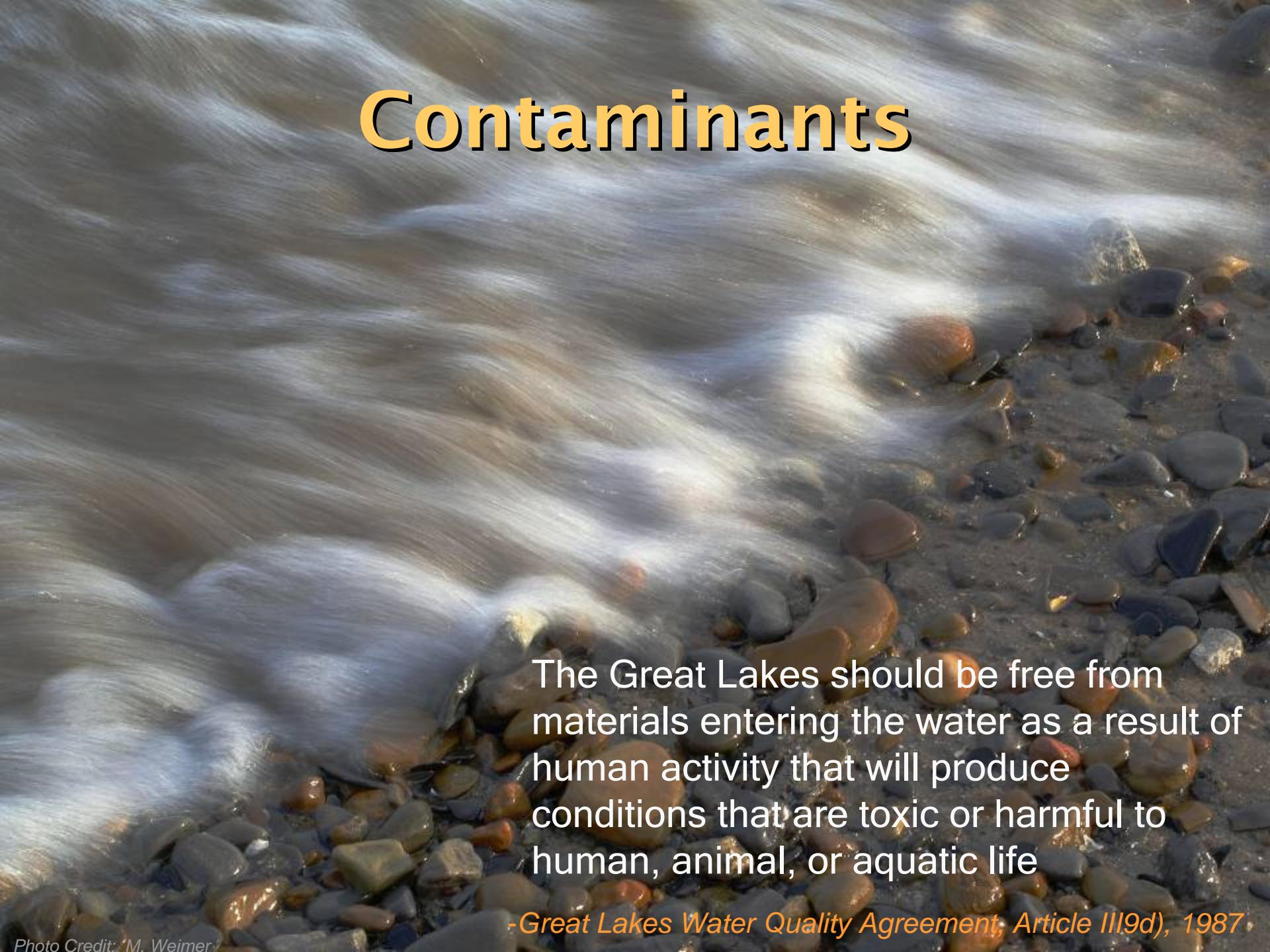
US EPA ARCHIVE DOCUMENT



Contaminants, Biotic Communities, and Invasive Species

Amy DeWeerd
U.S. Fish & Wildlife Service

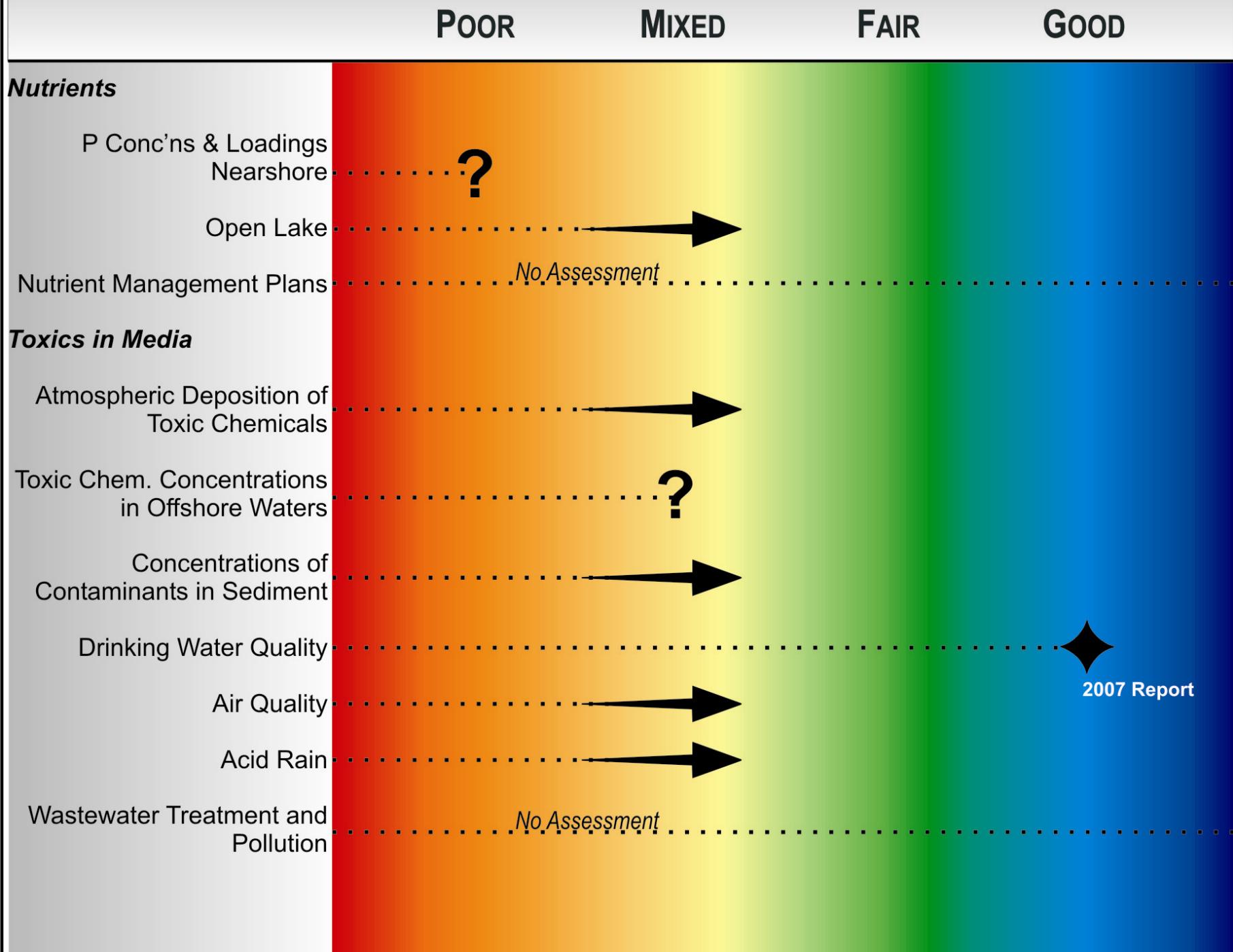
Contaminants



The Great Lakes should be free from materials entering the water as a result of human activity that will produce conditions that are toxic or harmful to human, animal, or aquatic life

-Great Lakes Water Quality Agreement, Article III9d), 1987

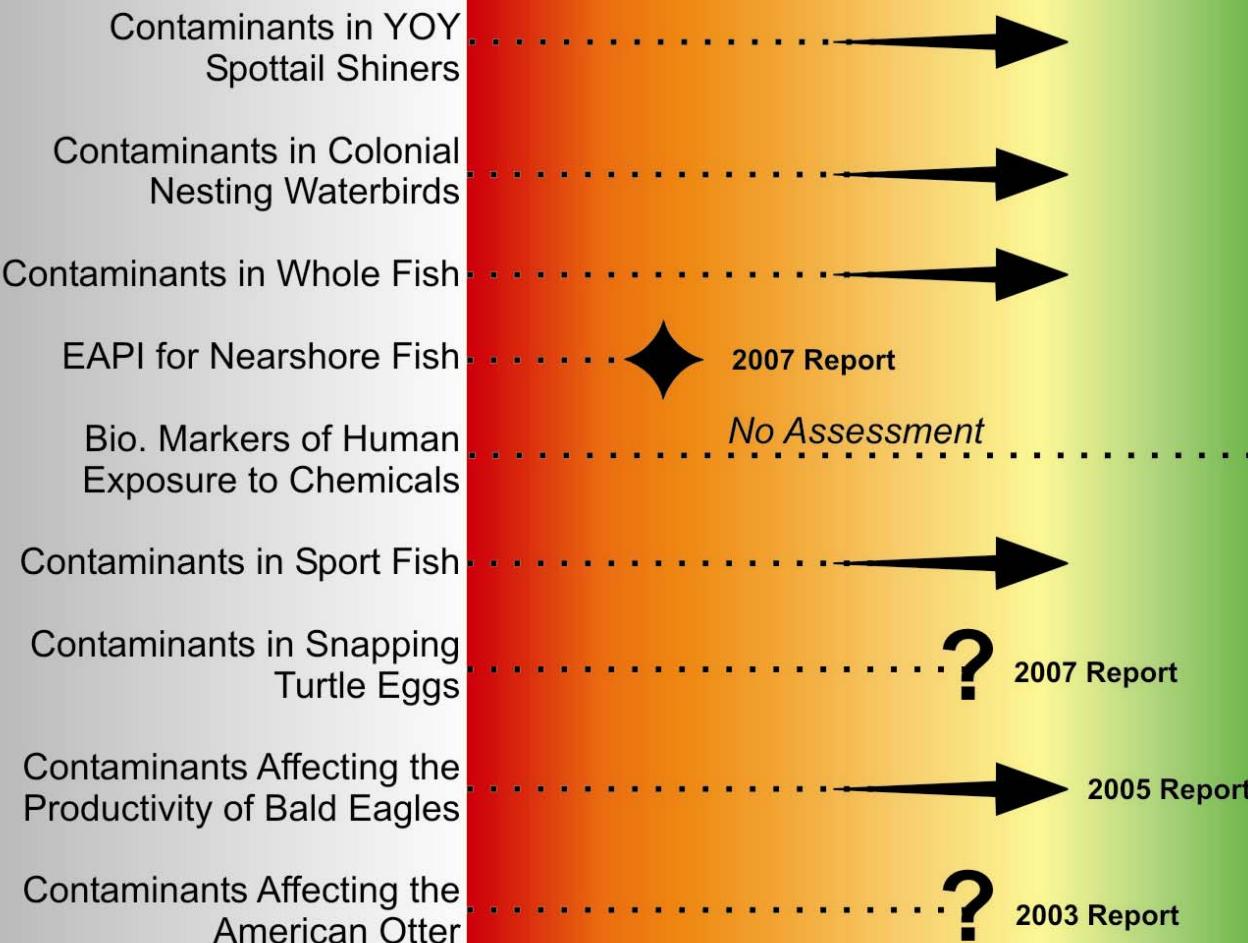
Contamination



Contamination

POOR MIXED FAIR GOOD

Toxics in Biota



Phosphorus Loading

Cladophora accumulation along the shoreline of Lake Erie Rock Point Provincial Park

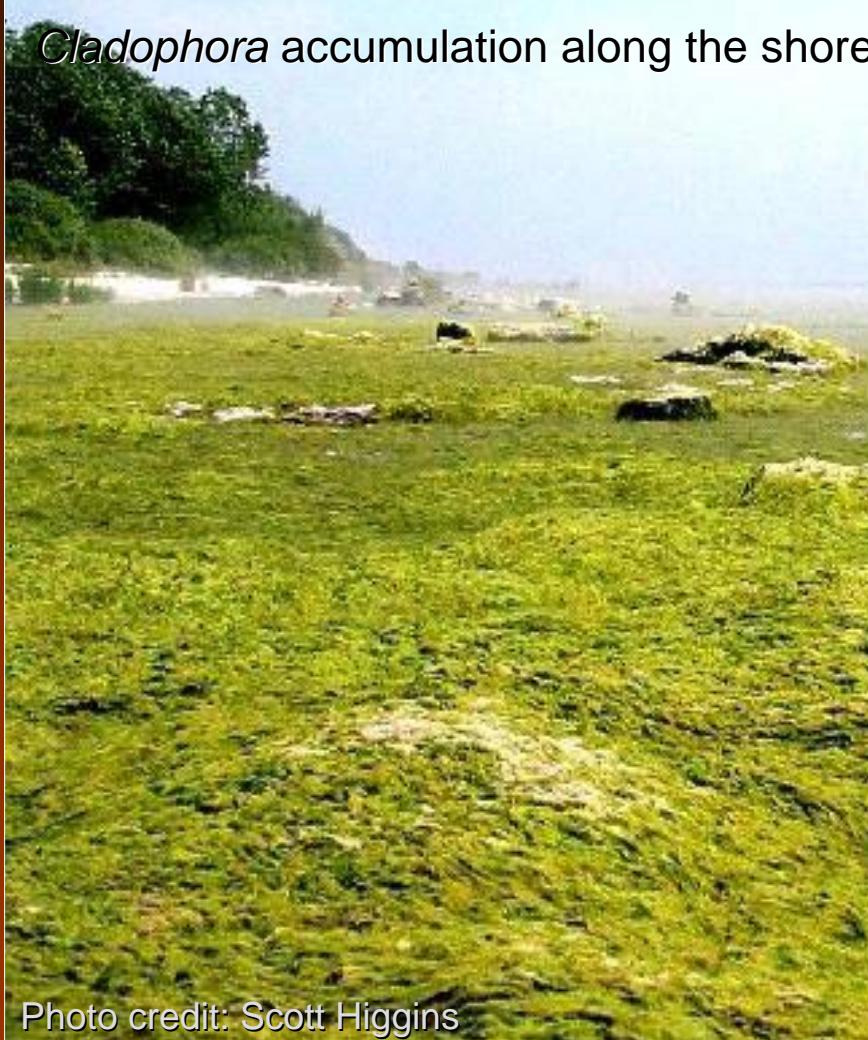


Photo credit: Scott Higgins



Photo credit: UW Sea Grant

Photo Credit: M. Weimer

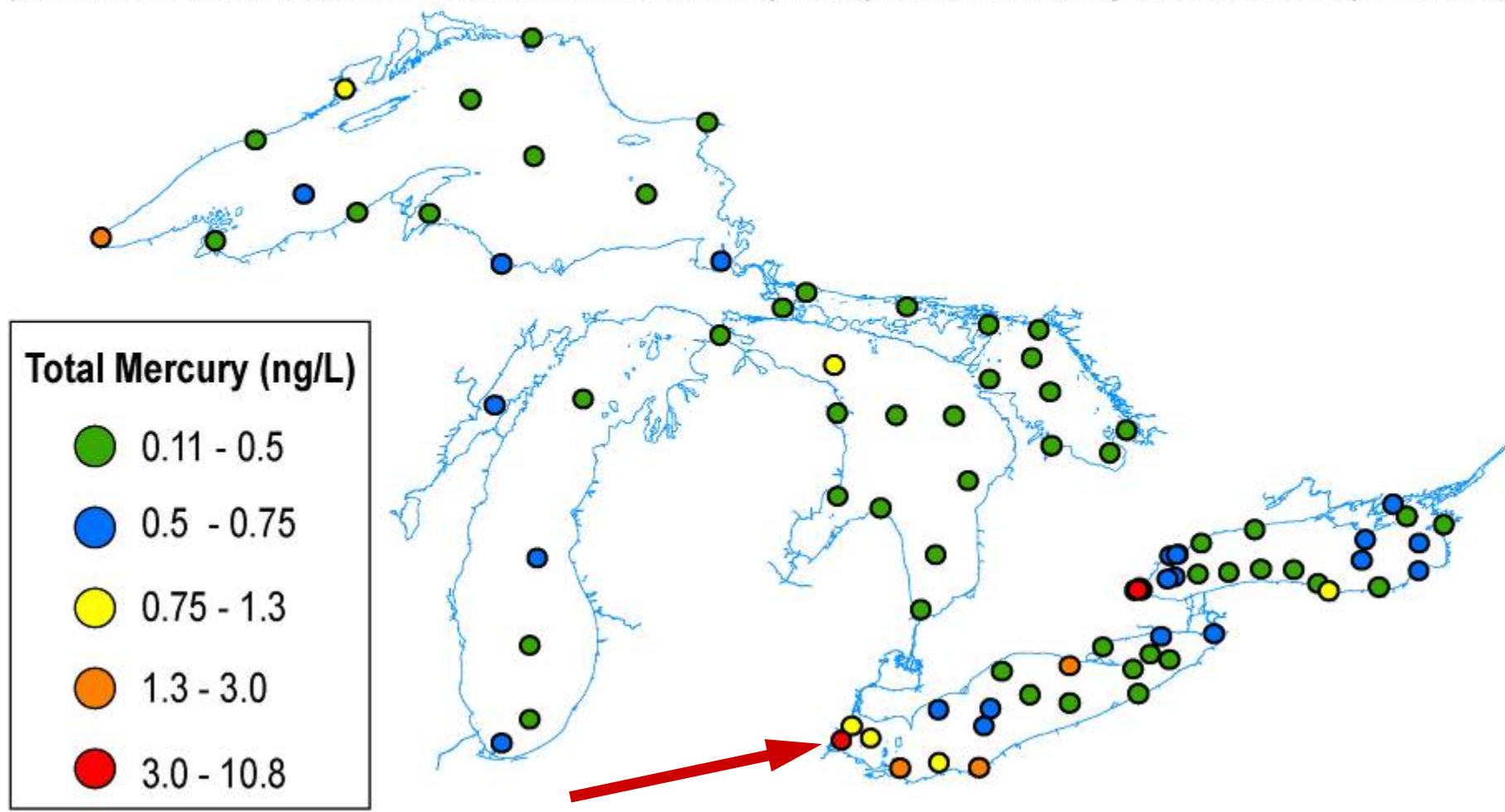


Acid Rain

Toxic Contaminants in Offshore Waters

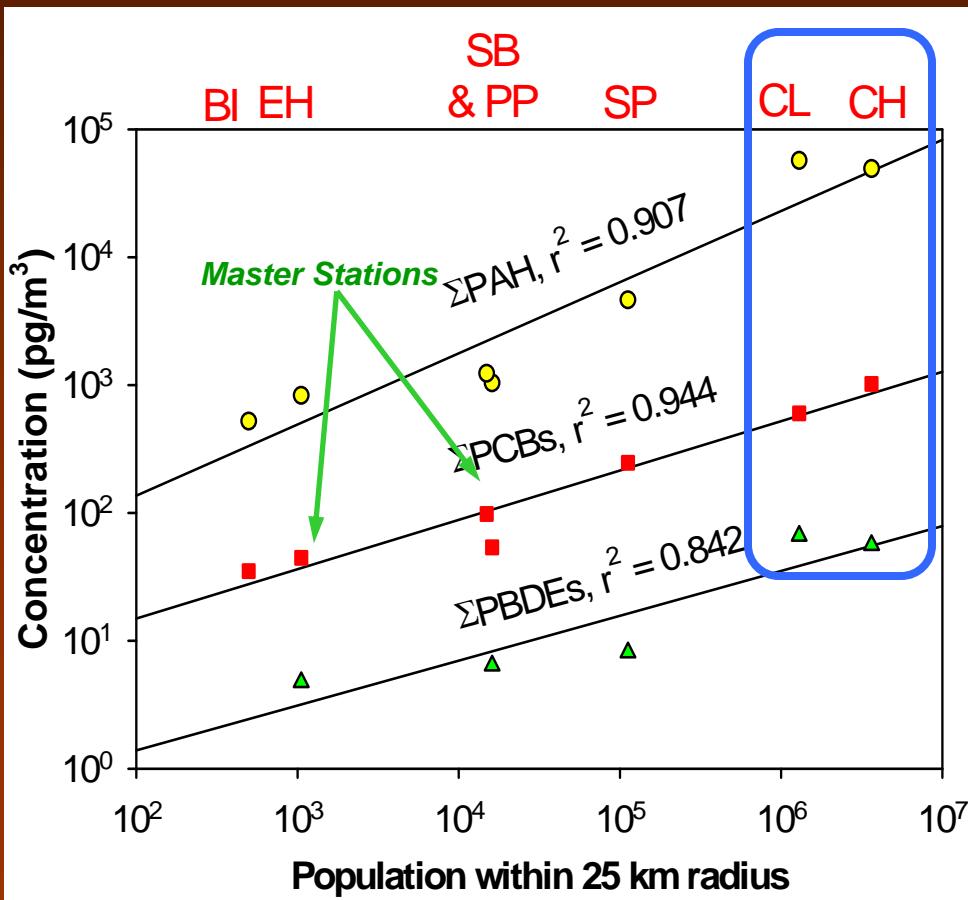
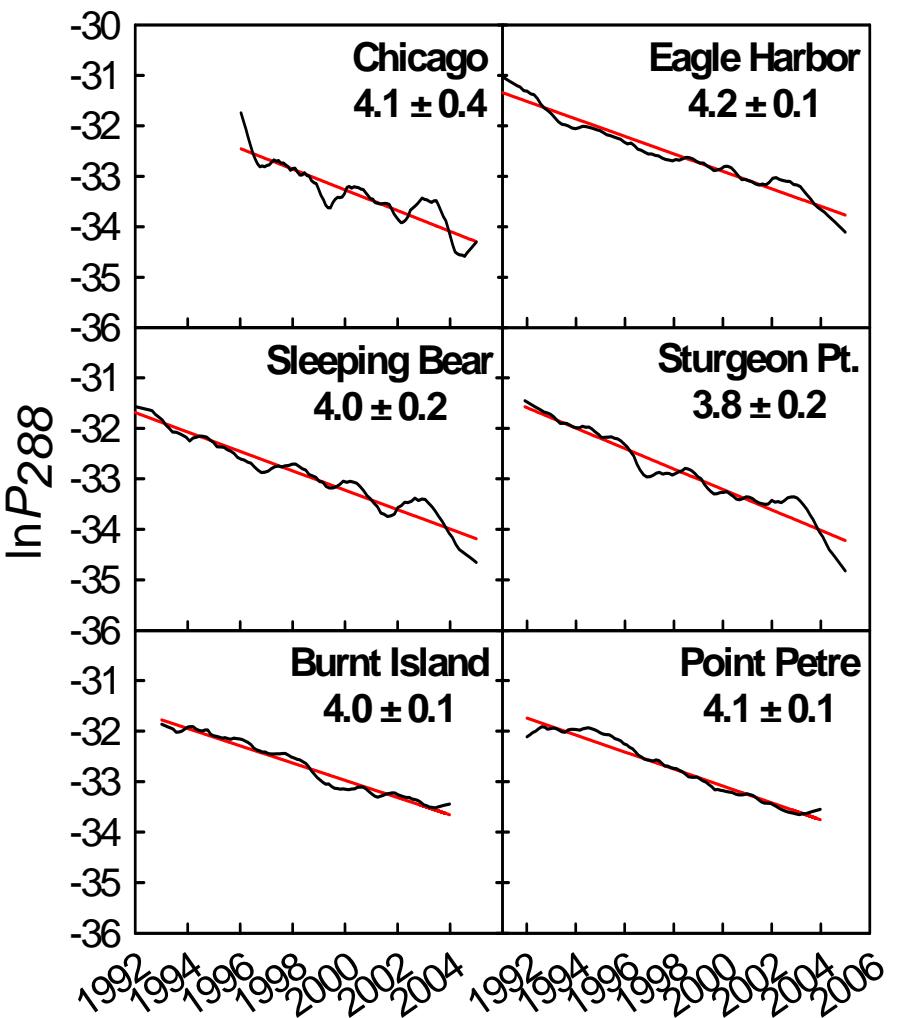
Organic Contaminants in the Great Lakes, 2005 - 2007

(Lake Ontario 2006, Lake Erie 2006, Lake Huron and Georgian Bay 2007, Lake Michigan 2006, Lake Superior 2005)



Atmospheric Deposition

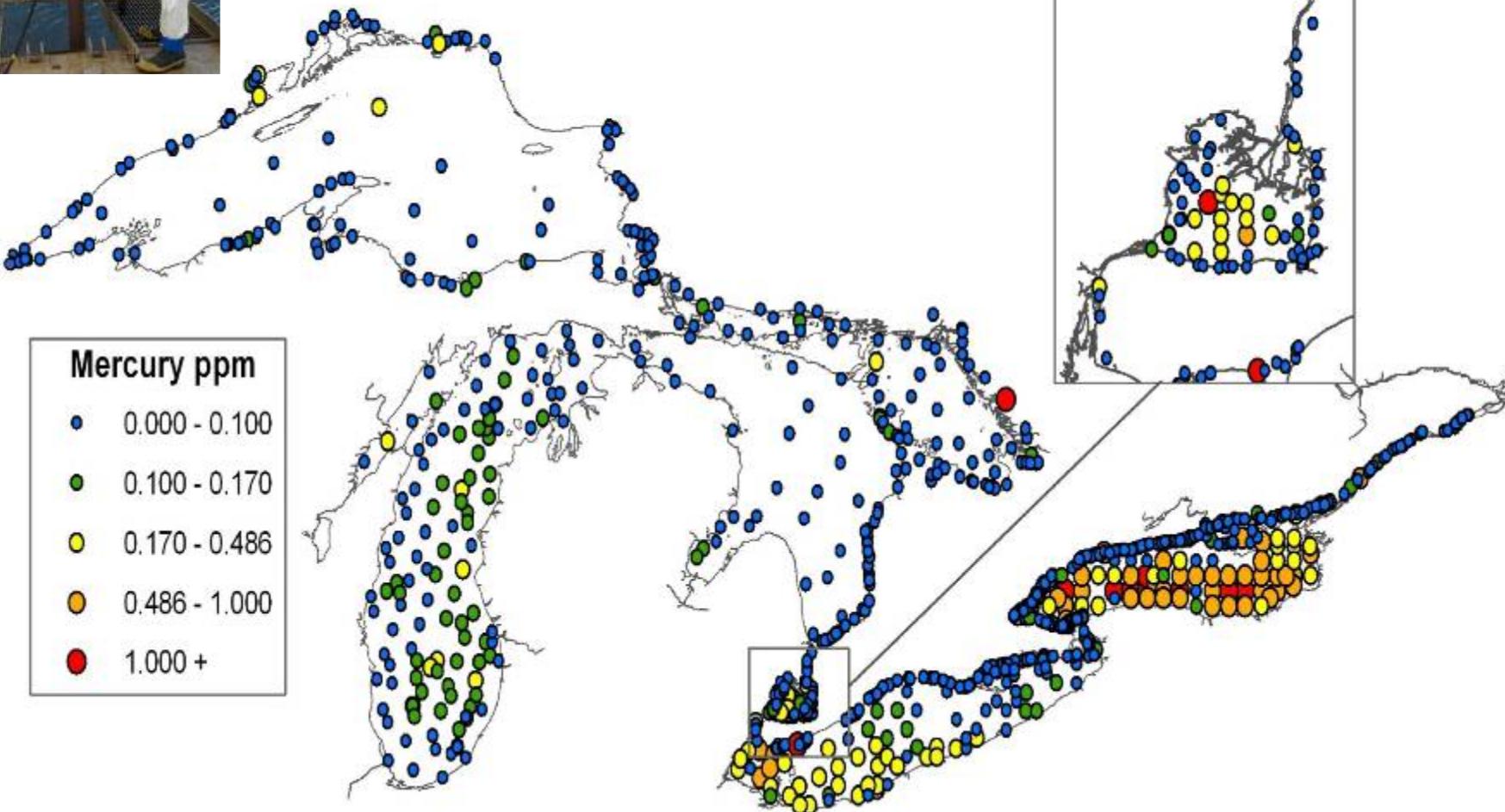
Gas phase α -HCH



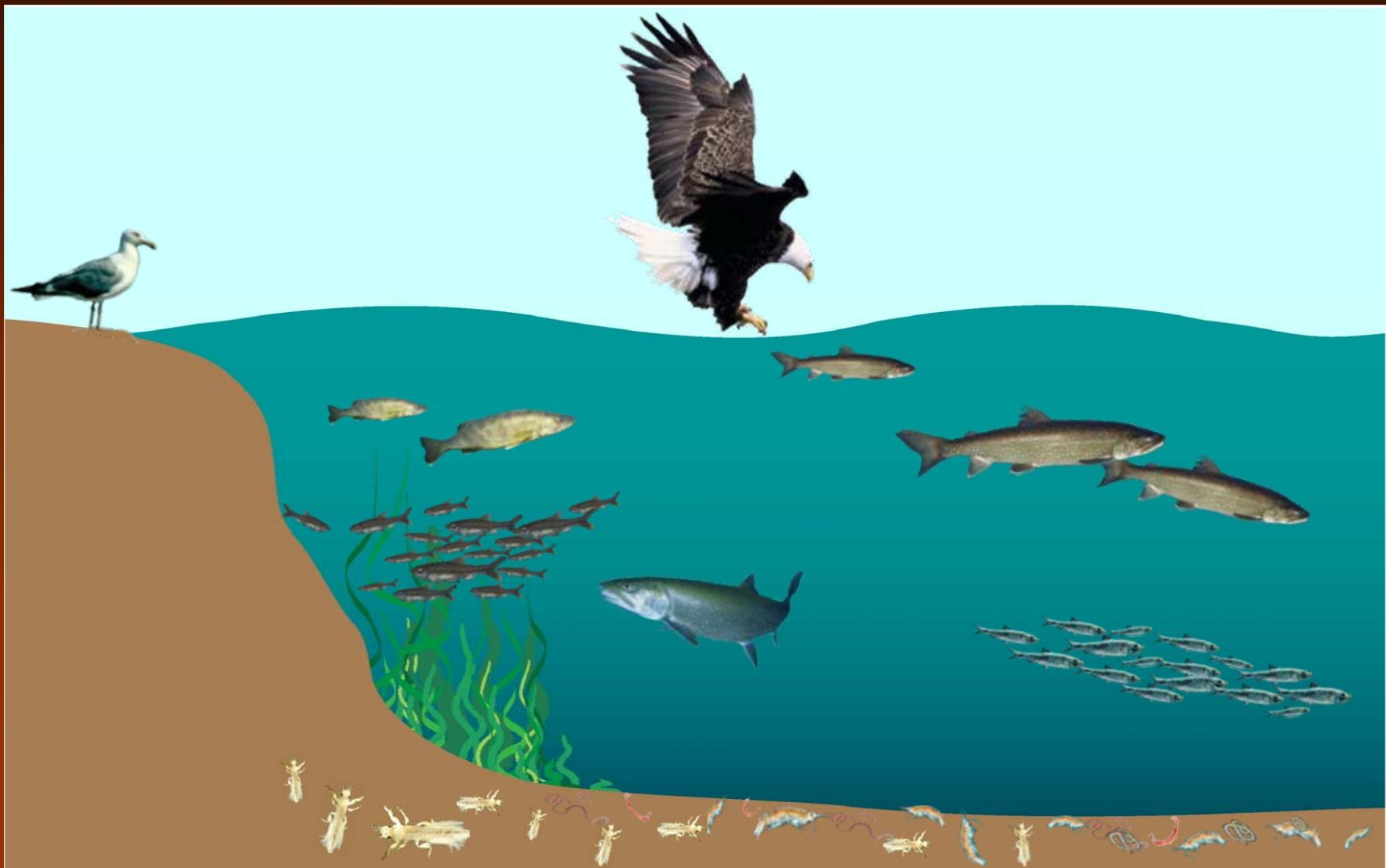


Sediments

Spatial distribution of mercury contamination in surface sediments
in open lake areas and tributaries of the Great Lakes



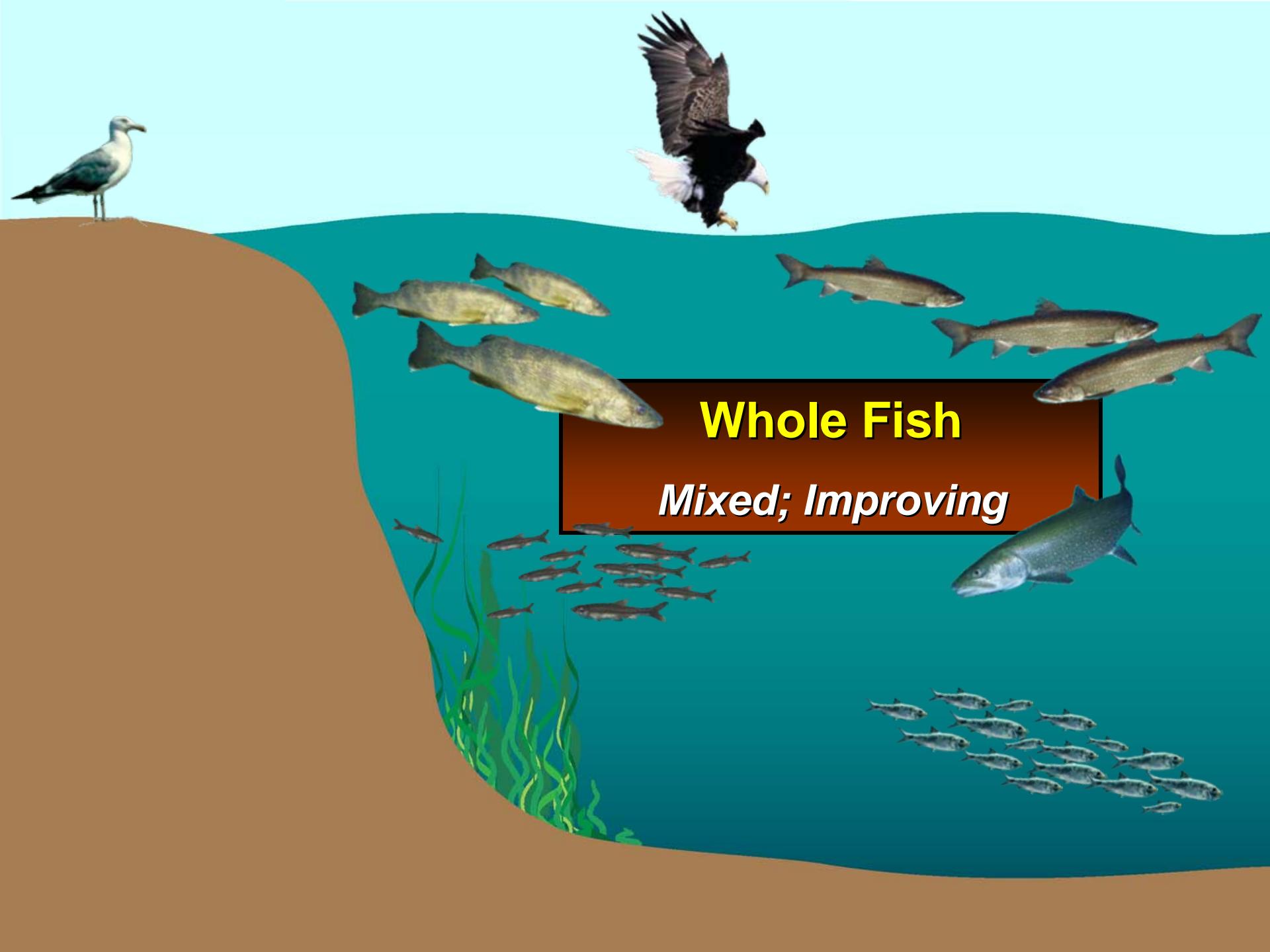
Contaminants in Fish and Wildlife





Spottail Shiners

Mixed; Improving

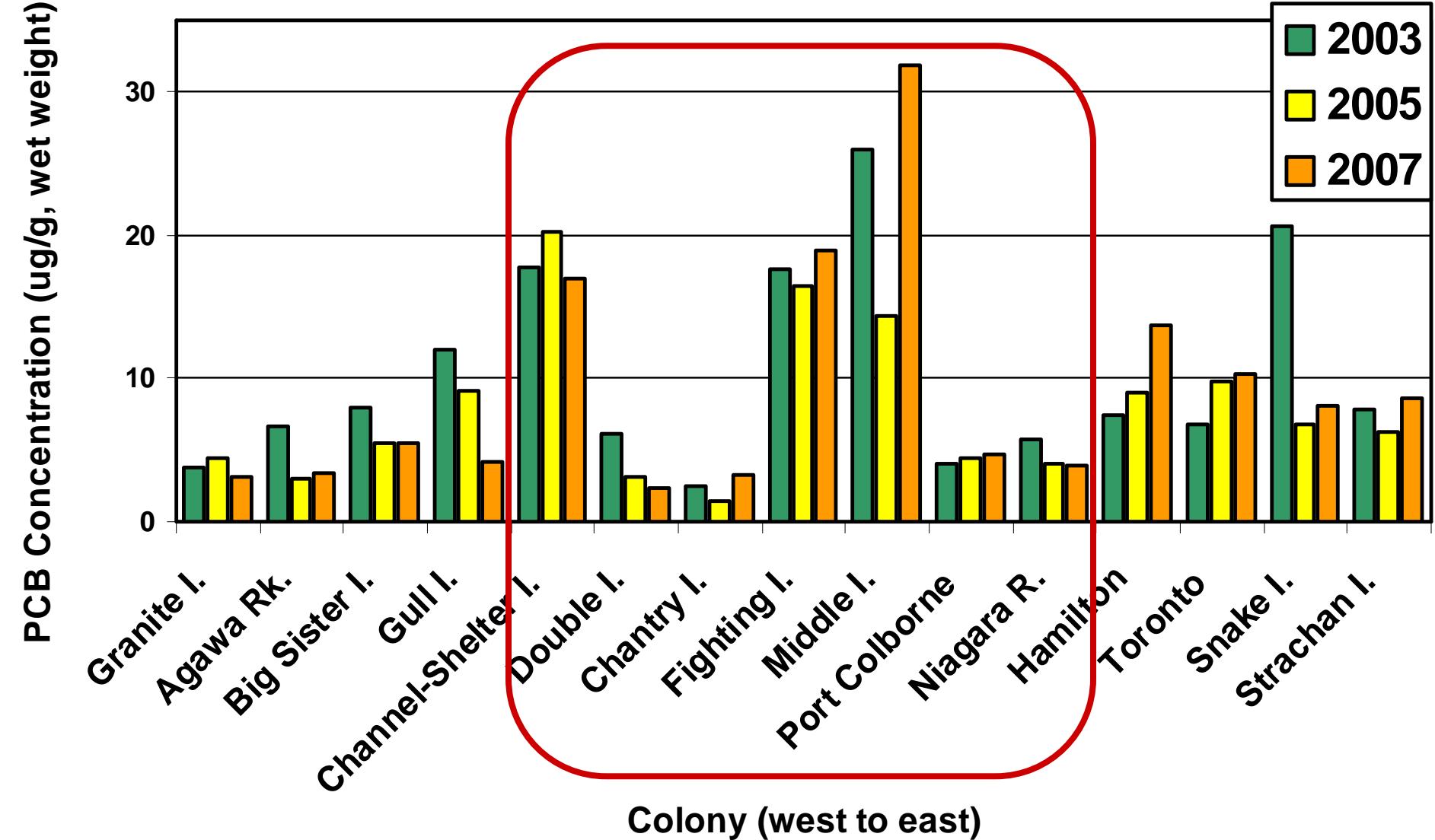


Whole Fish

Mixed; Improving

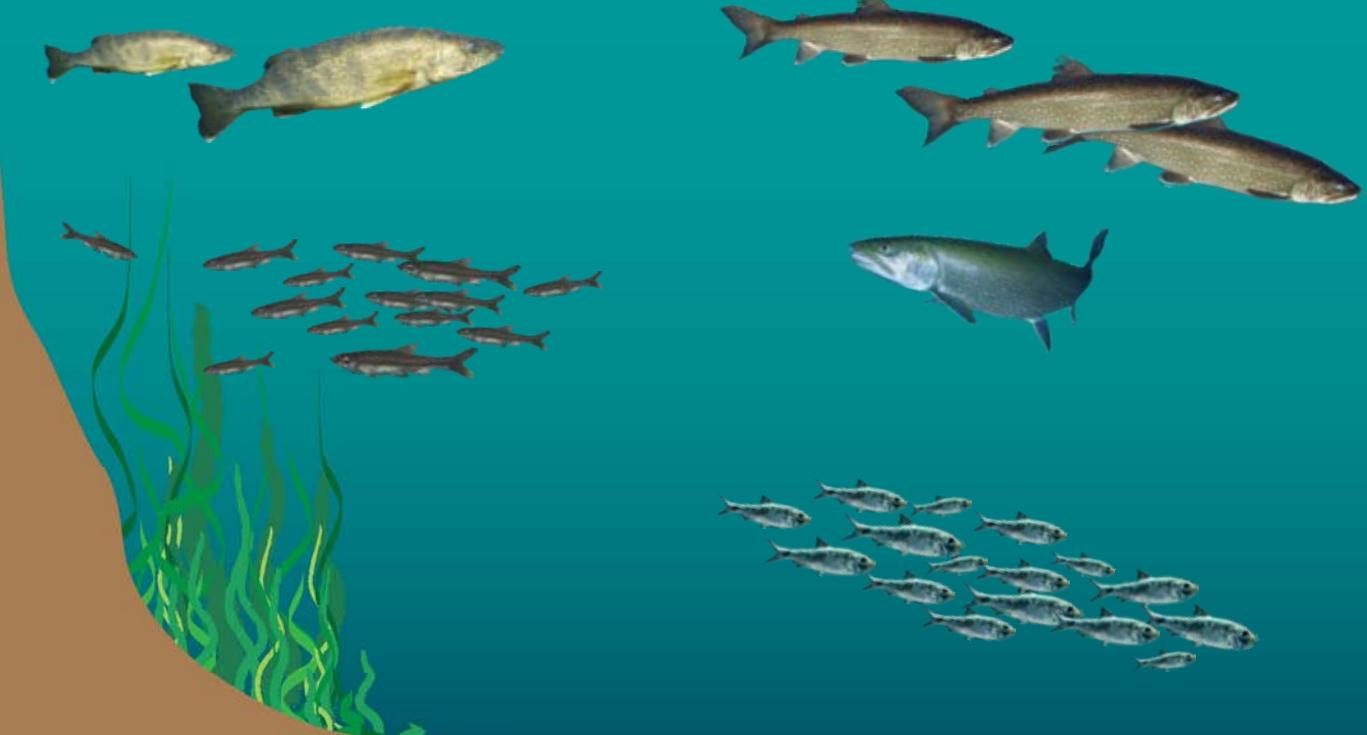
Colonial Nesting Waterbirds

Mixed; Improving



Bald Eagle

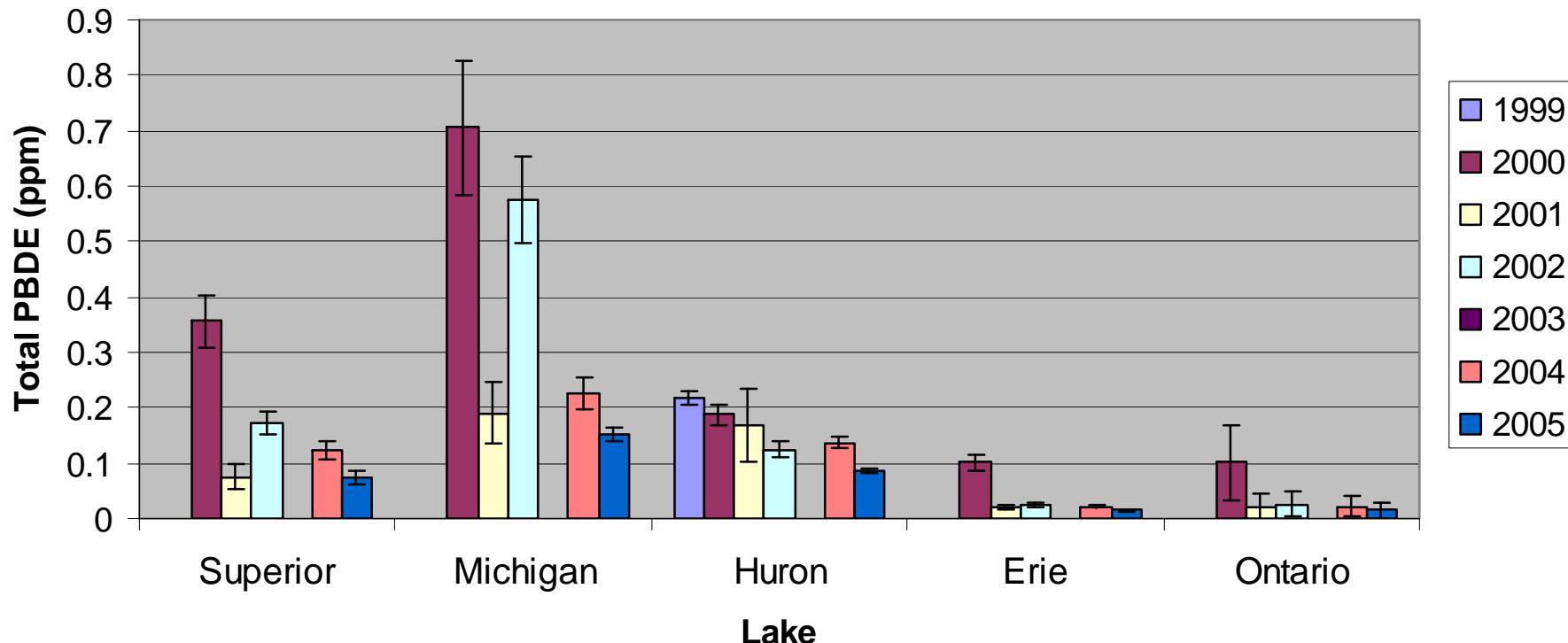
Mixed; Improving



Emerged Contaminants

Total PBDE in whole EPA Lake Trout composites* **
(Walleye in Lake Erie)

Total PBDE = BDE 47+99+100+153+154



* Even year samples collected: Apostle Islands - LS, Saugatuck - LM, Rockport - LH, Middle Bass Island - LE, Oswego - LO

** Odd year samples collected: Keewenaw Pen. - LS, Sturgeon Bay - LM, Port Austin - LH, Dunkirk - LE, North Hamlin - LO

EDITORIAL CARTOON By Nate Beeler/Examiner

JACKPOT!



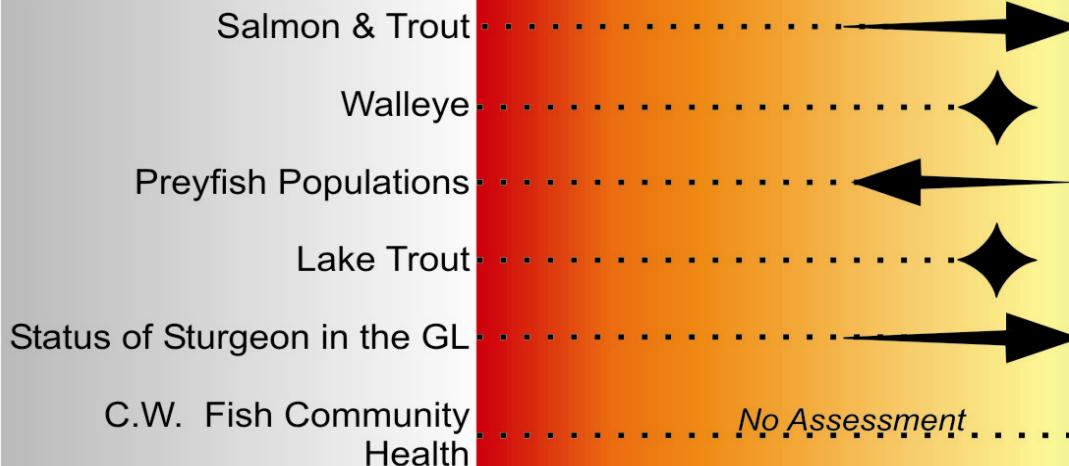


Biotic Communities

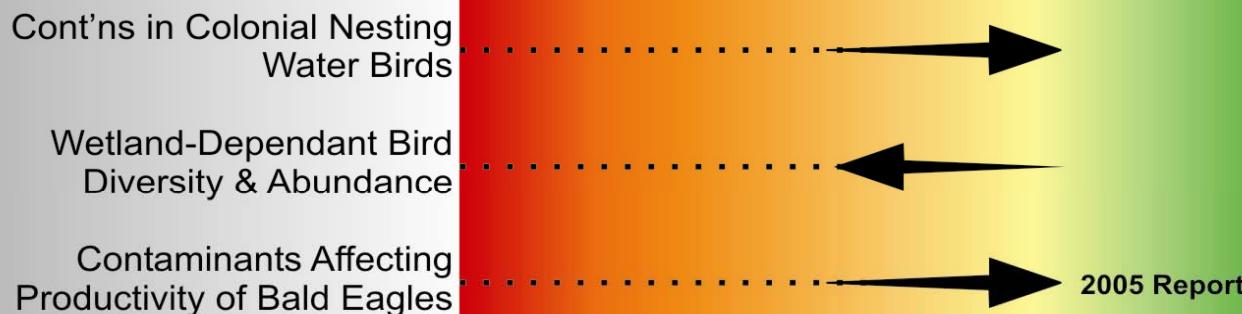
Biotic Communities

POOR MIXED FAIR GOOD

Fish



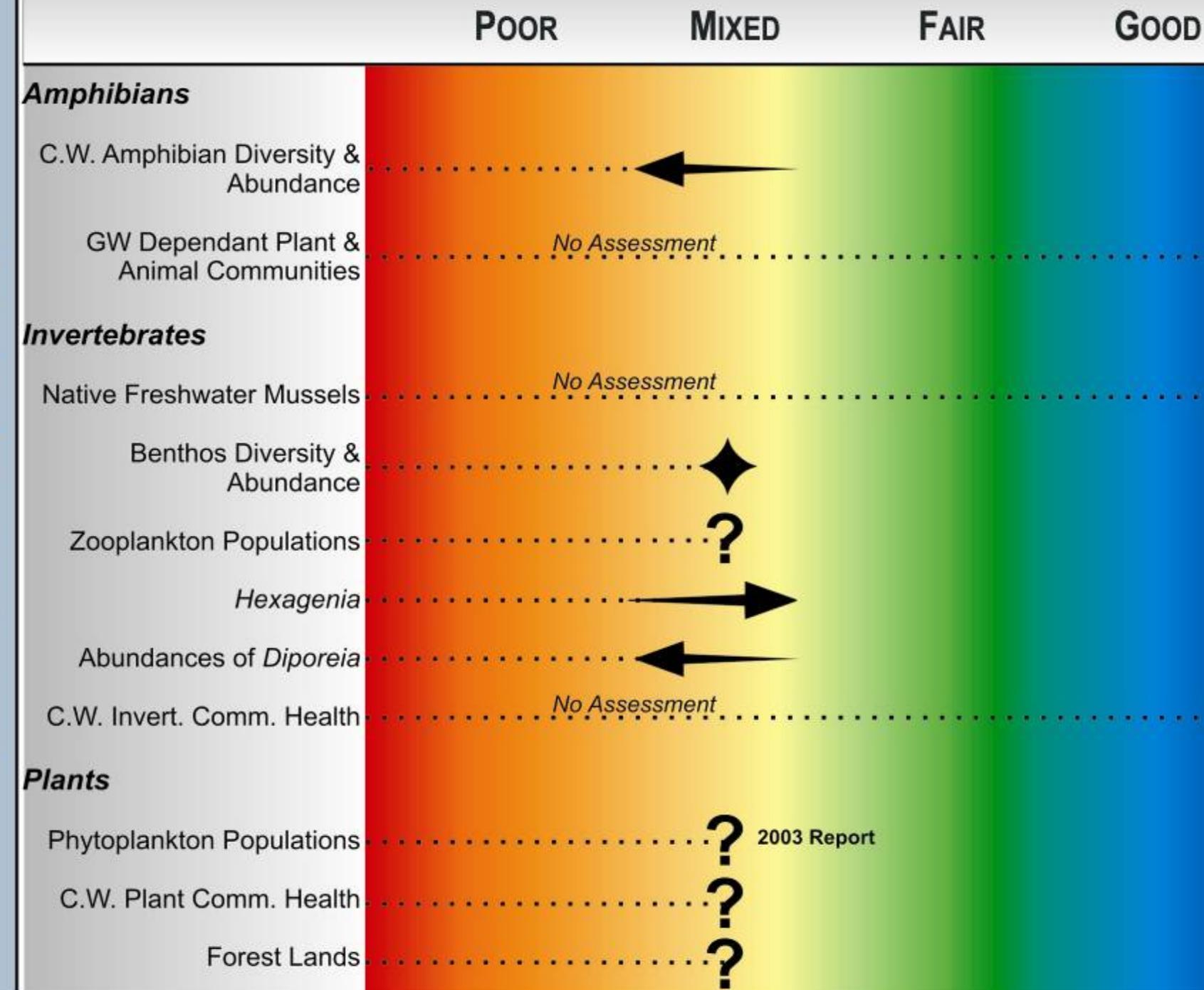
Birds



Mammals



Biotic Communities



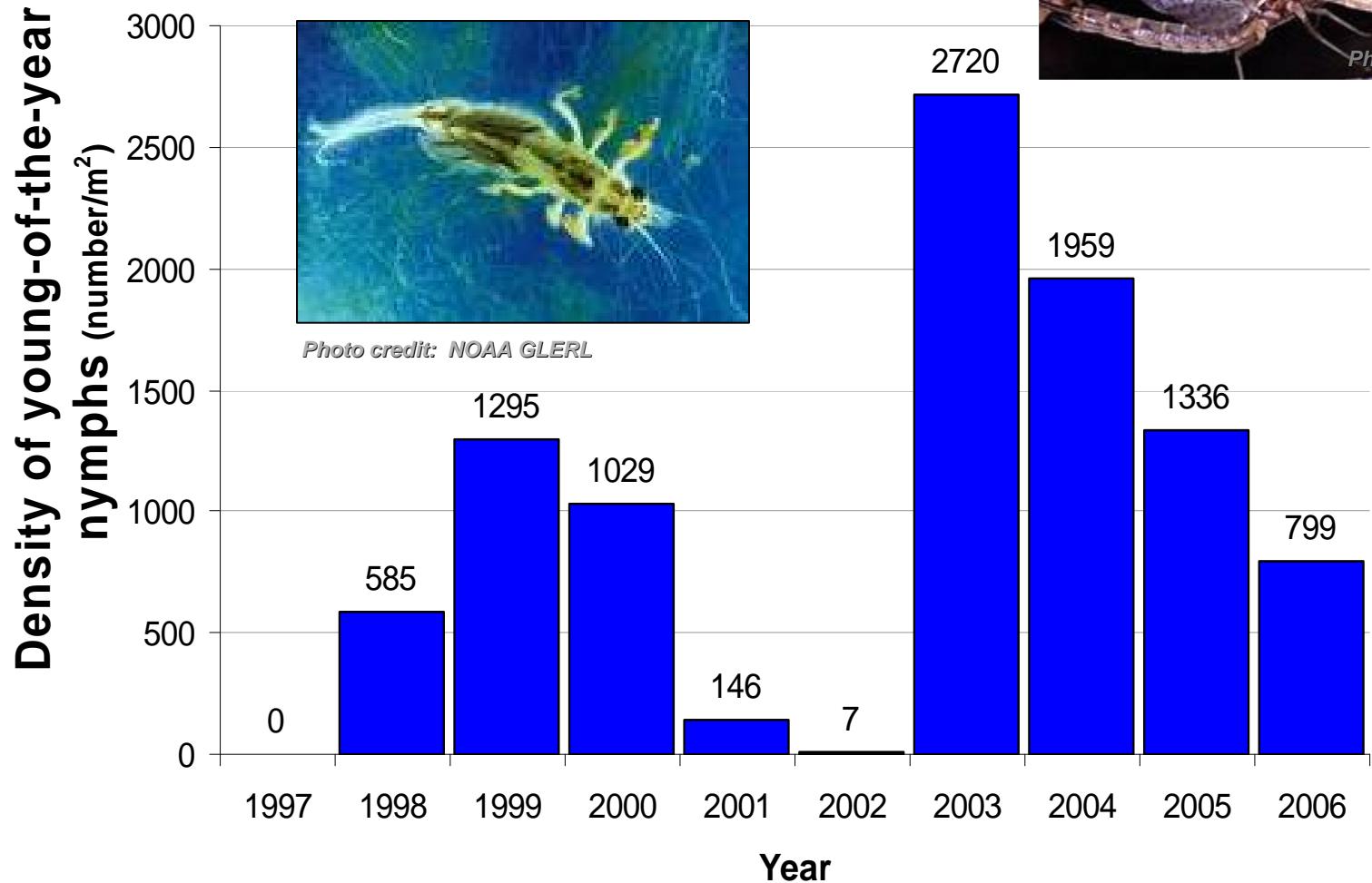


Benthos Diversity

Mixed; Unchanging/Deteriorating

Photo credit: NOAA, GLERL – G. Carter

Hexagenia

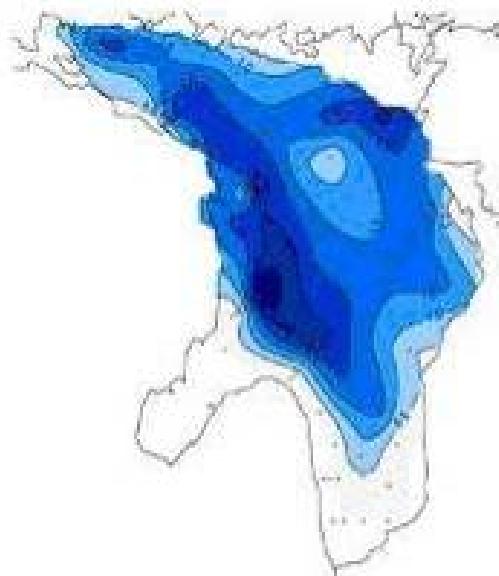


Lake Erie

Diporeia

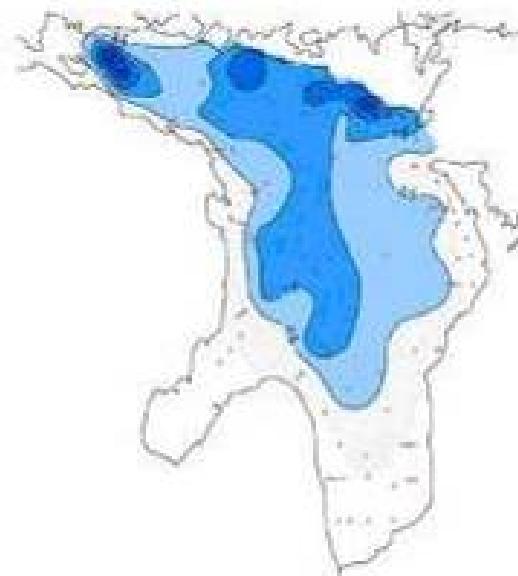


2000



Density (No. $\text{m}^2 \times 10^3$)

2003



Density (No. $\text{m}^2 \times 10^3$)

2007



Density (No. $\text{m}^2 \times 10^3$)

Native Freshwater Mussels

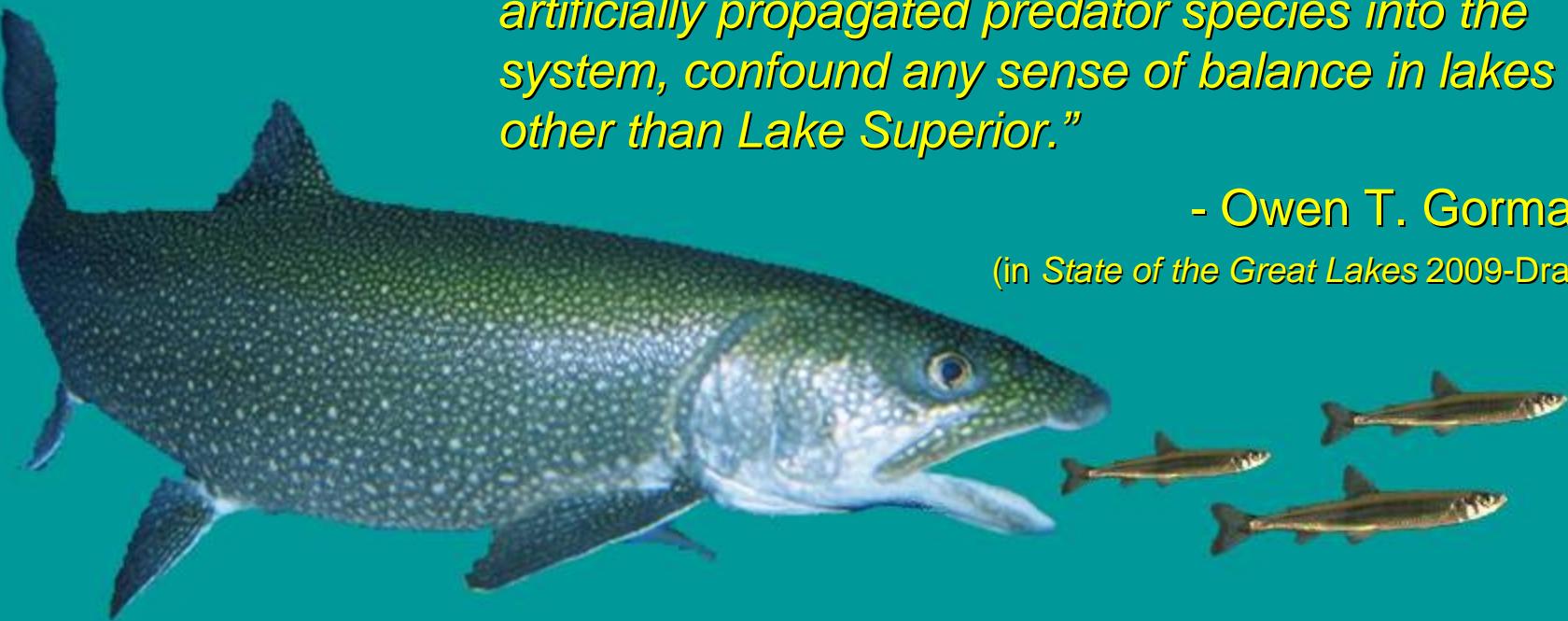


Prey Fish

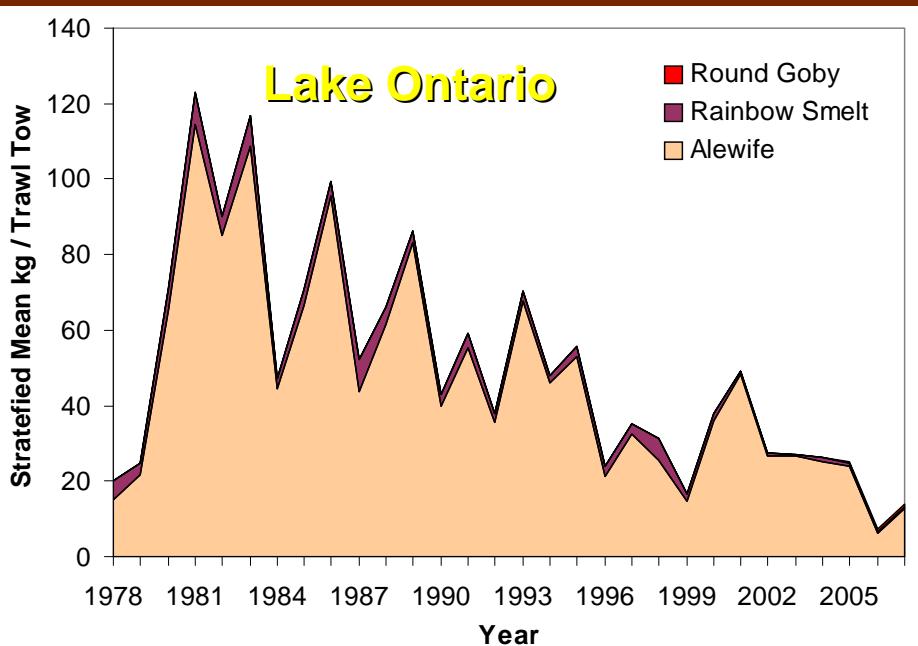
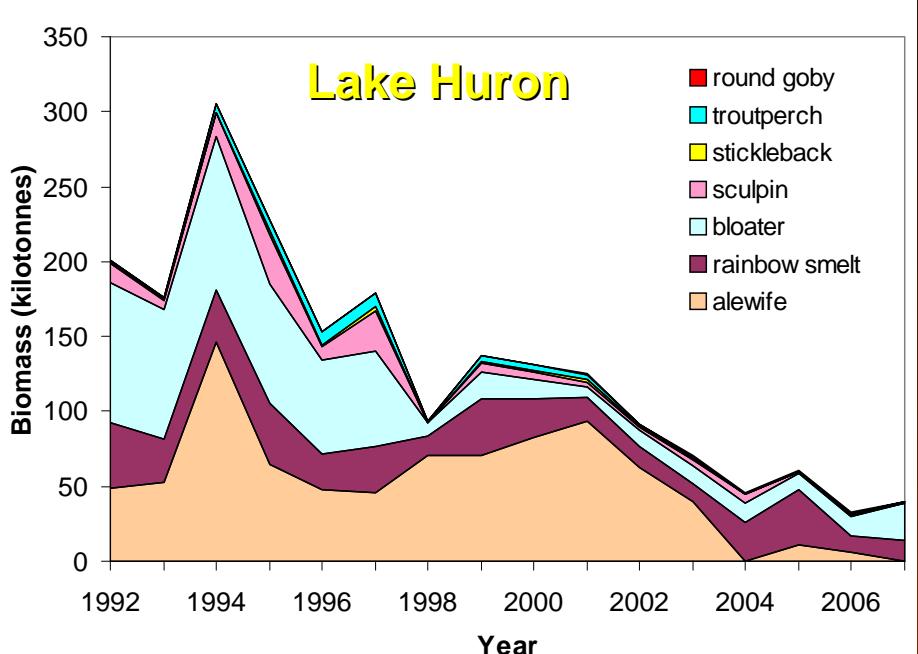
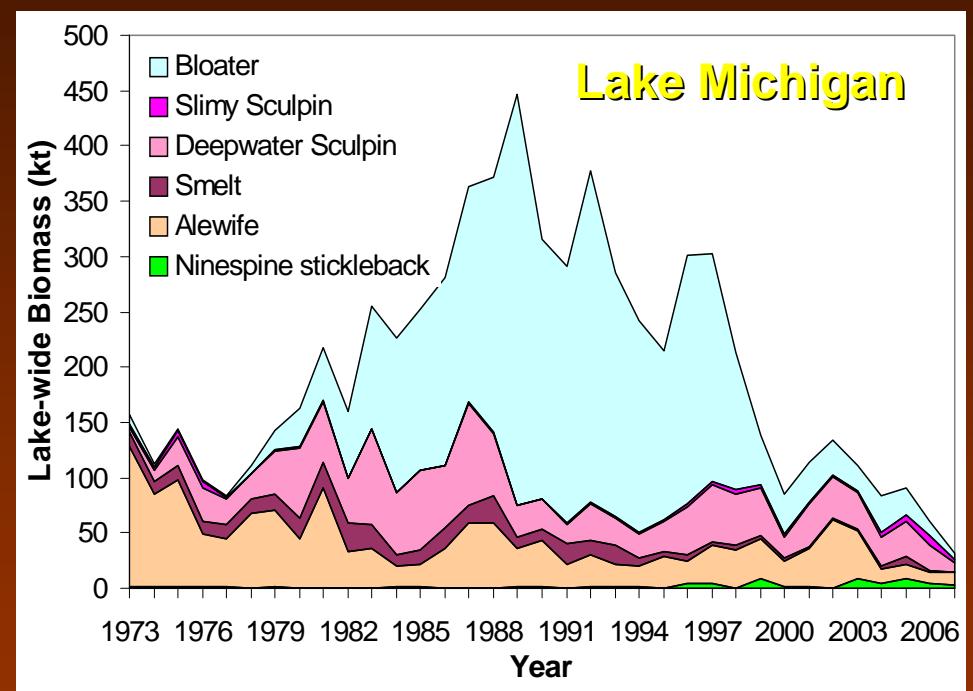
“...the current mix of native and naturalized prey and predator species, and the contributions of artificially propagated predator species into the system, confound any sense of balance in lakes other than Lake Superior.”

- Owen T. Gorman

(in *State of the Great Lakes 2009-Draft*)



Prey Fish





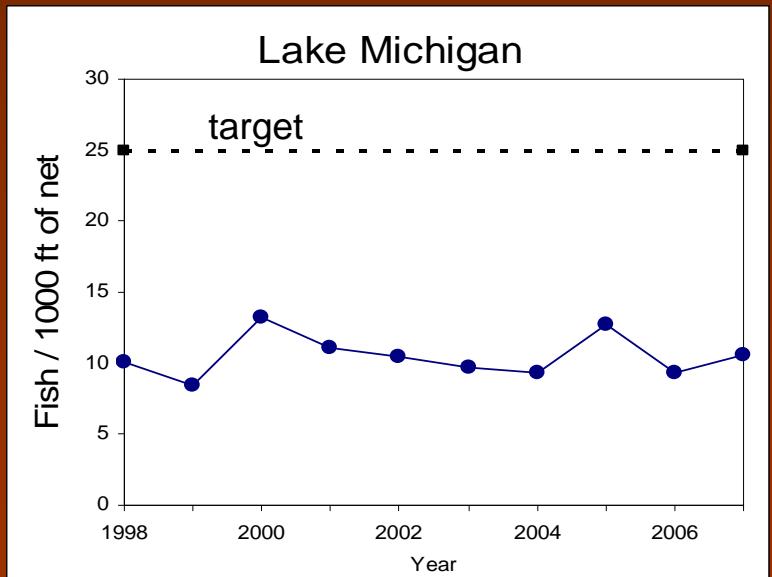
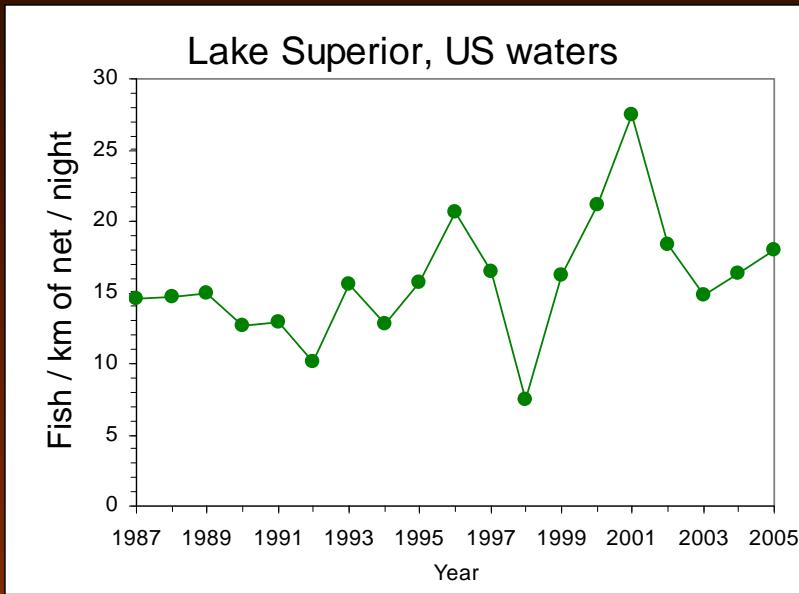
Eyed Lake Trout Eggs

USFWS

Salmon and Trout

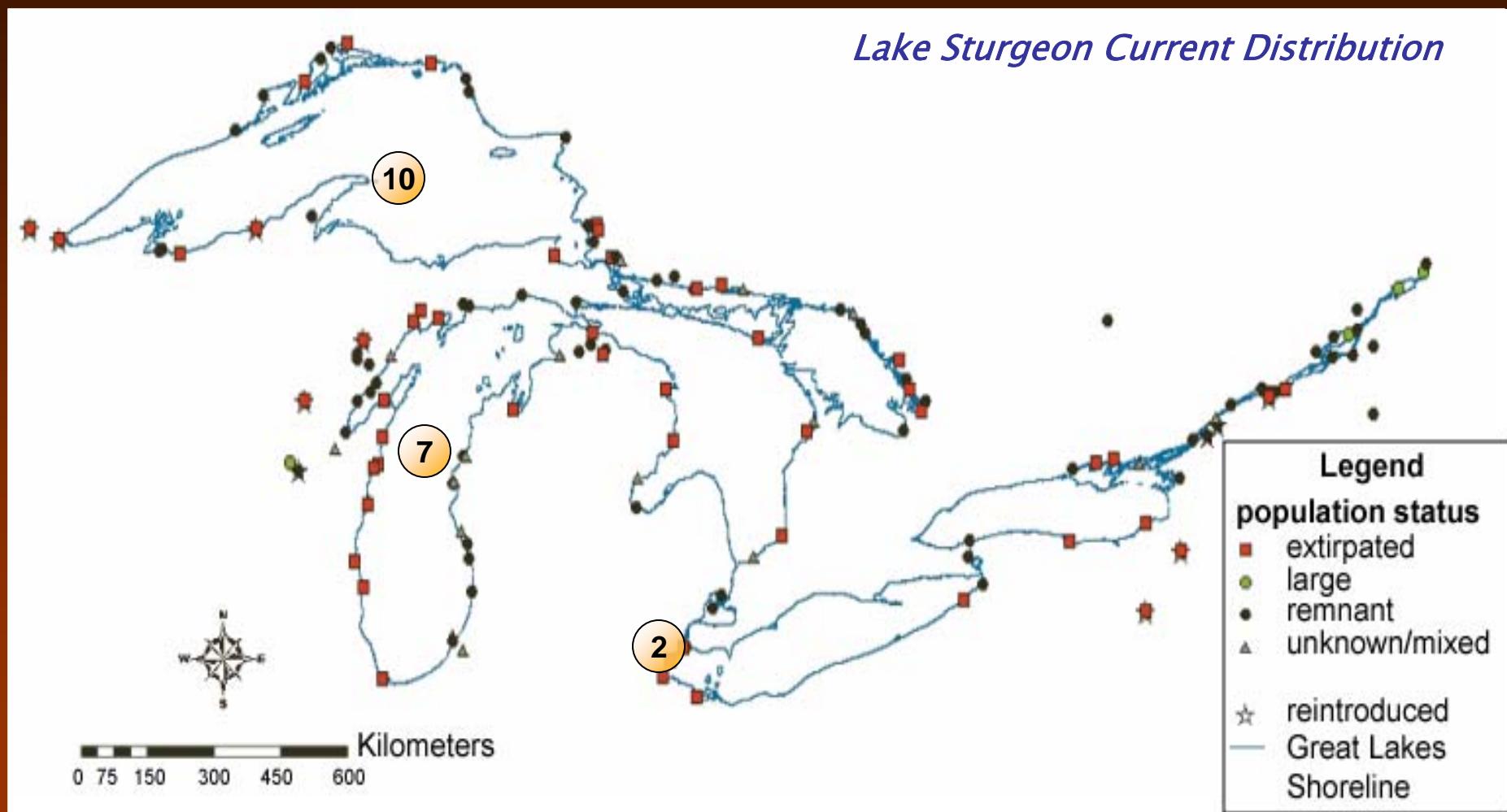


Lake Trout



Sturgeon

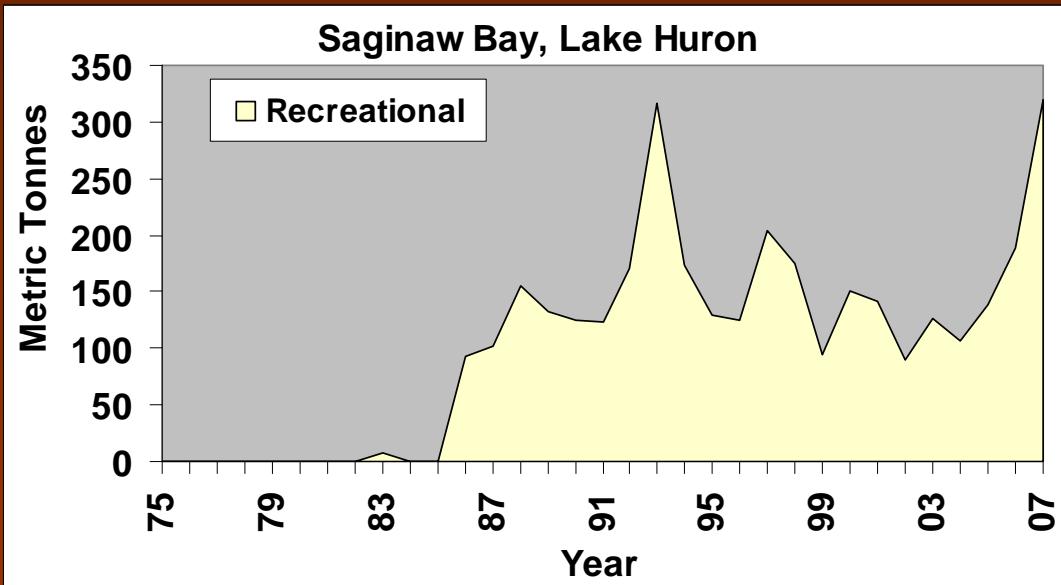
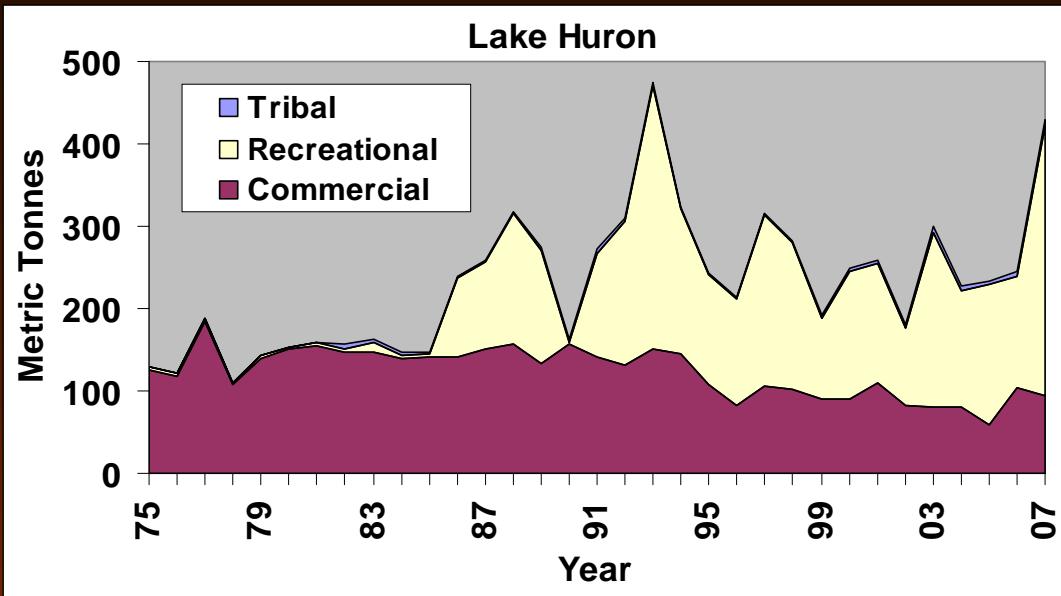
Lake Sturgeon Current Distribution





Sturgeon





Walleye



Participant in the Detroit River walleye tournament on April 8th, 2006 (Photo Credit: John Hartig, USFWS).



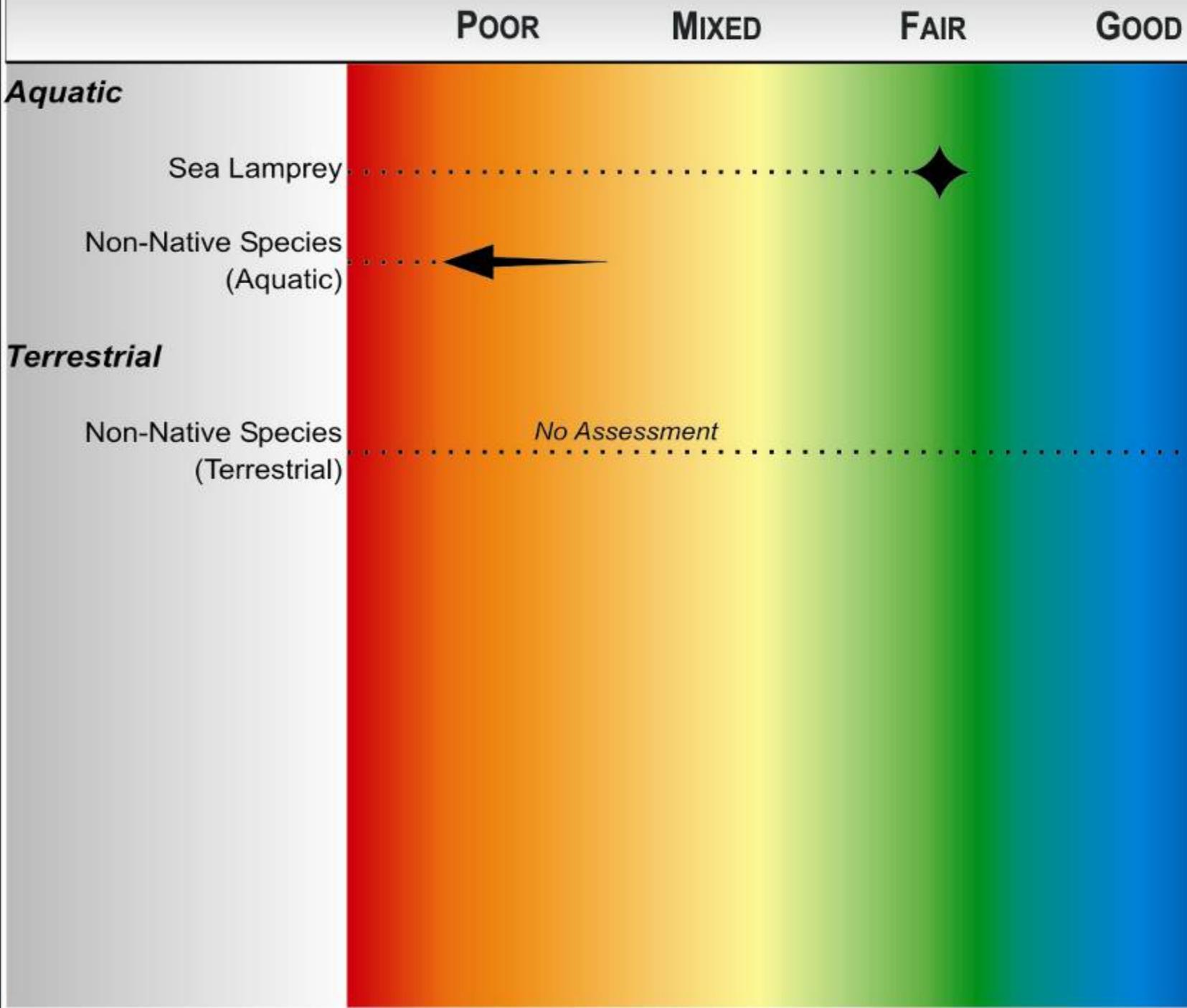
Conserving Lake Ontario and Upper St. Lawrence River Bald Eagle Habitats



Invasive Species



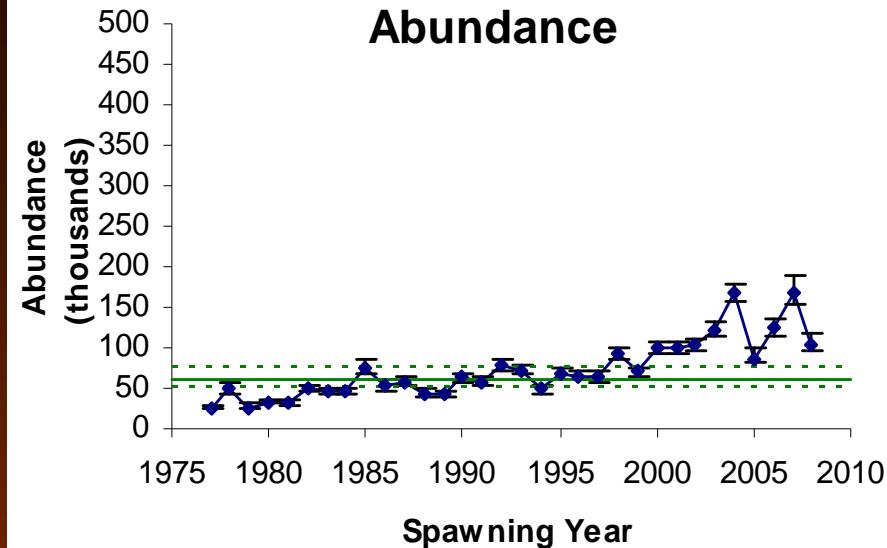
Invasive Species



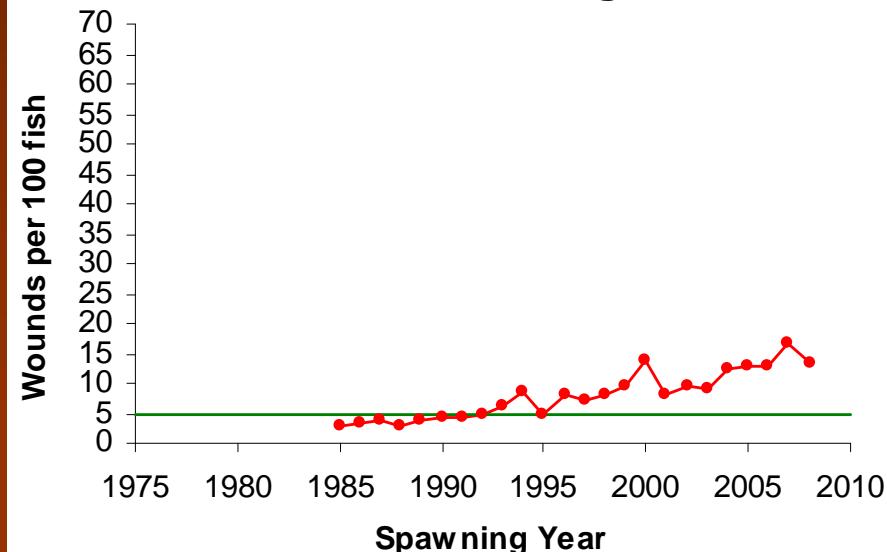
Sea Lamprey



**Spawning Sea Lamprey
Abundance**



Lake Trout Wounding Rates



Lake Michigan



Invasive Species and Aquatic Diseases



VHS Clinical Signs

Photos from Dr. Mohamed Faisal, MSU



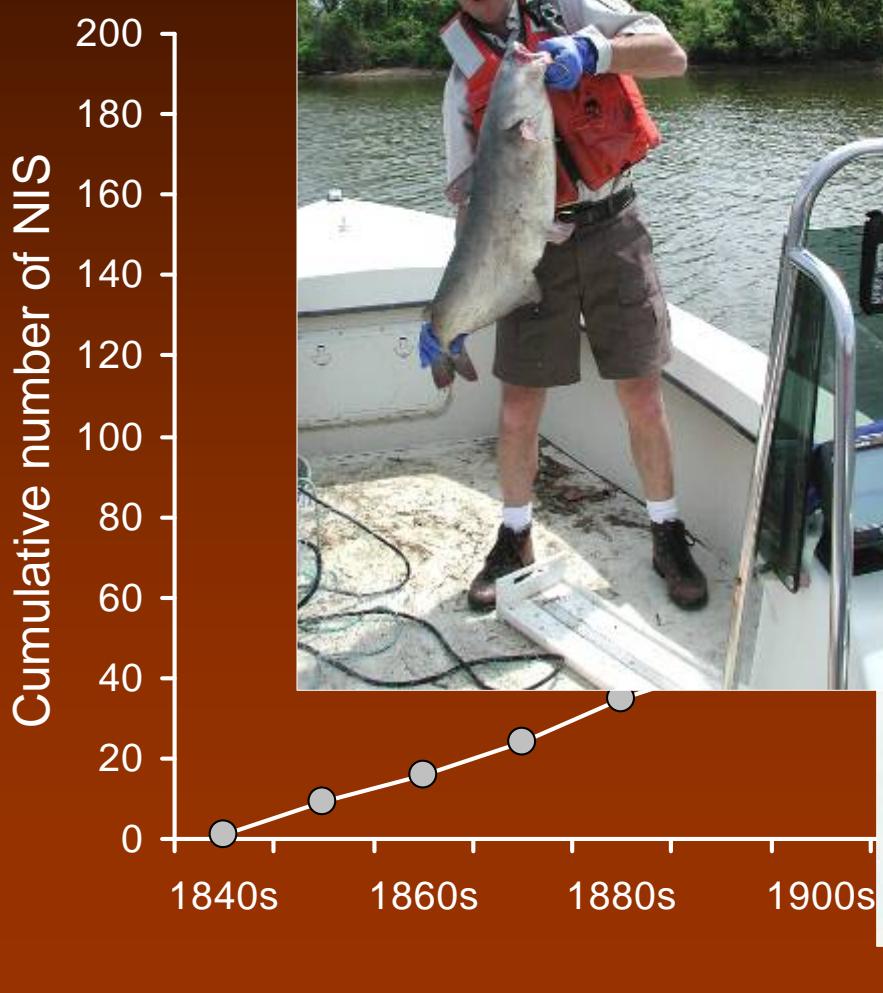
Hemorrhagic areas
on skin – Gizzard
Shad, Lake St Clair



Hemorrhagic areas
near eye – Yellow
perch, Lake St.
Clair

Photo credit: Alice Van Zoeren, NPS

Current and Predicted Introductions



30s 2000s

Decade



Chronologic Upstream Dispersal of Bighead and Silver Carp



Photo credit: Chris Young, State Journal-Register



Management Implications and Conclusions

- Maintain contaminant monitoring efforts
 - Nutrients
 - Media
 - Biota
- Consider cumulative effects of invasive species, contaminants, and climate change

Management Implications and Conclusions

- Conduct regular assessments of food-web dynamics
 - e.g. *Diporeia* – *Dreissena* interactions
- Continue and enhance sea lamprey control – integrated approach
- Integrate inventories, mapping, and mitigation of invasive species to improve strategies at a basin-wide scale

Acknowledgments

- U.S. EPA
- Environment Canada
- U.S. Fish and Wildlife Service
- U.S. FWS, Digital Library System and NCTC Image Library
- NOAA, Great Lakes Environmental Research Laboratory (GLERL) PhotoGallery
- USGS
- Ontario Ministry of Natural Resources (OMNR)
- Tetra Tech
- Wisconsin Sea Grant