

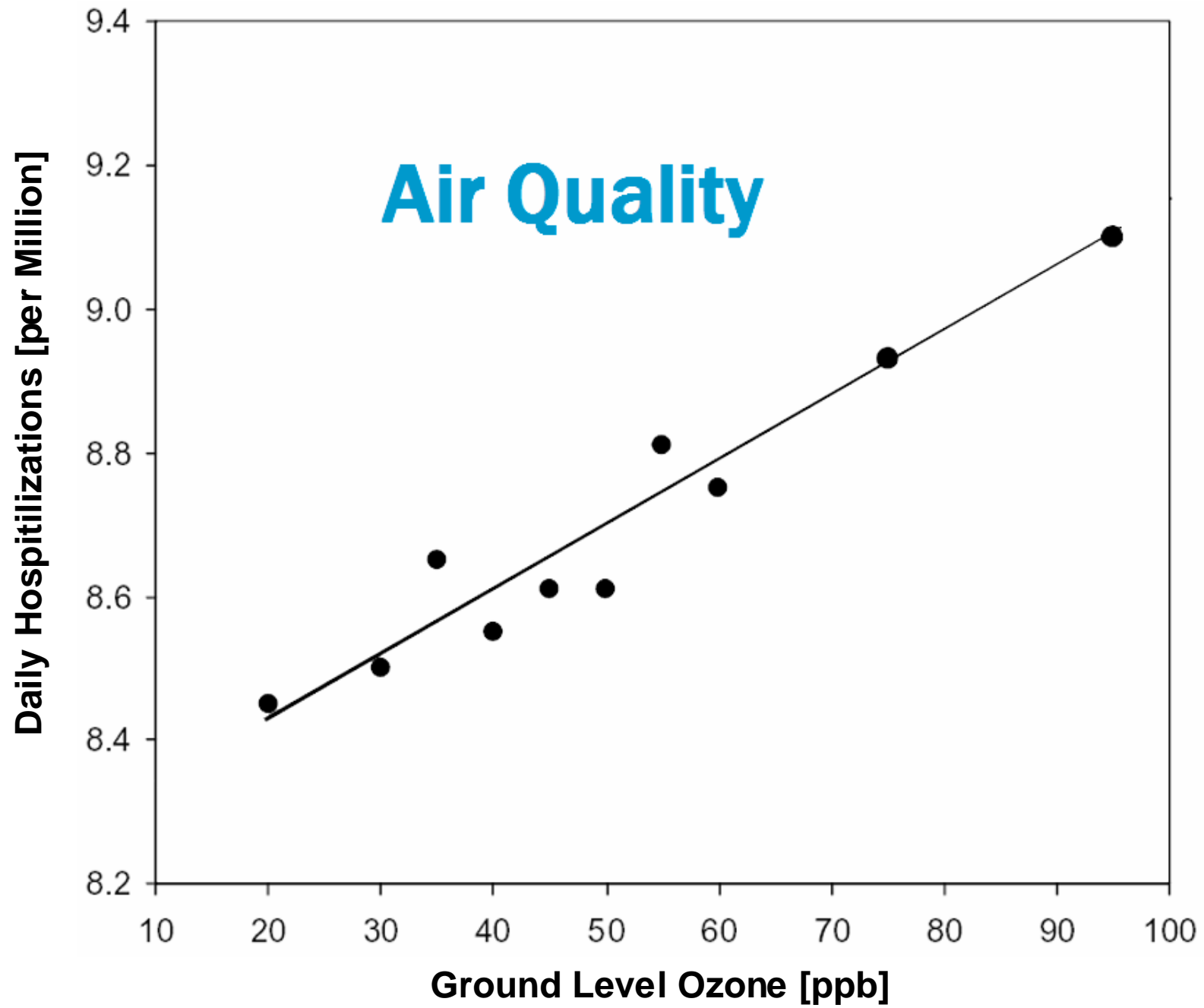
What is the State of the Great Lakes Ecosystem?

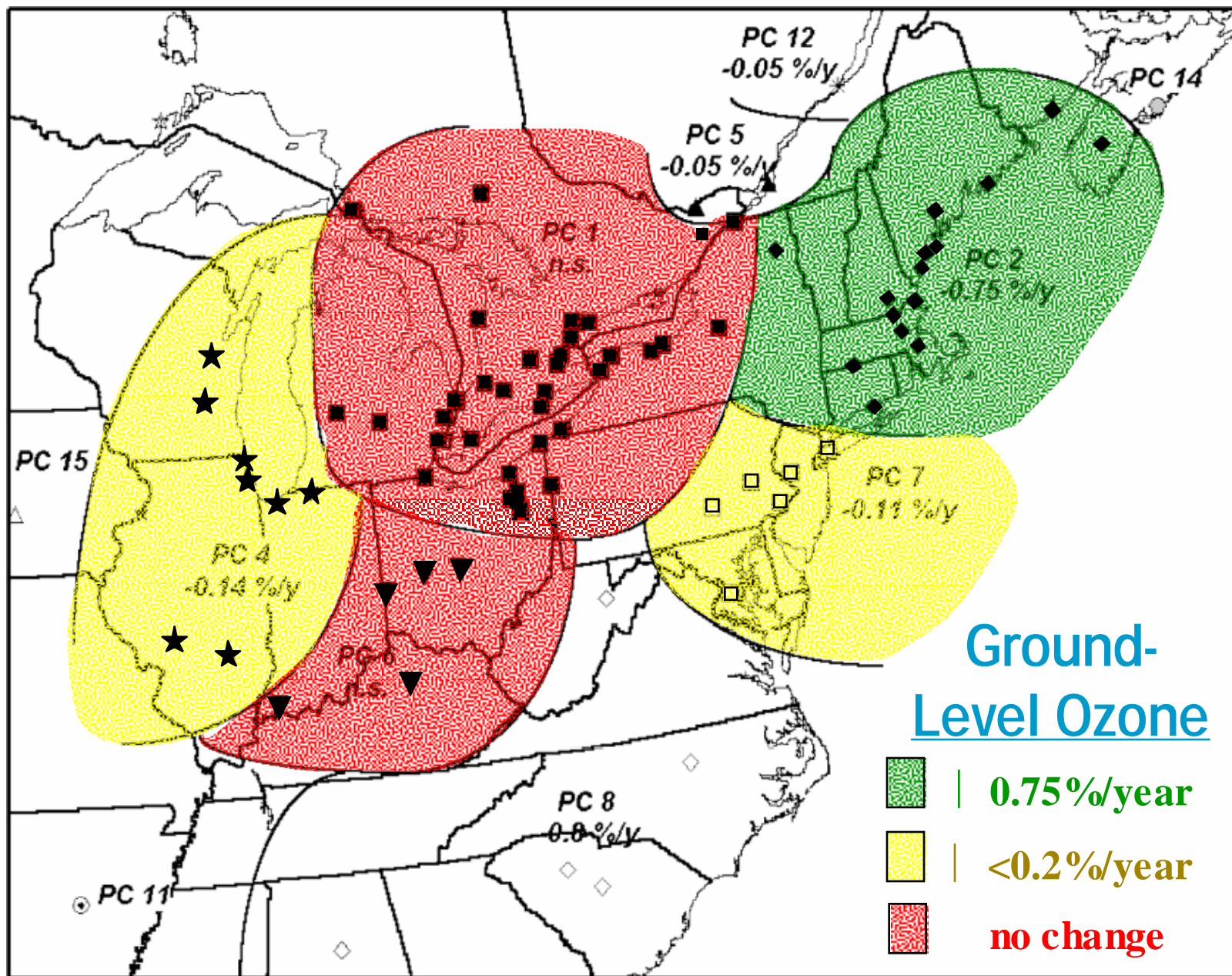
Jan Ciborowski
University of Windsor

Human perspective: Can we breathe the air?

- Air Quality







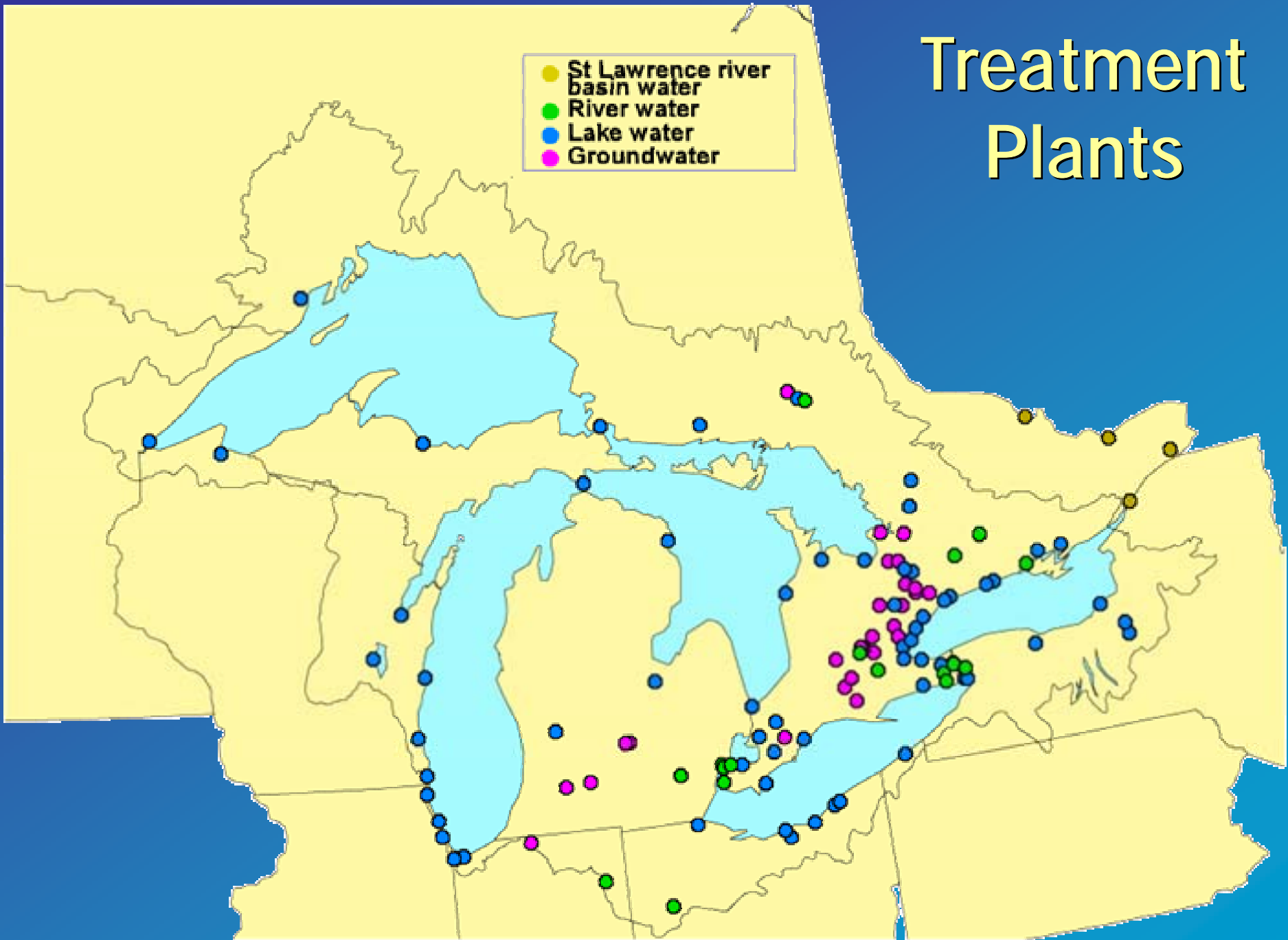
Human Perspective: Can we drink the water?

- Drinking water



Treatment Plants

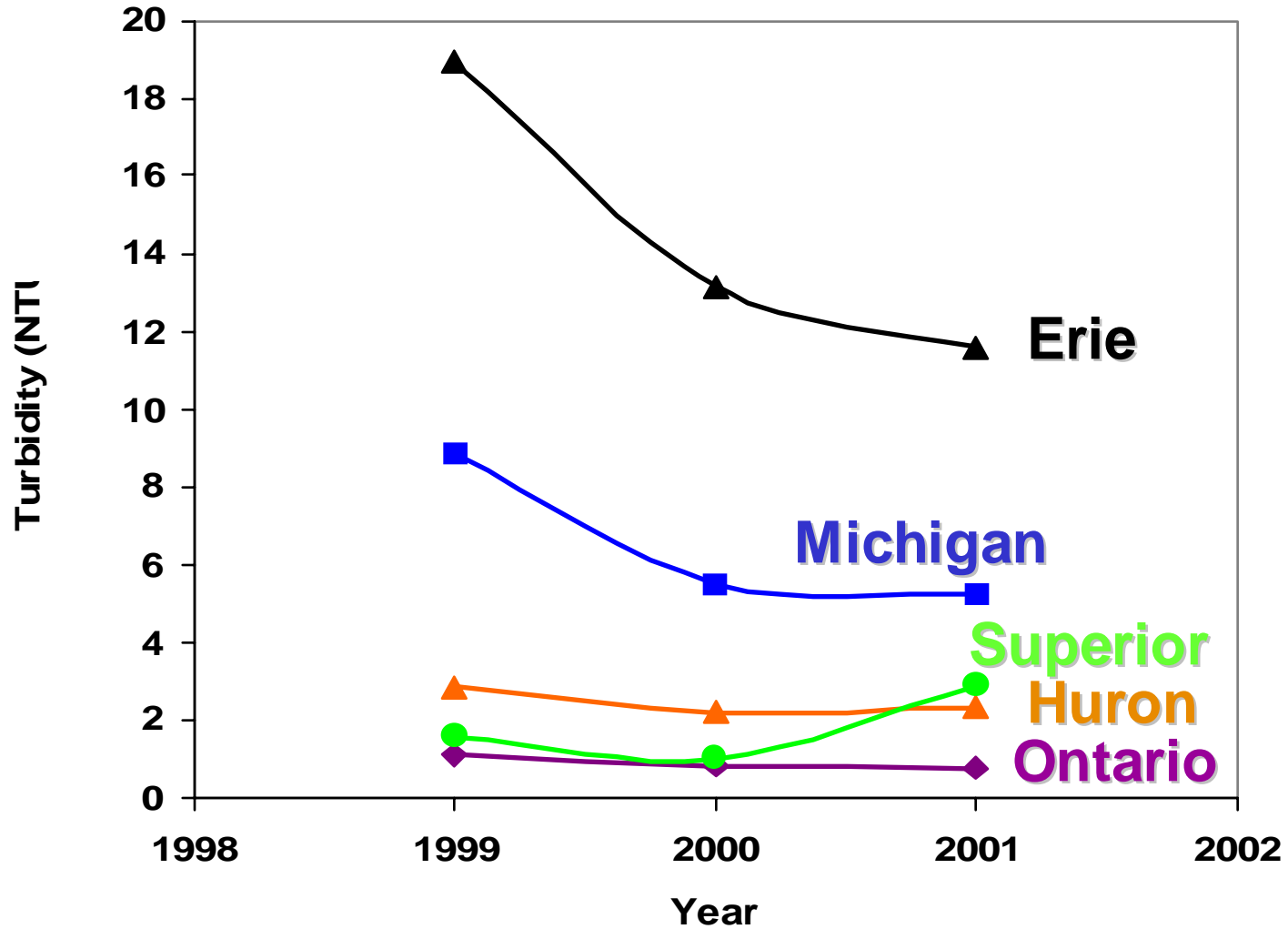
- St Lawrence river basin water
- River water
- Lake water
- Groundwater



Drinking Water

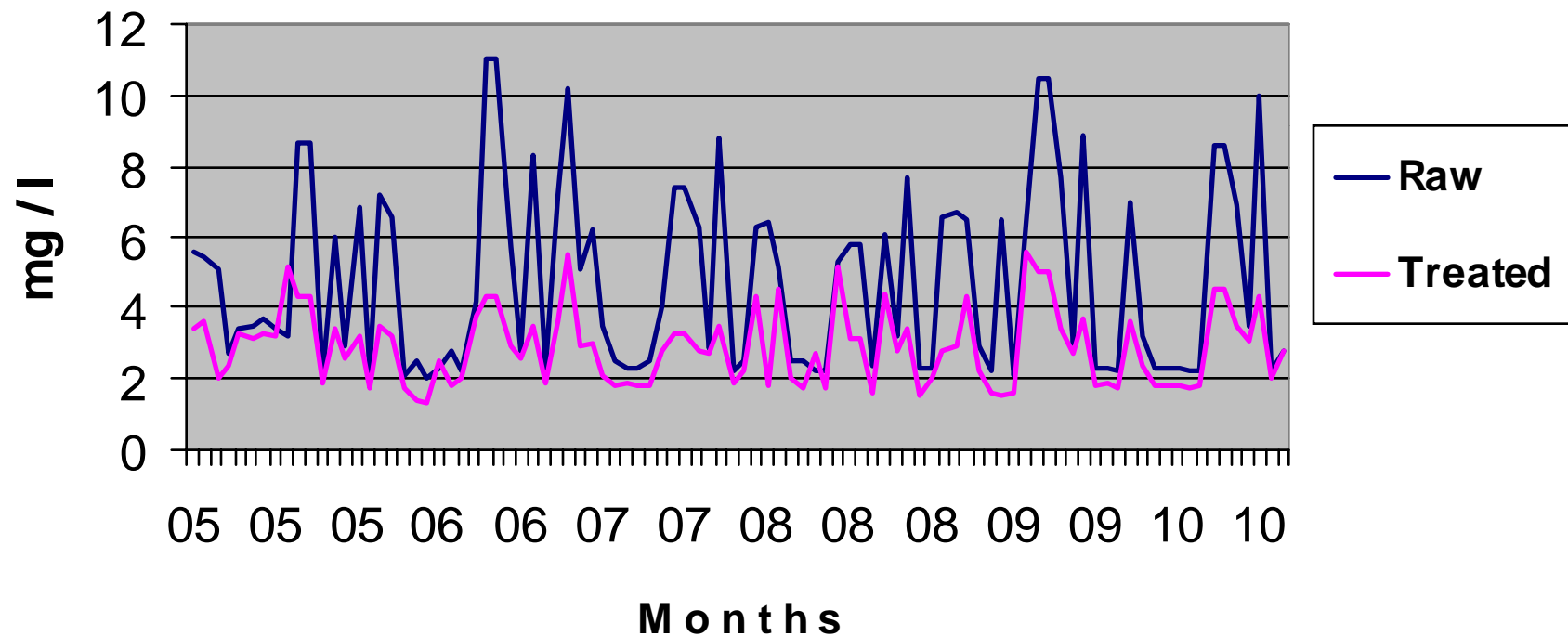
	Source Water Occurrences	Problems with Treated Water
Atrazine	Frequent	None
Nitrite	Frequent	None
Nitrate	Frequent	Rare
Total Coliform/E coli	Frequent	Rare
Cryptosporidium/Giardia	Frequent	Rare
Turbidity	Frequent	Rare
TOC/DOC	Frequent	Controlled
Taste/Odor	Not monitored	Controlled

Average Annual Turbidity for Raw Water



Drinking Water

2000 TOC/DOC: Raw vs. Treated



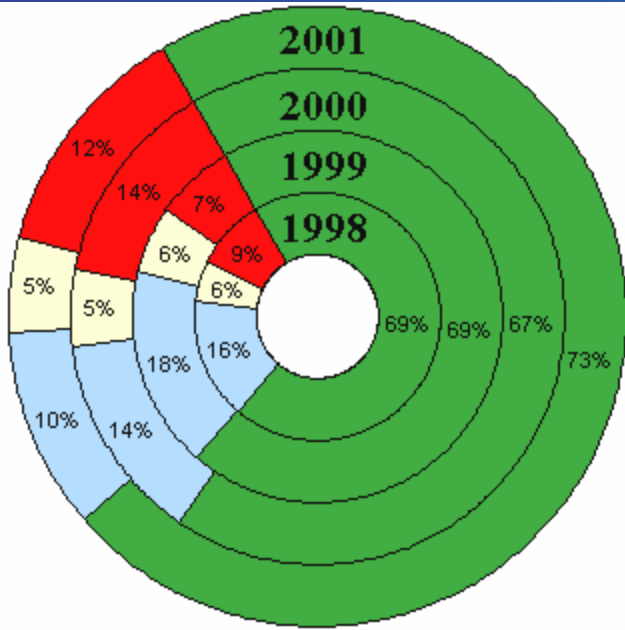
Human Perspective: Can we swim in the water?

- Beach advisories (E. coli & fecal coliform levels in recreational waters)



Beach Advisories

United States



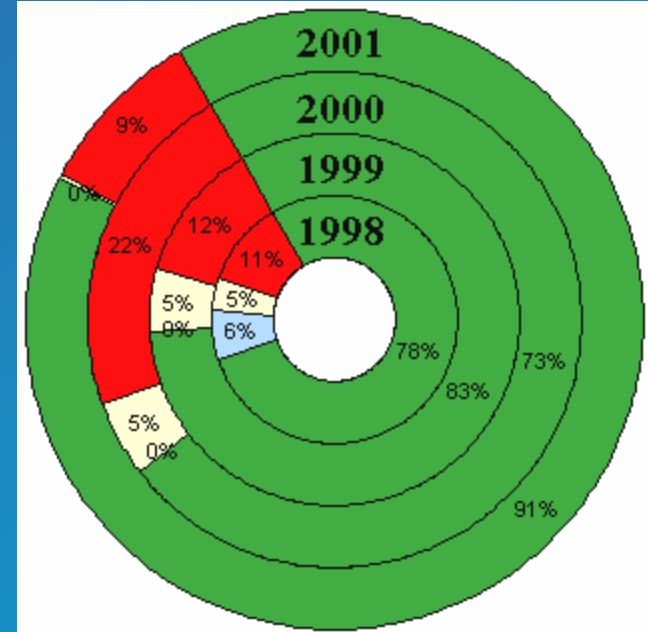
% Time with Beach Advisories and Closure

- 0% Closed
- 1% - 4% Closed
- 5% - 9% Closed
- > 10% Closed

Number of beaches reported each year:

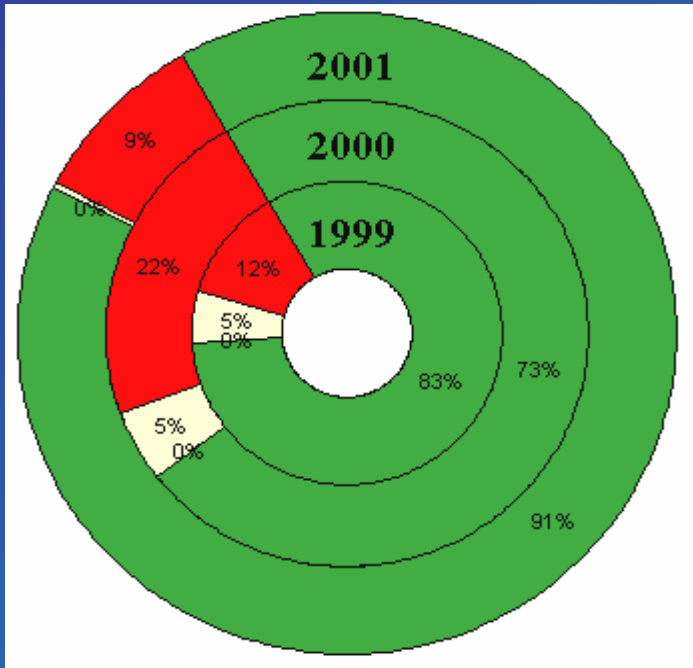
U. S.	Canada
315 - 2001	304
329 - 2000	293
316 - 1999	238
298 - 1998	218

Canada



Canadian Great Lakes Beach Advisories

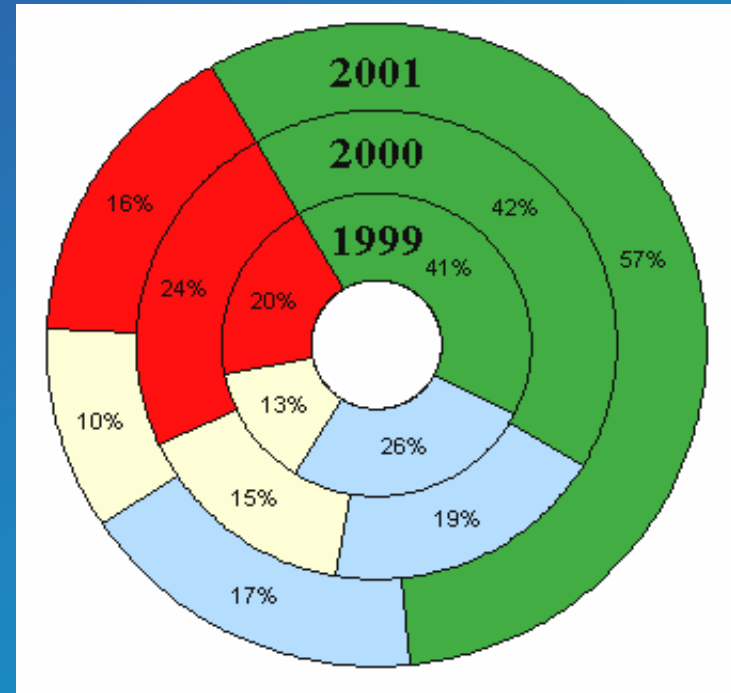
Beaches with Advisories



% Time with Beach Advisories or Closings

- 0% Closed
- 1% - 4% Closed
- 5% - 9% Closed
- > 10% Closed

Beaches that Exceeded the Standard



% Time Standard Exceeded

- 0%
- 1% - 4%
- 5% - 9%
- >10%

Human Perspective: Can we eat the Fish?

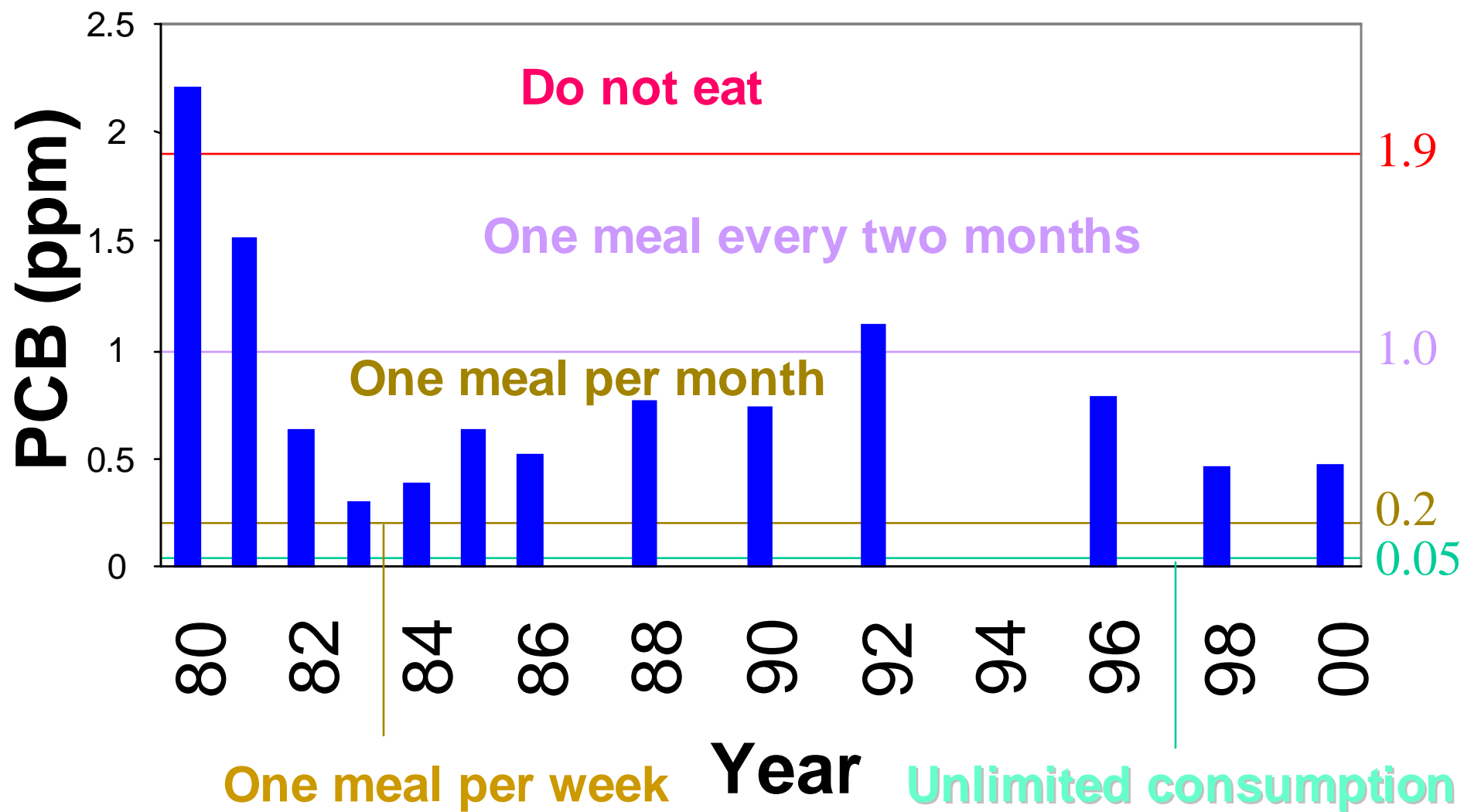
- Contaminants in edible fish tissue



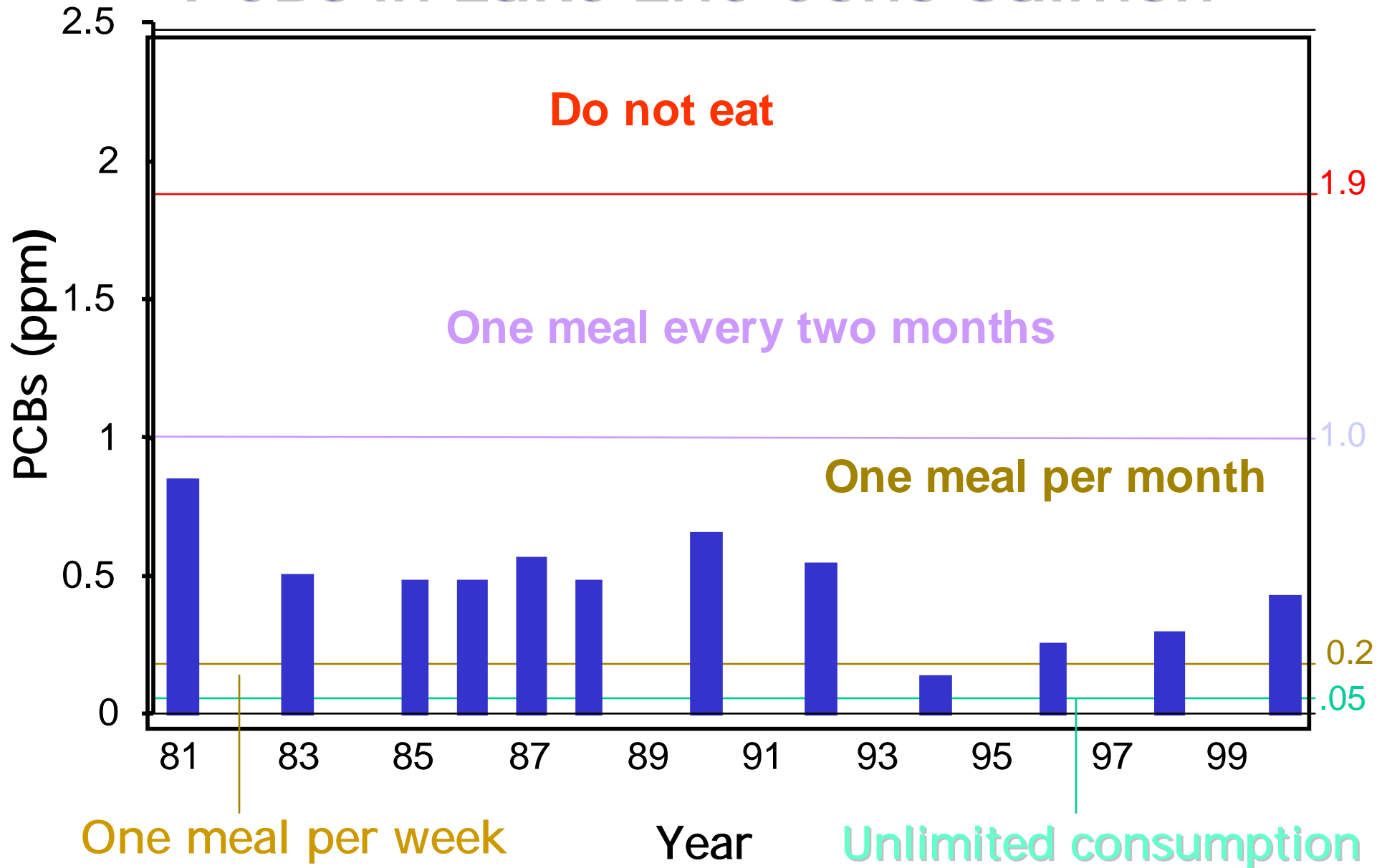
Contaminants in Edible Fish Tissue



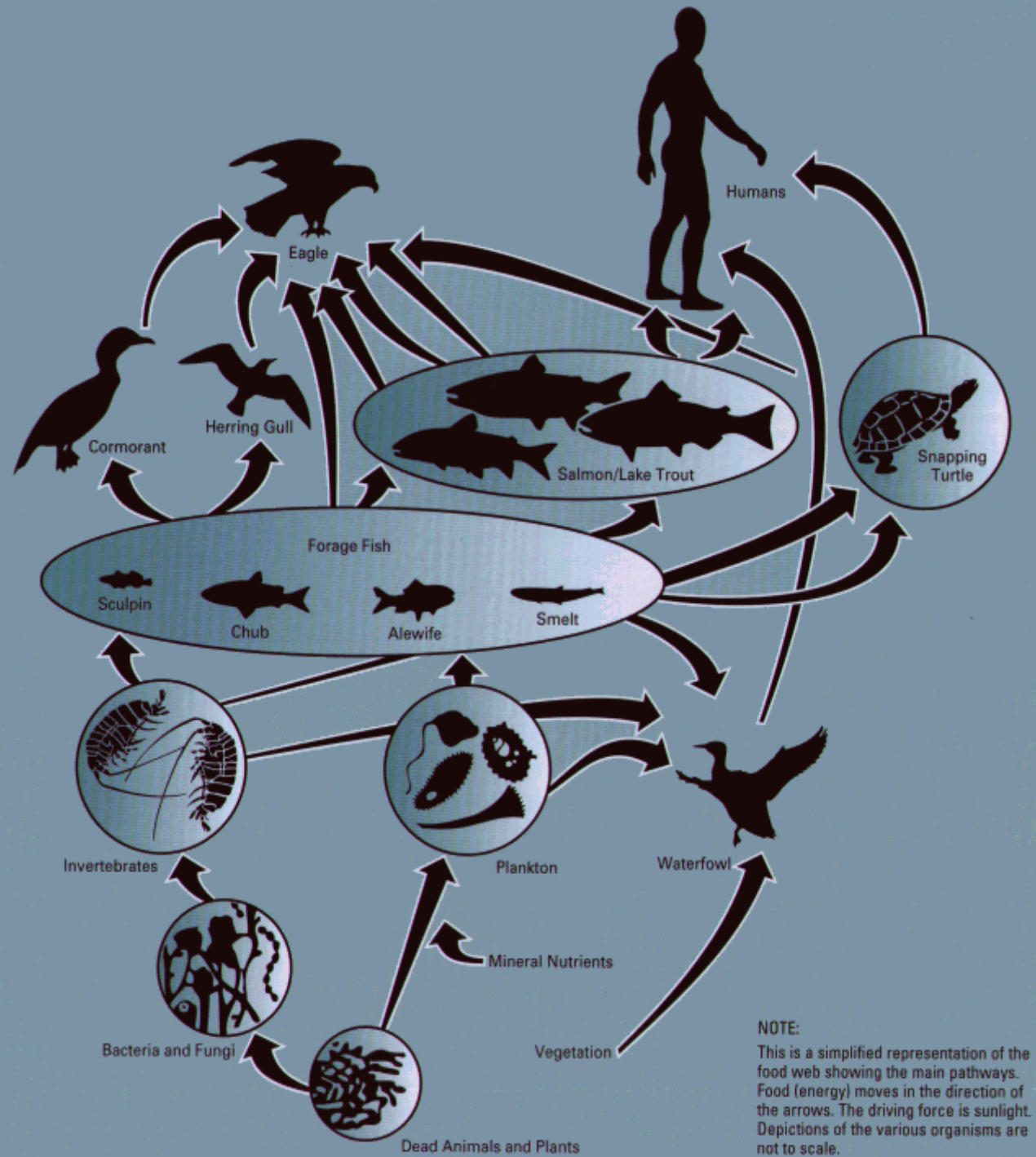
PCBs in Lake Michigan Coho Salmon



PCBs in Lake Erie Coho Salmon



Ecosystem Perspective



Are the fish healthy?

- Lake trout



- Salmon and trout



- Walleye



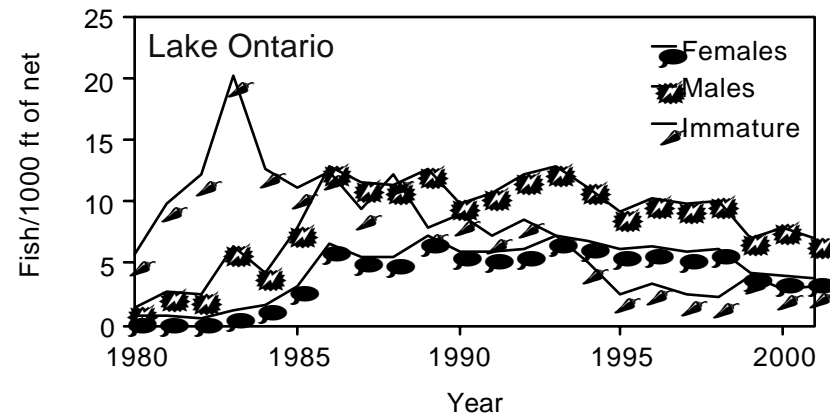
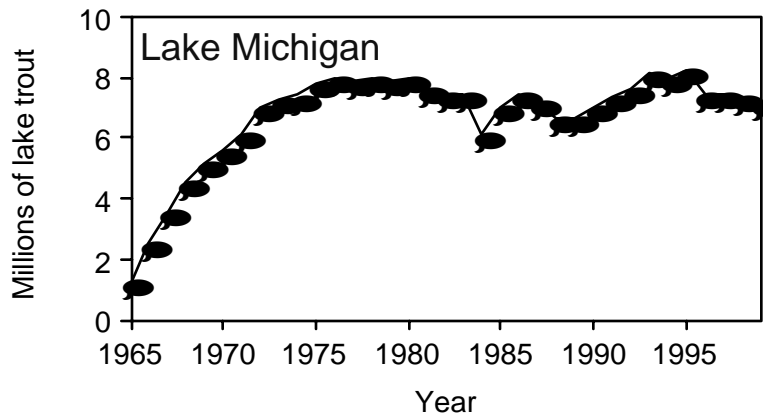
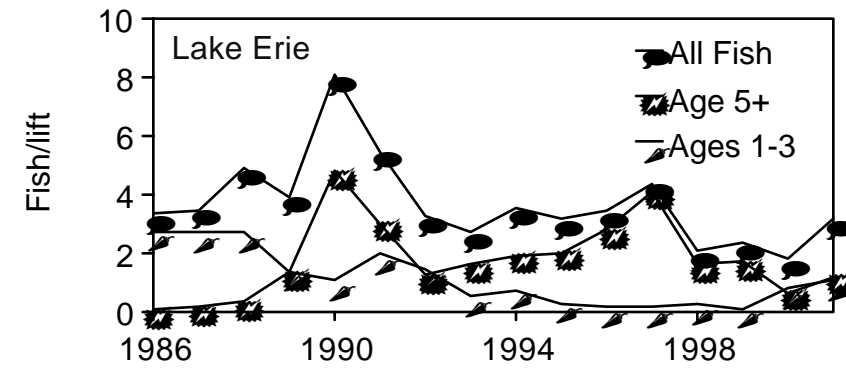
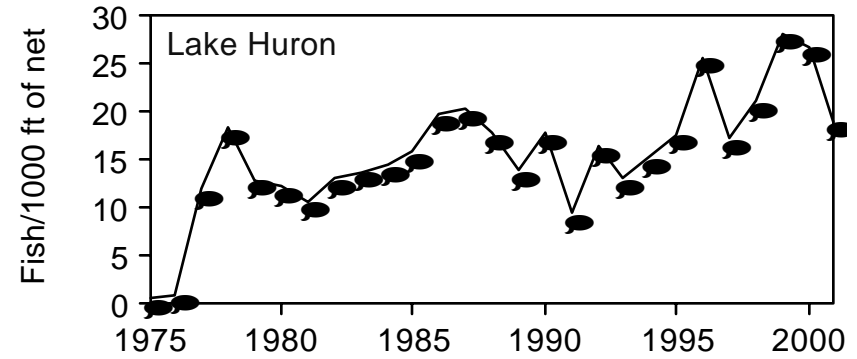
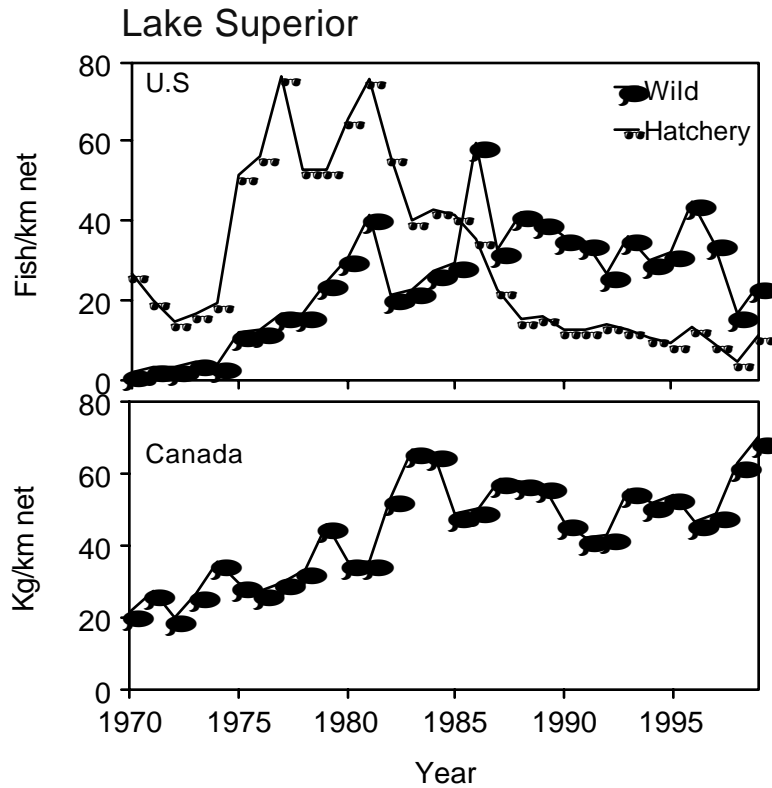
- Preyfish populations



Lake Trout



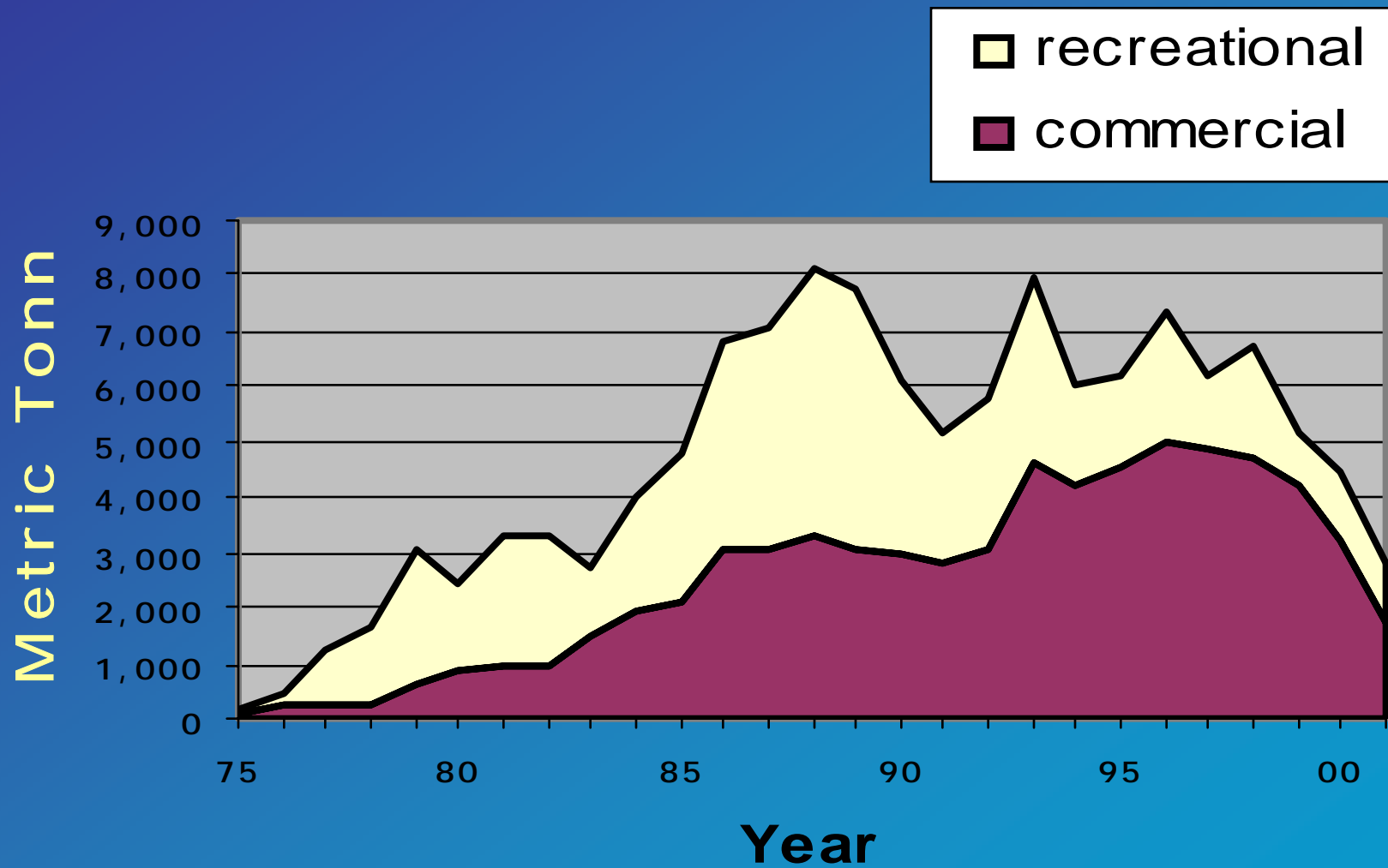
Lake Trout



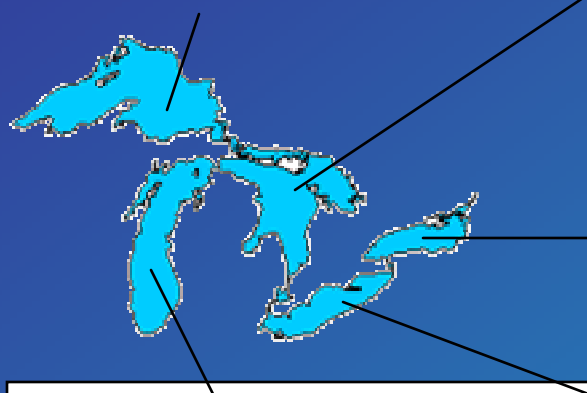
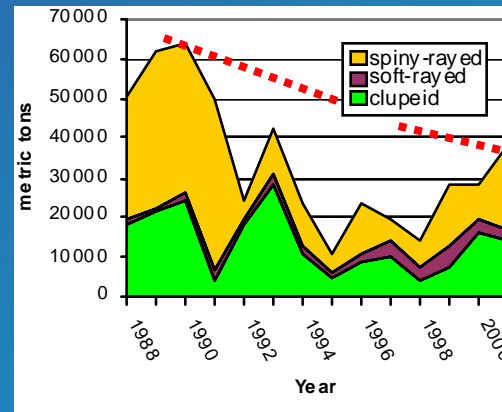
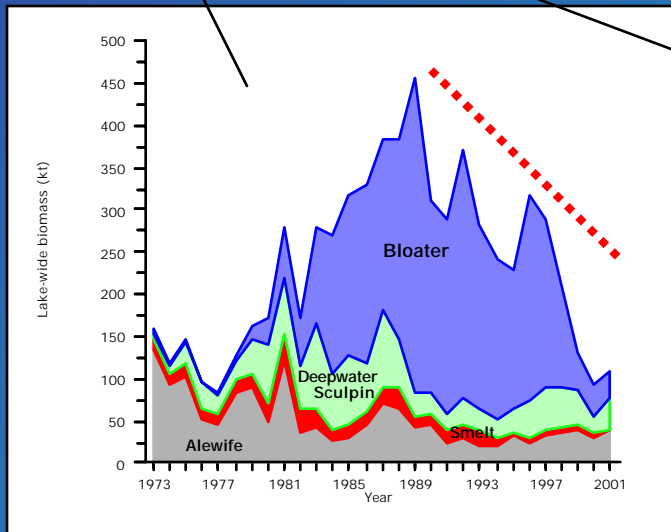
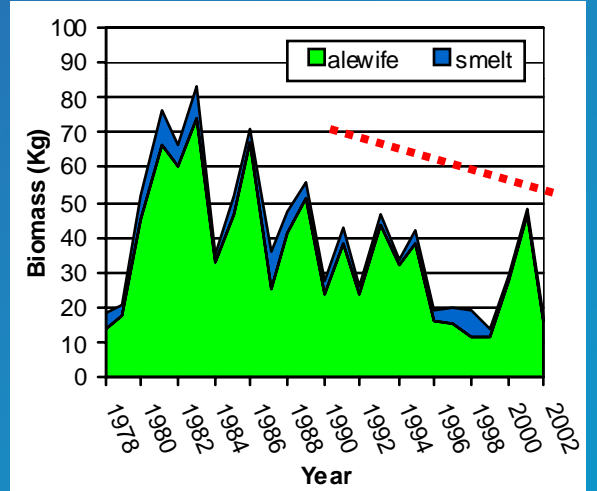
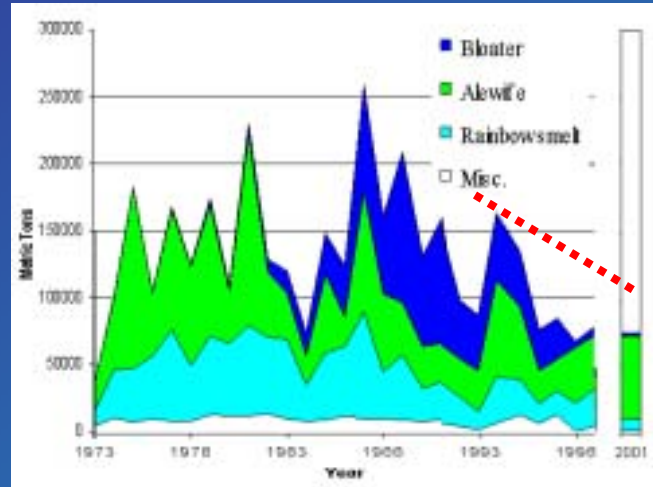
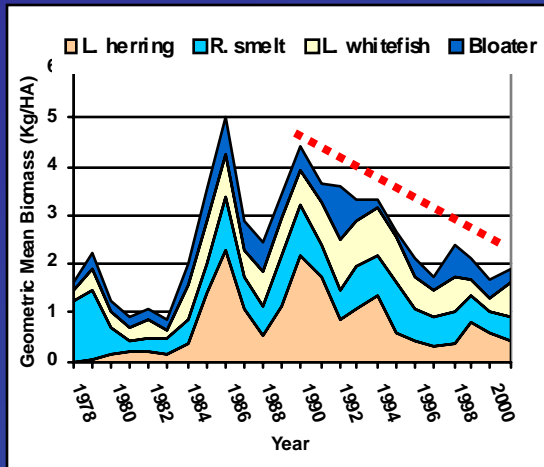
Walleye



Lake Erie Walleye



Preyfish Populations



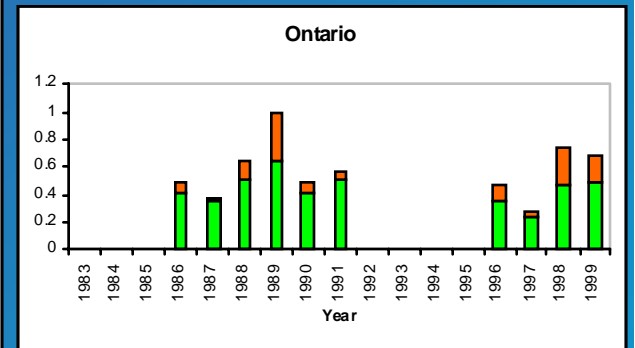
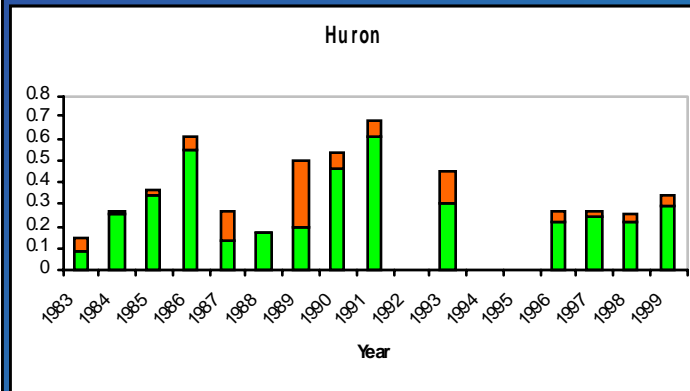
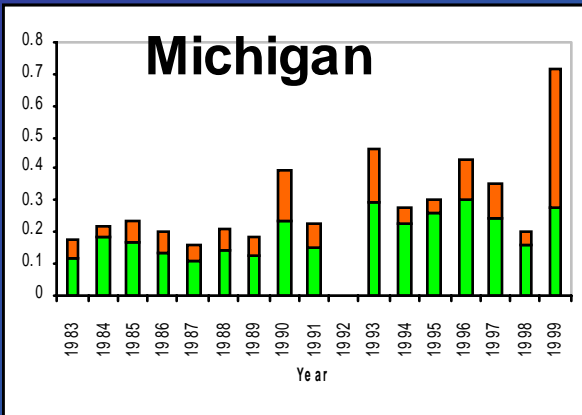
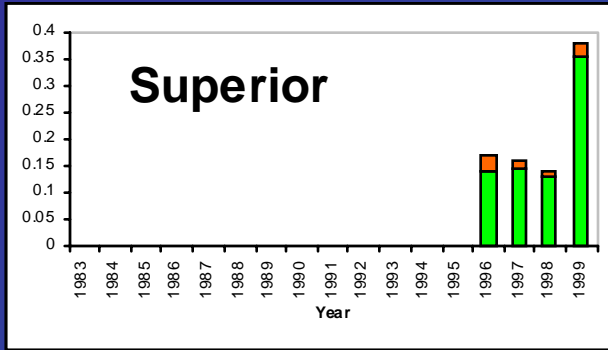
Ecosystem Perspective: Is the food web healthy?



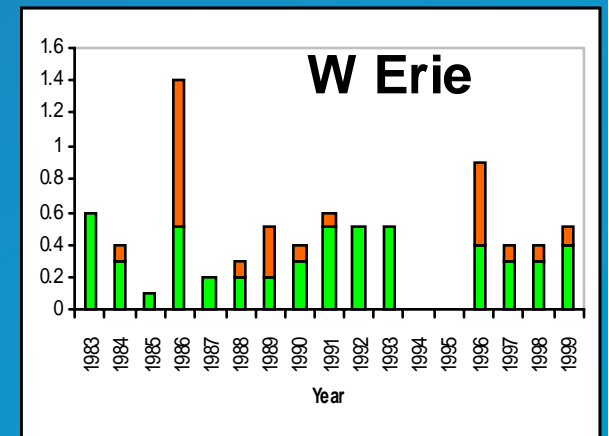
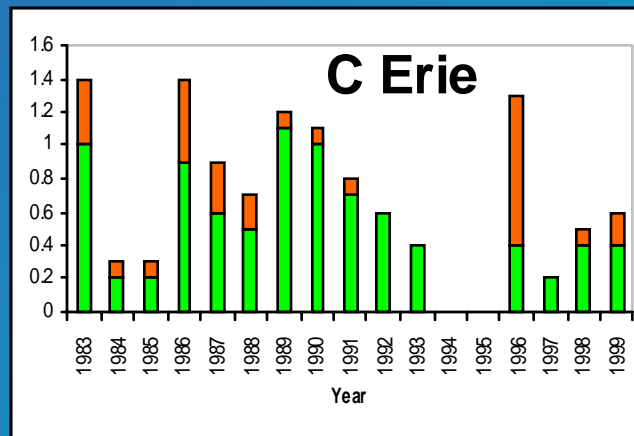
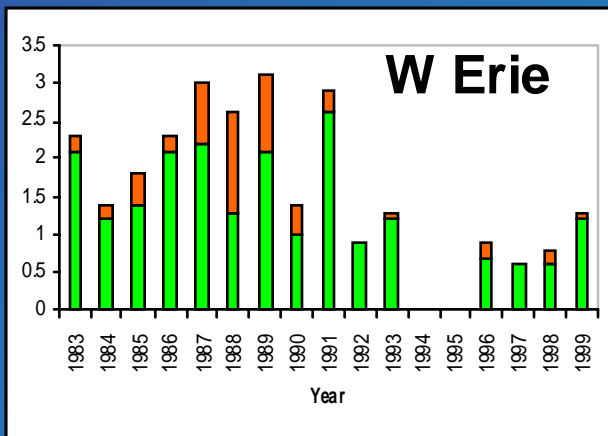
- Water Column
 - Zooplankton & Phytoplankton



Phytoplankton



Erie



Ecosystem Perspective: Is the food web healthy?

- Benthos

- Diporeia "Scud"



- Hexagenia "Mayfly"



- Native unionid mussels





Zebra
mussels

Quagga
mussels



Botulism Effects in Fish

- Disorientation
- Erratic Swimming
- Paralysis
- Death



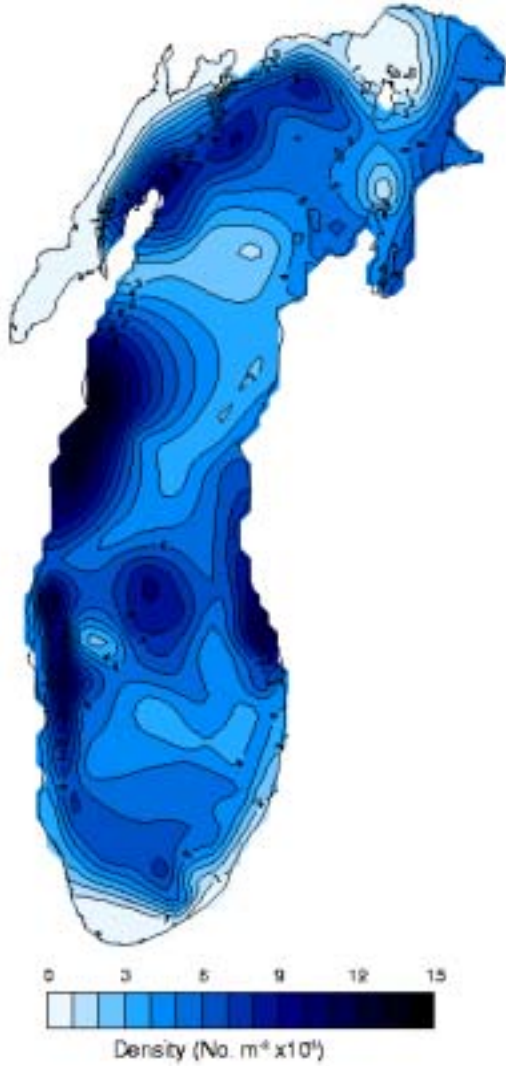
Botulism Effects in Birds

- Weakness
- Dizziness
- Inability to fly
- Muscular paralysis
- Respiratory impairment

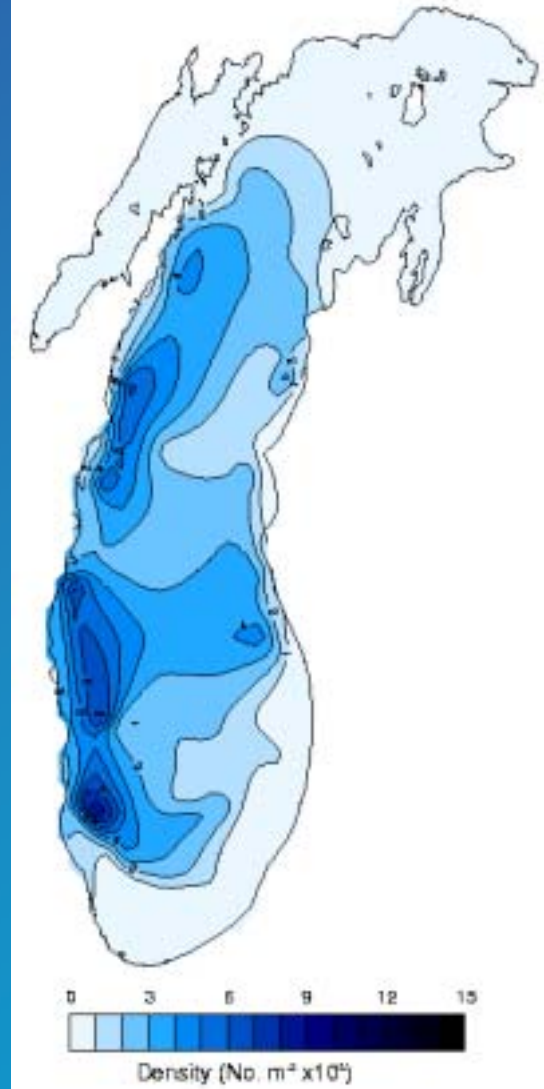


Diporeia in Lake Michigan

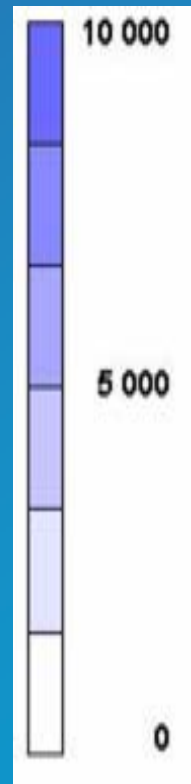
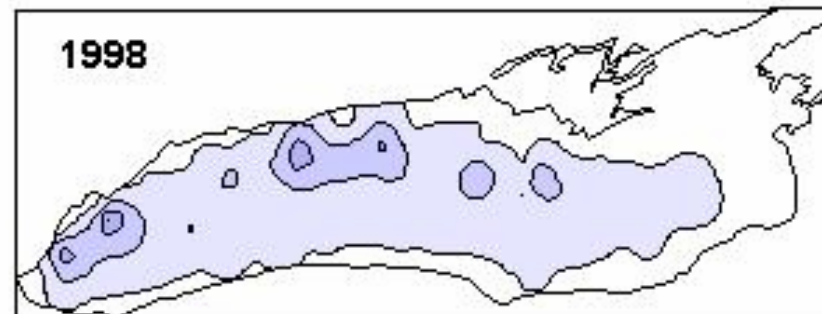
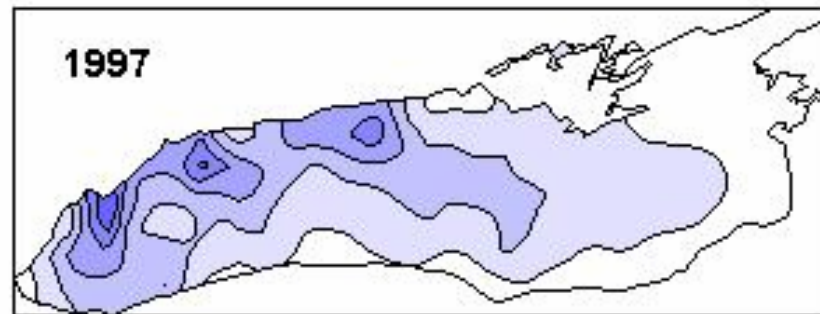
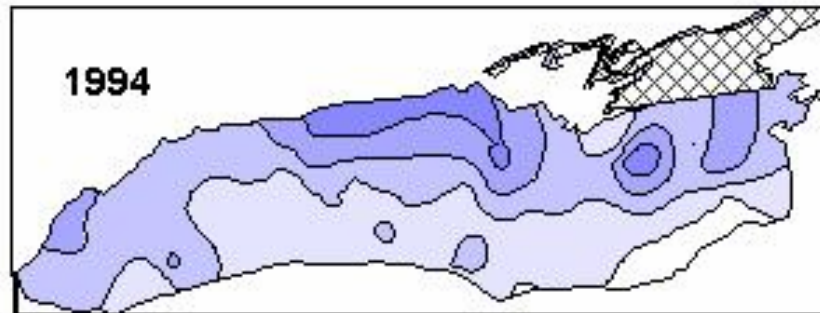
Diporeia Density, 1994 & 1995



Diporeia Density, 2000

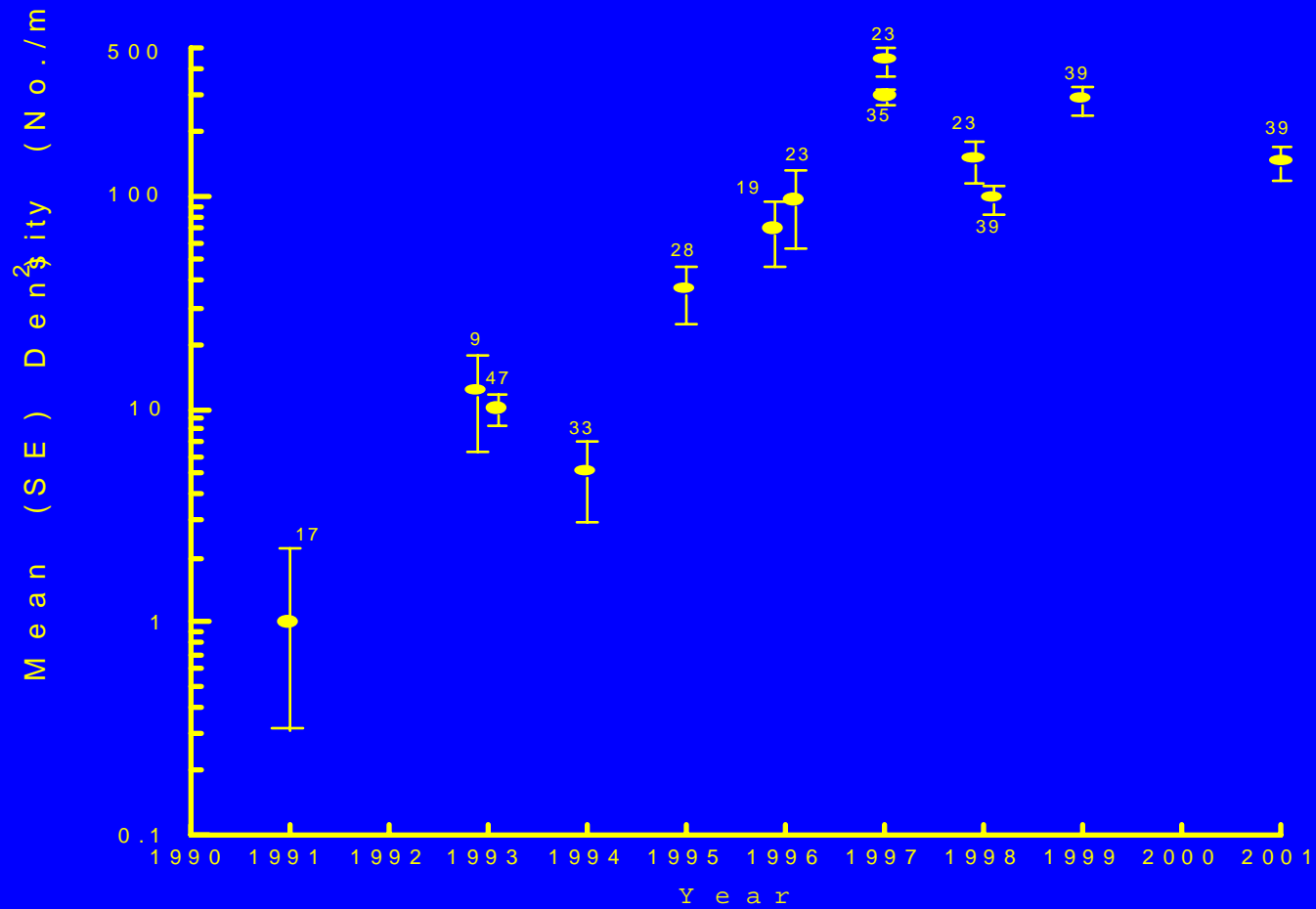


Diporeia

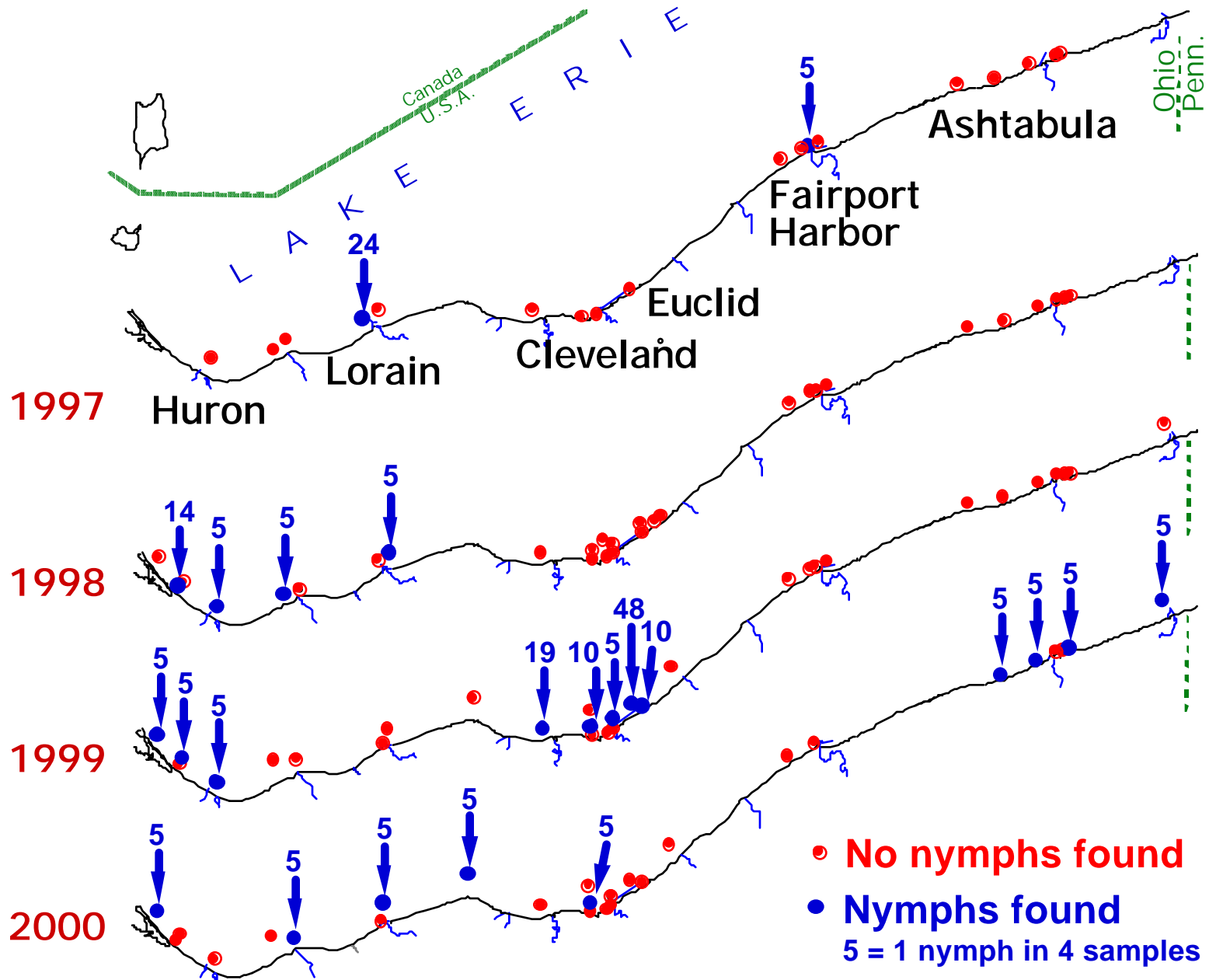


Hexagenia in western Lake Erie

Hexagenia Density in Western Lake Erie






Mayfly Nymphs in Central Basin

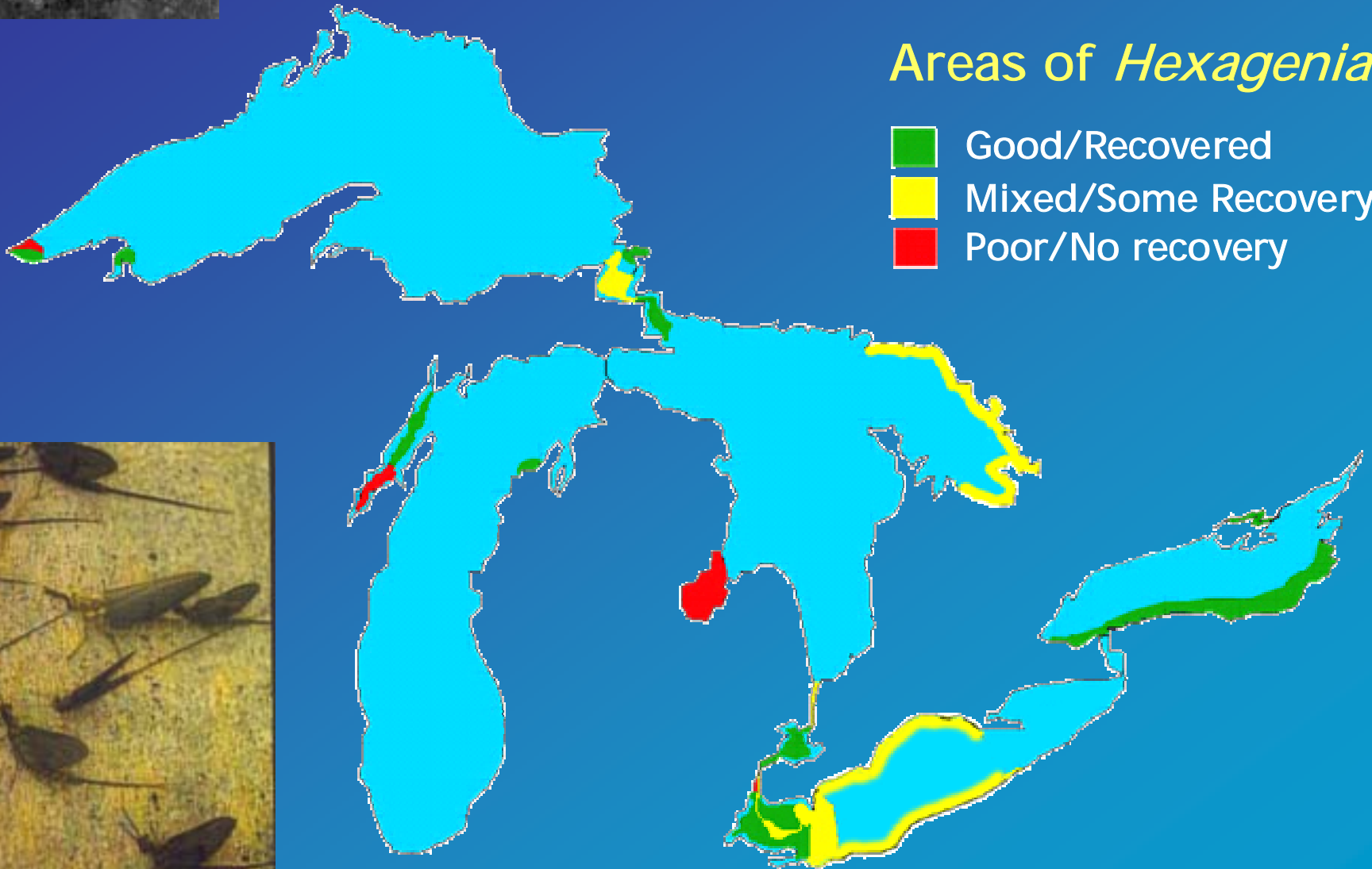


Hexagenia



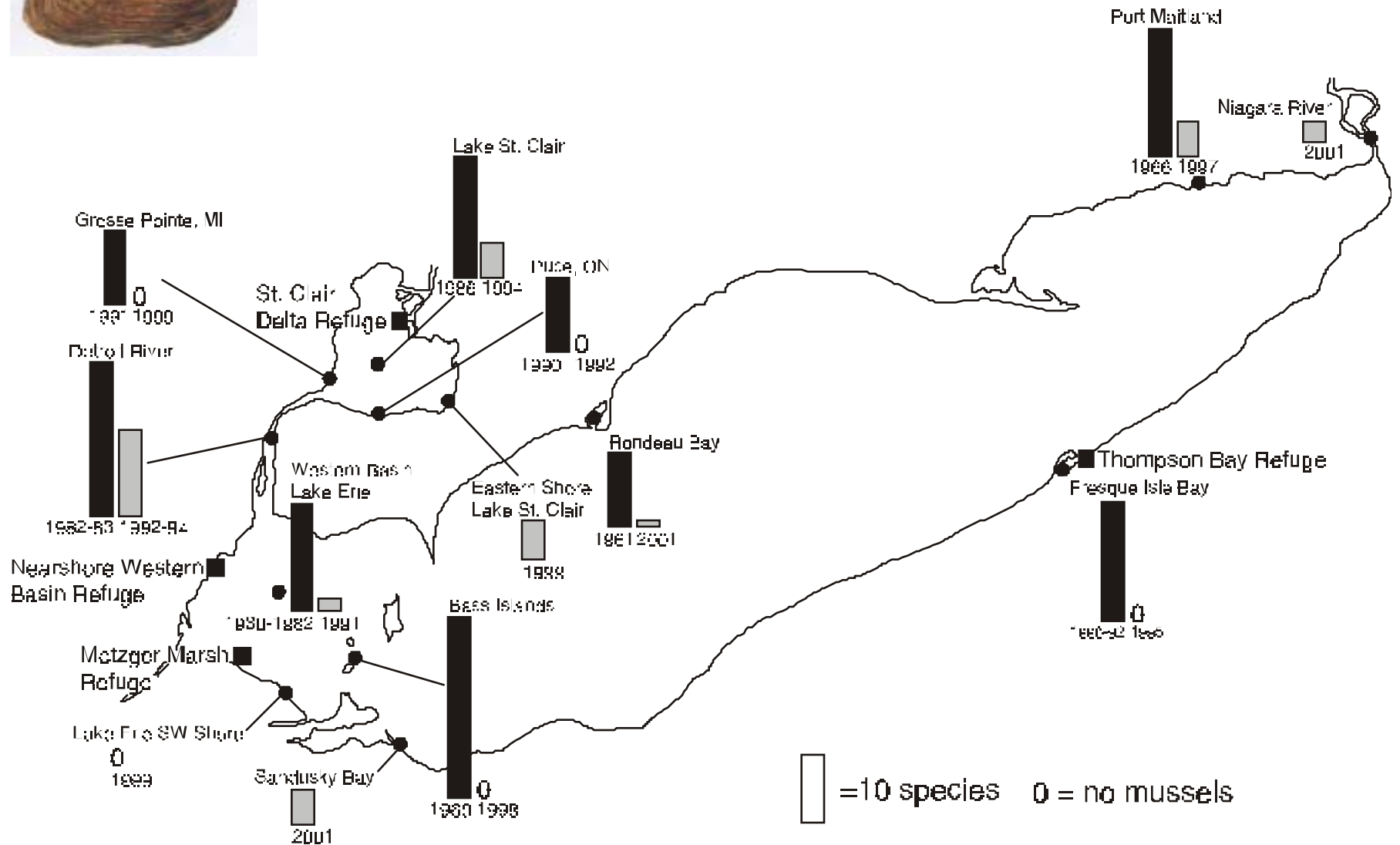
Areas of Hexagenia

-  Good/Recovered
-  Mixed/Some Recovery
-  Poor/No recovery





Native Freshwater Mussels in lakes Erie & St. Clair



Ecosystem Perspective: What do the indicators tell us about coastal wetlands?

- Amphibians
- Wetland birds

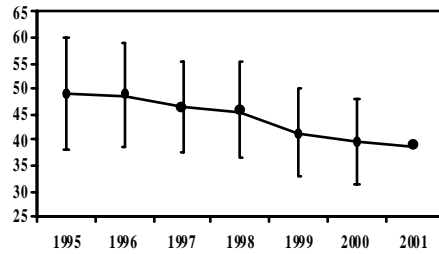
Amphibians



Amphibians

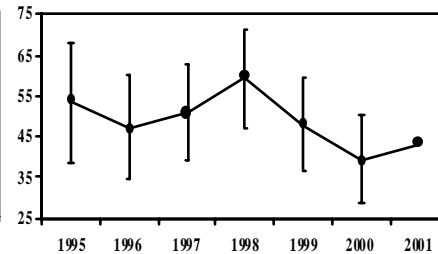
American Toad

-1.9 (-3.3, 0.5) $P < 0.01$



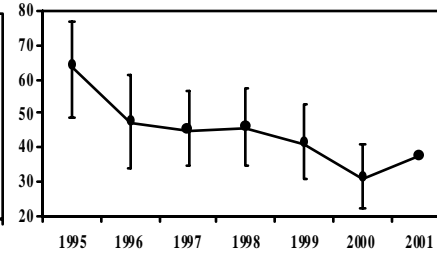
Bullfrog

-1.9 (-3.8, 0.1) $P = 0.069$



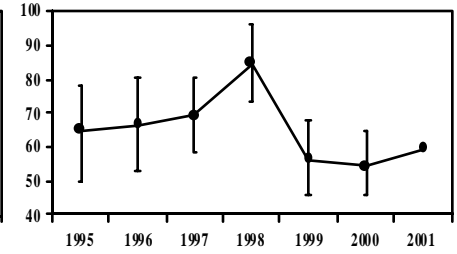
Chorus Frog

-3.5 (-5.3, -1.5) $P < 0.001$



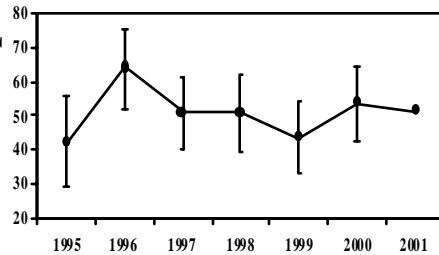
Green Frog

-2.9 (-4.5, -1.3) $P < 0.001$



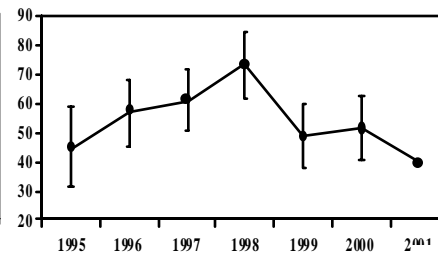
Grey Treefrog

-0.2 (-2.0, 1.7) $P = 0.84$



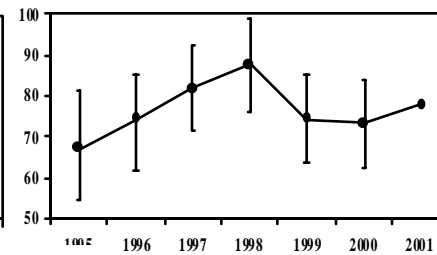
Leopard Frog

-1.5 (-3.1, 0.2) $P = 0.08$



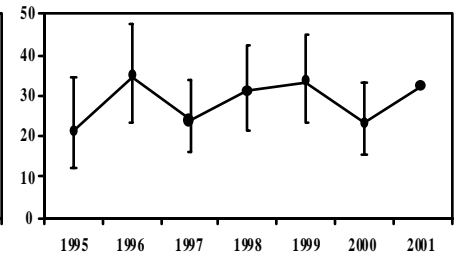
Spring Peeper

-0.1 (-1.8, 1.5) $P = 0.89$



Wood Frog

0.6 (-1.2, 2.5) $P = 0.52$

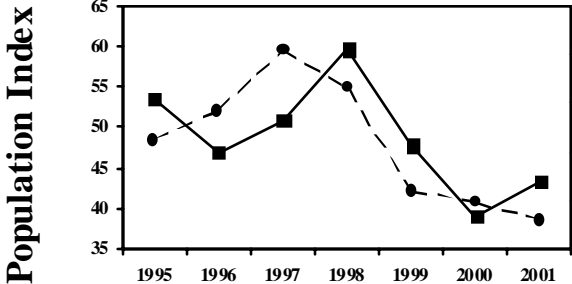


Population Index

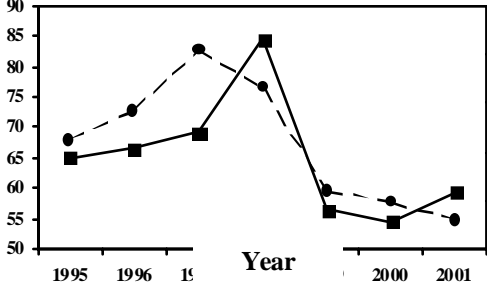
Year

Amphibians

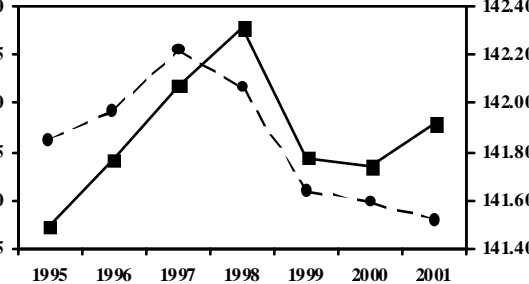
Bullfrog



Green Frog



Spring Peeper

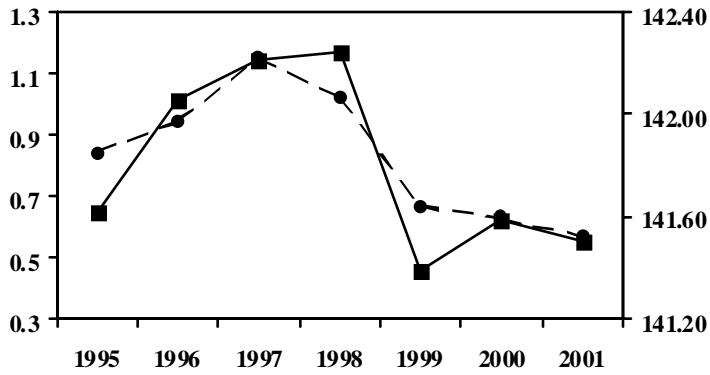


Wetland Birds

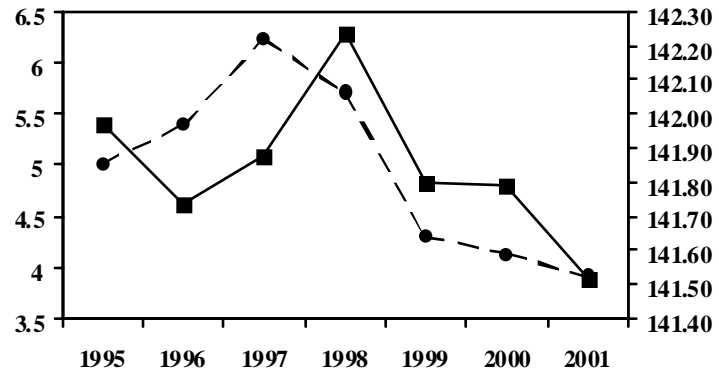


Wetland Birds

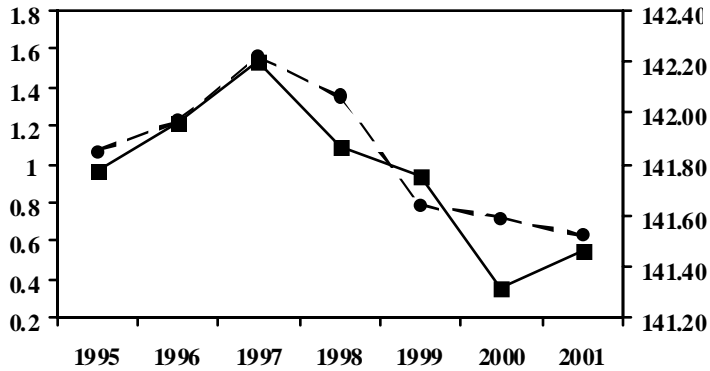
American Bittern



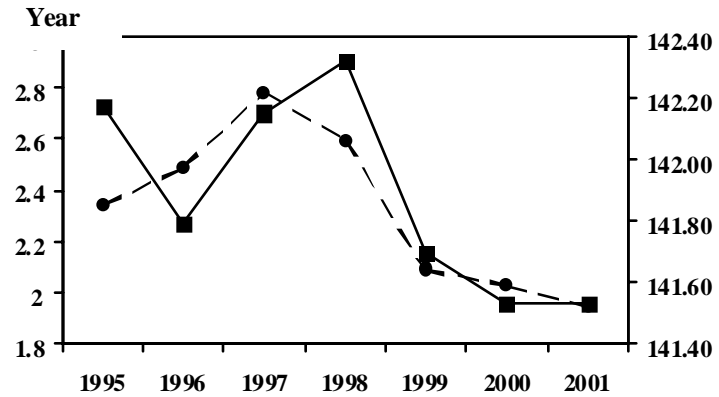
Marsh Wren



Sora



Virginia Rail



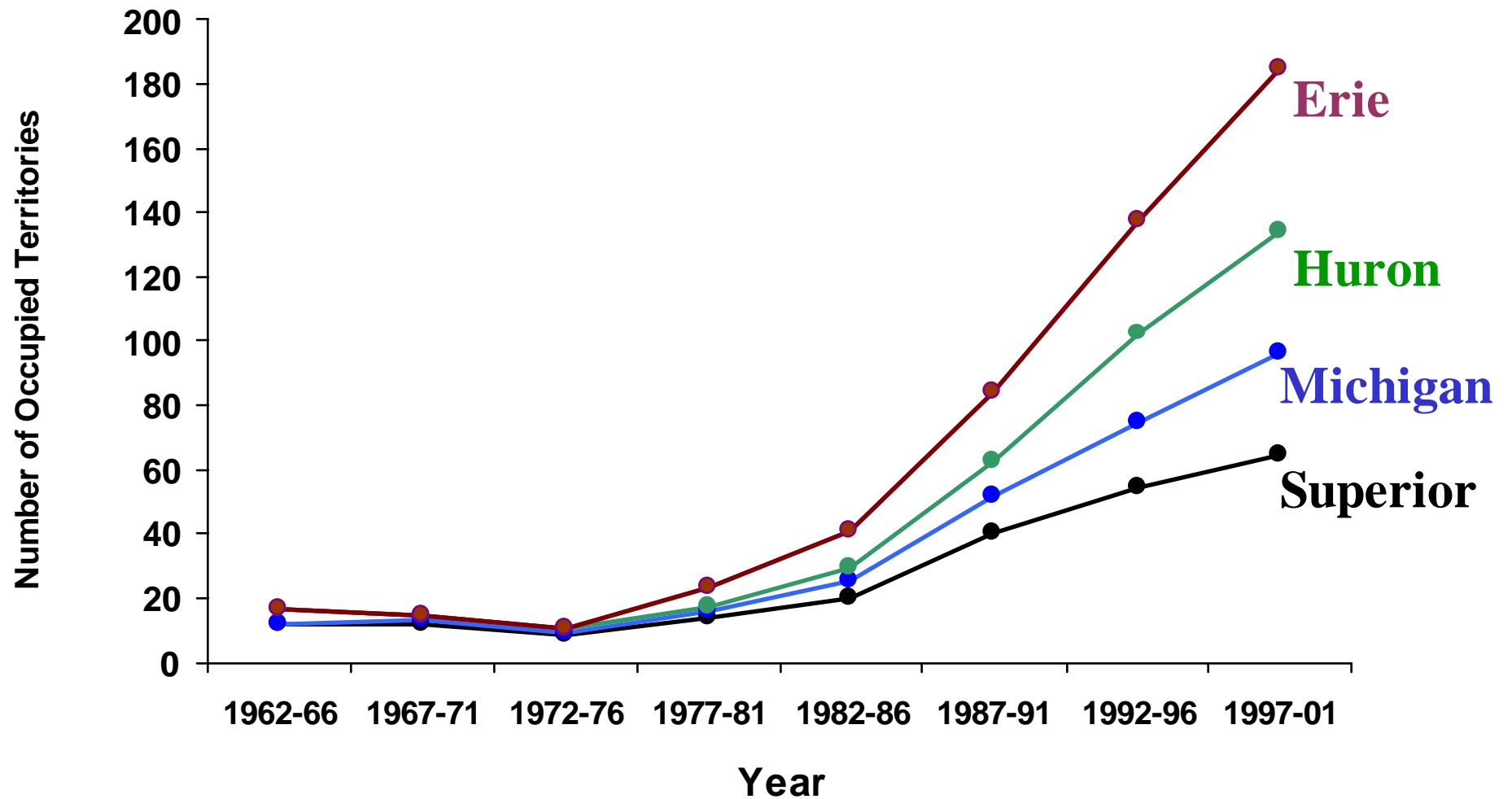
Nearshore Terrestrial Ecosystem



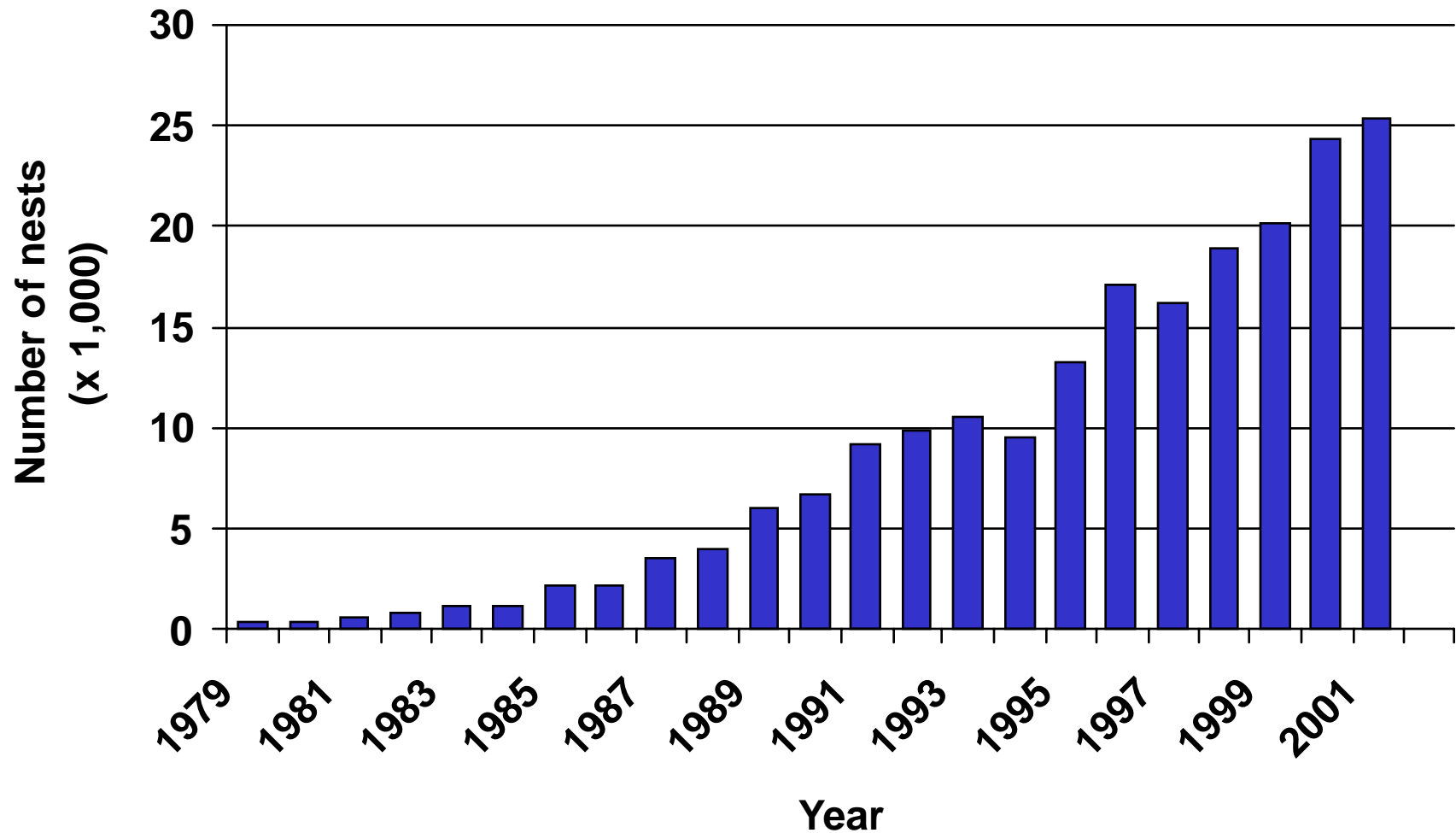
- Productivity of bald eagles
- Colonial nesting water birds



Occupied Territories by Eagles per Year by Lake



Double-crested Cormorant nests (breeding pairs) on Lake Ontario, 1979-2002



STATE - HUMAN PERSPECTIVE

POOR MIXED MIXED MIXED GOOD
DETERIORATING IMPROVING

Drinking Water Quality
Contaminants in Edible Fish Tissue
E. coli and Fecal Coliform Levels in Nearshore Recreational Waters
Air Quality

