

US EPA ARCHIVE DOCUMENT

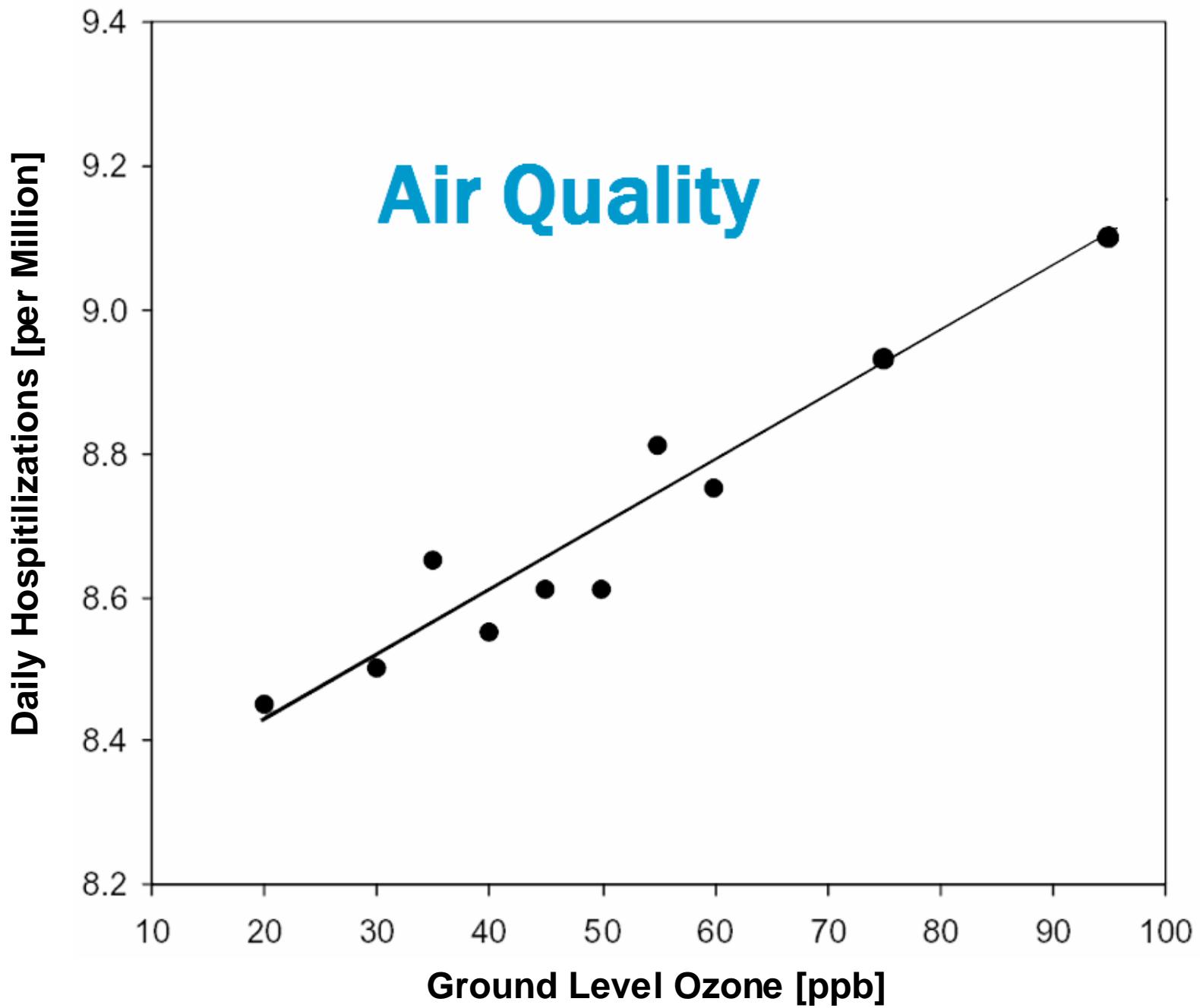
# What is the State of the Great Lakes Ecosystem?

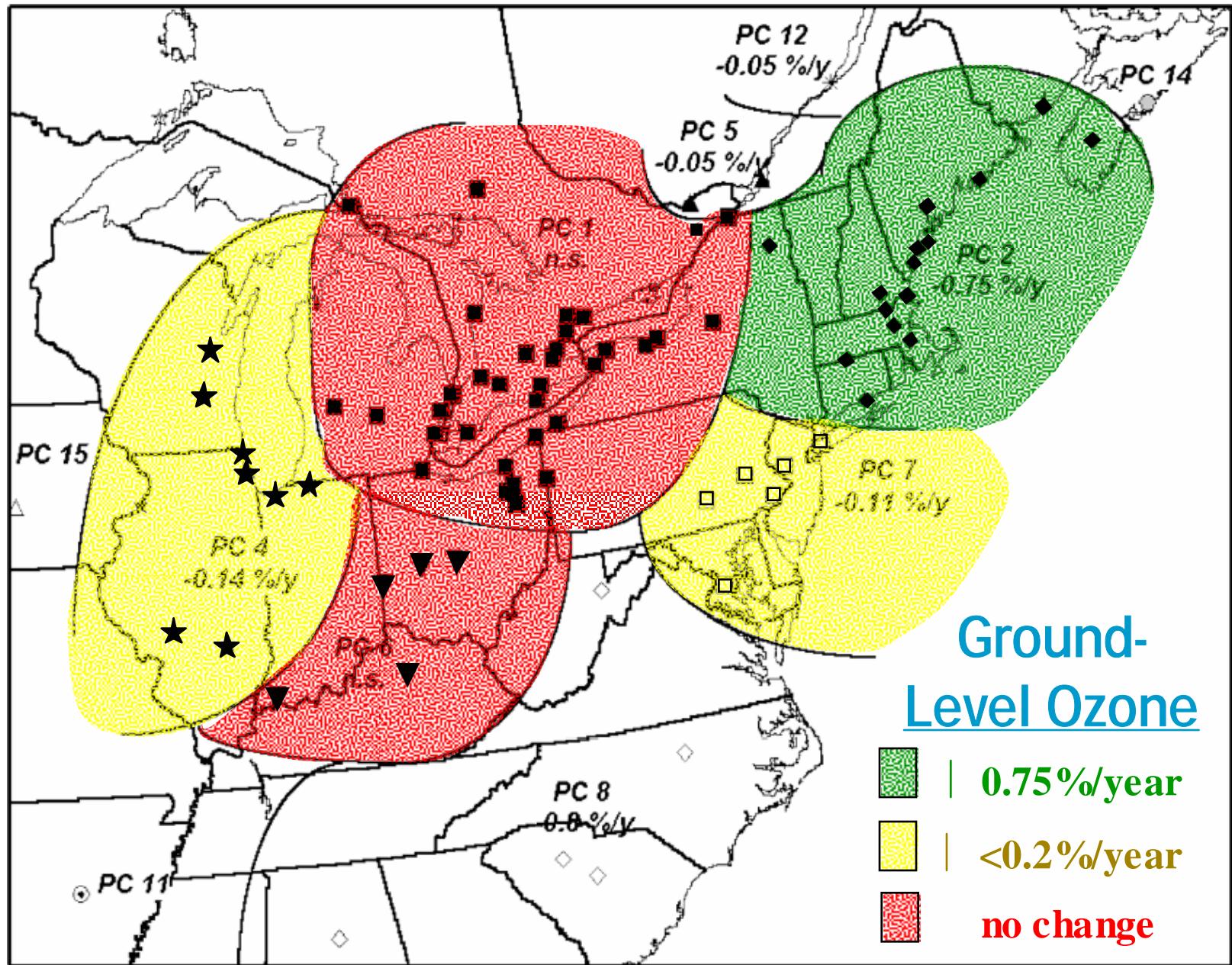
Jan Ciborowski  
University of Windsor

# Human perspective: Can we breathe the air?

- Air Quality





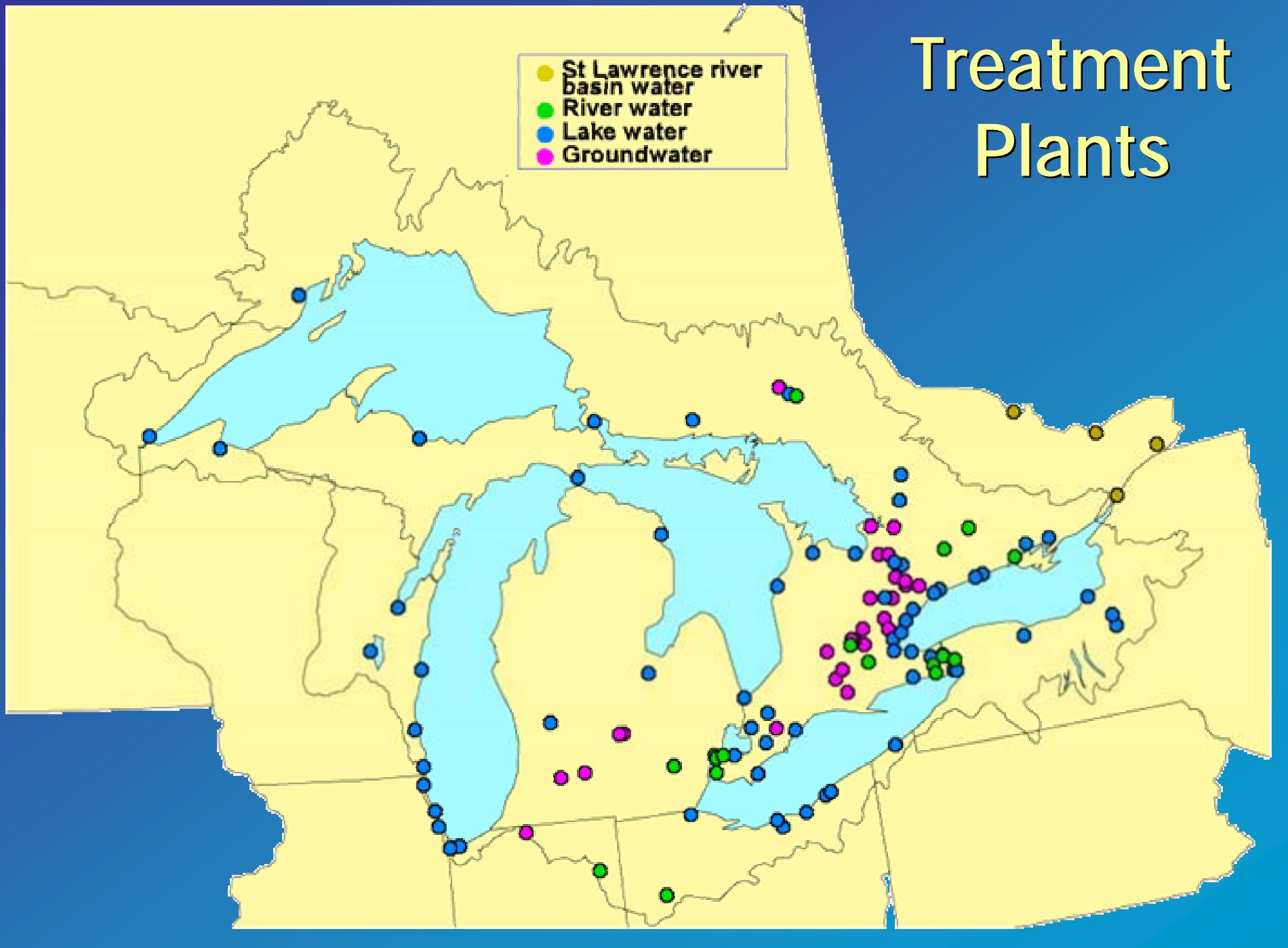


# Human Perspective: Can we drink the water?

- Drinking water



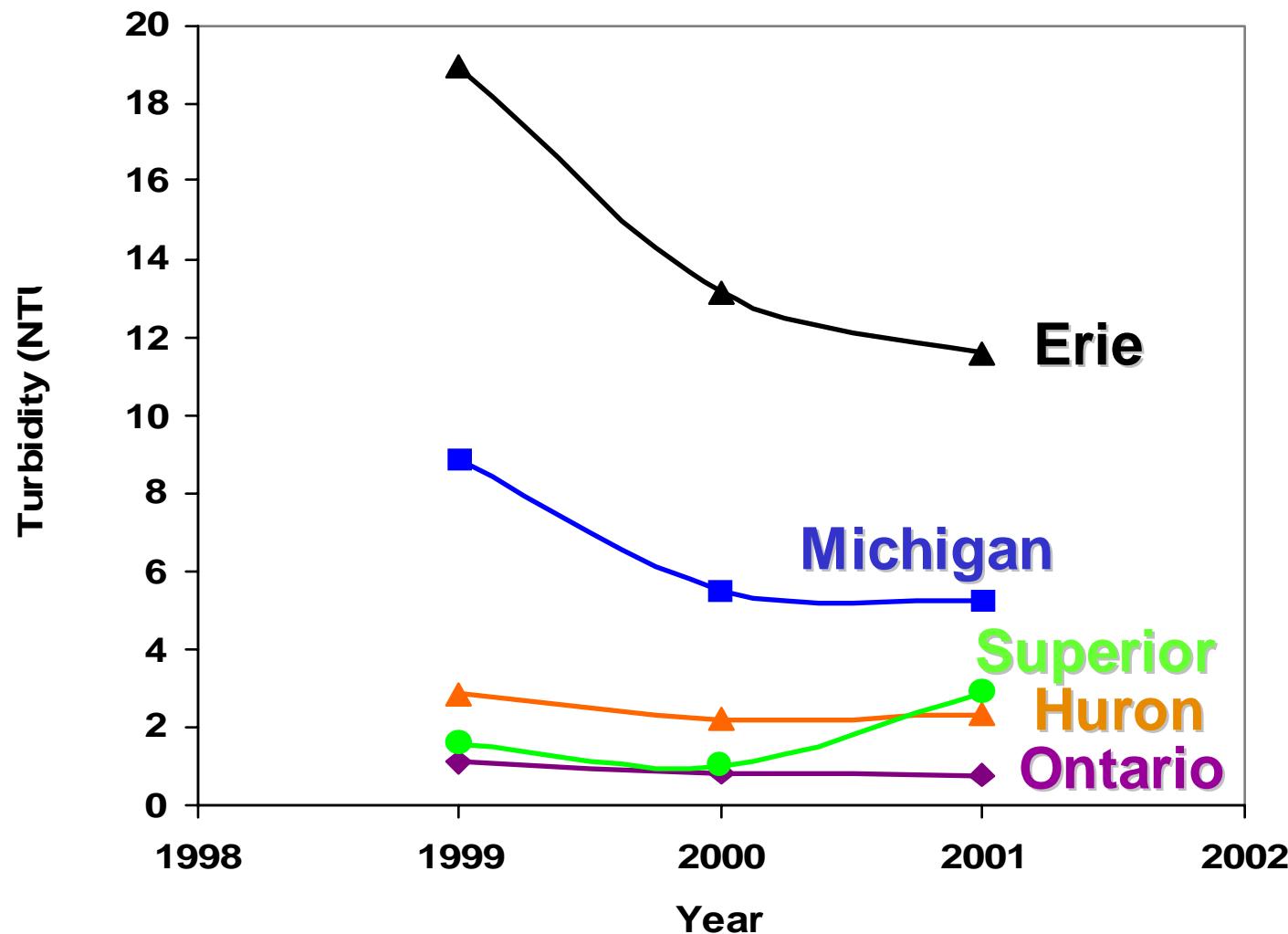
# Treatment Plants



# Drinking Water

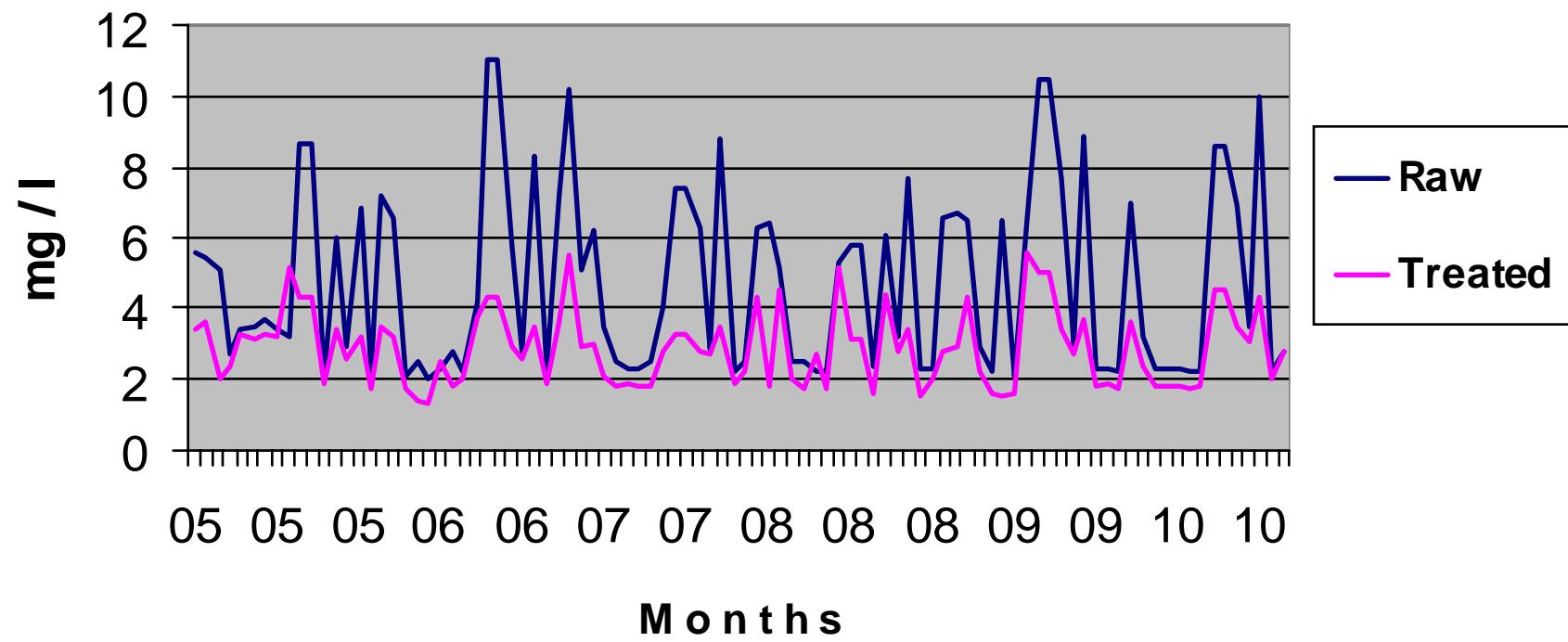
	Source Water Occurrences	Problems with Treated Water
Atrazine	Frequent	None
Nitrite	Frequent	None
Nitrate	Frequent	Rare
Total Coliform/E coli	Frequent	Rare
Cryptosporidium/Giardia	Frequent	Rare
Turbidity	Frequent	Rare
TOC/DOC	Frequent	Controlled
Taste/Odor	Not monitored	Controlled

# Average Annual Turbidity for Raw Water



# Drinking Water

## 2000 TOC/DOC: Raw vs. Treated



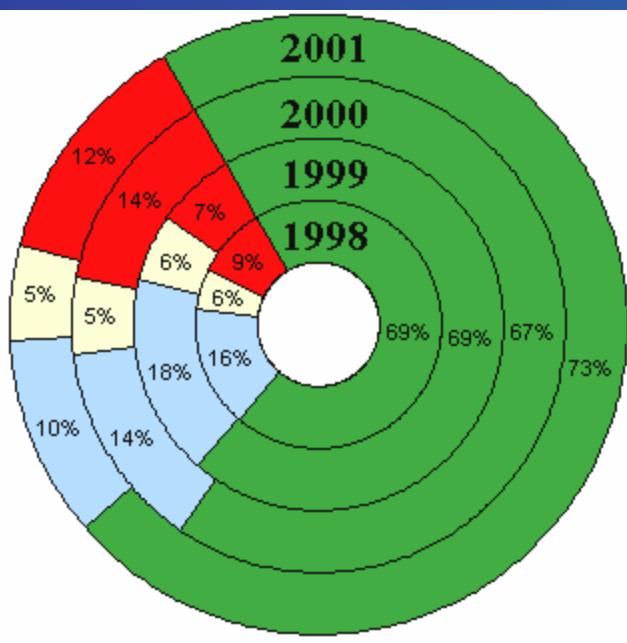
# Human Perspective: Can we swim in the water?

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



# Beach Advisories

## United States



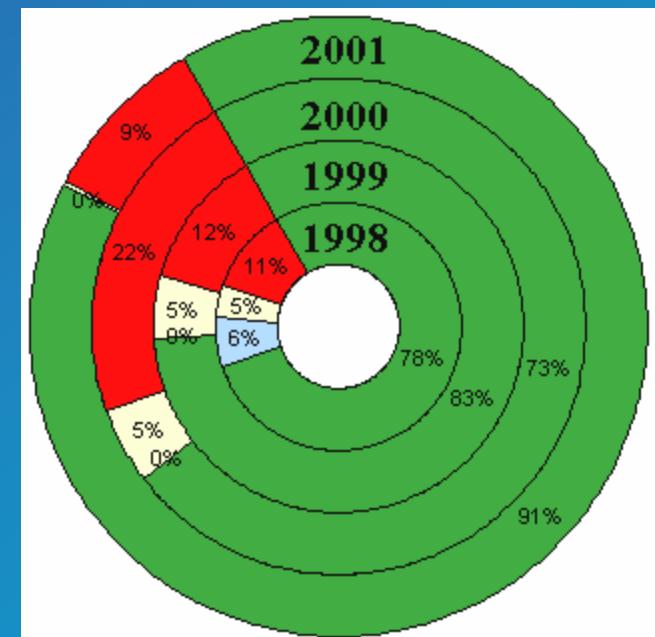
### % Time with Beach Advisories and Closure

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

Number of beaches reported each year:

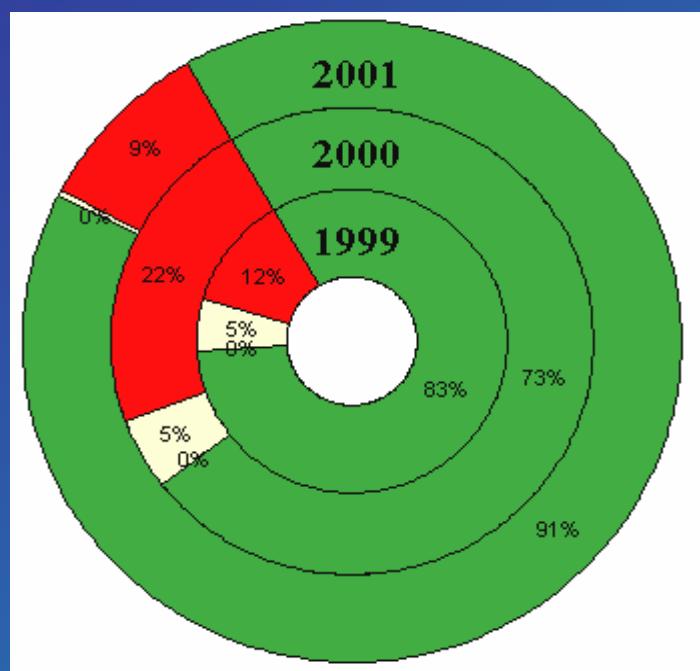
U.S.	Canada	
315	- 2001 -	304
329	- 2000 -	293
316	- 1999 -	238
298	- 1998 -	218

## Canada

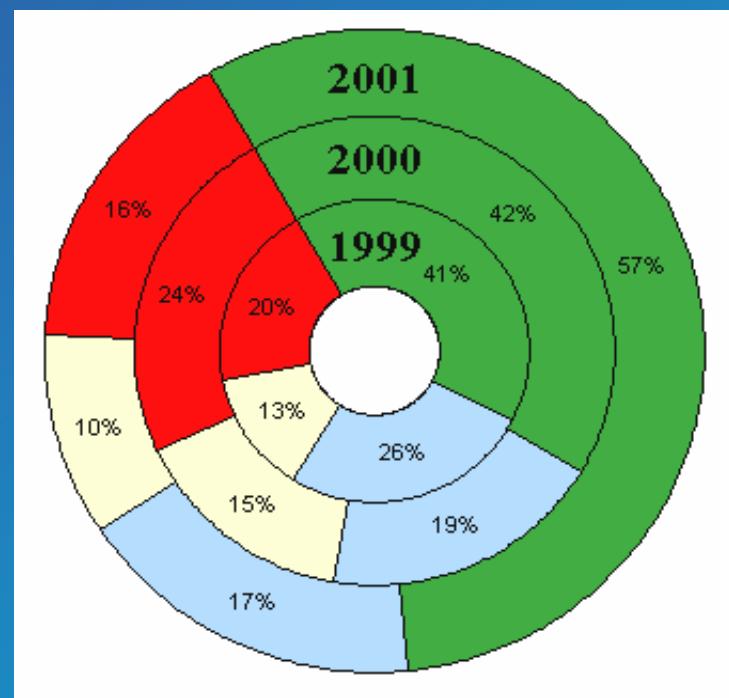


# Canadian Great Lakes Beach Advisories

Beaches with Advisories



Beaches that Exceeded the Standard



% Time with Beach Advisories or Closings

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

% Time Standard Exceeded

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

# Human Perspective: Can we eat the Fish?

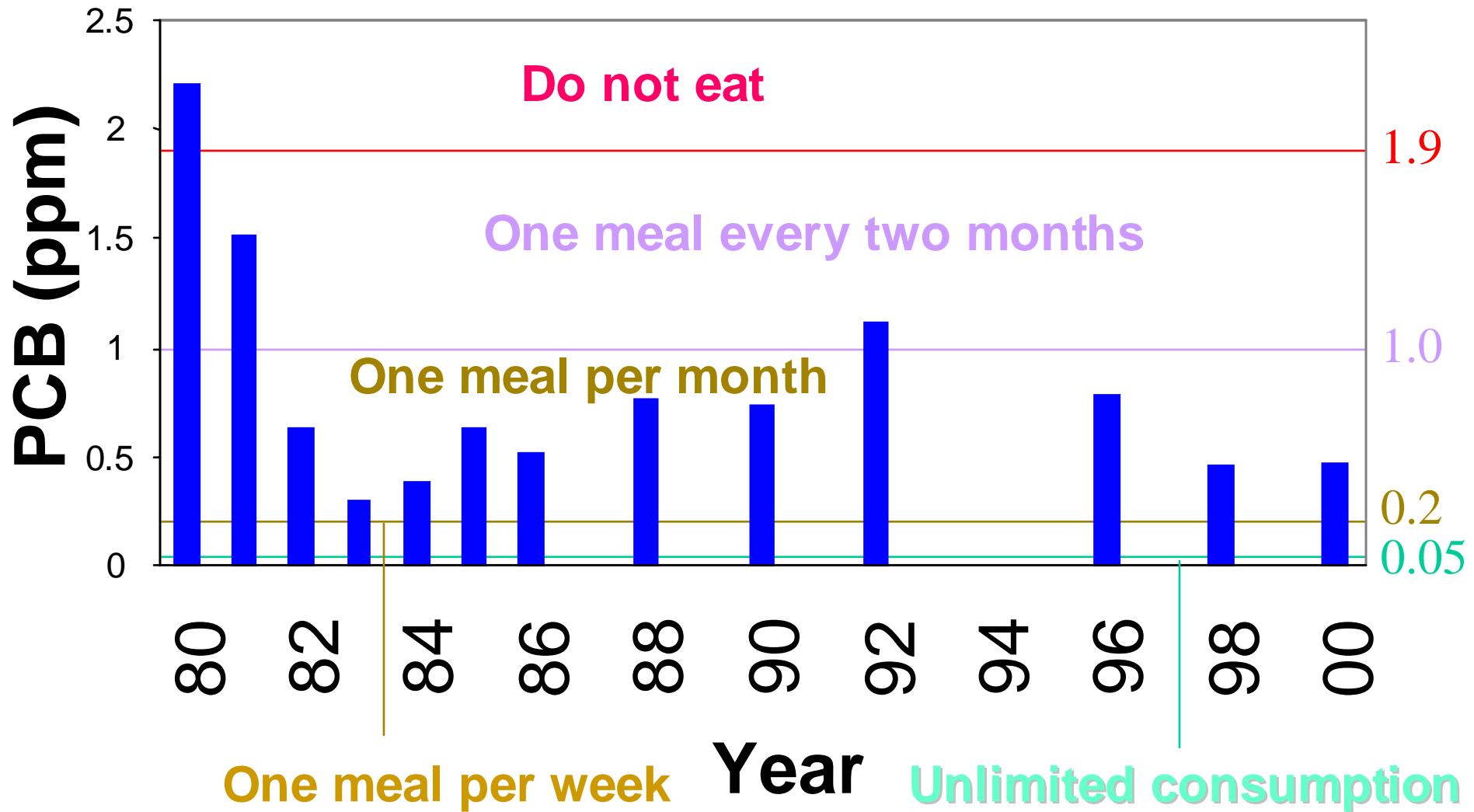
- Contaminants in edible fish tissue



# Contaminants in Edible Fish Tissue



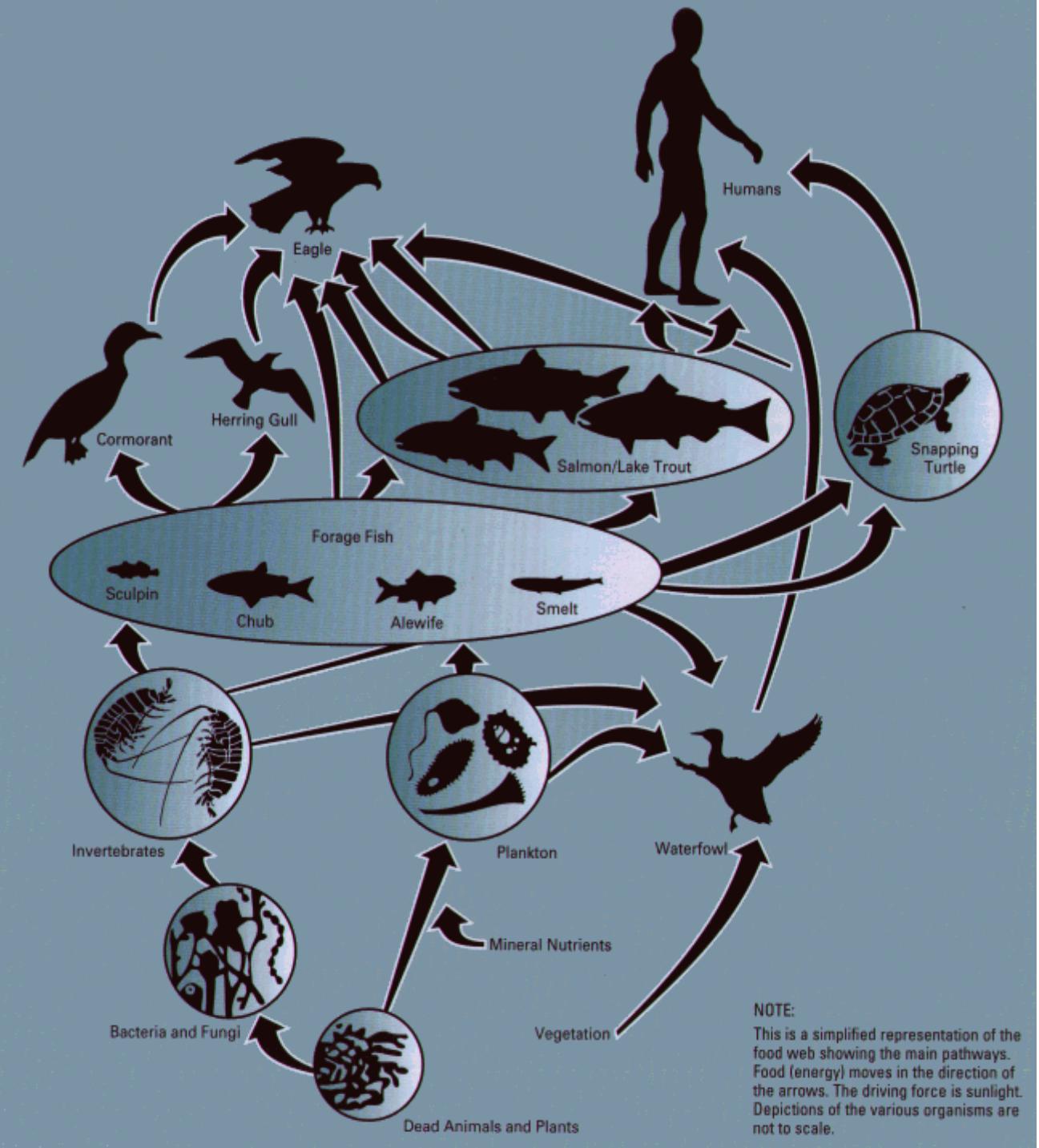
# PCBs in Lake Michigan Coho Salmon



# PCBs in Lake Erie Coho Salmon



# Ecosystem Perspective



# Are the fish healthy?

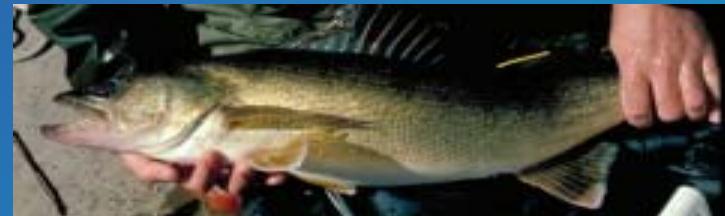
- Lake trout



- Salmon and trout



- Walleye



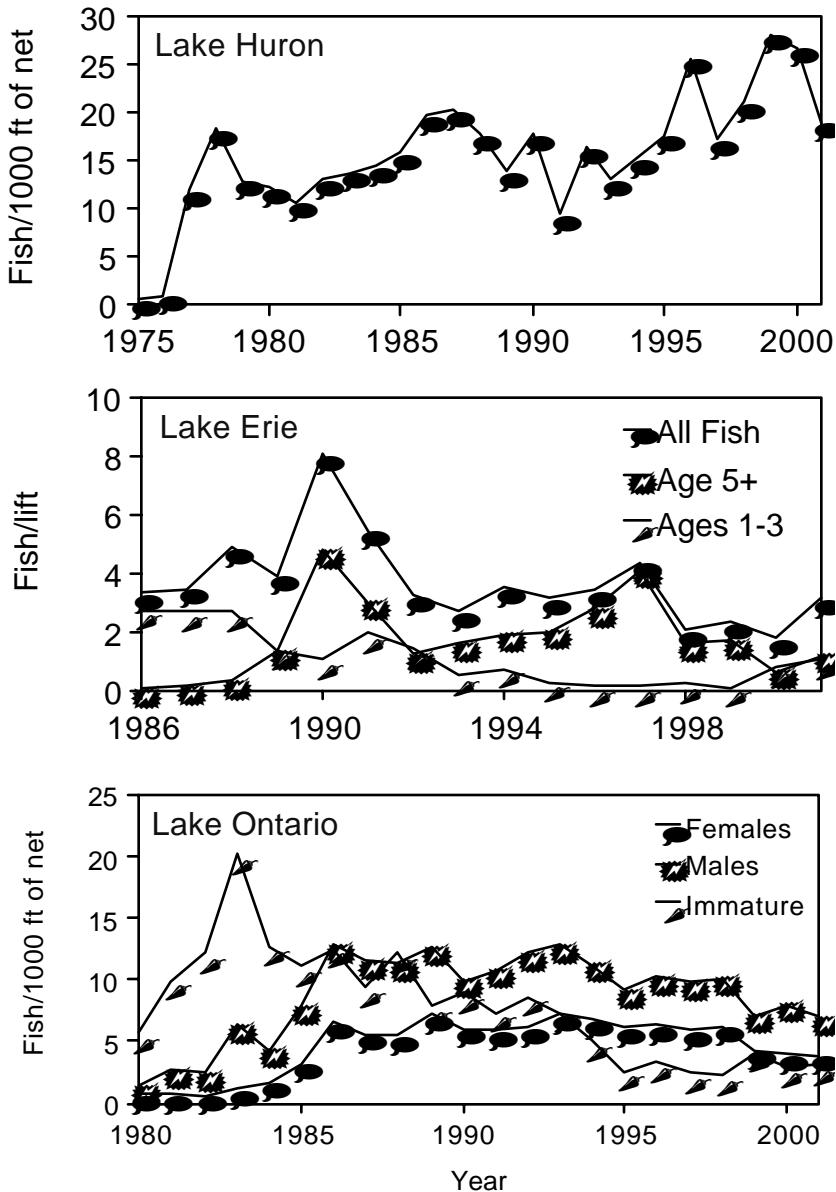
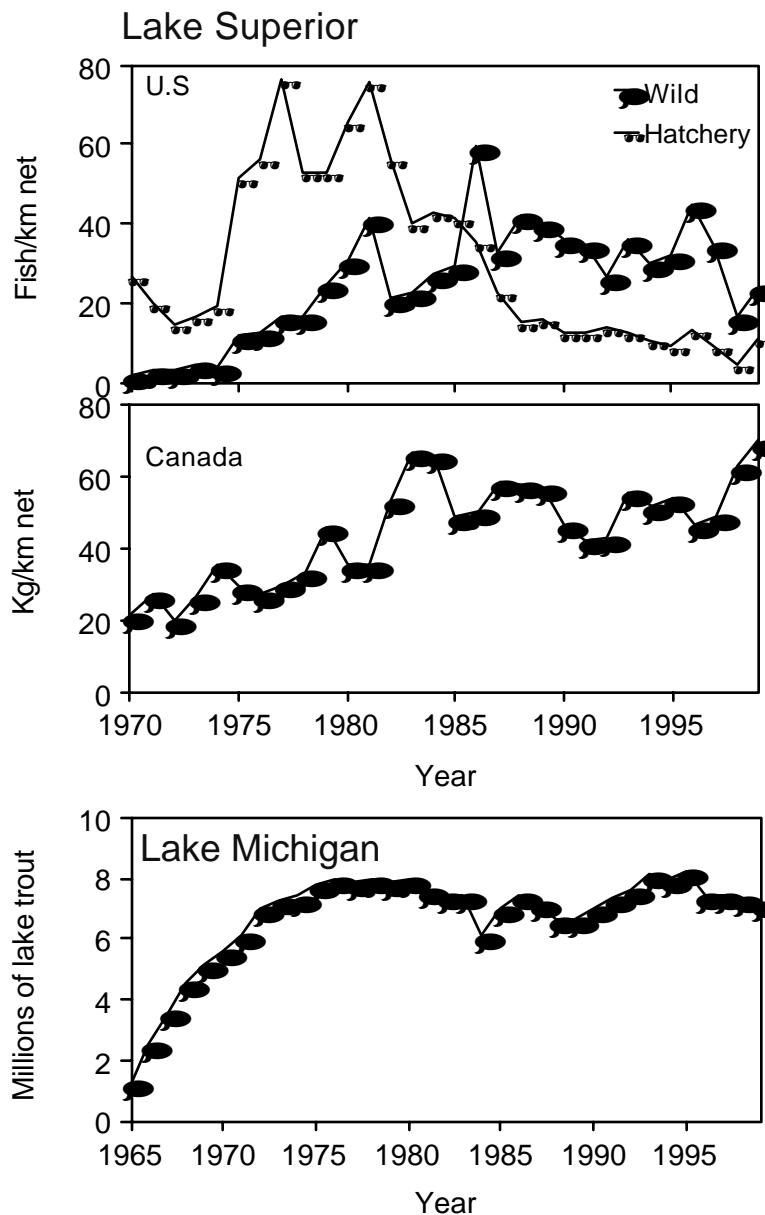
- Preyfish populations



# Lake Trout



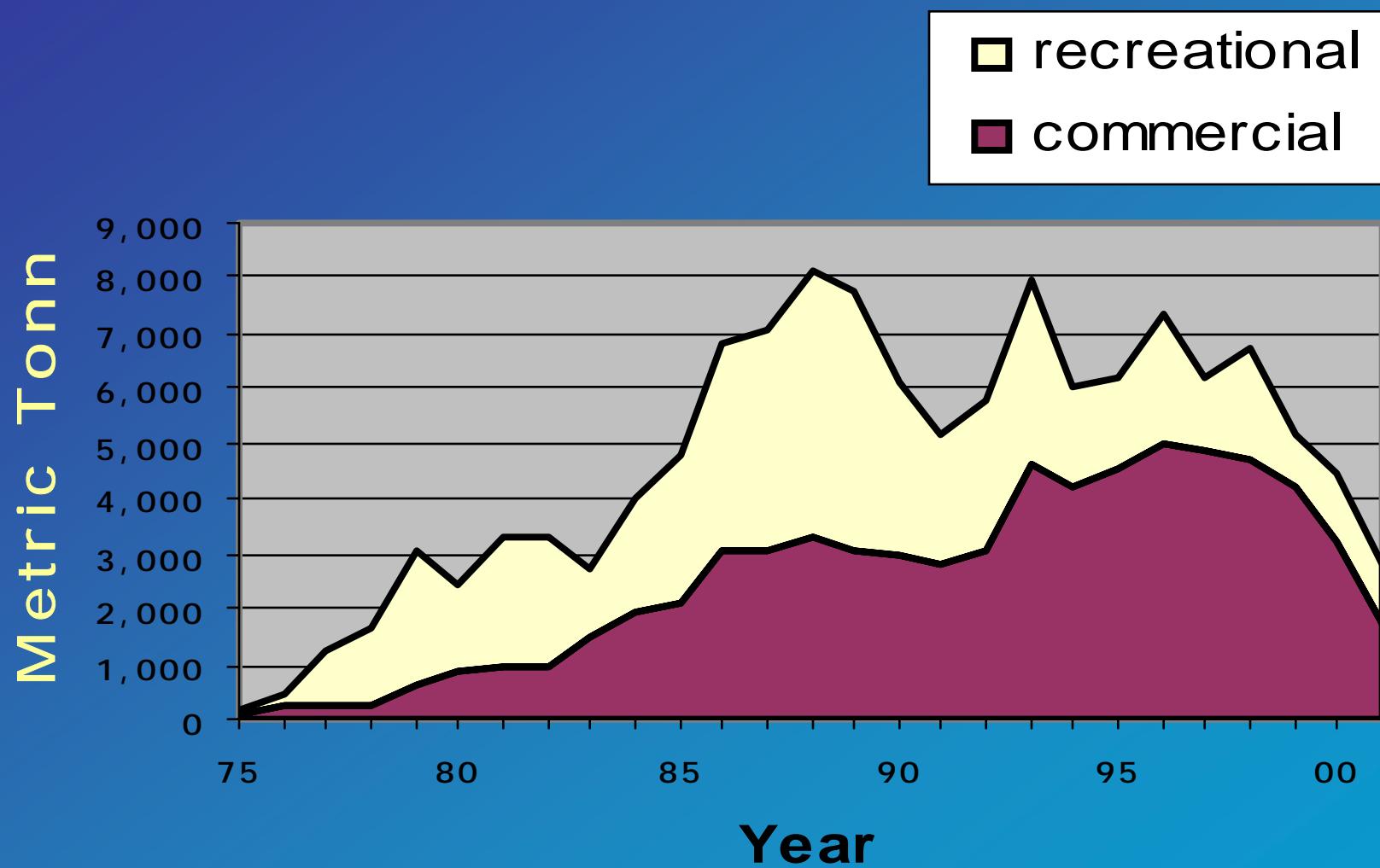
# Lake Trout



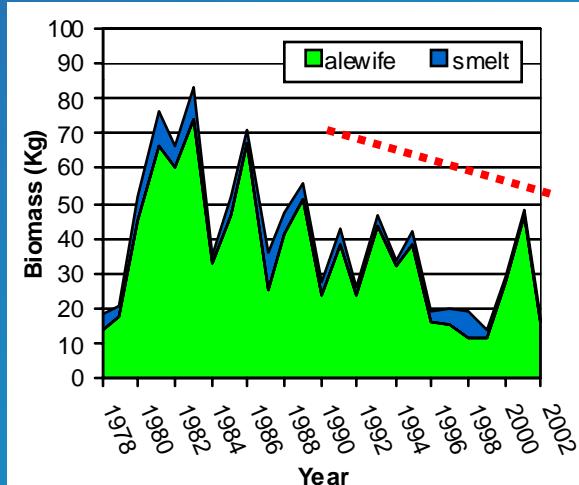
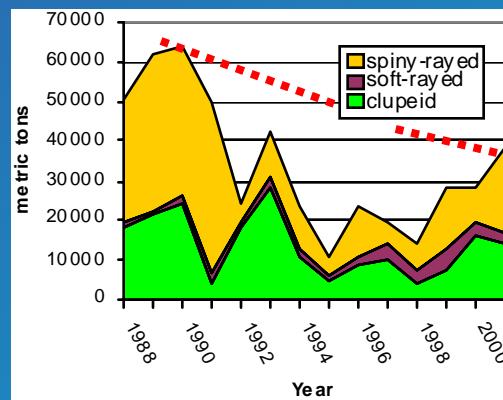
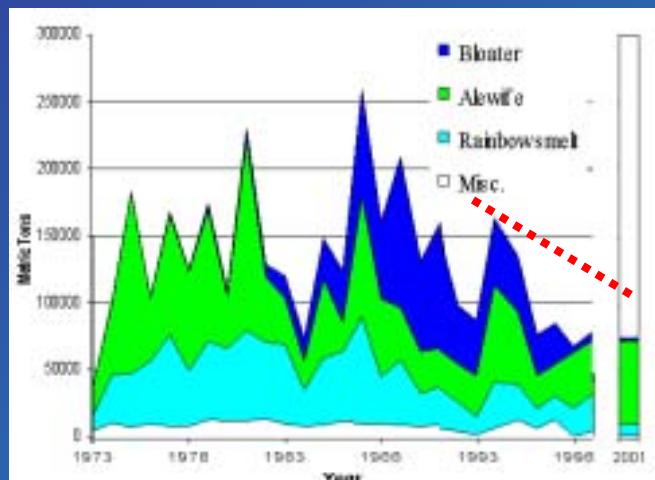
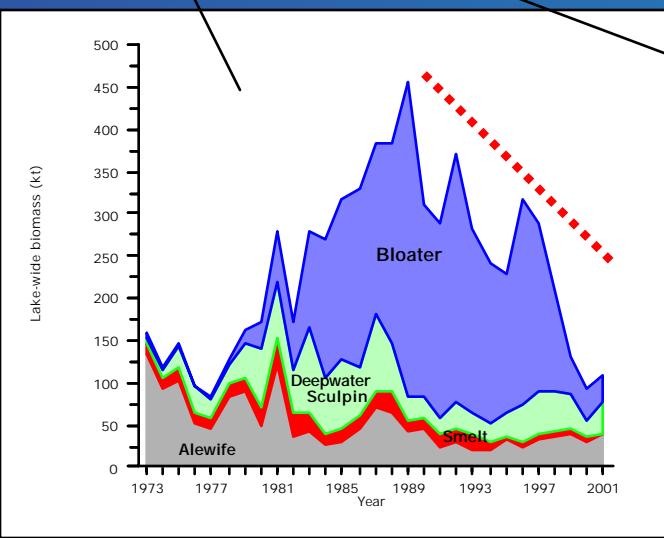
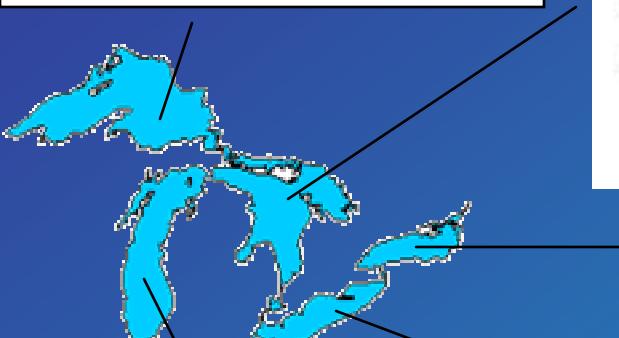
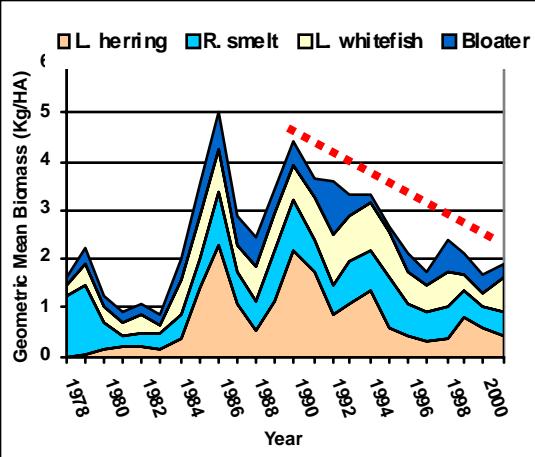
# Walleye



# Lake Erie Walleye



# Preyfish Populations

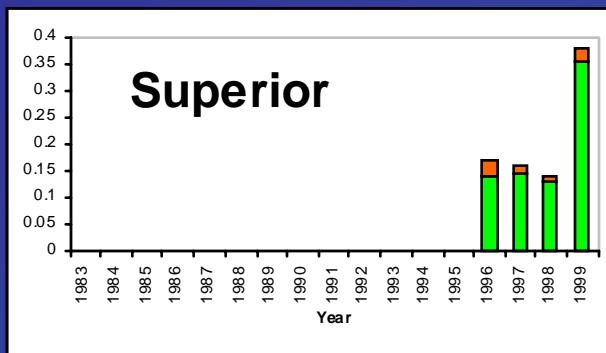


# Ecosystem Perspective: Is the food web healthy?

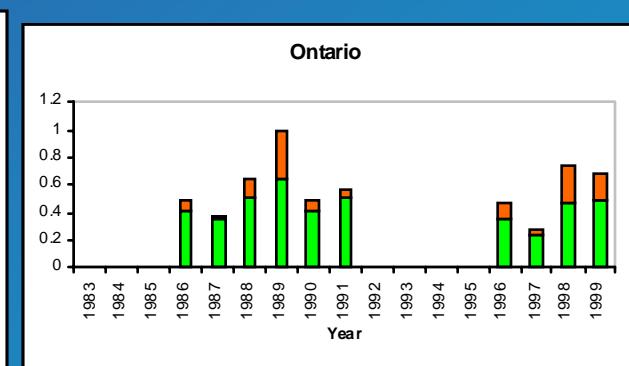
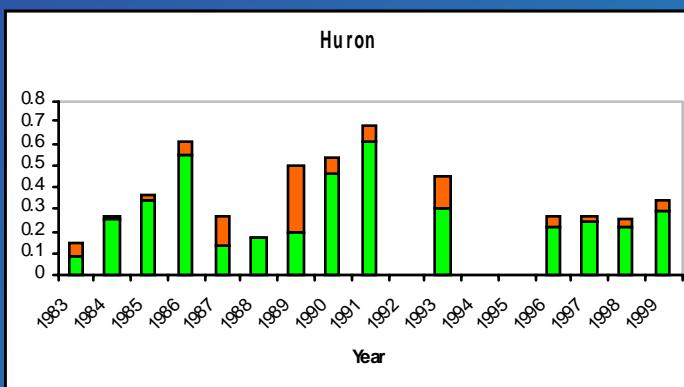
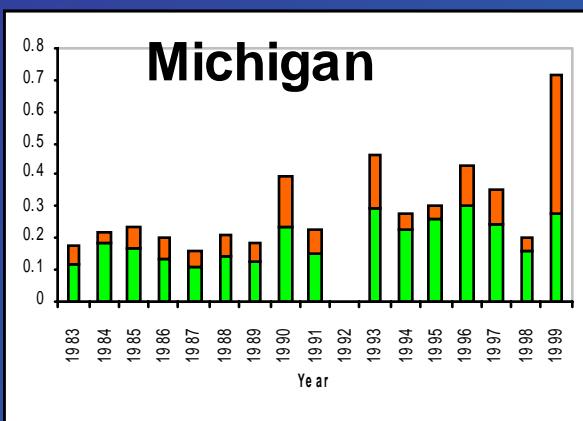


- Water Column
  - Zooplankton &
  - Phytoplankton

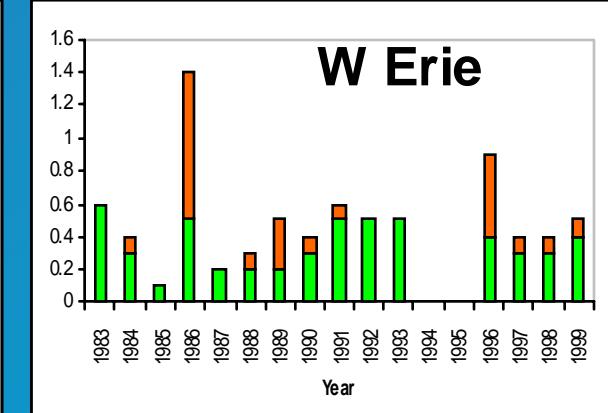
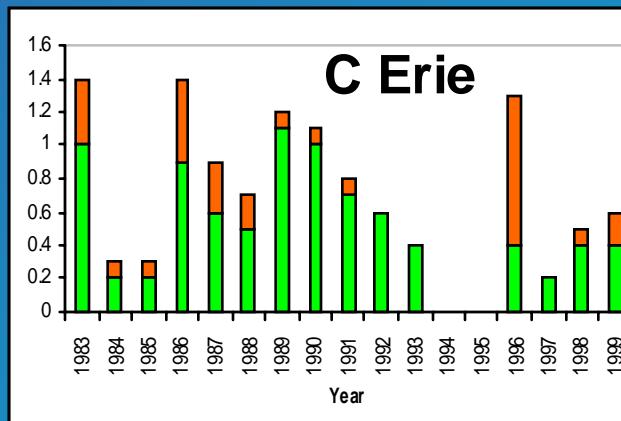
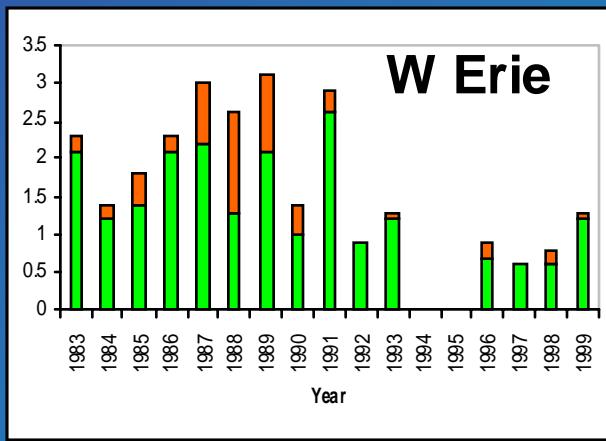




# Phytoplankton



## Erie



# Ecosystem Perspective: Is the food web healthy?

- Benthos
  - Diporeia "Scud"



- Hexagenia "Mayfly"



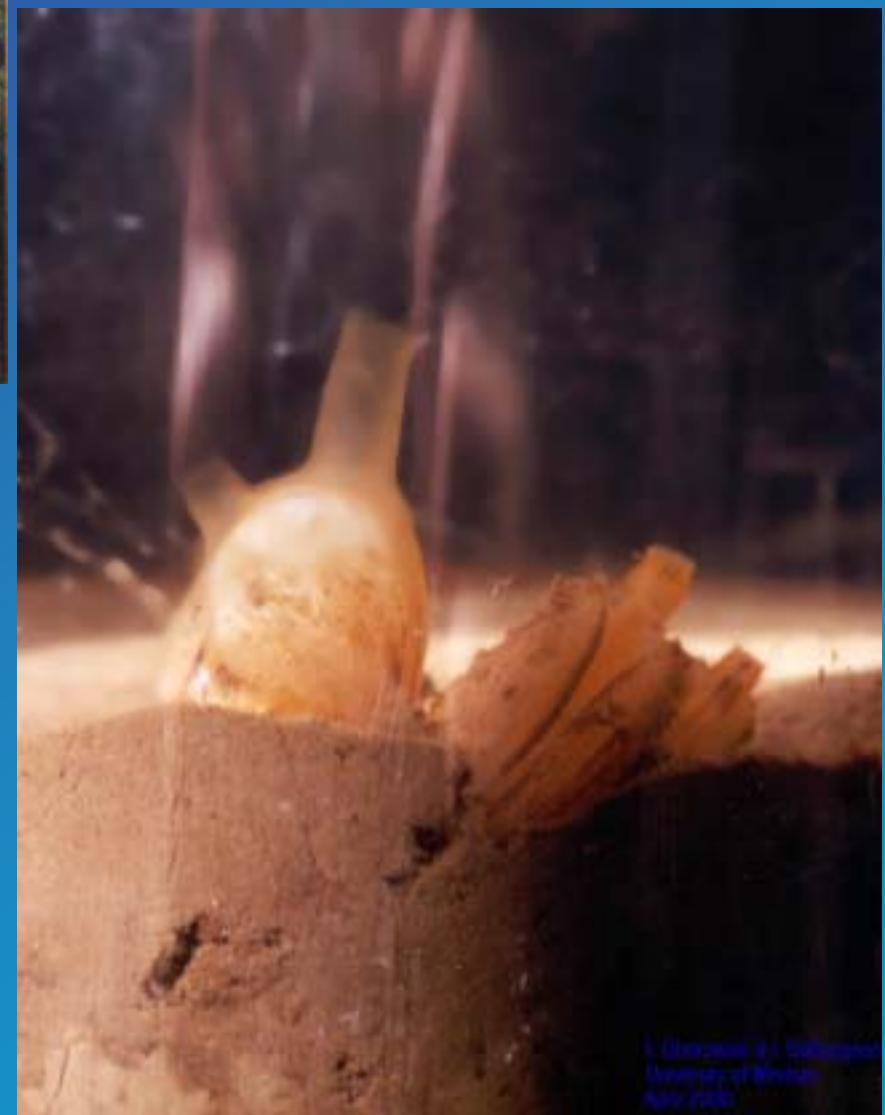
- Native unionid mussels





Zebra  
mussels

Quagga  
mussels



J. G. Gieskes & J. M. van der Velde  
University of Groningen  
April 2000

# Botulism Effects in Fish

- Disorientation
- Erratic Swimming
- Paralysis
- Death

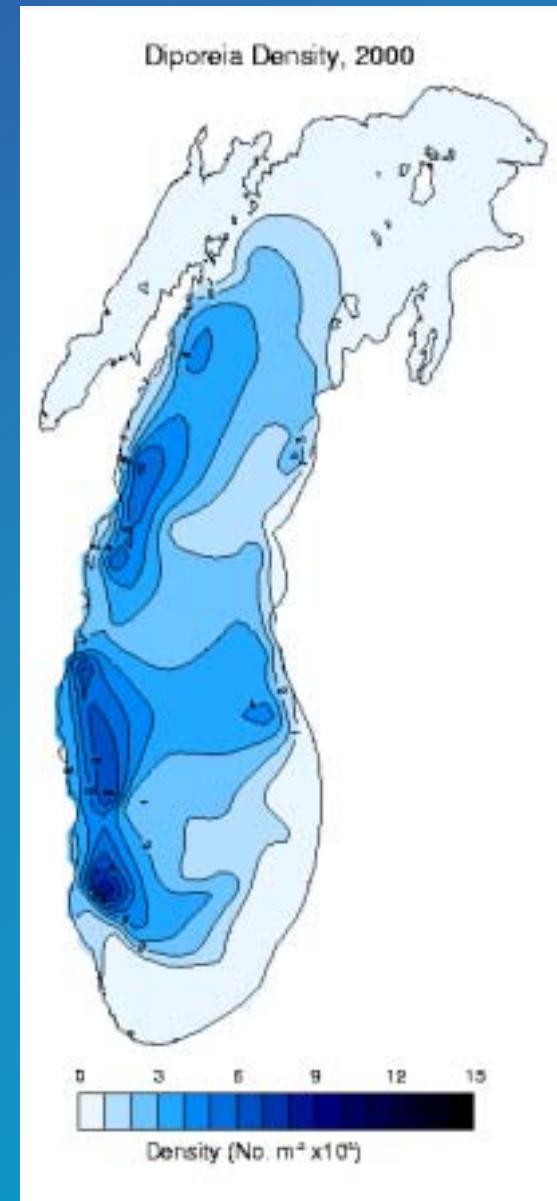
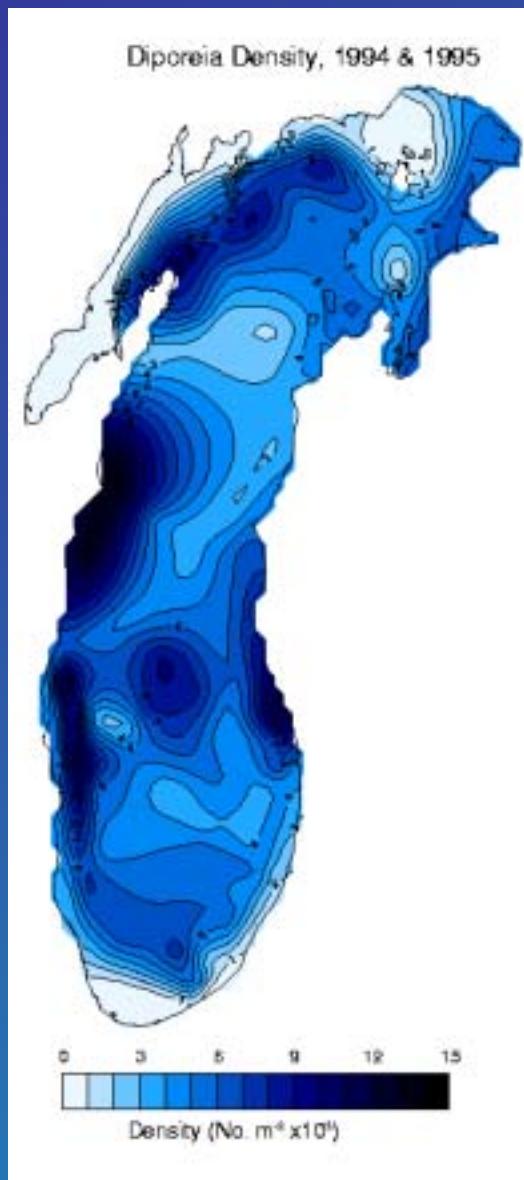


# Botulism Effects in Birds

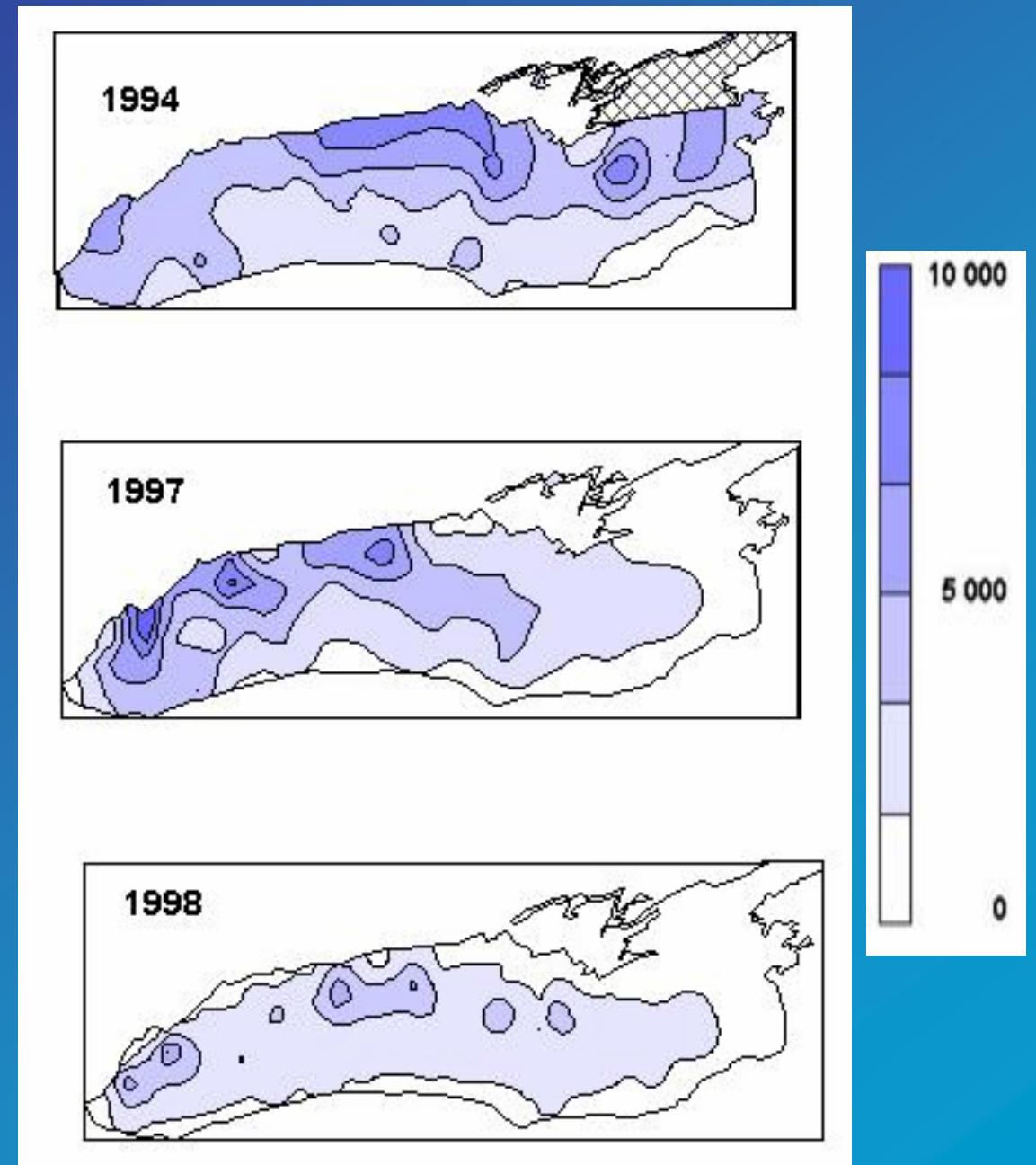
- Weakness
- Dizziness
- Inability to fly
- Muscular paralysis
- Respiratory impairment



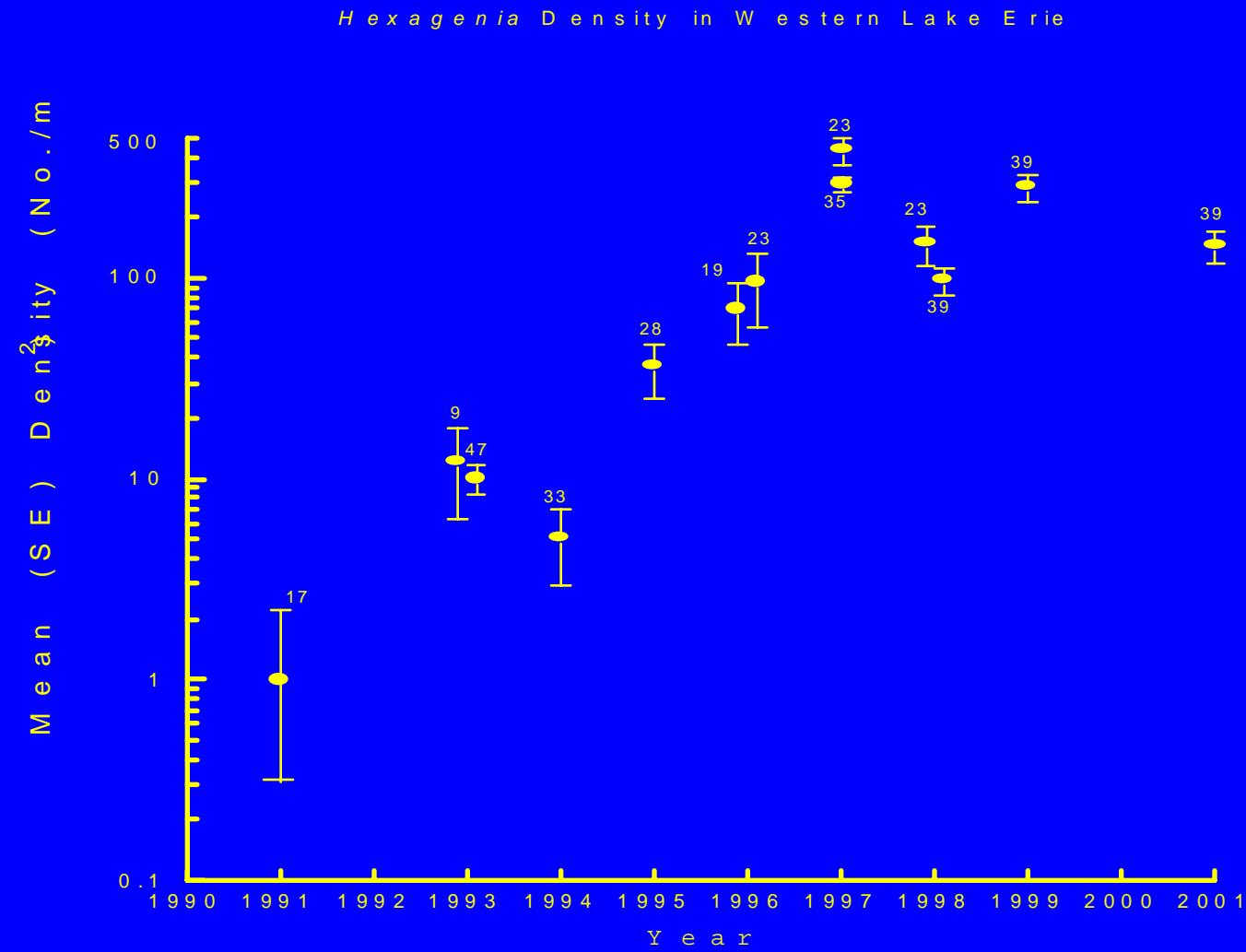
# *Diporeia* in Lake Michigan



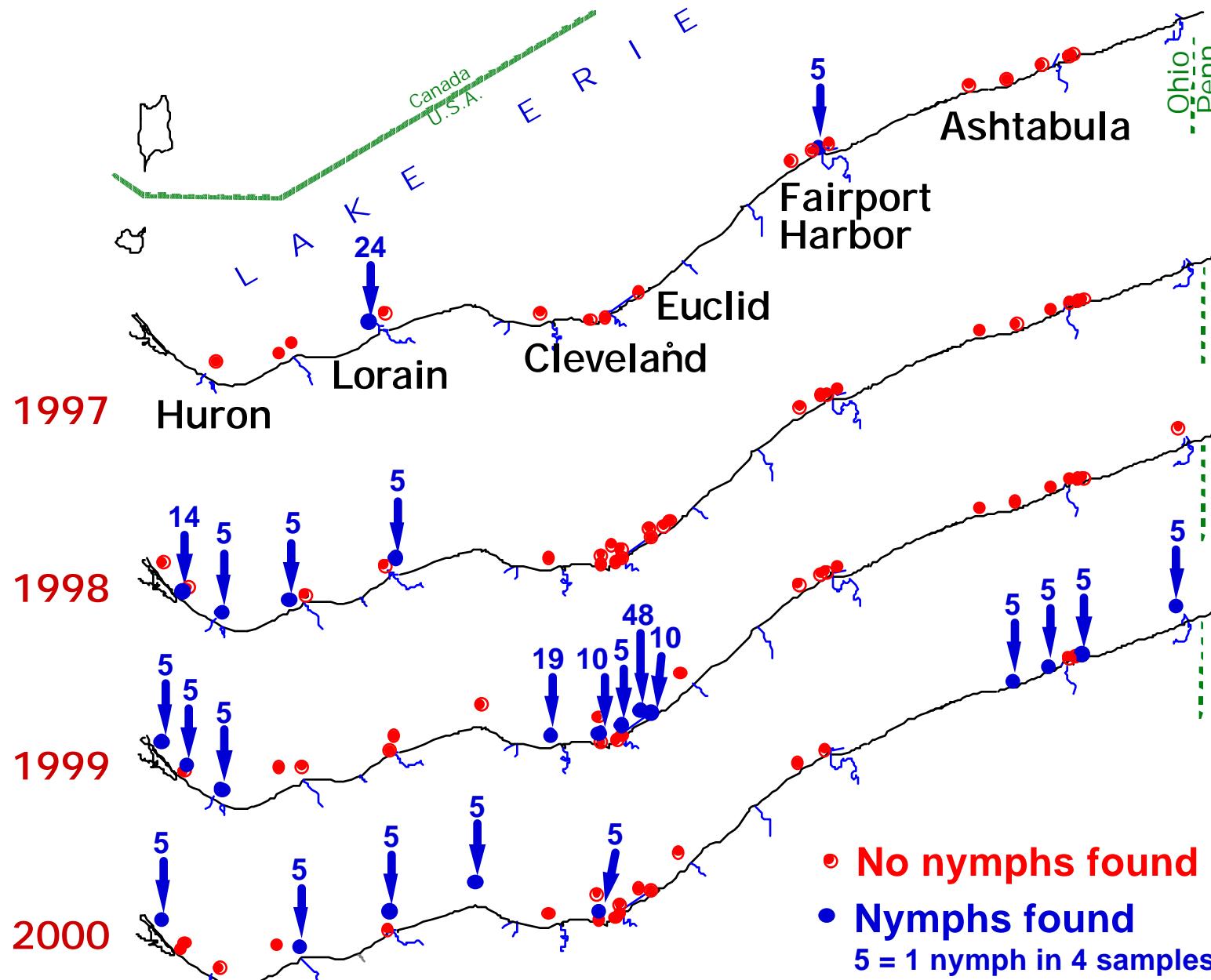
# Diporeia



# *Hexagenia* in western Lake Erie



# Mayfly Nymphs in Central Basin

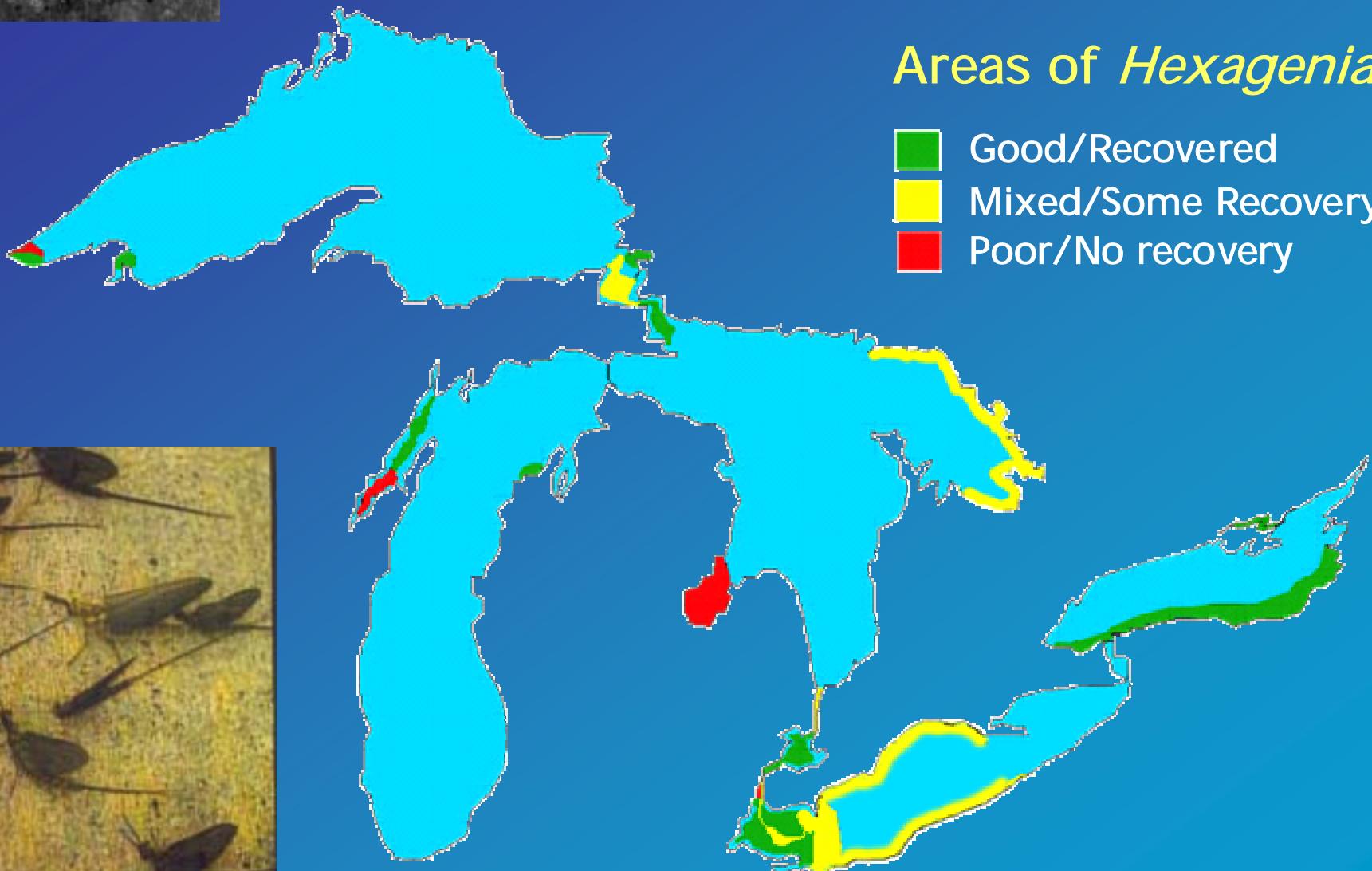




# *Hexagenia*

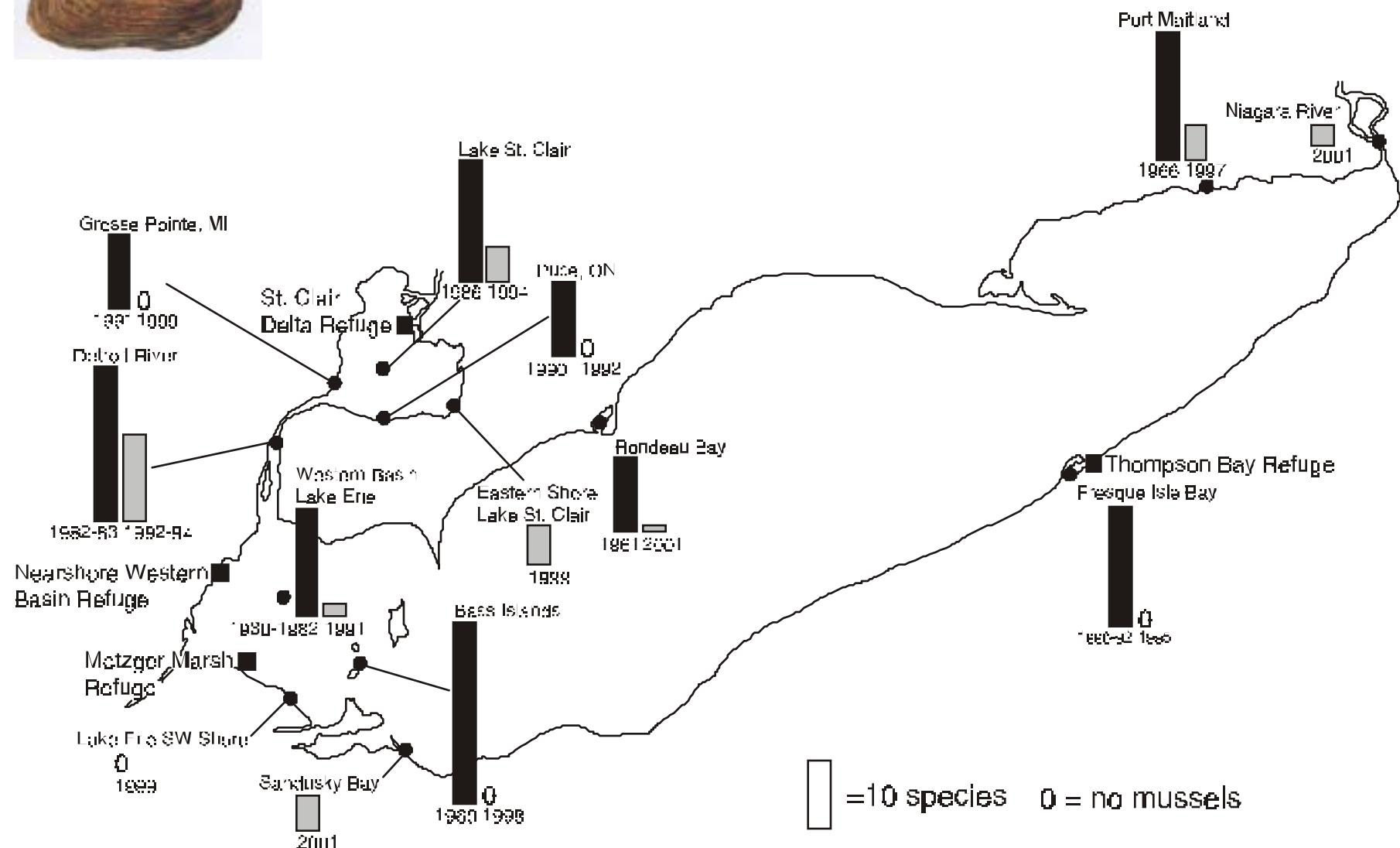
## Areas of *Hexagenia*

- Good/Recovered (Green)
- Mixed/Some Recovery (Yellow)
- Poor/No recovery (Red)





# Native Freshwater Mussels in Lakes Erie & St. Clair



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

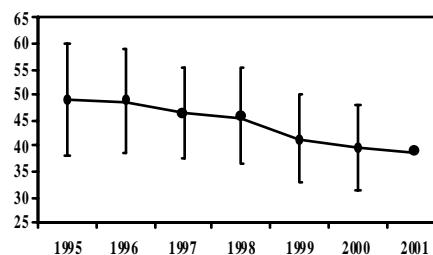
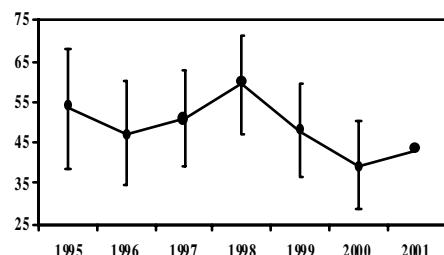
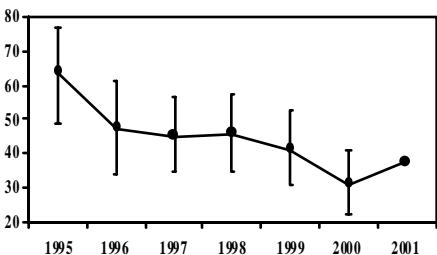
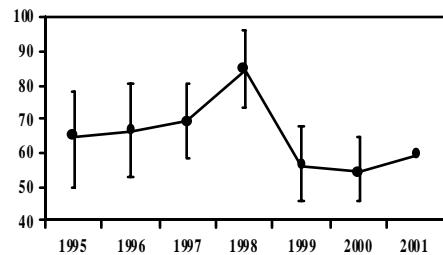
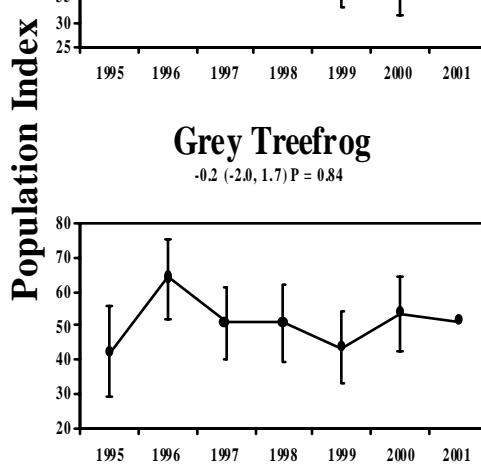
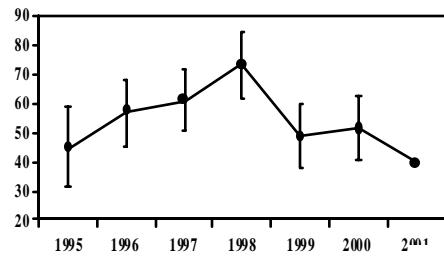
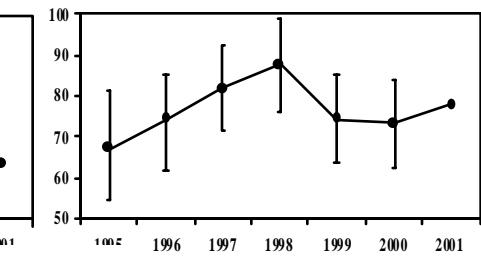
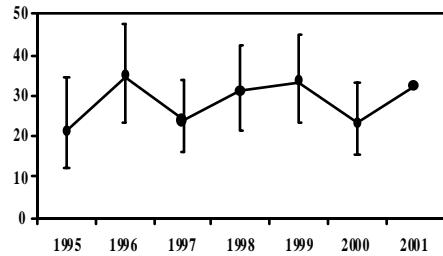
- Amphibians
- Wetland birds



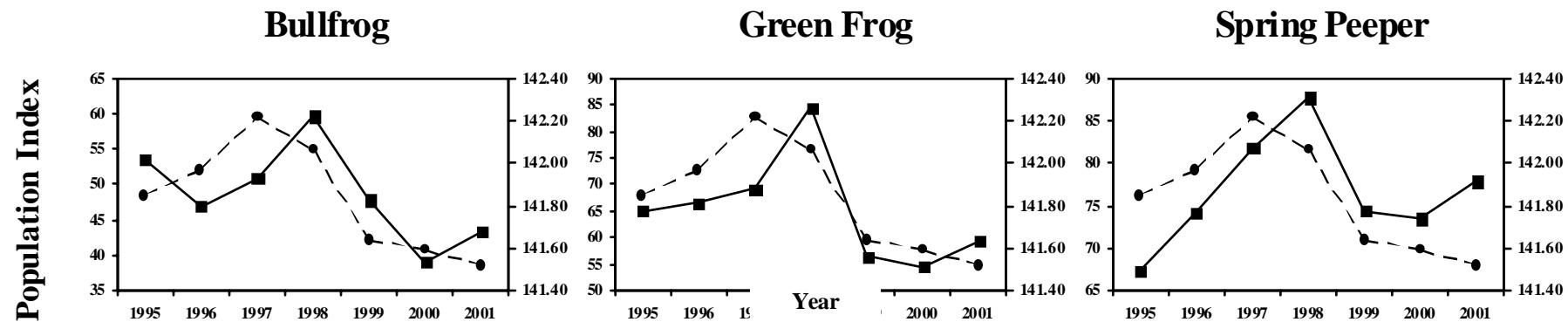
# Amphibians



# 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** $0.6 (-1.2, 2.5) P = 0.52$ **Year**

# Amphibians



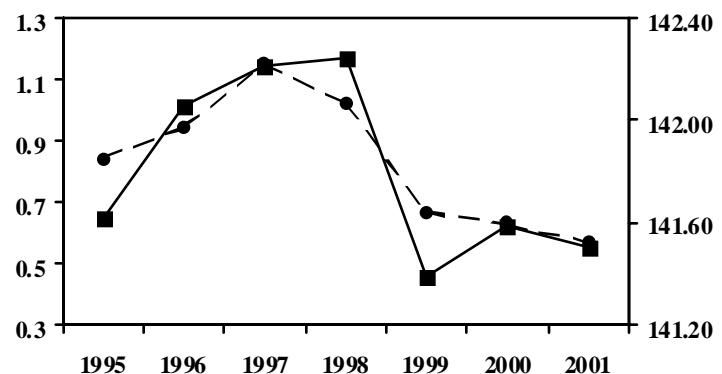


## Wetland Birds

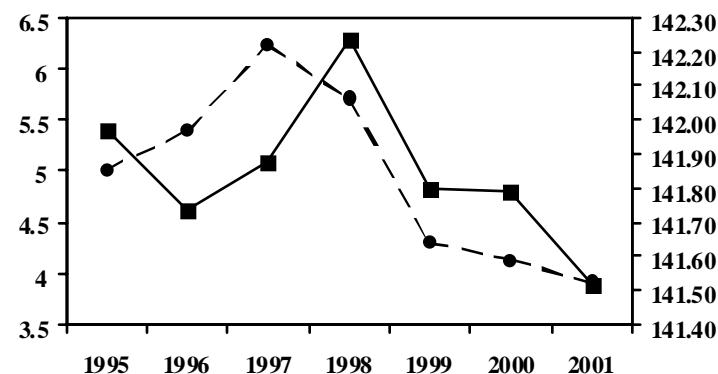


# Wetland Birds

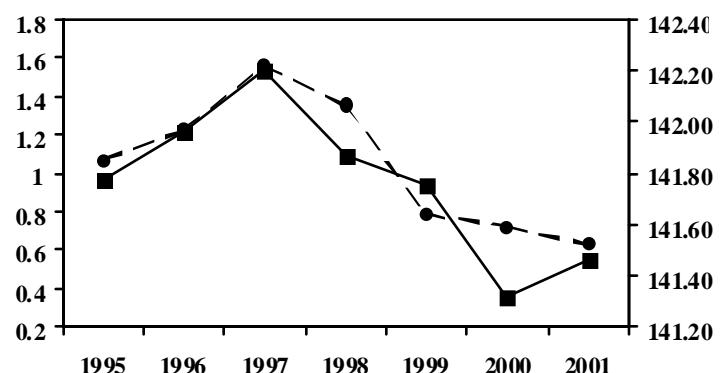
American Bittern



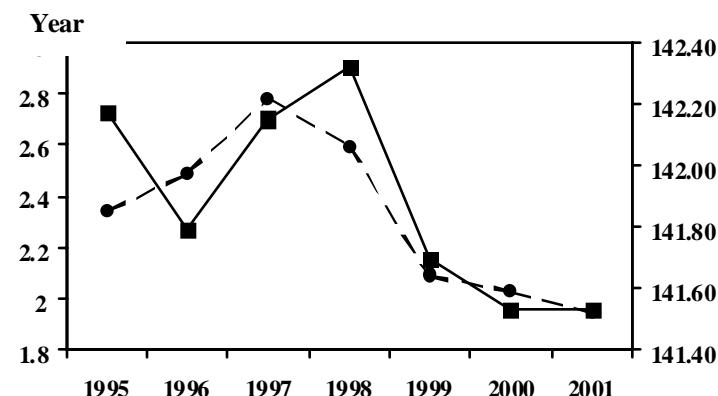
Marsh Wren



Sora



Virginia Rail



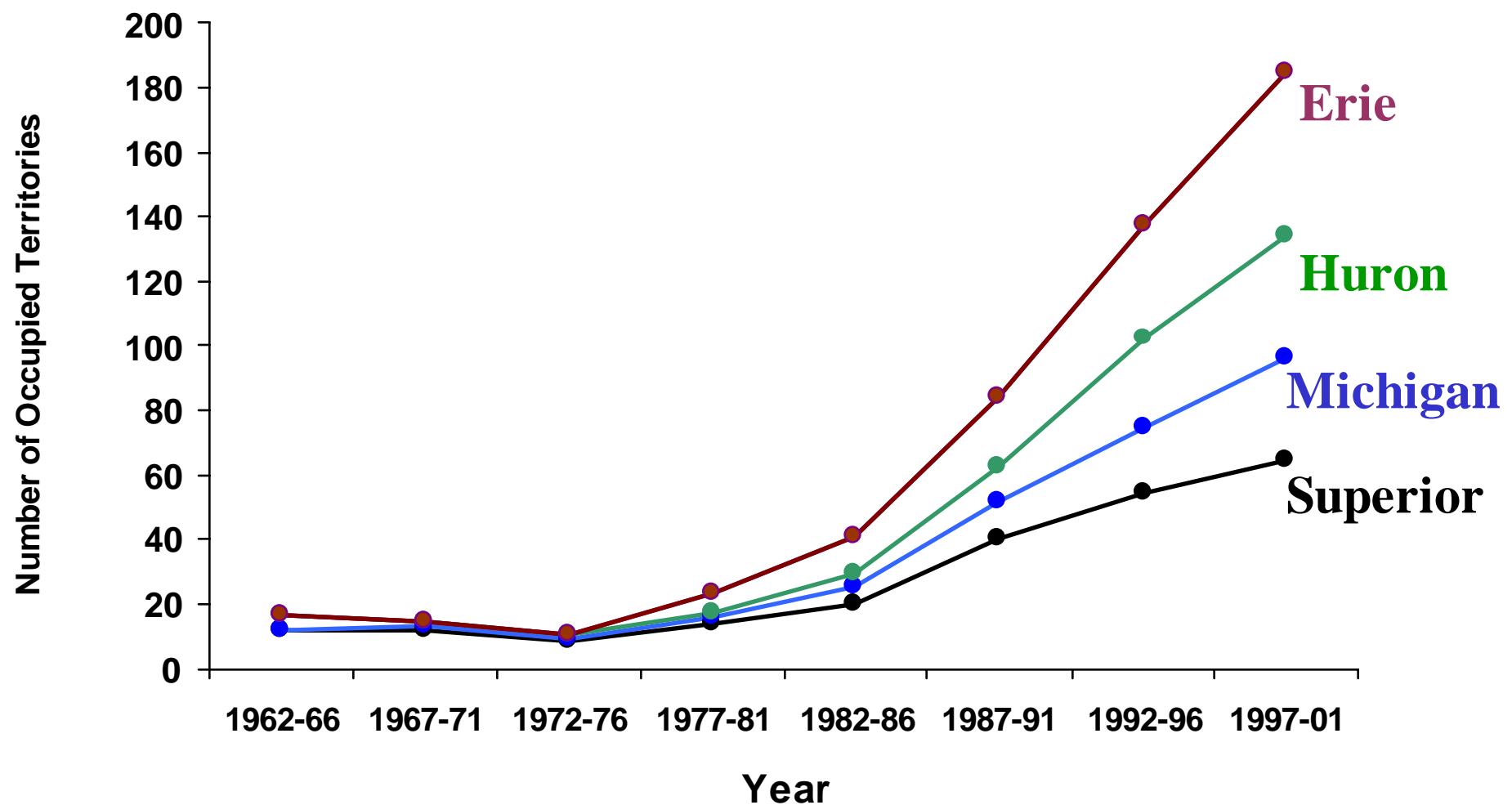
# Nearshore Terrestrial Ecosystem



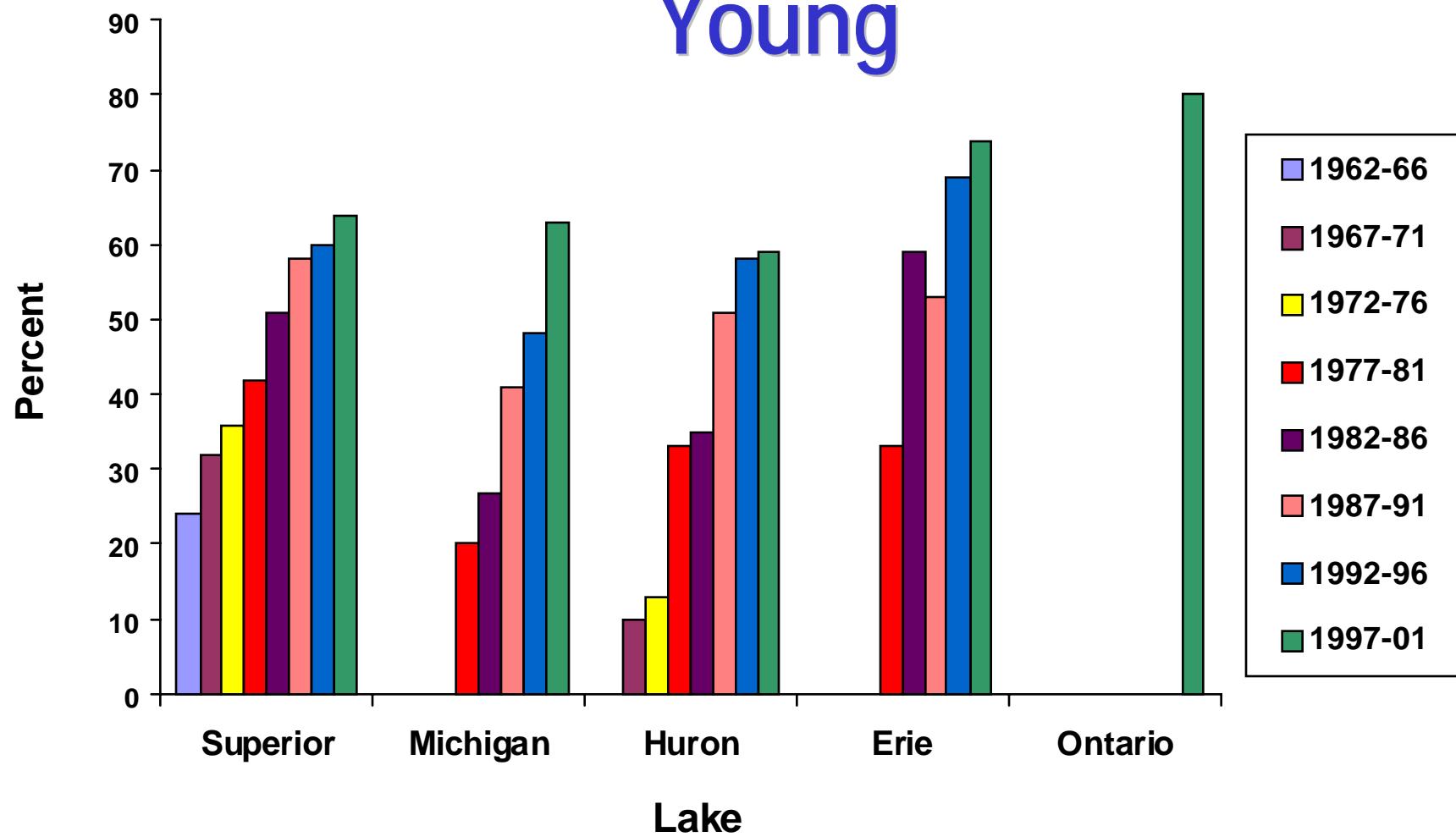
- Productivity of bald eagles
- Colonial nesting water birds



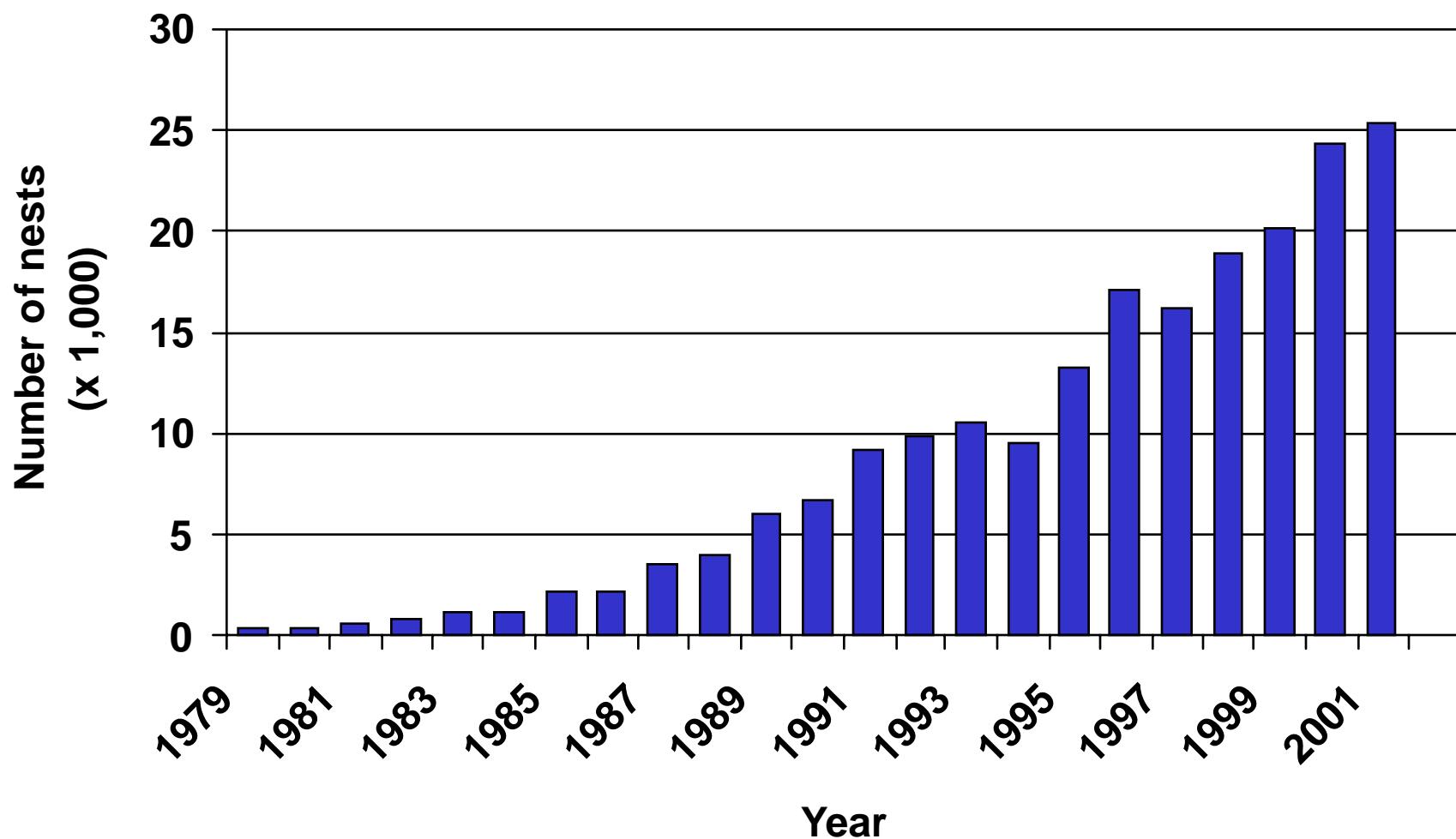
# Occupied Territories by Eagles per Year by Lake



# Average Percentage of Occupied Territories Fledging at Least One Young



## 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



## STATE - ECOSYSTEM PERSPECTIVE

POOR      MIXED      MIXED      MIXED      GOOD  
DETERIORATING      IMPROVING

### Fish

- Walleye
- Salmon & Trout
- Lake Trout

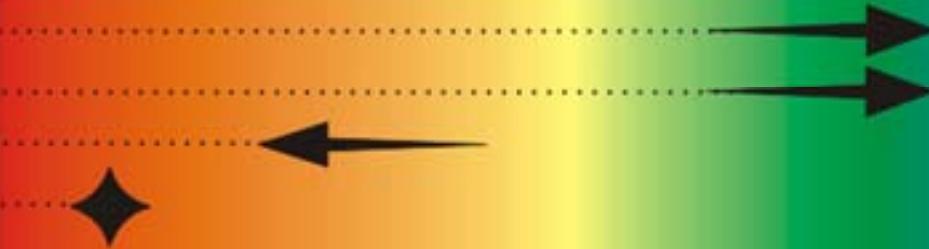
### Preyfish Populations



### Food Web

- Phytoplankton
- Hexagenia
- Diporeia

### Native Mussels



### Coastal Wetlands

- Amphibians
- Wetland Birds



### Nearshore Terrestrial

- Bald Eagles
- Colonial Nesting
- Waterbirds

