



Nearshore and Offshore Waters Indicators

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Ann Arbor, Michigan



“If we could first know where we are
and whither we are tending, we
could better judge what we do and
how to do it ...”

Abraham Lincoln

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Nearshore and Offshore Waters of the Great Lakes

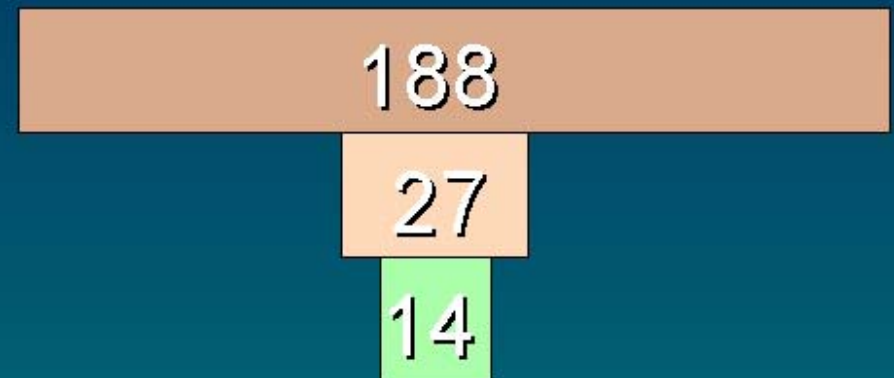


- Nearshore Waters
- Offshore Waters



Indicator Development

- Searched 37 Documents
- Developed list of 188 candidate indicators
- Reduced list to 27
- Further reduced list to 14





Philosophical Approach

- Minimum number of indicators
- Solid scientific underpinnings
- Easily understood for non-technical audience
- Good status and trends information
- Monitoring and management plans in place
- Measurable reference values
- Address aquatic biota, aquatic habitat, and water quality issues



Indicator Name

Lake trout and *Diaporeia hoyi*.



Scud

Diaporeia hoyi



Ecosystem Objective Being Supported

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Annex I of the GLWQA says that Lake Superior should be maintained as a balanced, stable, oligotrophic (nutrient poor) ecosystem

- with lake trout as the top aquatic predator of the coldwater community**
- and *Diaporeia hoyi* as a key organism in the coldwater community food chain.**



Purpose or Nature of the Indicator

Maintain Lake Superior in a condition that preserves its integrity and health through an ongoing process of self-organization carried out by natural aquatic communities.



Desired Endpoint, Range, Outcome or Other Reference Value

■ Lake trout:

- ▶ *productivity greater than 0.38 kg/ha;*
- ▶ *stable, self-producing stocks;*
- ▶ *free from contaminants that adversely affect the trout themselves*
- ▶ *or the quality of the harvested products.*



Diaporeia hoyi

The abundance of the crustacean, Diaporeia hoyi, maintained throughout the entire lake

at present levels of 220- 320/ m²

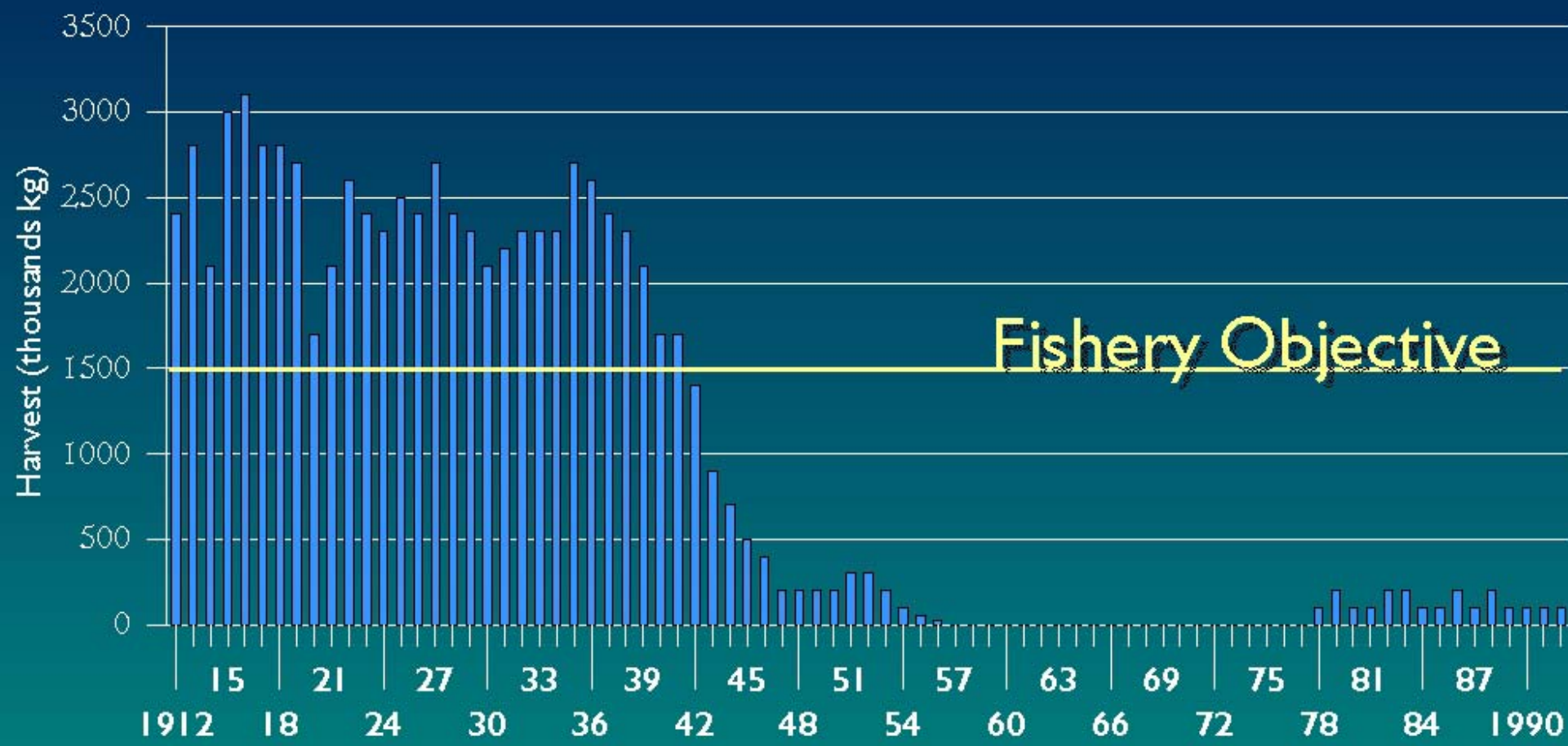
at depths < 100 m and,

30-160 at depths > 100 m.



Lake Trout Harvests

Lake Huron, 1912 - 1992





Indicator Interpretation

- Interpretation is direct and simple.
- If the target values are met, the ecosystem can be assumed to be healthy.
- If the values are not met there is impairment.



Indicator Name

Walleye and *Hexagenia*.



Burrowing Mayfly

Hexagenia





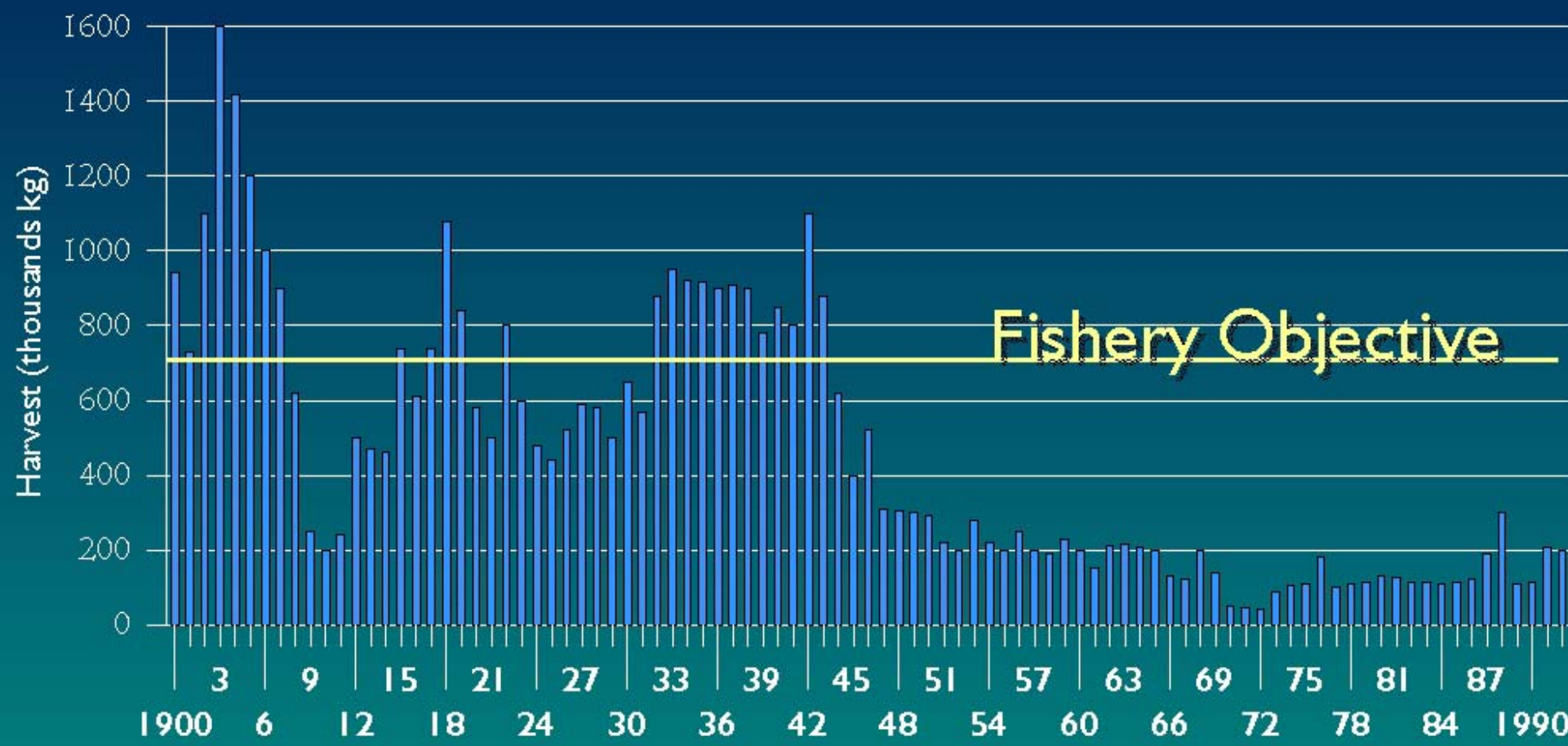
Desired Endpoint, Range, Outcome or Other Reference Value

Existing harvest or population data can be used to develop reference values for walleye for each lake.



Walleye Harvests

Lake Huron, 1900 - 1992



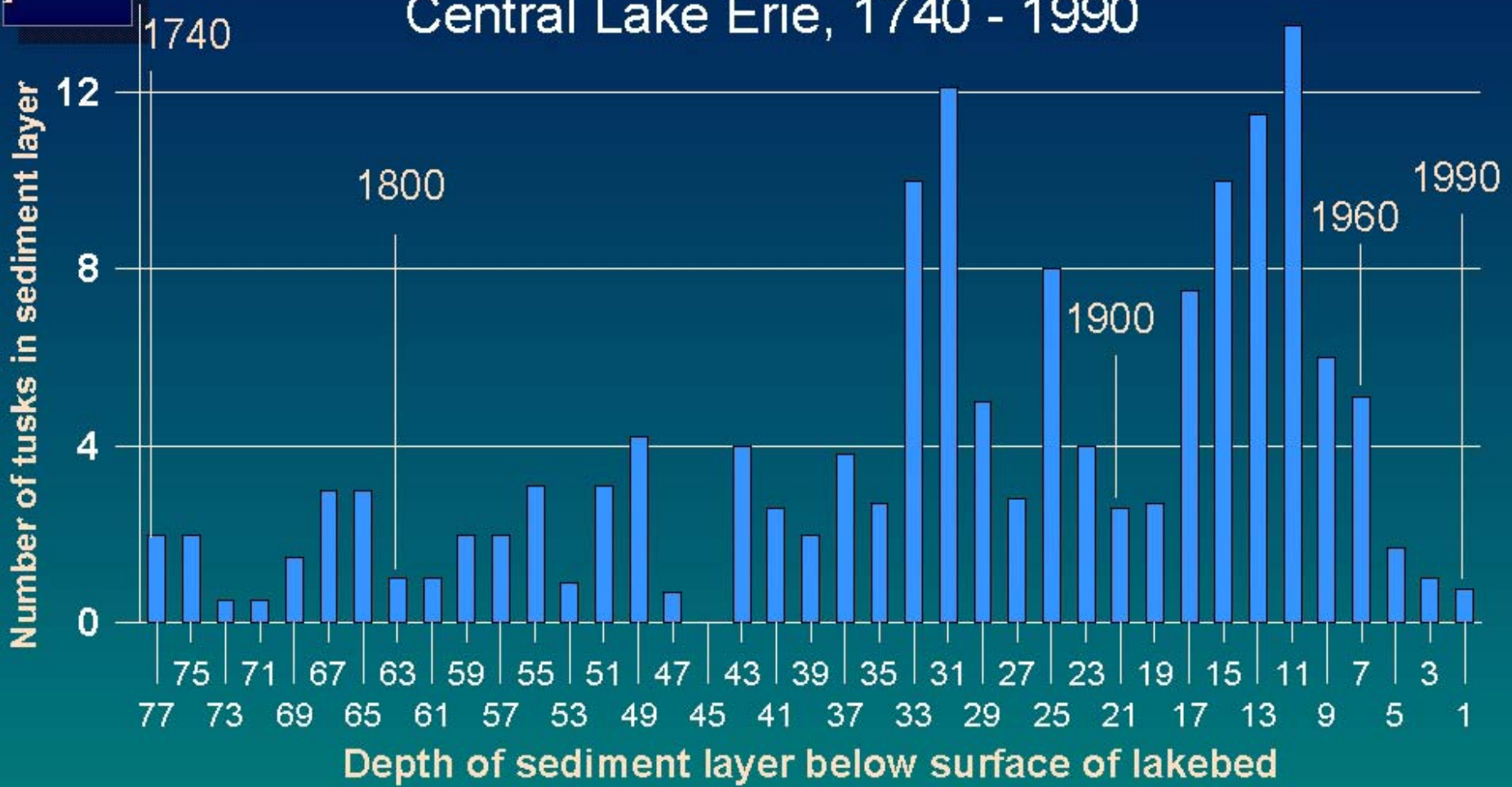
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Trends in Abundance Of the Burrowing Mayfly

Hexagenia

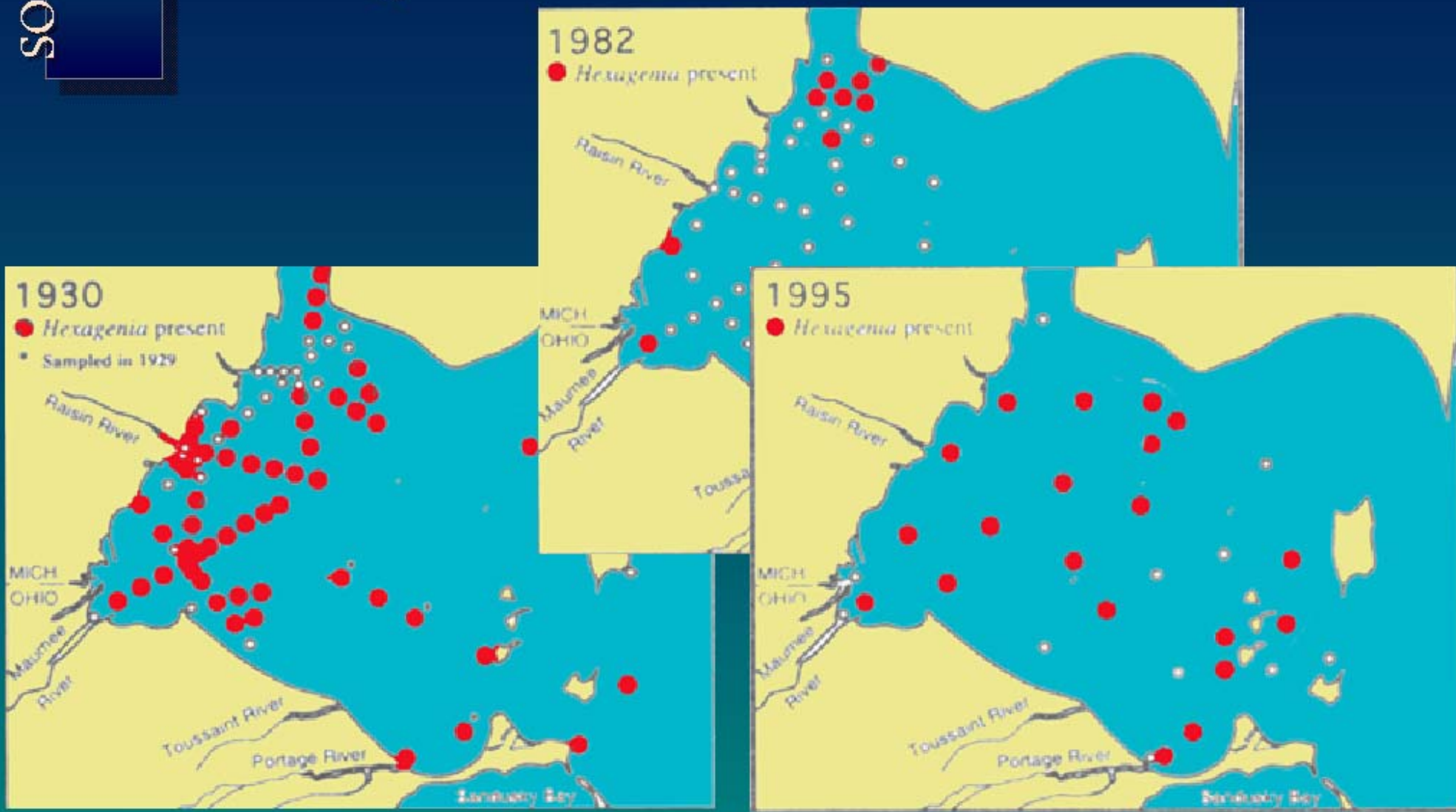
Central Lake Erie, 1740 - 1990





Changes in abundance of the Burrowing Mayfly

Hexagenia, In Western Lake Erie, 1930, 1982, 1995





Indicator Name

Phosphorus Concentrations

Ecosystem Objective Being Supported

Supports Annex 3 of the GLWQA, which outlines specific goals in phosphorus reduction and provides objectives for each lake.



Desired Endpoint, Range, Outcome or Other Reference Value

- Manage loadings to prevent noxious algal blooms, scums, taste and odour and clarity problems, and beach accumulations of *Cladophora*.
- Yield 50-60 million lbs. good fish/year.



Indicator Features

■ Data availability:

- ▶ Monthly surveillance data available for 1976-1981.
- ▶ Biannual survey data available for 1982 to present.



Total Phosphorus Concentrations

In the Early 1990's



Legend

- 0.002 - 0.004 ppm
- 0.005 - 0.009 ppm
- 0.010 - 0.014 ppm
- 0.015+ ppm

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Indicator Name

Aquatic Habitat

Ecosystem Objective Being Supported

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This indicator addresses:

- Annex 2 of the 1987 GLWQA, which calls for the restoration of lost or damaged habitat.**
- The FCGOs referencing habitat.**
- The GLFC Draft Binational Policy and Action Plan, which calls for protection and enhancement of aquatic habitat in the Great Lakes.**



Desired Endpoint, Range, Outcome or Other Reference Value

The indicator will address specific habitat types

---for example

---Tributary Habitat.



Tributary Habitat

- The potential reference values could include:
 - ▶ Number of stream miles in a watershed.
 - ▶ Number of dams.
 - ▶ Miles of impounded stream channel.
 - ▶ Miles of impounded, high-gradient stream channel.
 - ▶ Miles between the river mouth and the first dam.
 - ▶ Number and location of dams with functional fish passage facilities.



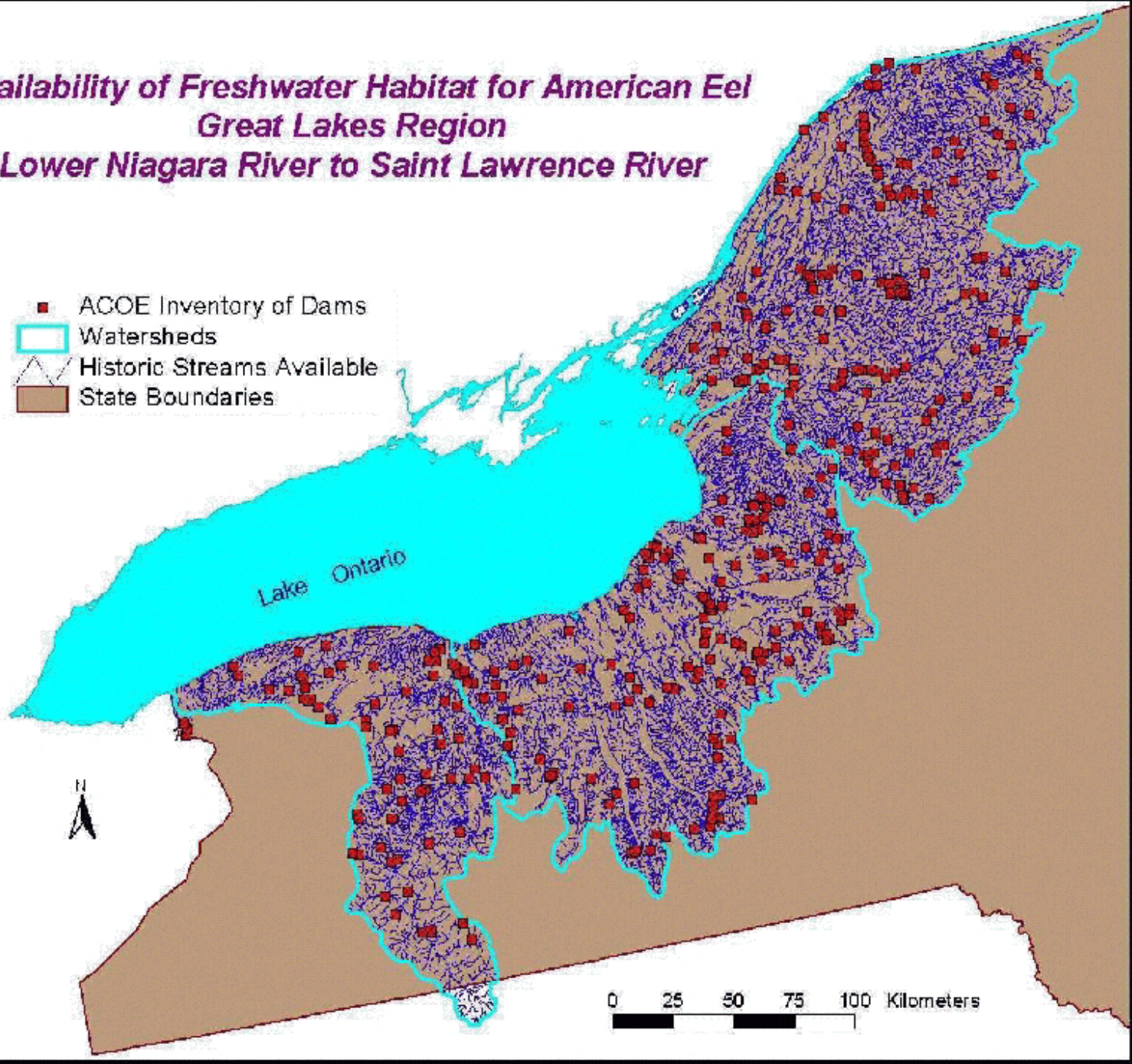
Indicator Features

■ Data availability:

- ▶ Data are being developed in connection with FERC dam relicensing in the United States.
- ▶ ACOE data are presently available for many U.S. Great Lakes tributaries.

**Availability of Freshwater Habitat for American Eel
Great Lakes Region
Lower Niagara River to Saint Lawrence River**

- ACOE Inventory of Dams
- Watersheds
- △ Historic Streams Available
- State Boundaries





Inventory of Dams

US Lake Ontario Tributary Streams

Dam Height (ft.)	Number of Dams
<10	64
10 - 24	238
>24	153
Total	455



Limitations of the Indicator

Systematic inventory, classification, and mapping of most Great Lakes aquatic habitats has not been widely undertaken.



Indicator Interpretation

- Improvements in tributary health include:
 - ▶ dam removal;
 - ▶ restoration of run-of-the-river
 - ▶ flows below dams; and
 - ▶ installation of fully functional upstream and downstream fish-passage facilities.