

Plants as Indicators of Biological Integrity in Great Lakes Coastal Wetlands

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Features Inventory
(MSUE)

Study Objective:

Identify plant IBIs that reflect:

- Land Use at sampling sites.
- Water Chemistry at sampling sites.

COST?

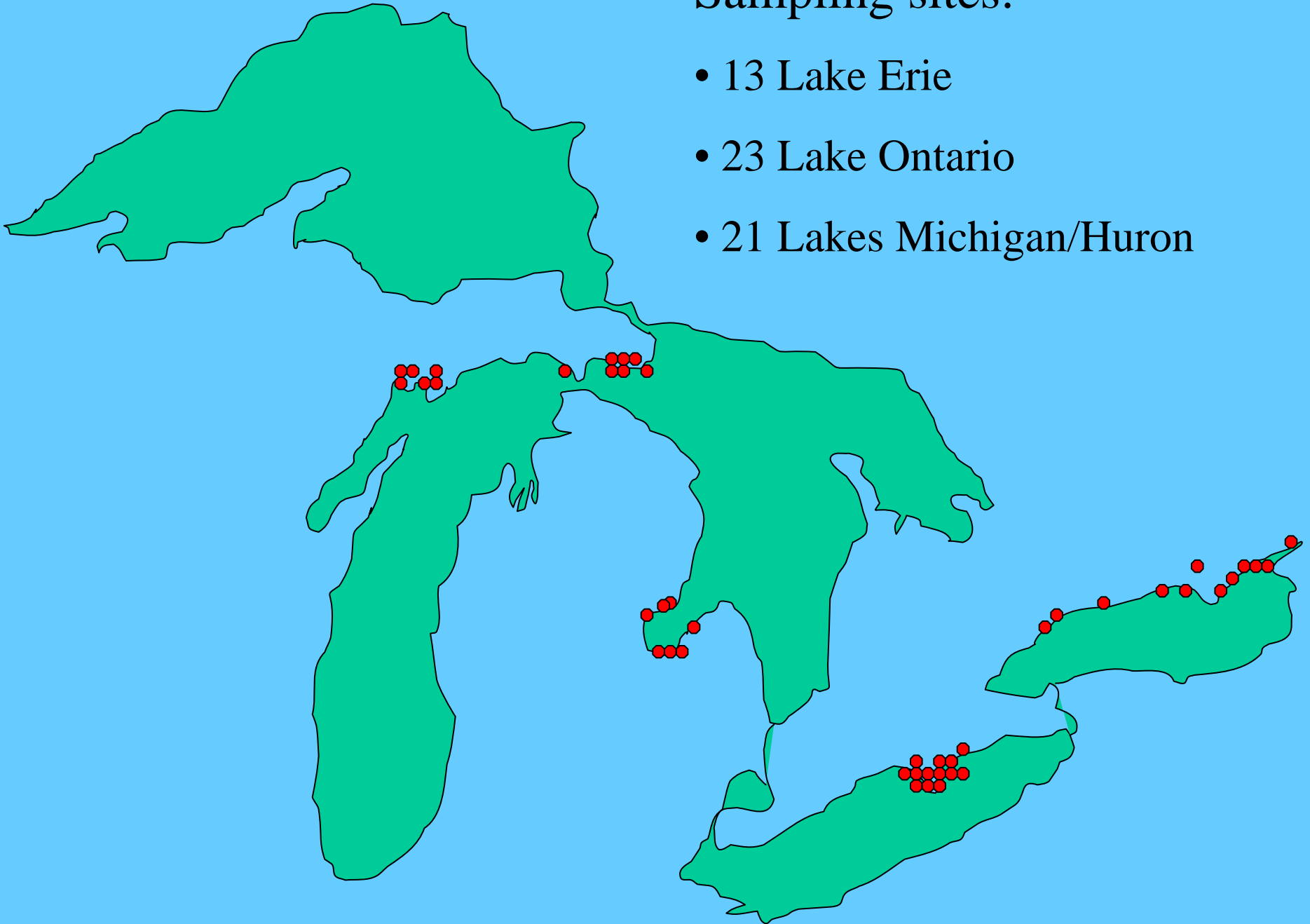
Collection and analysis:

\$468/sample site.

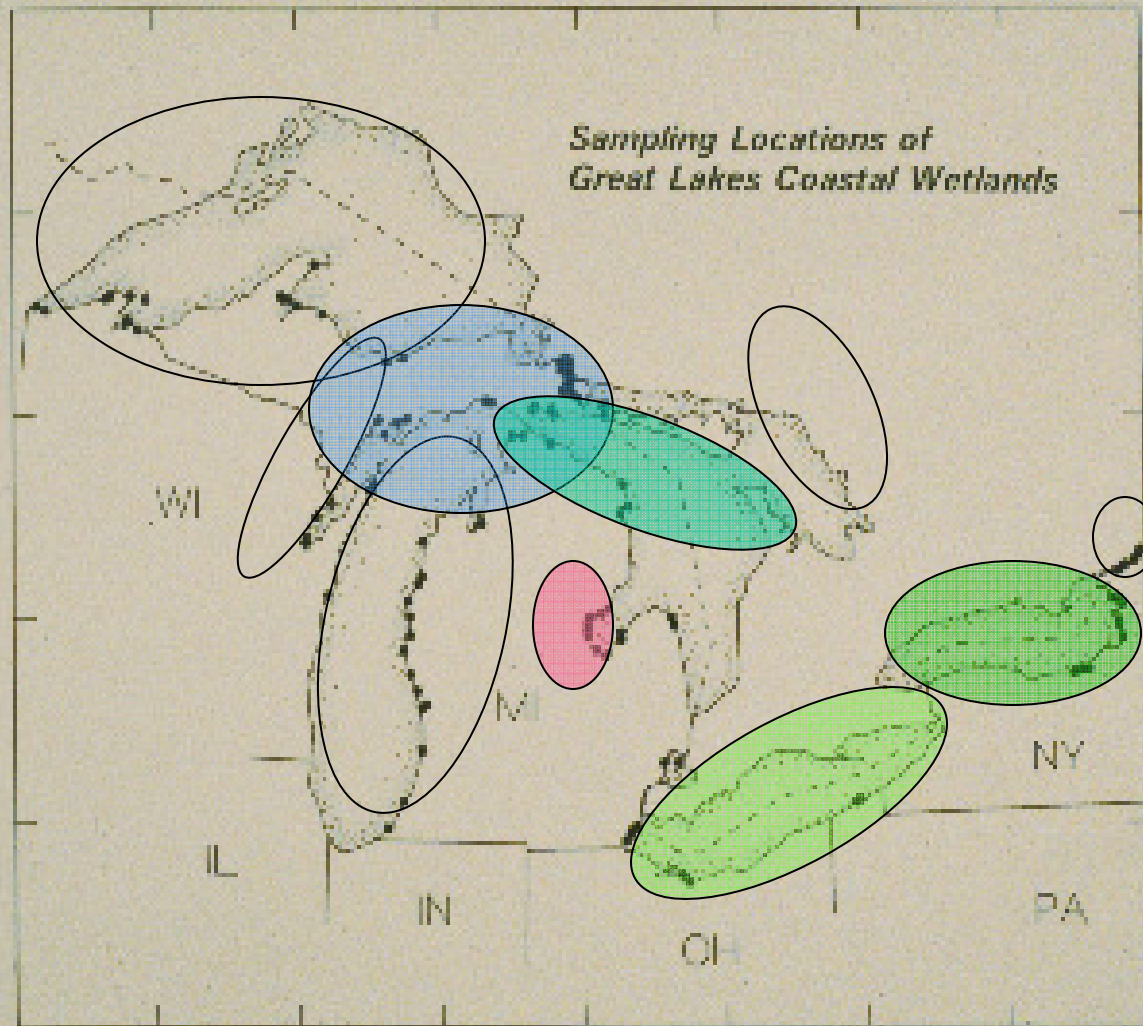
Focus on rapid assessment.

Sampling sites:

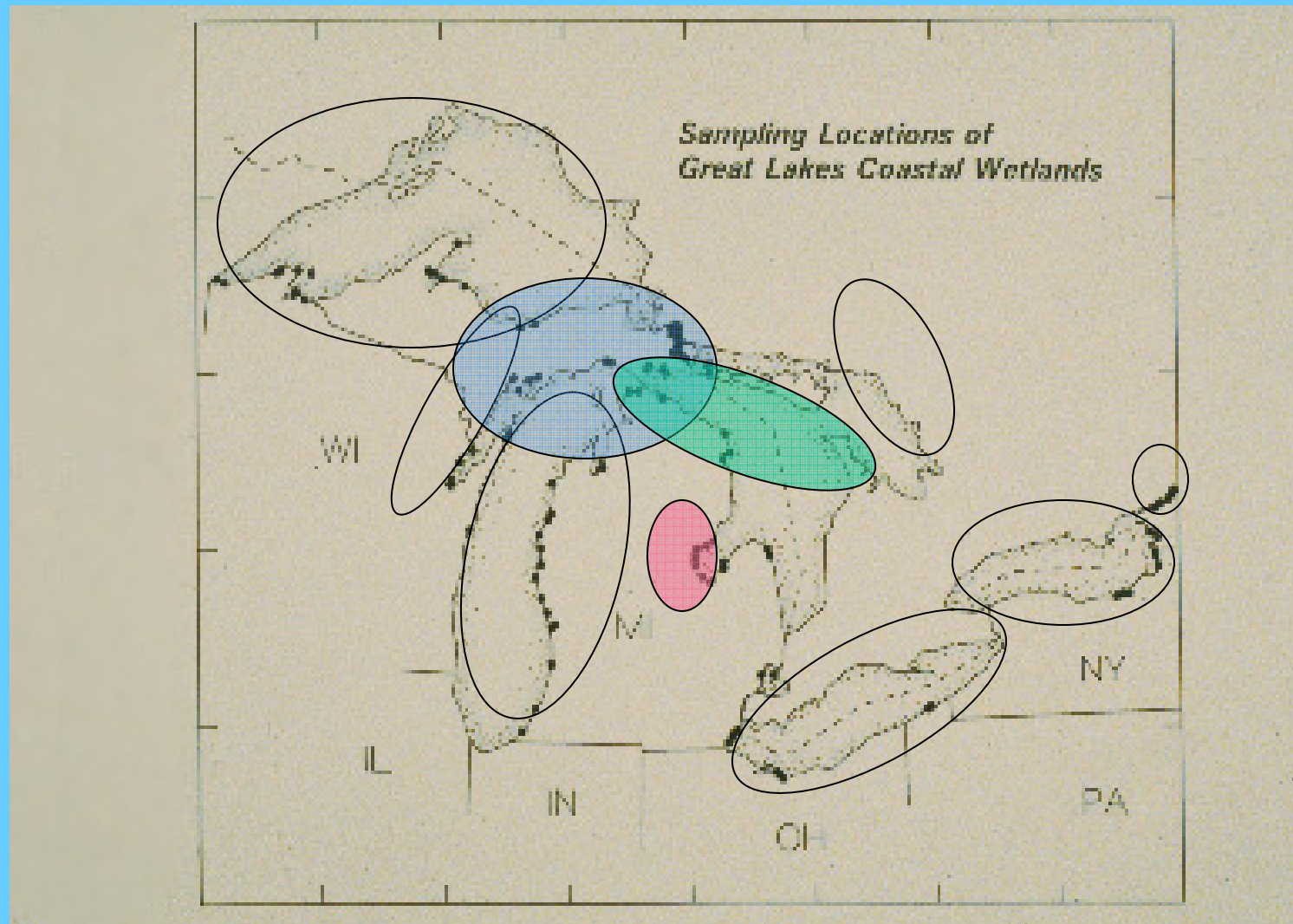
- 13 Lake Erie
- 23 Lake Ontario
- 21 Lakes Michigan/Huron



Sampling for this IBI study (2001): Open and protected embayments



Focus areas of final data analysis (Due to more complete chemistry data)



Sampling conducted along transects:
5 sampling points per zone – random
location of 0.5 m² plots



Land Use Variables From Aerial Photography (#):

- Dwellings
- Industrial buildings
- Other buildings
- Boat docks
- Paved parking lots
- Dirt parking lots
- Boat launches
- Channels in wetland
- Drainage ditches
- culverts entering wetlands
- construction sites
- sediment sources
- other hydrologic alterations

Land Use Variables From Aerial Photos (%):

- surrounding upland forest
- surrounding upland farming
- surrounding upland urban
- hardened shoreline
- eroding shoreline
- Shoreline with dirt road
- Shoreline with paved road
- Mining within 5 km.

Additional Land Use Databases:

- Alternative aerial photography:
no consistent source
- Specialized agricultural data
sets: none found
- EPA point source database
(HUCCS): inconsistent for basin

Vegetation metrics: 26 evaluated

- # of species & % mean cover by taxonomic group
- # & % mean cover of native (or exotic) species
- # & % mean cover of species by plant zone
- Floristic Quality Index (FQI) for site or plant zone
- Conservatism coefficient for site or plant zone
- Wetland coefficient for site or plant zone

Water quality variables sampled:

- Water temperature
- Maximum water depth
- Dissolved Oxygen
- Specific Conductivity
- Salinity
- pH
- Alkalinity
- Turbidity
- Chlorophyll a
- Soluble reactive phosphates
- Chloride
- Sulfate
- Nitrate
- Ammonium

Test potential plant IBIs at sites with differing types and levels of land use.

Summary of Plant Indicators: (Based on Regression Analysis)

- Strongest relationships between land-use and plant IBIs seen with site-based indices (Floristic Quality or Conservatism Indices).
- Taxonomic-based metrics were not effective.
- Metrics based on ecological groups of species were not effective.

PCA summary:

- PCA of land-use variables identified 6 factors accounting for 70% of variability.

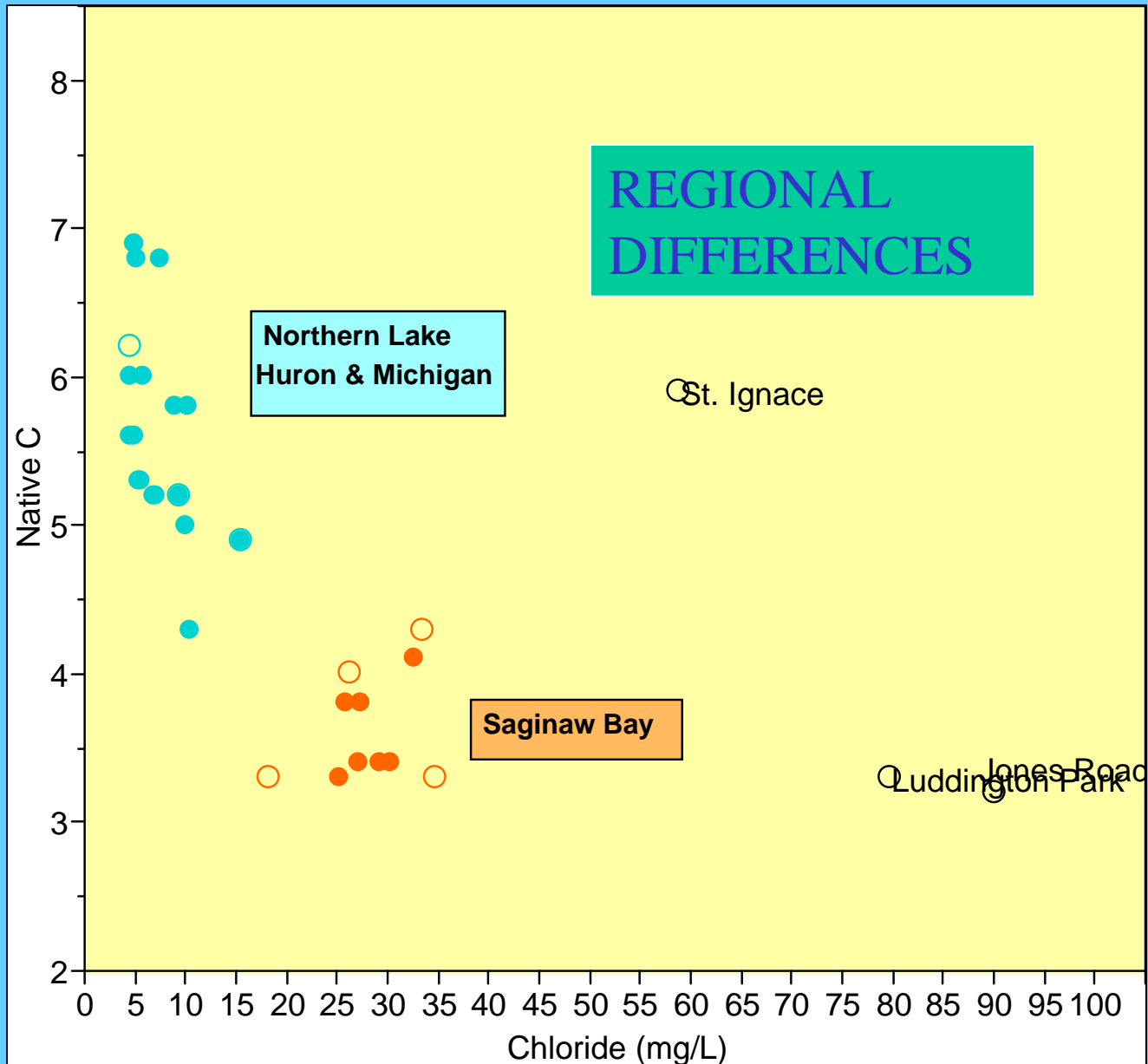
BUT:

- PCA of water-quality variables and land-use variables: no strong relationships found.

- PCA of land-use variables and plant indices: no strong relationships found.

Test plant IBIs against water chemistry differences.

Plant – water chemistry relationships:



Summary of Plant Indicators:

- Regional relationships between site-based plant indicators (FQI or C) and water chemistry.
- No strong relationship between species-based metrics and water chemistry.

WHY SUCH WEAK RESULTS?

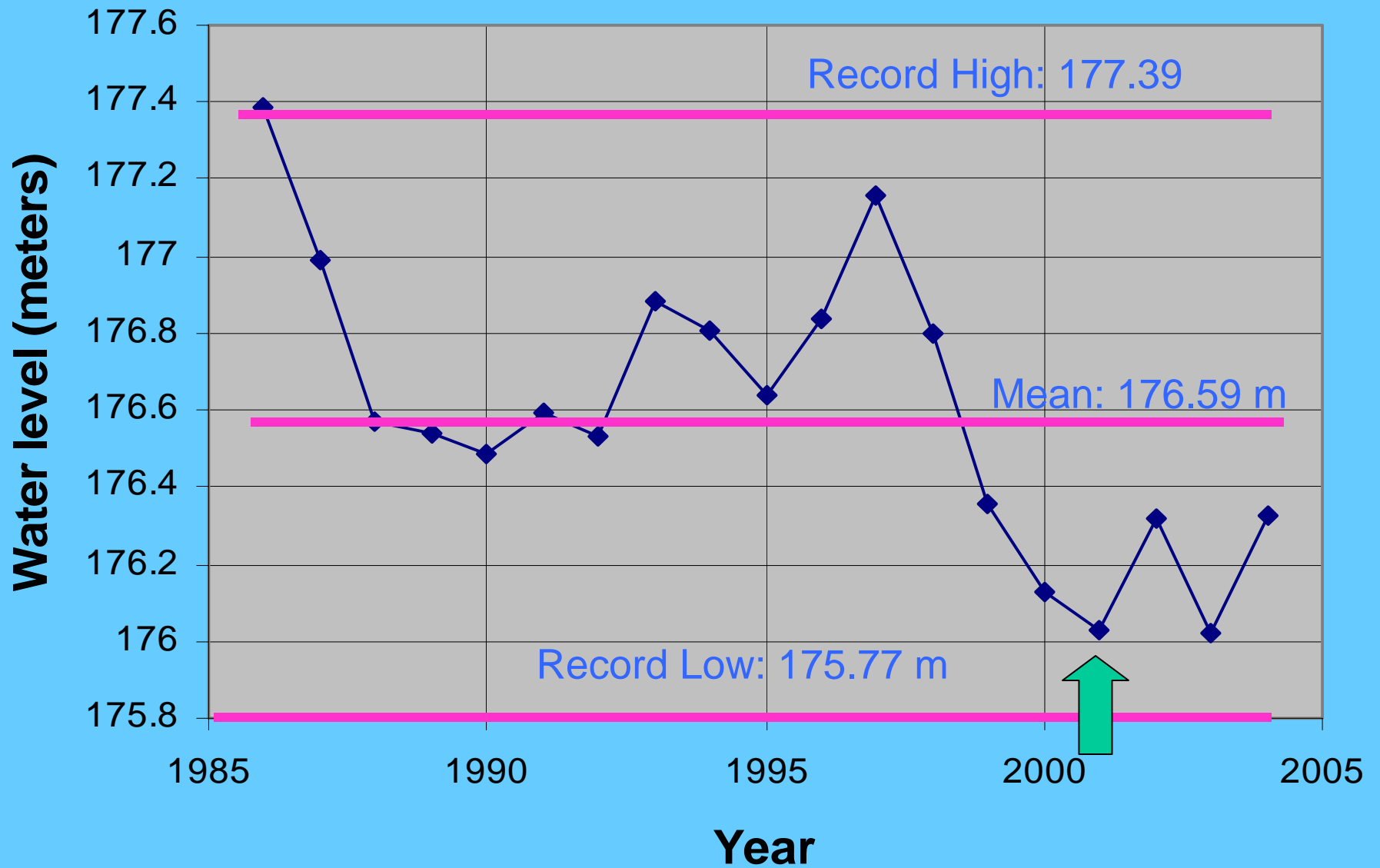
Sparse data for individual species or species groups (e.g. turbidity-tolerant submergents).

To improve results:

Sampling more effective in high-water periods for some metrics:

- submergents in high water -12 species
- submergents in low water – 4 species

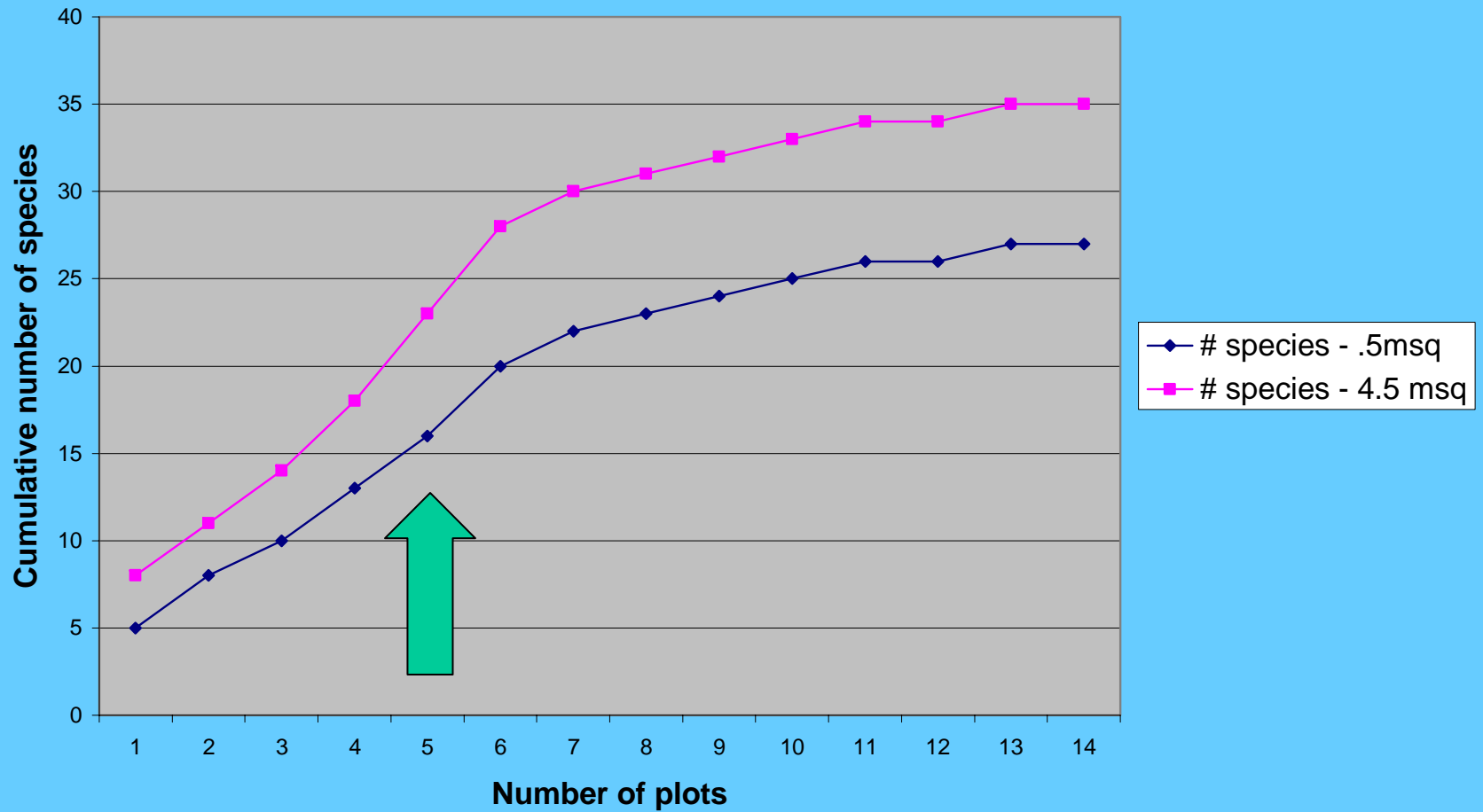
Lake Huron Water Levels: 1986-2004



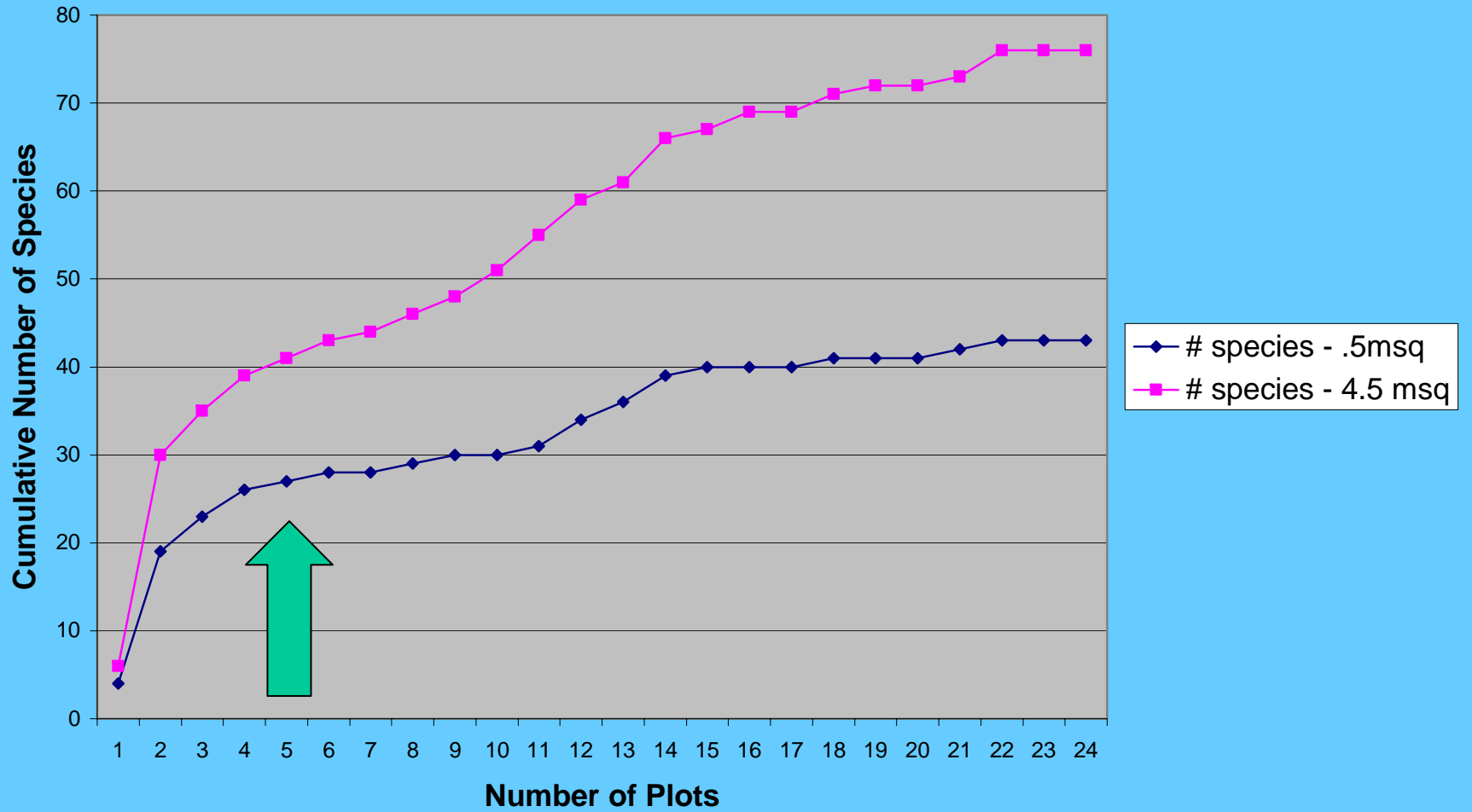
To improve results:

- Larger number of sampling points
- Larger plot size

Cumulative Number of Species in Different Sized Plots - Bais de Gris (wet to dry)



Cumulative Number of Species in Different Sized Plots - Wildfowl Bay Prairie



Random Walk vs. Transects

- Transects have 32 to 75% of species encountered in random walk.
- But, random walk lacks quantitative coverage values needed for developing species-based metrics.