

# WATER QUALITY - BIOLOGICAL RESPONSE RELATIONSHIPS

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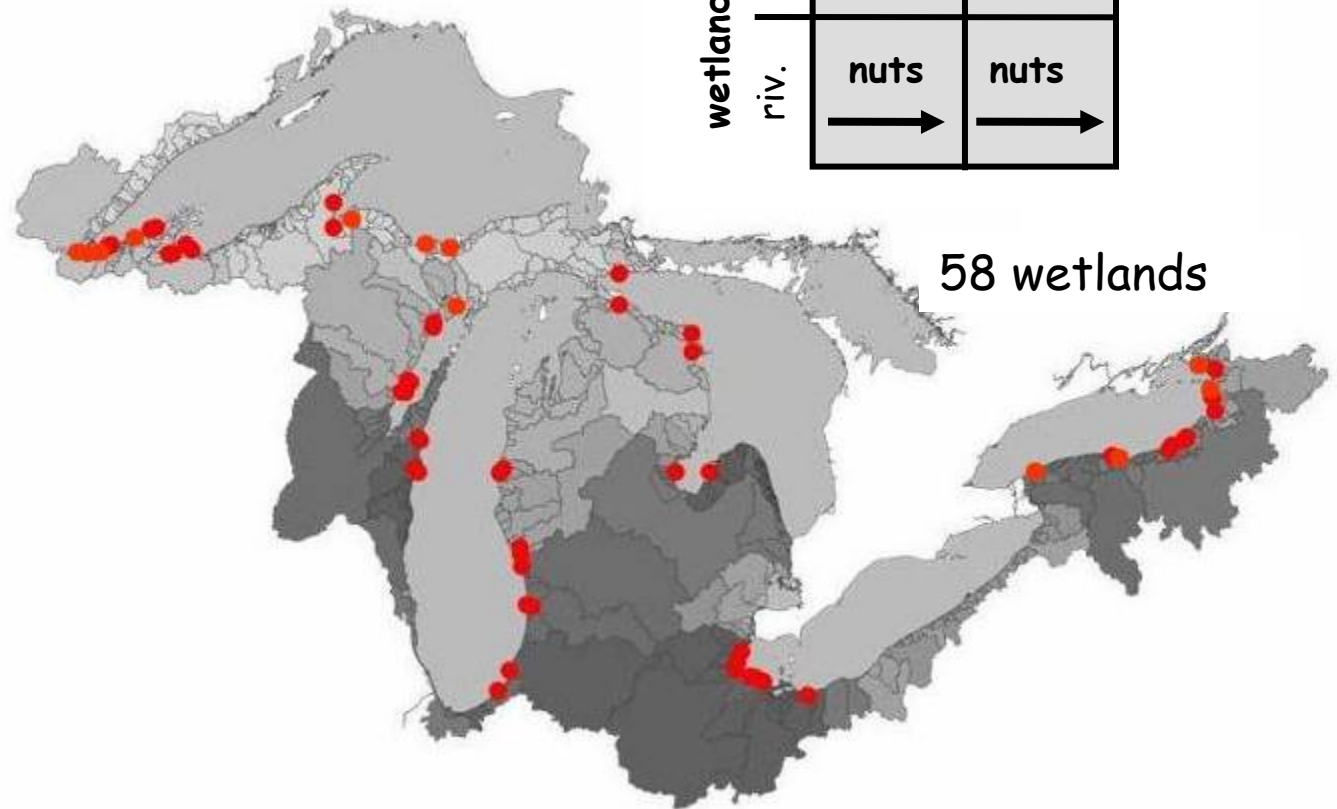
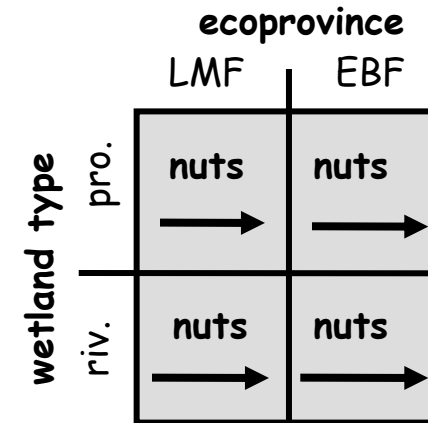
US-Environmental Protection Agency,  
Mid Continent Ecology Division,  
Duluth MN

Presentation for Great Lakes Coastal Wetlands Consortium Science Committee  
Workshop,  
22-23 Jan 2007, Duluth MN

# EPA-Duluth project...

A collaboration with GLEI - separate sampling effort building on GLEI landscape characterization and experimental design.

Goal: developing stressor-response relationships for coastal wetlands.



**Water Qual.**

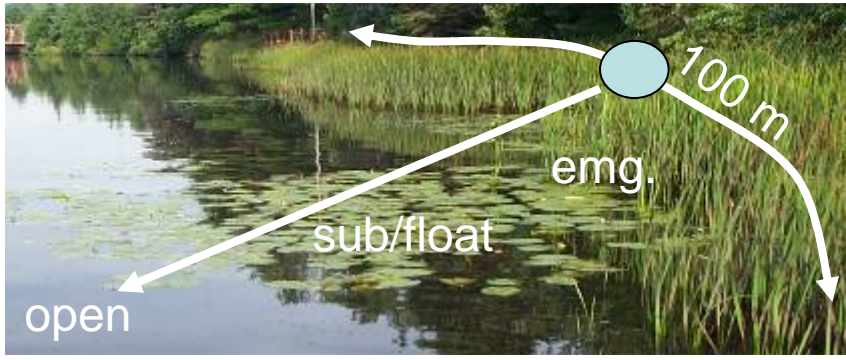
- clarity (chl-a, secchi, TSS, light profile)
- nutrients (DOC, TN, NH<sub>4</sub>, NO<sub>3</sub>, TP, SRP, Si)
- cations & anions (Ca<sup>++</sup>, Cl<sup>-</sup>, K<sup>+</sup>, Mg<sup>++</sup>, Na<sup>+</sup>, SO<sub>4</sub><sup>2-</sup>)
- hydrolab (temp., O<sub>2</sub>, pH, turb., cond.)

**Biota**

- electro-fish survey (composition, size)
- aquatic plants (cover, composition by zone)
- attached algae (chl-a, composition)
- food web (via isotopes)
- sediment microbial enzymes

**Physical**

- stream & lake inputs (discharge, WQ, seiche)
- sediments (density, TVS, TP, TN)
- morphology (area, shape, water depth)
- visible impacts (roads, docks, etc.)



**Goal:** quantify this conceptual model, with a focus on nutrients, such that condition assessments and protection standards for Great Lakes coastal wetlands can be established.

**Watershed Land Use:**

- nutrient loading
- sedimentation
- hydrology alteration

**In-Wetland Activities:**

- shoreline hardening
- dredging/plant removal
- power boating

**Water Quality**

- increasing nutrients
- declining clarity
- declining DO
- algae proliferate

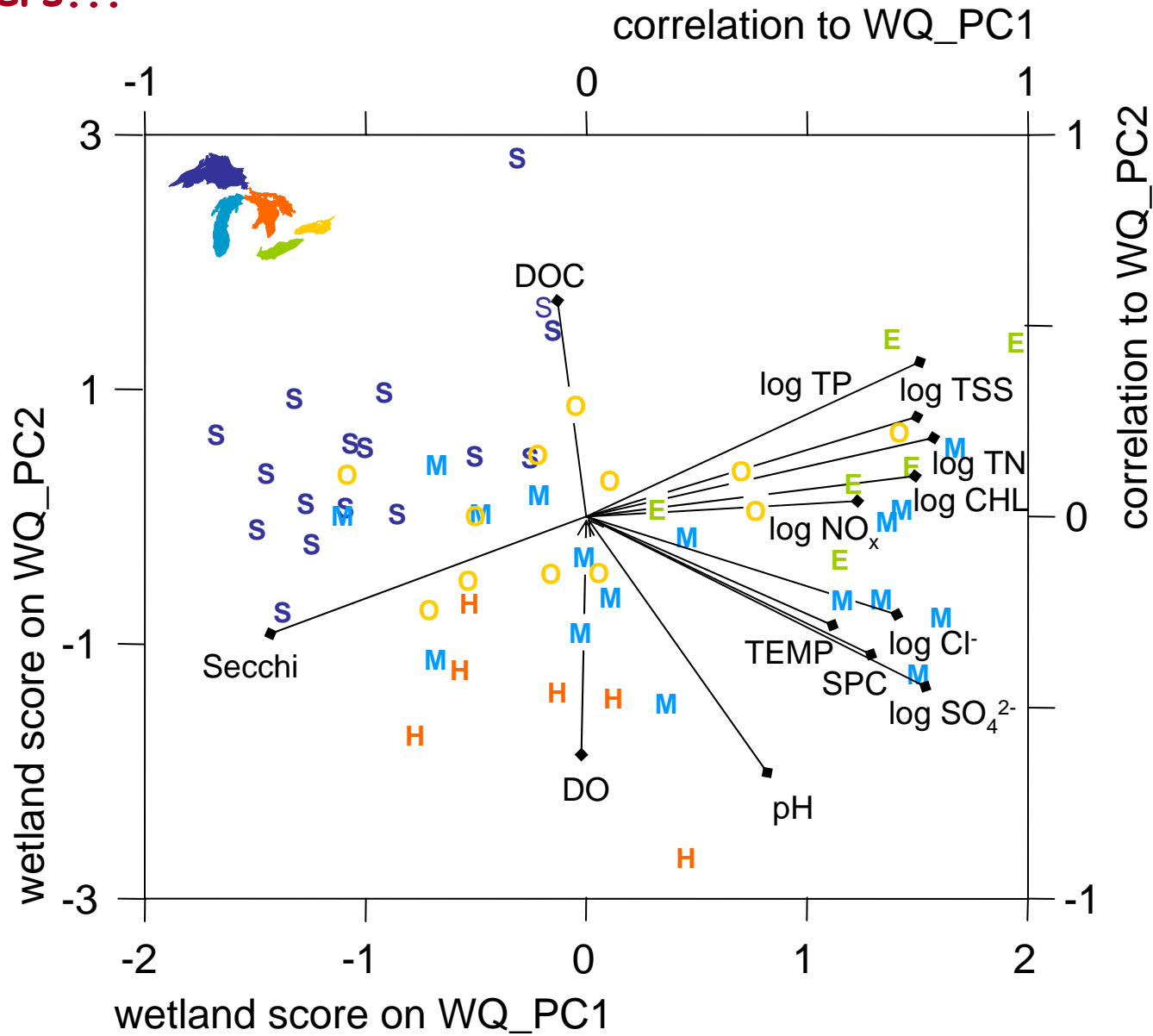
**Aquatic Veg**

- loss of submerged veg.
- increasing nuisance spp.
- degraded habitat

**Fish**

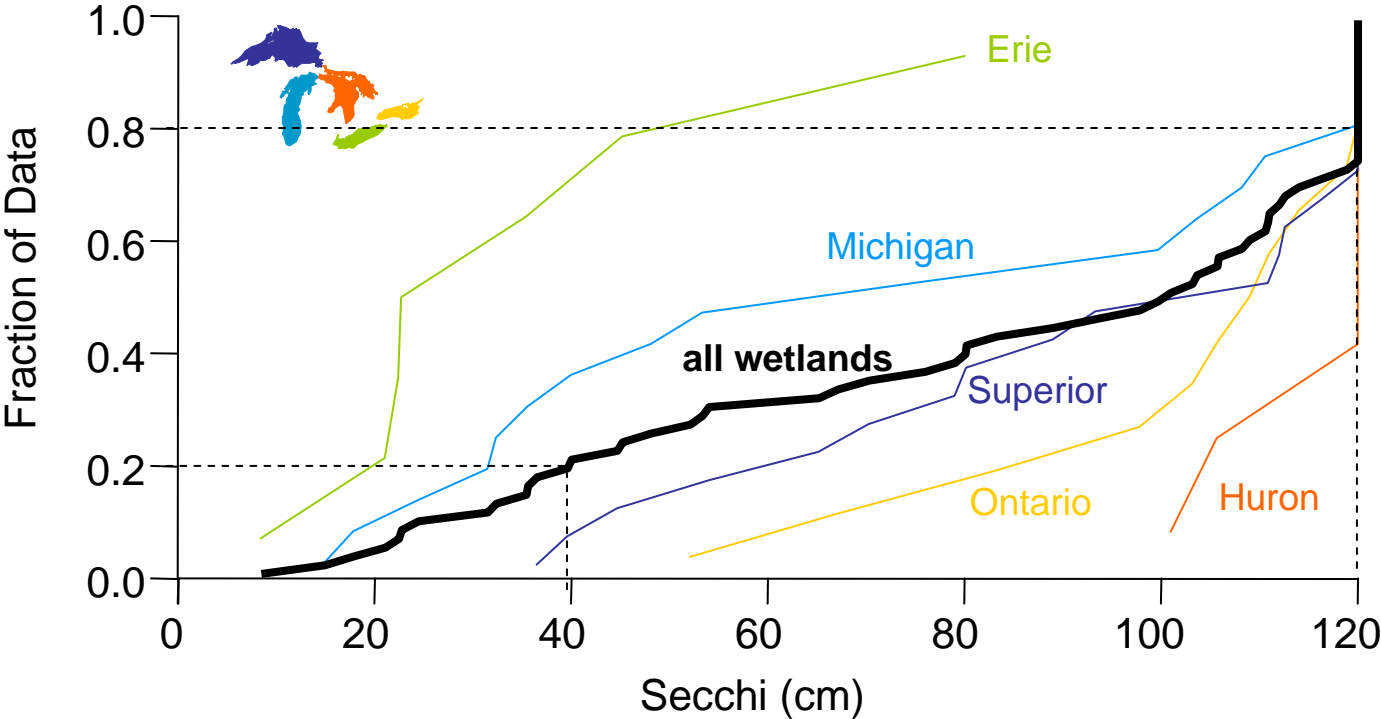
- exotic spp. thrive
- biodiversity declines
- fewer gamefish
- etc...

# Relationship among water quality parameters...



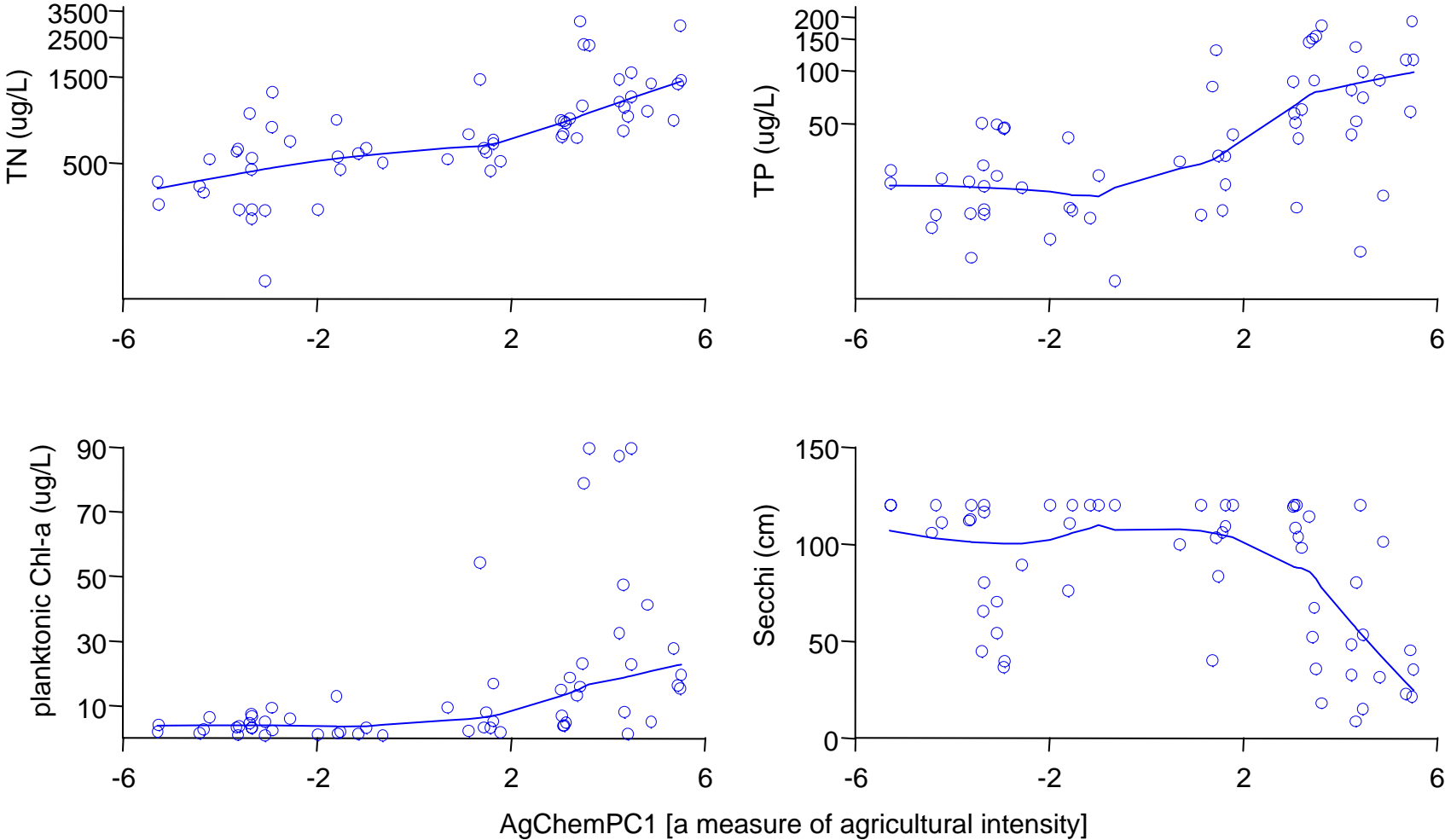
NMDS ordinations of wetlands in water quality space

# A traditional means for establishing protective criteria...



Cumulative distributions using wetland avg. data., N=58

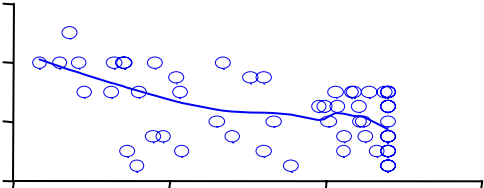
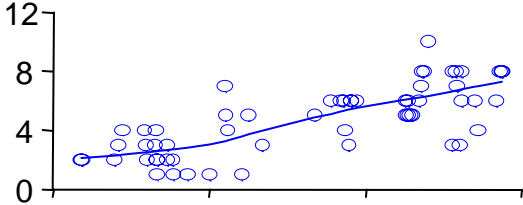
# Water quality as an indicator of landscape condition...



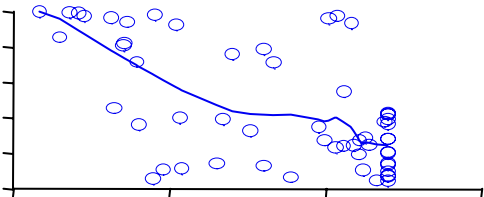
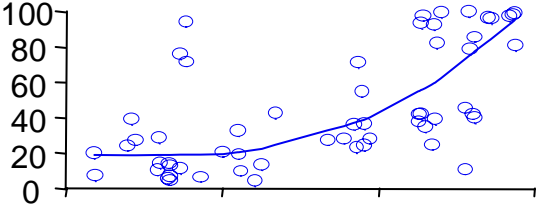
Lowess smoother of wetland avg., N=58

# Water quality as a mediator of biological response...

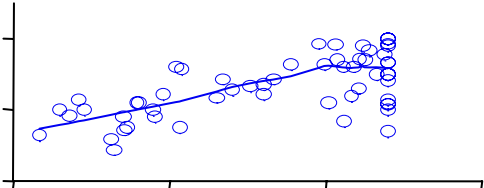
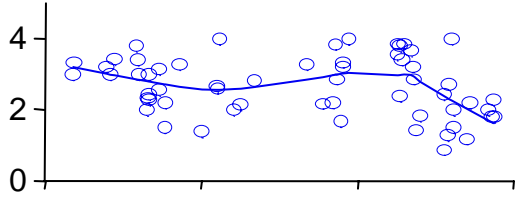
nuisance plant score  
(*M. spicatum* + phragmites  
+ typha + *S. pectinatus*)



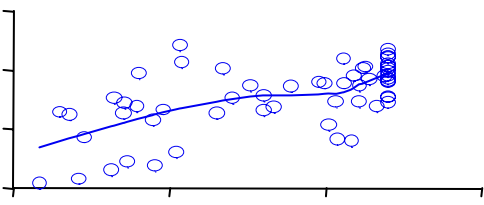
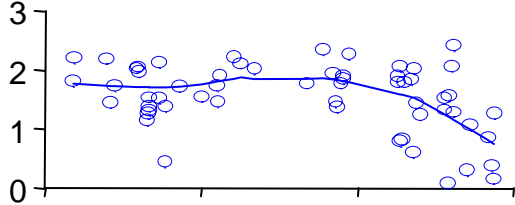
% turbidity  
tolerant fish



submerged vegetation  
cover score



fish Shannon-  
Wiener diversity



AgChemPC1

Secchi (cm)

Lowess smoother of wetland avg., N=58

