

Nutrient Criteria Development in Pennsylvania

Bill Brown

Pennsylvania Department of Environmental Protection

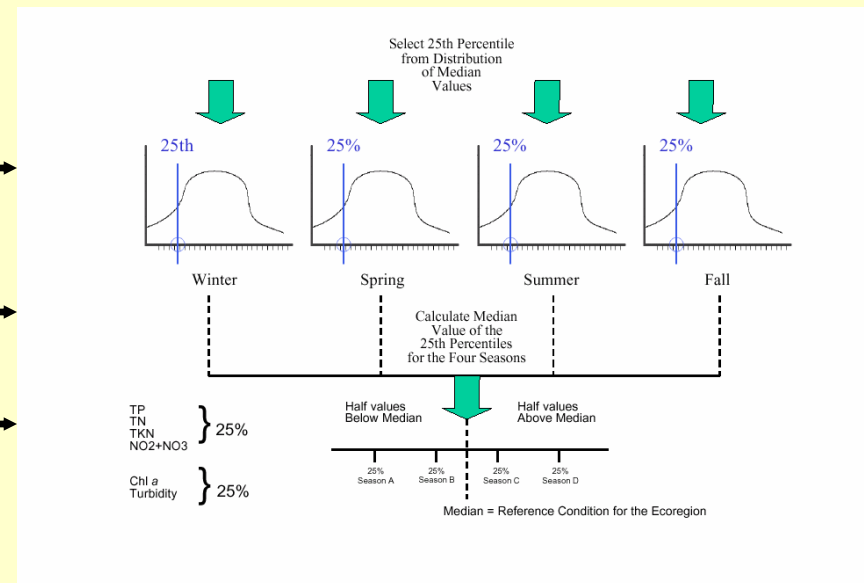
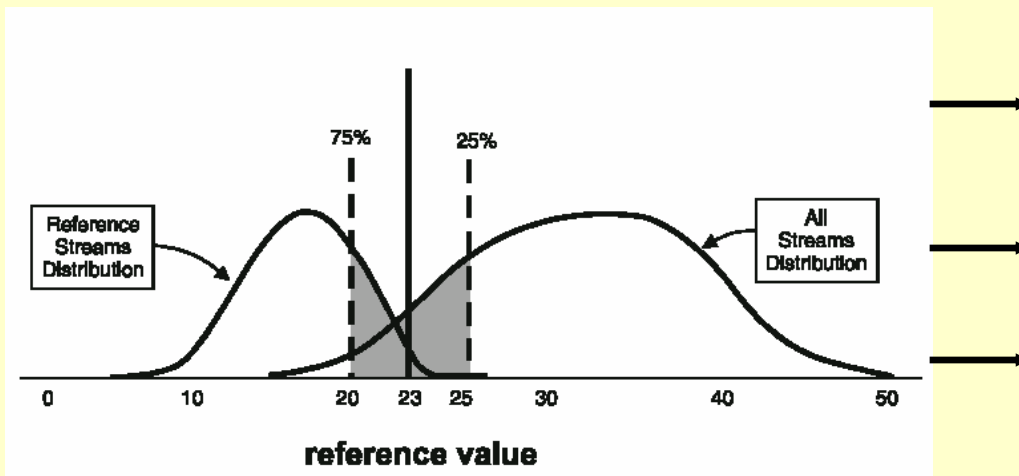
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National Strategy for the Development of Regional Nutrient Criteria

- January 9, 2001 *Federal Register* notice called for Nutrient Criteria Development Plan by end of 2001
- November 14, 2001 memorandum from EPA OST extended due date to October 2002
- Plan to include
 - Strategy for criteria development
 - Detailed schedule ending with criteria adoption
- Pennsylvania's Plan agreed to by Region 3 in June 2002 - criteria adopted by 2009

Concerns with EPA Proposed Method

- Not response-based

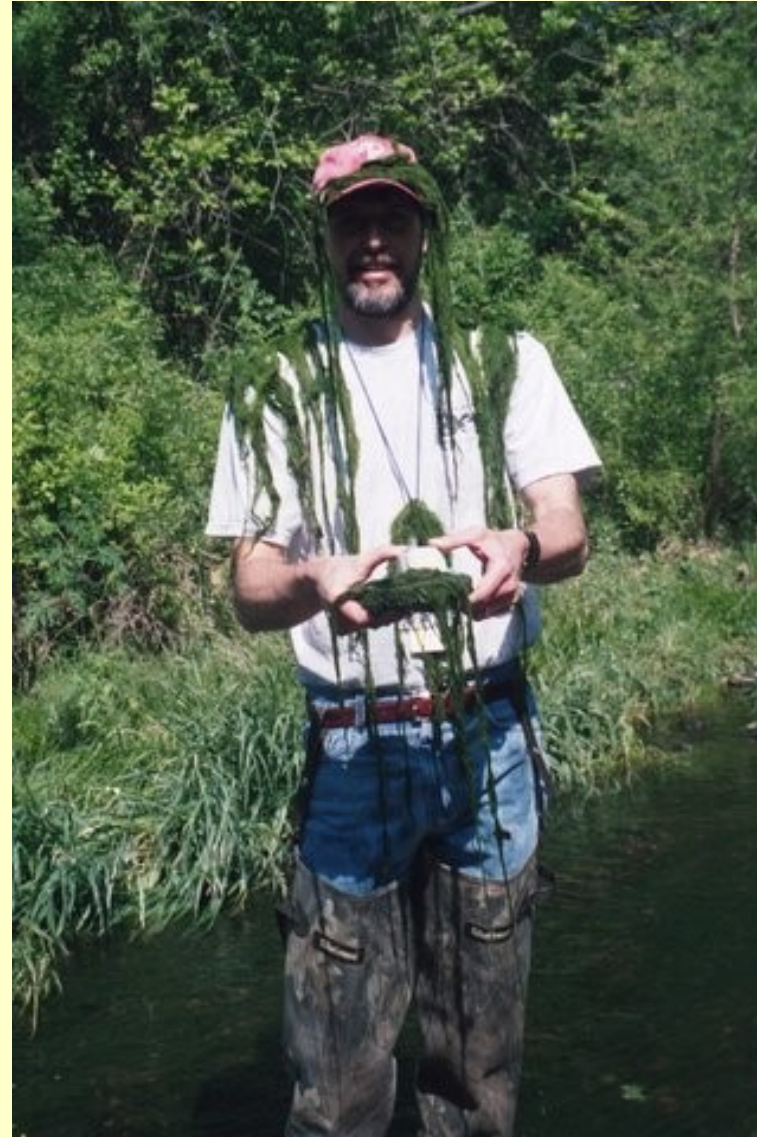


- Derived using data over all seasons and flow regimes
- Not related to Designated Use support
- EPA has strongly encouraged States to develop their own criteria

Questions

- What constitutes a nutrient impairment?
 - Dissolved oxygen violations?
 - Excessive algae?
 - What is excessive?
 - Is there a level excessive enough to deem the stream impaired in the absence of a DO violation?

Excessive algae?



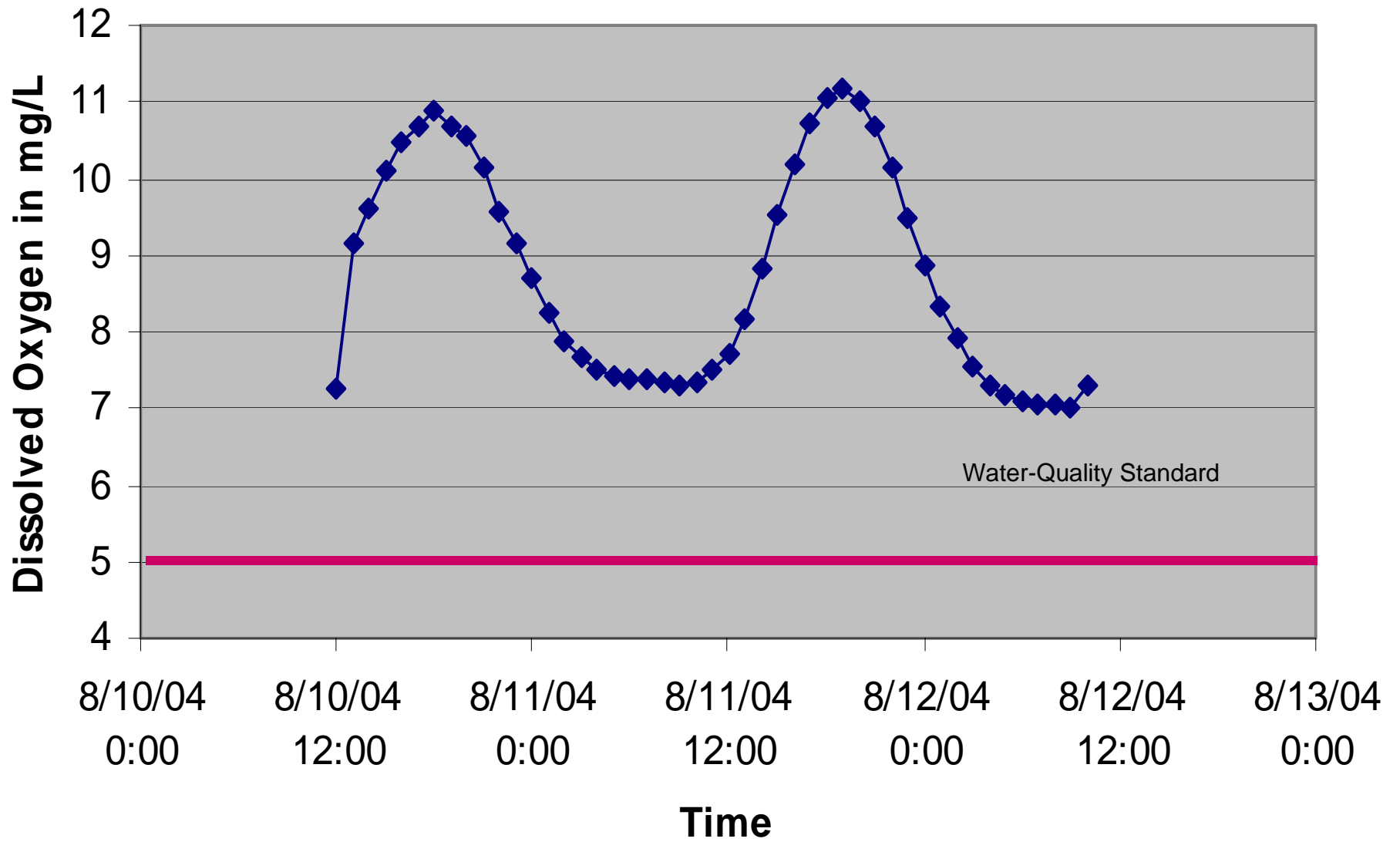
Region 3 Periphyton Study

- Periphyton exhibit rapid response to environmental conditions
- Data collected at 50 sites across Region 3 over two years including:
 - Full nutrient suite
 - Diurnal dissolved oxygen, pH, temperature and conductance over 48 hour period
 - Algae sampling
 - Chlorophyll-a
 - Ash-Free Dry Mass
 - Periphyton identification/assemblage composition
 - Relationship between nutrient concentrations, DO and algae (amount and type)

Project Goals

- Use DO, periphyton chlorophyll-*a* to define over-enrichment (effects-based approach)
- Assess periphyton communities
- Suggest nutrient criteria based on results of the work

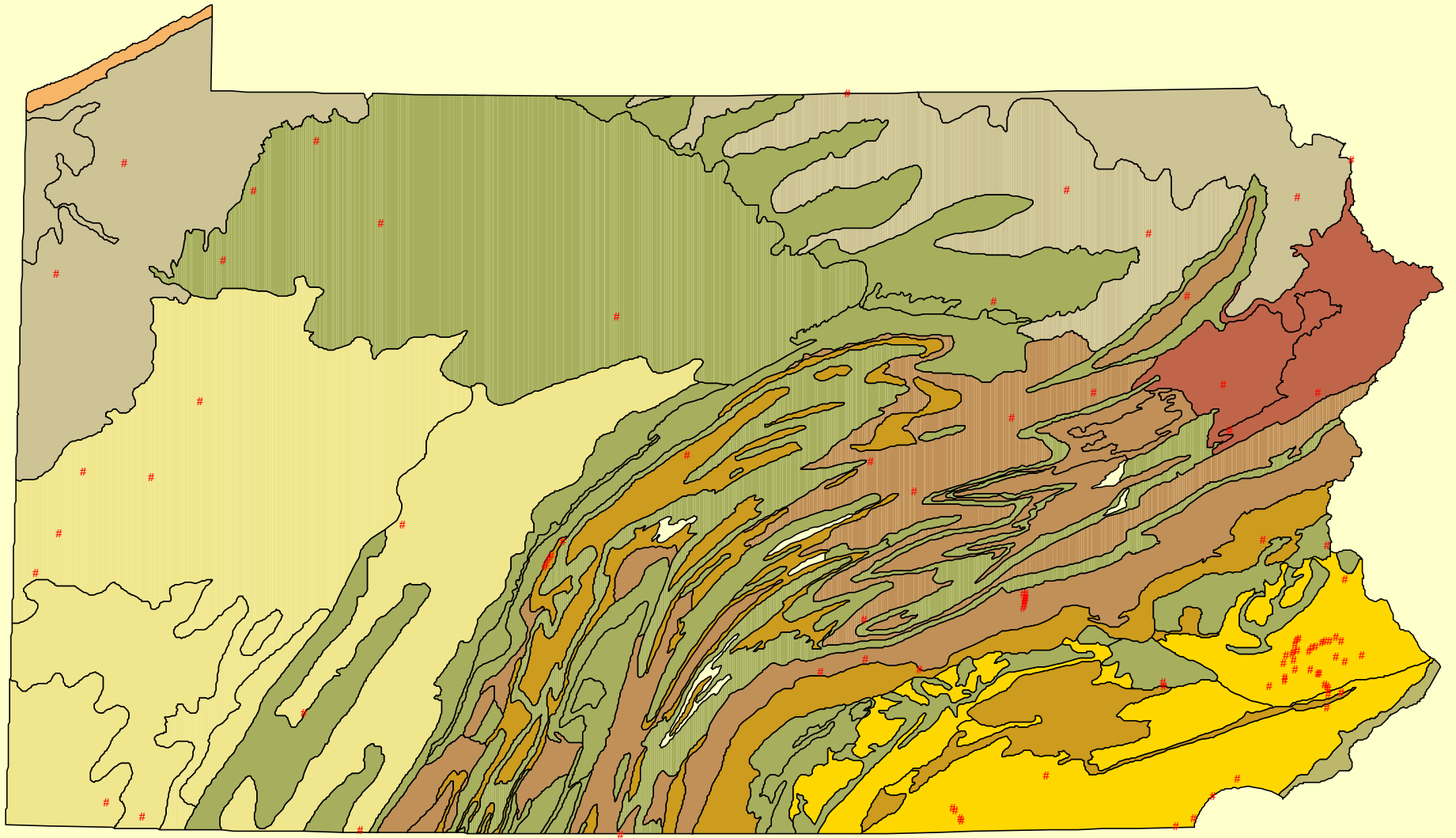
WEST CONEWAGO CREEK



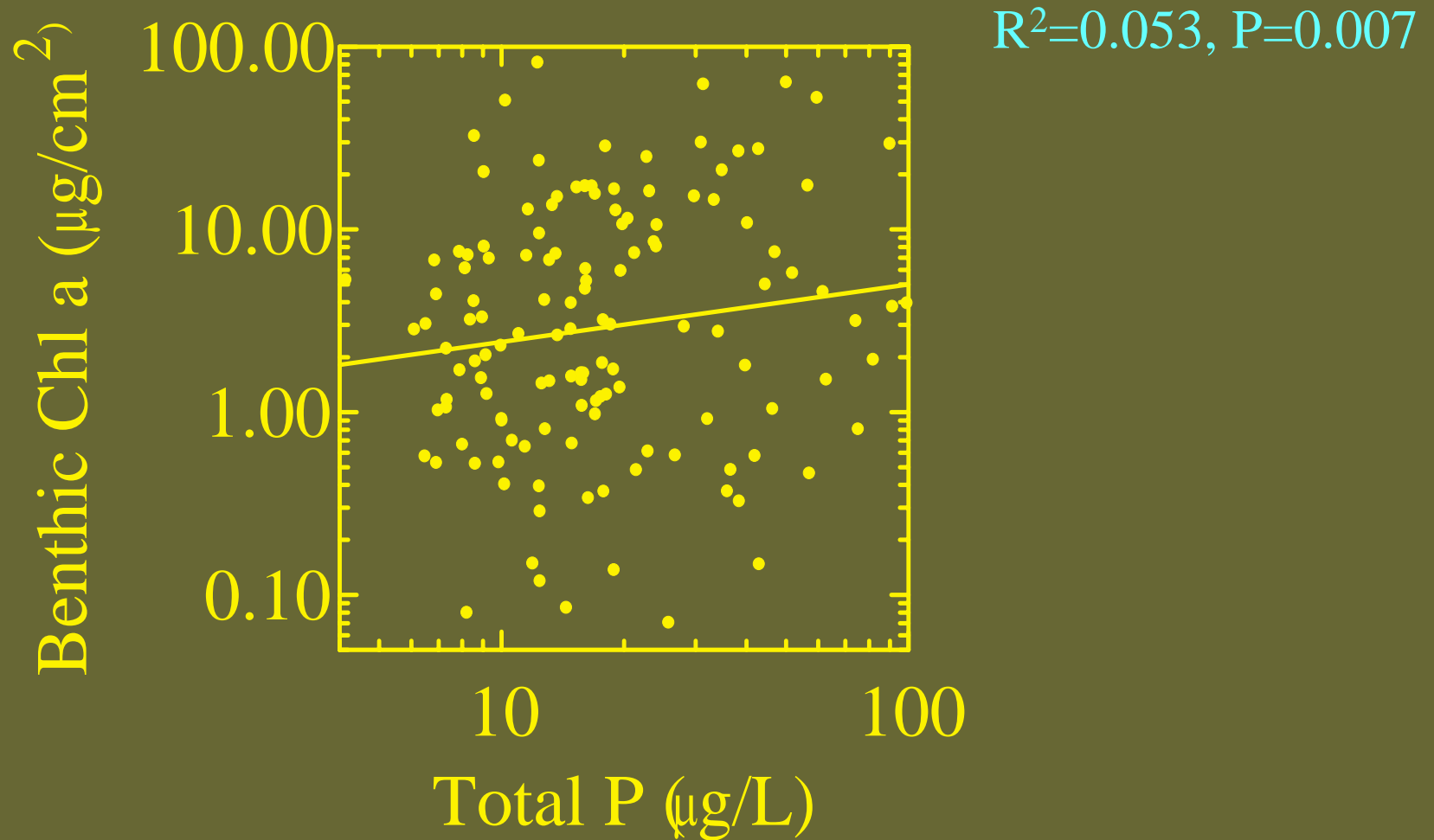
Pennsylvania Nutrient Criteria Work

- Sampling periphyton biomass, water column chemistry, field chemistry, algal species counts state-wide
- Eight fixed water quality monitoring stations sampled 2-3 times in each of our six regions and \approx 100 TMDL related sites
- Nutrient releasing substrata study
- Macroinvertebrate work similar to Smith et al. (NY)

Periphyton Sample Sites

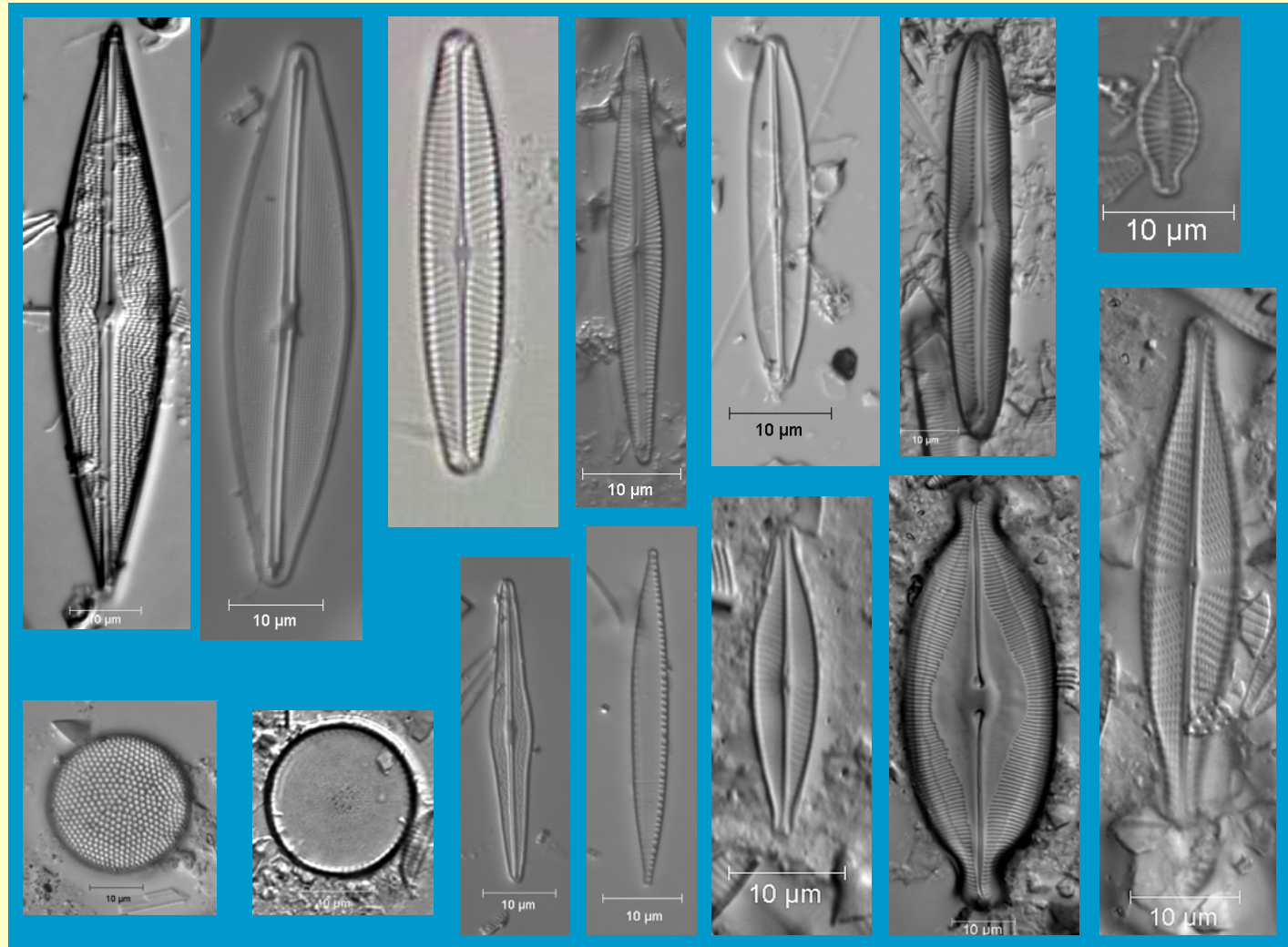


Algal Response to TP



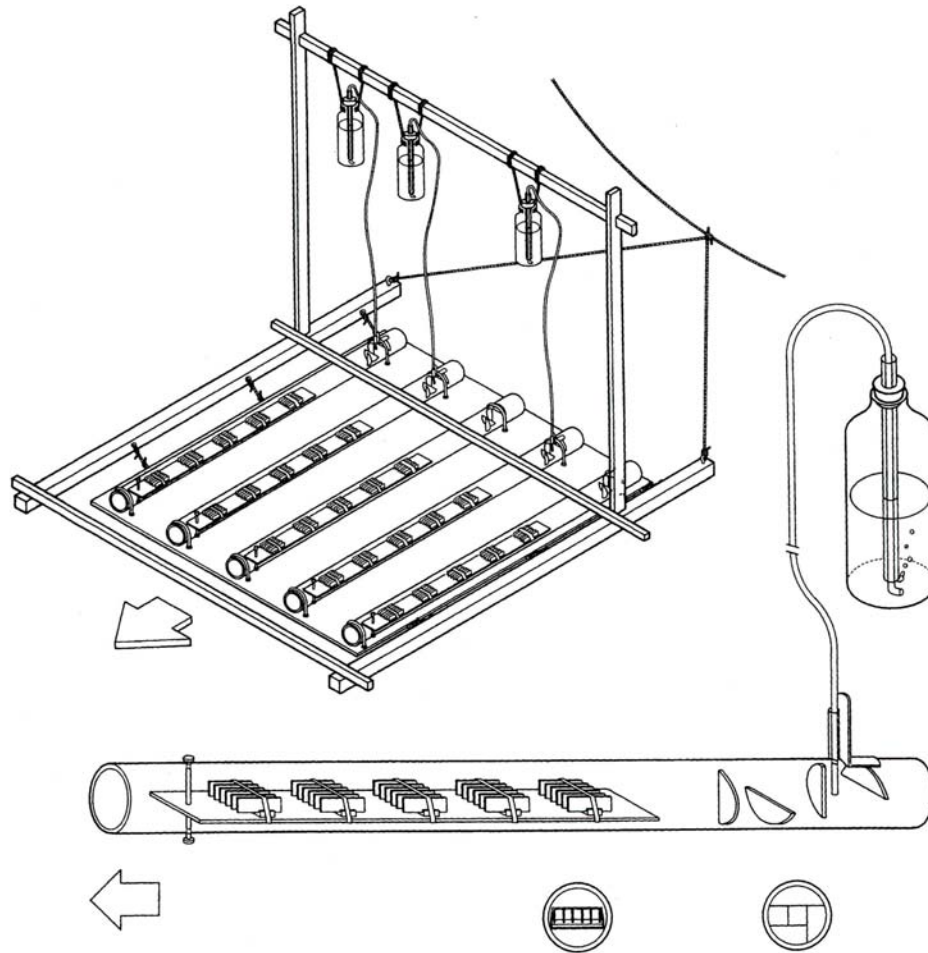
Distinguishing Differences Among Assemblages

Sensitive
Taxa



Tolerant
Taxa

Nutrient Releasing Substrata



- Controlled nutrient amount and rate release
- External variables minimized
- Data collection in 2007-2008

Challenges

- Assessments/Listings
 - Listing for exceeding standards for “parameters without standards”
 - Definitions for “dense algal or macrophyte growth”
 - Rationale for listing stating that DO criteria need not be violated, interpreted to be WQS being met but water listed as impaired

Application of Data

- Models relate in-stream P (and N) concentrations to periphyton biomass (chl).
- Several studies have identified a range of conditions where periphyton achieve nuisance accumulations (as chlorophyll):
 - 50 mg/m²: Low end prior to problems
 - 100 mg/m²: Nuisance algal accumulation.
 - 150 mg/m²: Extreme algal accumulation.
- If we have a known criterion for Chl-a, then we can use models to predict corresponding nutrient levels.

Benthic chlorophyll-a endpoint

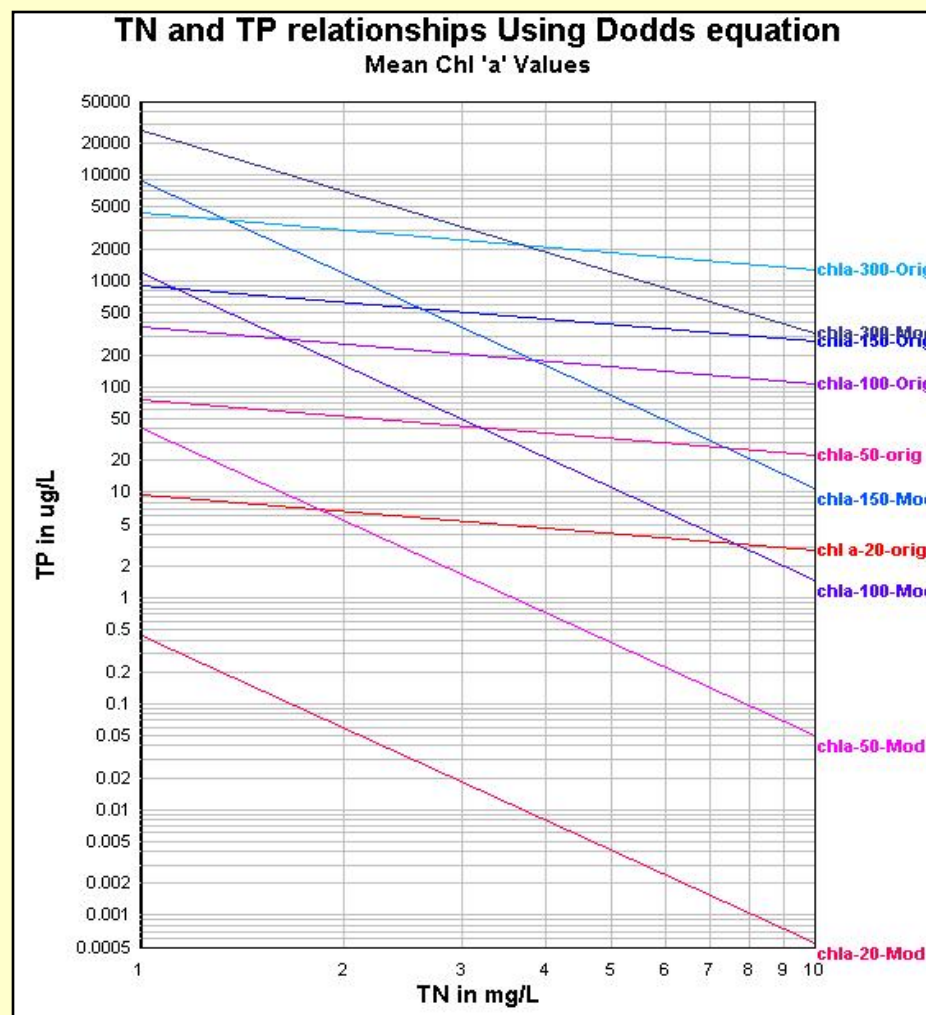
- 100 mg/m² chl-a not scientifically defensible
 - Welch based nuisance on fishermen foot traffic
 - No demonstration of impairment of aquatic life use
 - Dodds' equation changed

**Example: Assuming
chl a = 100 mg/m²,**

If TP = 100 ug/L, then

TN = 10 mg/L old

TN = 2.5 mg/L new



Scientific Needs

- Demonstration of aquatic life use impairment from excessive nutrients without DO violations
- Develop a better understanding of point vs. nonpoint contributions to impairments observed under critical conditions
- Determine impact of nutrient reductions to levels higher than K_s