EPA United States Environmental Protection Agency

Introduction to Numeric Nutrient Criteria

ACWA Nutrients Permitting Workshop
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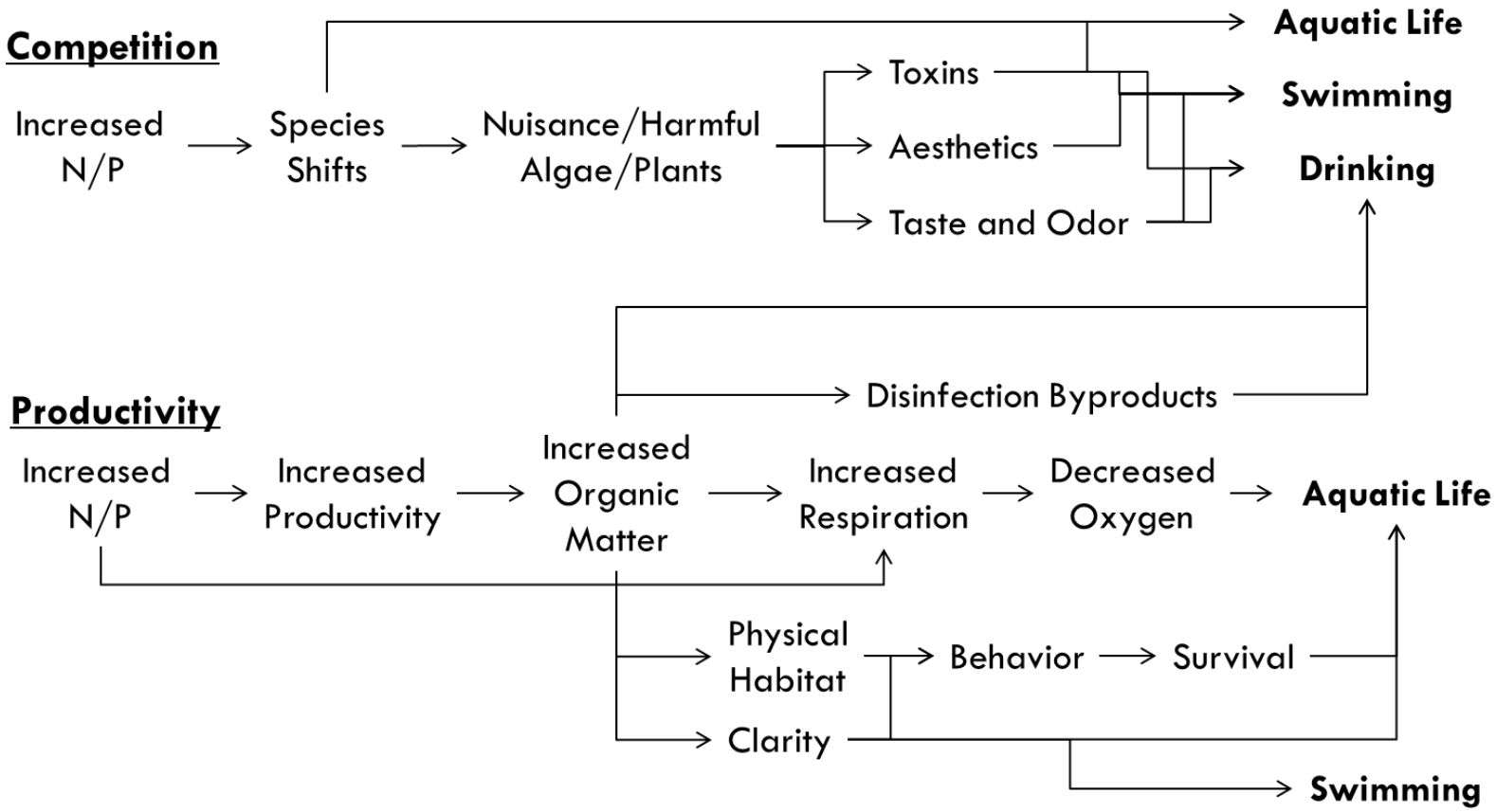
Overview

- Background on Numeric Nutrient Criteria Development
- Review of State Support Through N-STEPS
- Discussion on Similarities in Numeric Criteria Values to Date

Nutrient Pollution Destabilizes Ecosystems

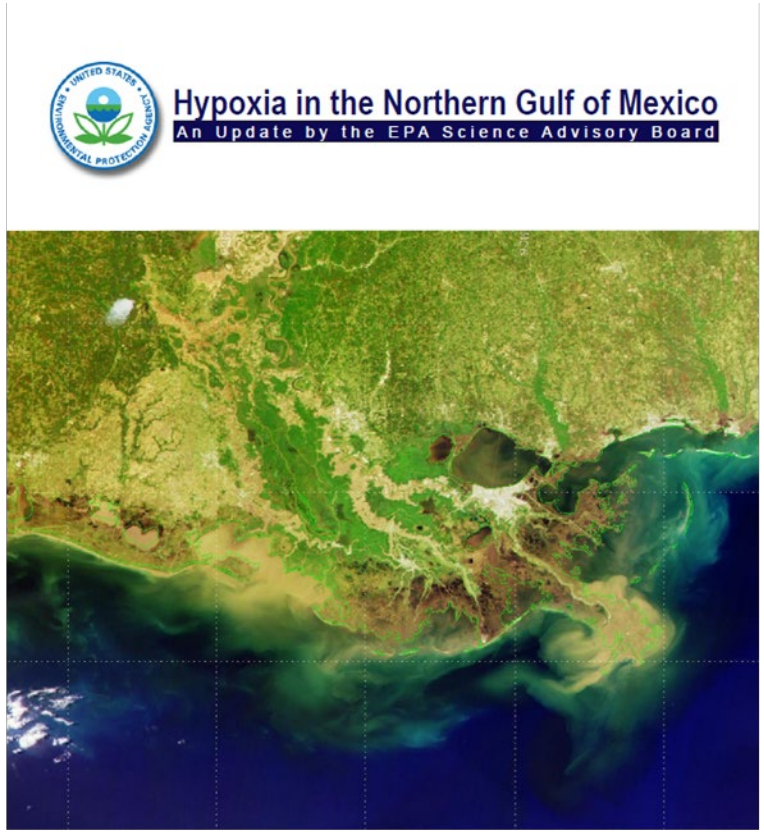
- Two main pathways by which nutrients affect water quality



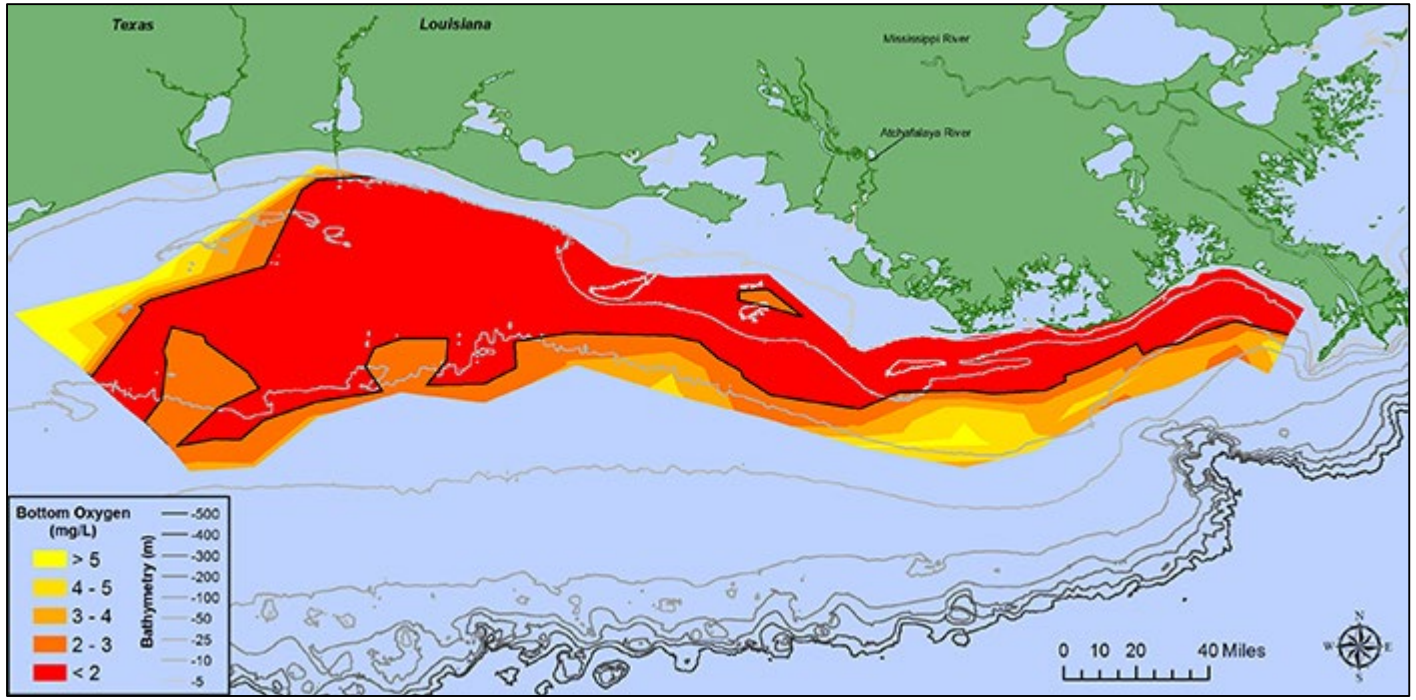
Nuisance/Harmful Taxa Are Poor Competitors

Nutrients Stimulate Organic Matter Production

Nutrient Pollution Impacts Water Quality



U.S. EPA, 2007, EPA-SAB-08-003



Gulf of Mexico dead zone in July 2017

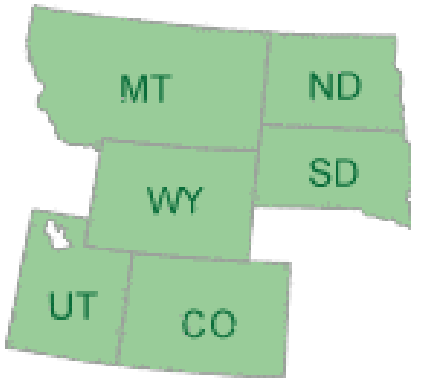
At 8,776 square miles, the 2017 dead zone in the Gulf of Mexico was the largest ever measured (Courtesy of N. Rabalais, LSU/LUMCON)

Nutrient Pollution Impacts Designated Use Support

Region 8
Causes of Impairment in Assessed Lakes, Reservoirs, and Ponds

Description of this table

Cause of Impairment Group	Acres Threatened or Impaired
Mercury	858,446
Metals (other than Mercury)	369,197
Nutrients	241,964
pH/Acidity/Caustic Conditions	181,538
Algal Growth	156,412
Polychlorinated Biphenyls (PCBs)	152,160
Salinity/Total Dissolved Solids/Chlorides/Sulfates	109,511
Organic Enrichment/Oxygen Depletion	75,249
Flow Alteration(s)	51,859



U.S. EPA ATTAINS accessed on November 8, 2018

473,625 acres listed under 303(d)

Nutrient Criteria Are Important to Protect and Restore Uses

- WQS requirement (40 CFR 131)
  - Designated Use
  - Criteria
  - Antidegradation
- Criteria must:
  - Protect sensitive designated uses
  - Be based on a sound scientific rationale

State Regulations: Narrative Criteria

*"Plant nutrients from other than natural causes shall not be present in concentrations which will produce **undesirable aquatic life** or result in a **dominance of nuisance species** in surface waters of the state."*

–State of New Mexico Standards for Interstate and Intrastate Surface Waters (Subsection E of 20.6.4.13 NMAC)

*"Taste- and odor-producing materials. Materials which will impart **undesirable tastes** or **undesirable odors** to the receiving water may not be discharged o caused to be discharged into surface waters of the state in concentrations that impair a beneficial use."*

–Administrative Rules of South Dakota, Surface Water Quality Standards (74:51:01:08)

Narrative Free Froms

Numeric Nutrient Criteria Will Help

- Narratives were proving insufficient to protect designated uses
- Needed a more efficient and effective way for CWA water quality management purposes
- Encourage development of numeric nutrient criteria

EPA Strategy and Technical Support

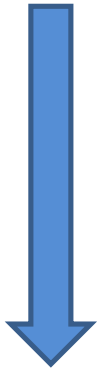
National Strategy for the Development of Regional Nutrient Criteria (1998)

Technical support documents (pursuant to 33 USC 1314, CWA Section 304)

- Nutrient criteria = nitrogen, phosphorus, chlorophyll-a, and water clarity
- Waterbody-specific technical support documents (2000, 2001, 2006)
- Recommended criteria for most lakes/reservoirs, rivers/streams (2000-1)
- Stressor-response approaches (2010)

Numeric Nutrient Criteria Approach

Identify the management goal

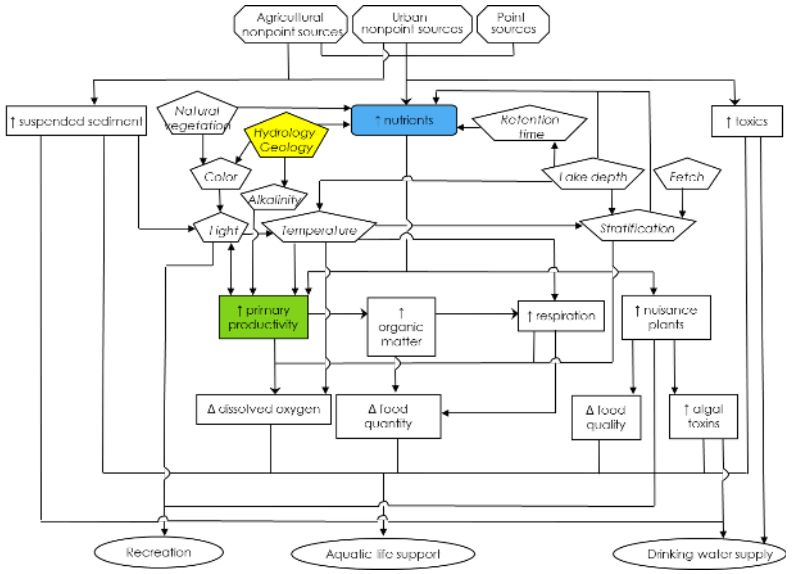


WQ pollutant target (numeric criteria)

Term	Definition
Management Goal ★	Narrative criteria or statement reflective of protecting a designated use
Assessment Endpoint ★	Ecological entity and its attributes to be protected to support designated use
Measure ★	Measurable attributes of an assessment endpoint
Water Quality Target ★	Numeric value that indicates attainment of the management goal

Numeric Nutrient Criteria Approach

- Develop conceptual models
- Compile Data
- Conduct Analyses
  - Classification
  - Stressor-Response Modeling
  - Reference Condition
  - Mechanistic Models
- Implement



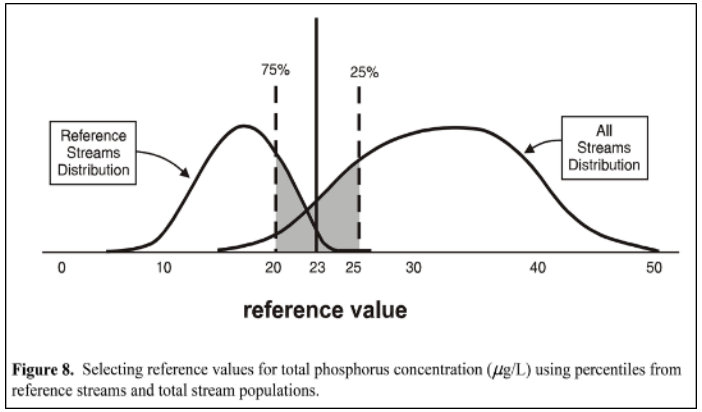
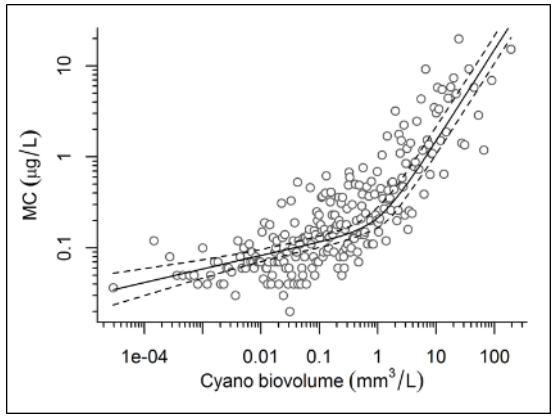


Figure 8. Selecting reference values for total phosphorus concentration (μg/L) using percentiles from reference streams and total stream populations.



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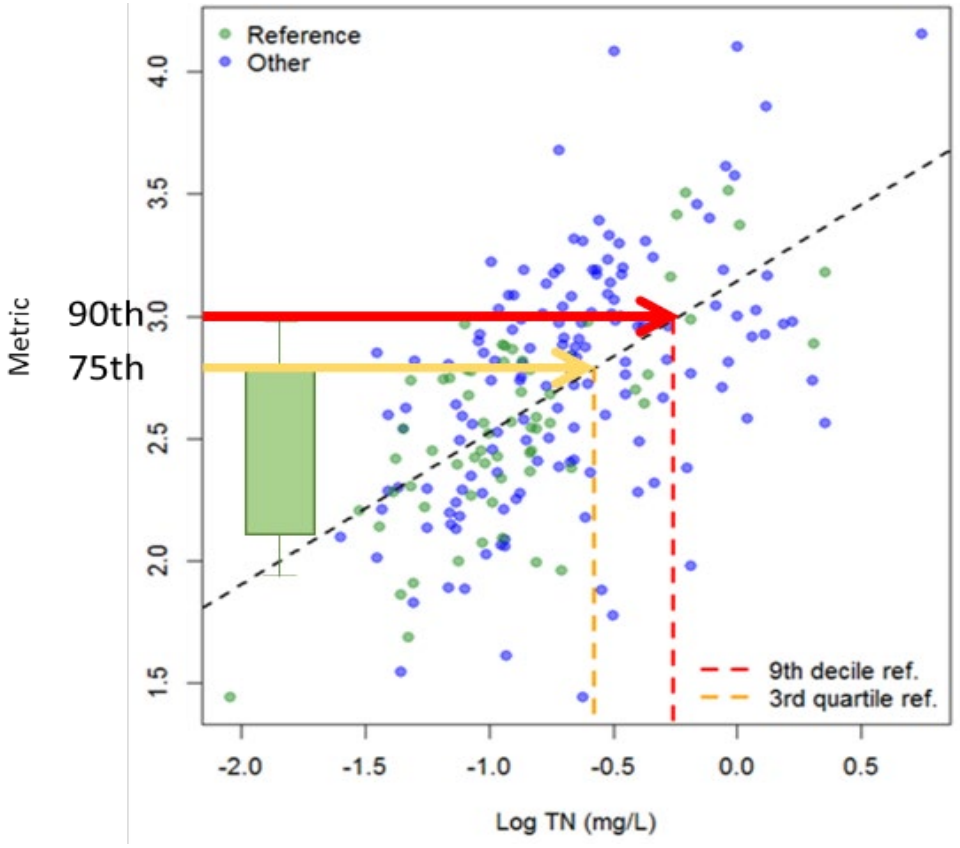
Coming soon!
New National Criteria Recommendations for Lakes/Reservoirs

- Stressor-response relationships are used to link chl *a* concentration to attainment of each of three designated uses (aquatic life, recreation, and drinking water source).
- When multiple use designations apply to a lake, states and tribes can calculate and compare candidate criteria for each applicable use to inform their risk management decisions (40 CFR 131.11(a)).
- Criteria development tools are based on stressor-response models and combine state and national data to derive state-specific values that reflect local conditions.
- Tools provide flexibility for each state to incorporate their own risk management decisions in deriving final criteria.

N-STEPS Assistance is Available to States and Tribes

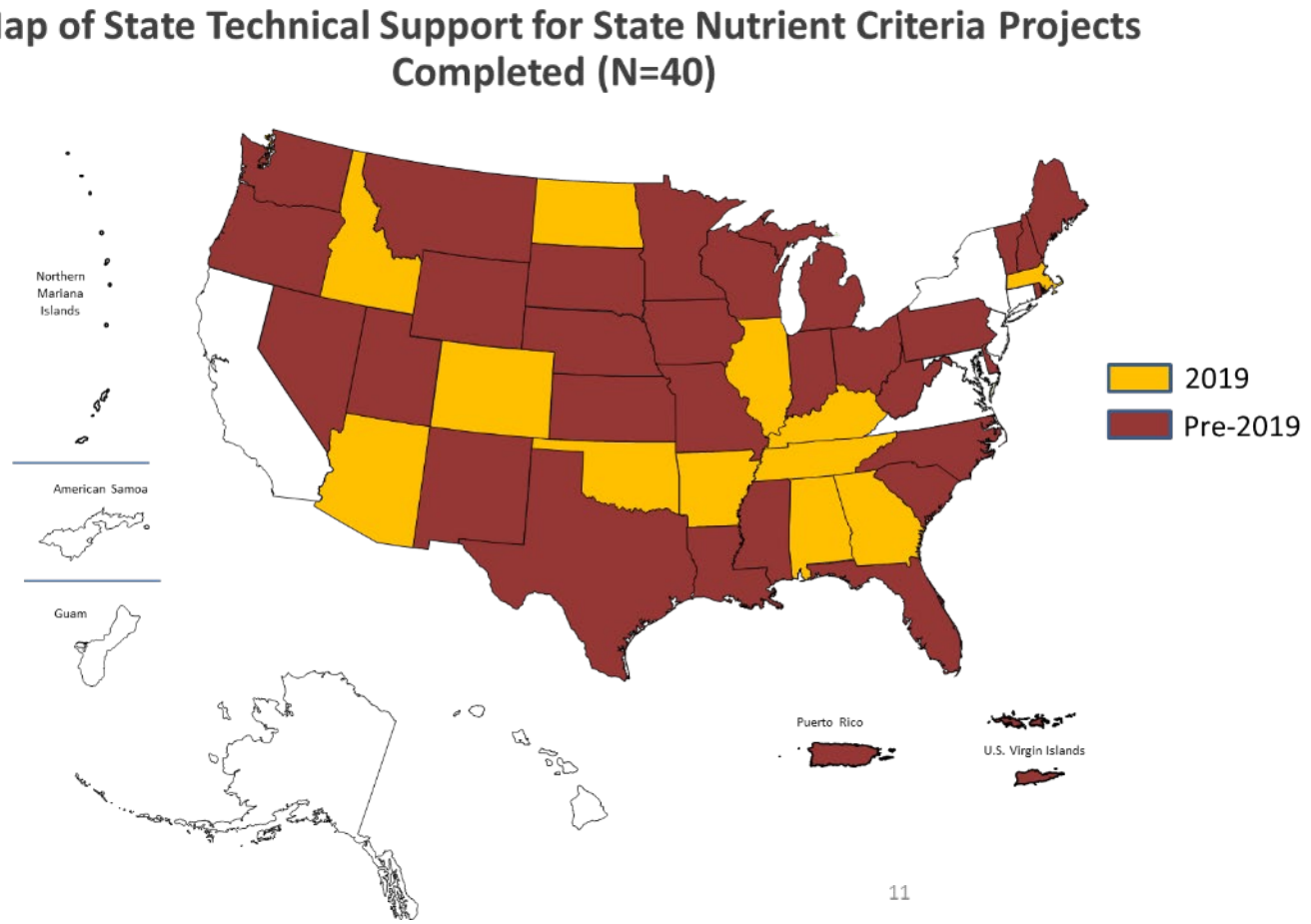
- Since 2005, EPA has provided technical support to States and Tribes to help them use their data to derive criteria through N-STEPS (Nutrient Scientific Technical Exchange Partnership and Support).
- States and Tribes can request N-Steps Technical Support through their EPA regional nutrient coordinator, or through our website.

NSTEPS: WA Stream Diatom Models



N-Steps Technical Assistance for Numeric Nutrient Criteria Projects

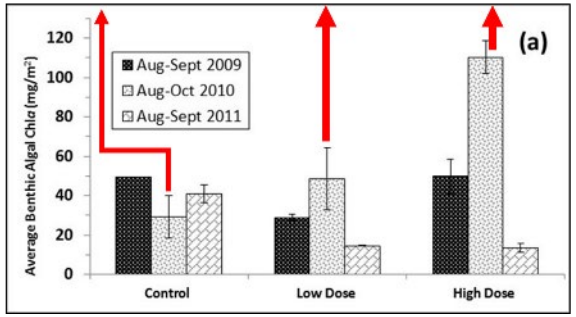
- NSTEPS State Partnership Projects
- 42 States + 4 tribes/territories
- All steps in derivation process
  - From Data Exploration to Peer Review



Numeric Nutrient Criteria Approach

- States have greatly expanded on this

Montana Small Stream Dosing Experiments



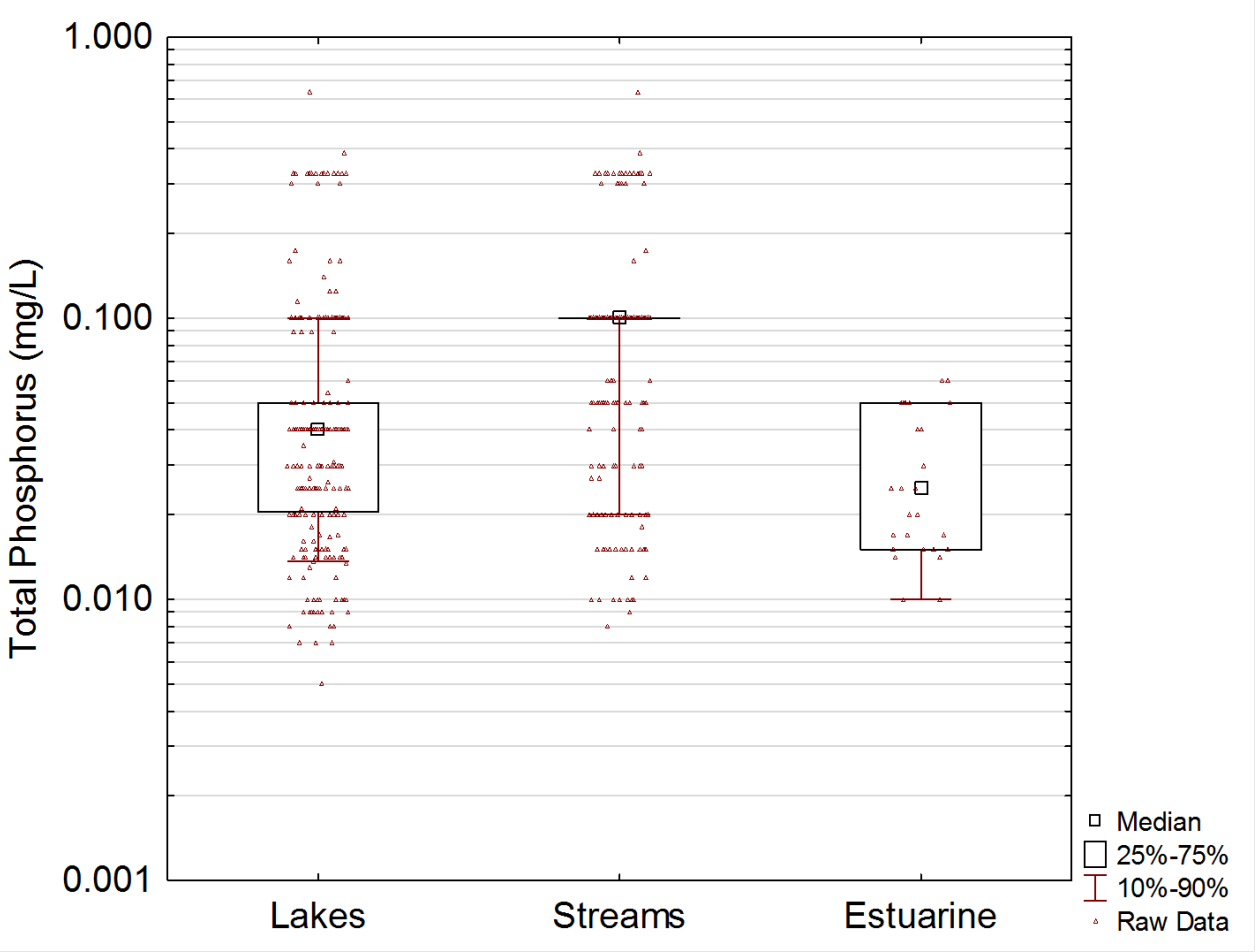
Montana Large River Mechanistic Modeling

What sort of Values are States Using?

- State Adopted Criteria
- Published Research

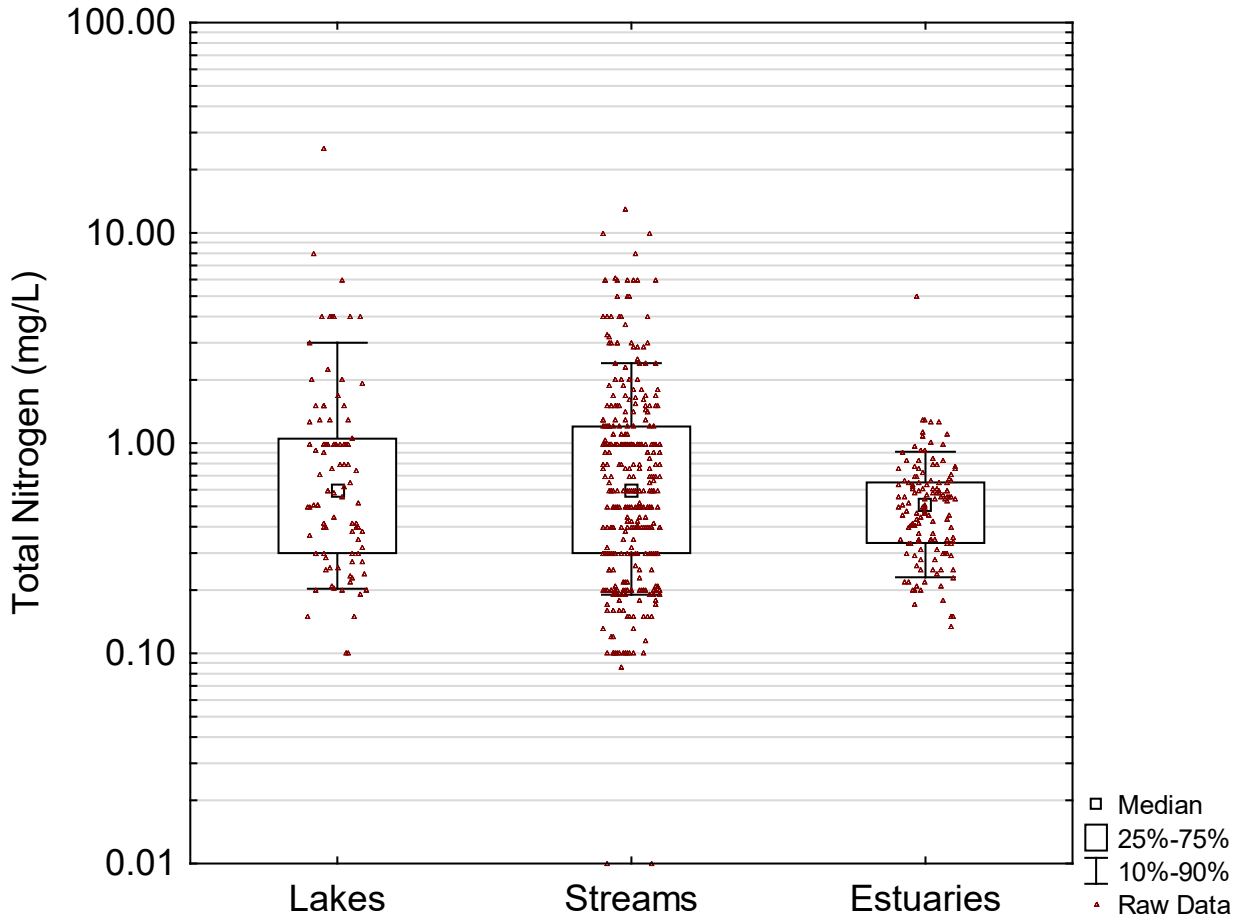
Results: Adopted TP Criteria Across the US

- 90 percent of Total Phosphorus (mg/L) values:
  - Lakes: 0.02 to 0.100
  - Streams: 0.02 to 0.100
  - Estuaries: 0.015 to 0.05



Results: Adopted TN Criteria Across the US

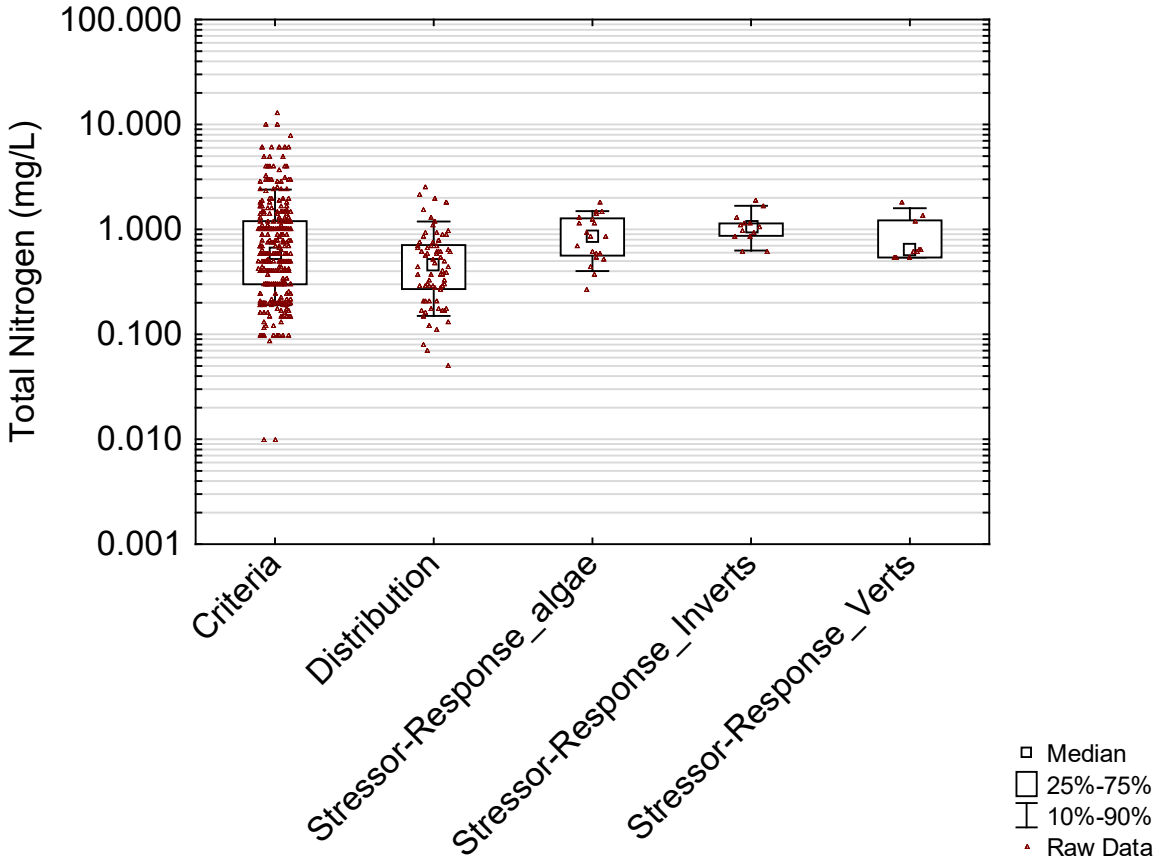
- 90 percent of Total Nitrogen (mg/L) values:
  - Lakes: 0.20 to 1.20
  - Streams: 0.20 to 1.25
  - Estuaries: 0.20 to 0.90



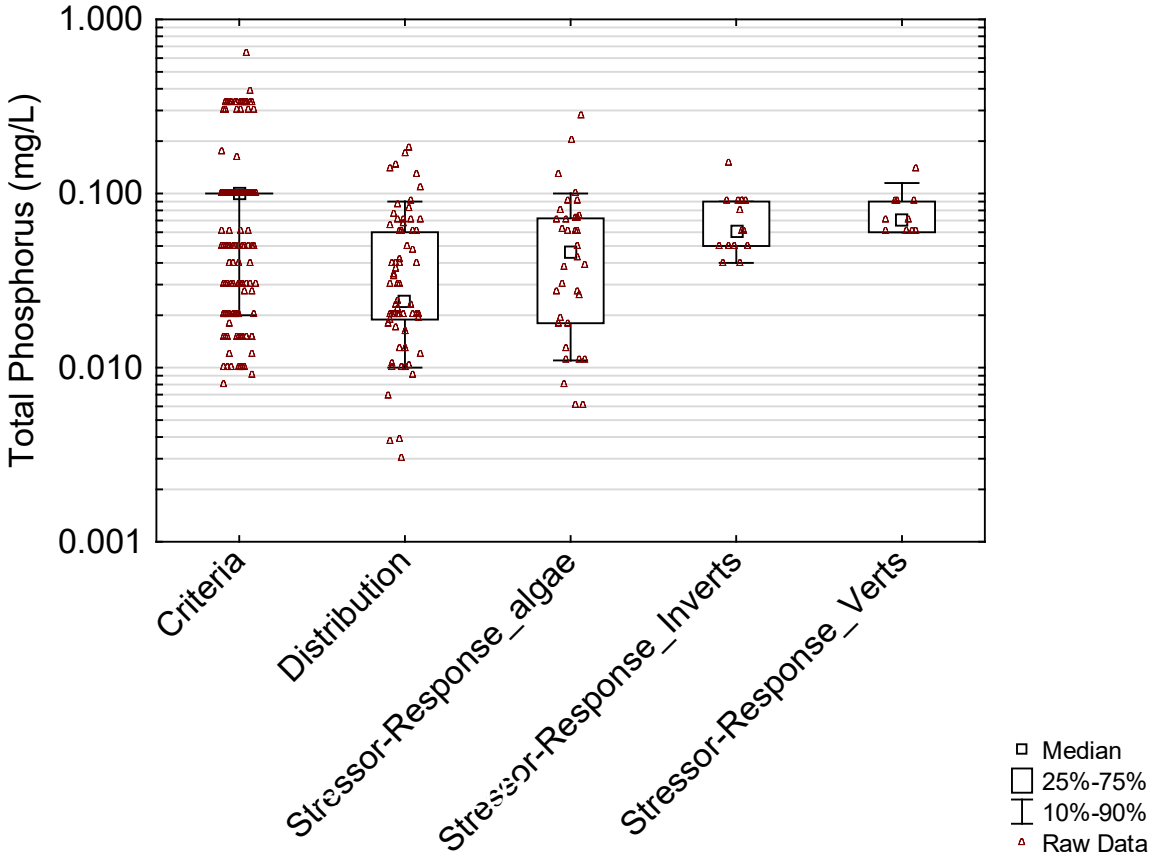
Results: Published Studies in Streams

- Across the United States
- For Streams: 90% of values where impacts occur very by less than a factor of 10

Total Nitrogen: 0.20 to 1.1 mg/L

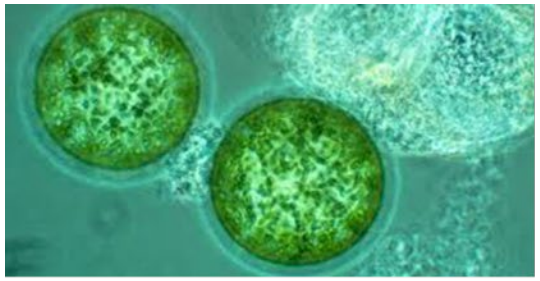
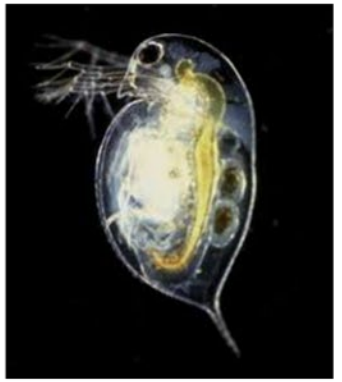


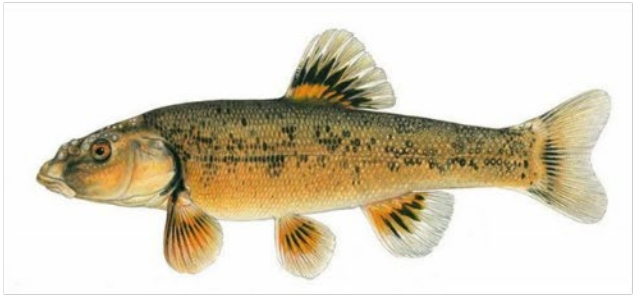
Total Phosphorus: 0.01 to 0.10 mg/L



Why aren't the Ranges Larger?

- Phosphorus and nitrogen are naturally rare but every cell needs them
- Tight competition means quick shifts with enrichment
- Limitation means quick organic matter increases with enrichment
- Excess production destabilizes ecosystems and the services we rely on




Take Home Messages

- Numeric nutrient criteria are important for the protection and restoration of designated uses of water bodies.
- There are a variety of ways to derive numeric thresholds and most states are actively pursuing them.
- Through N-STEPS, EPA is providing much needed technical support for these state efforts.
- The range of resulting numeric values are relatively narrow for sound scientific reasons.

Learn More About Technical Support Opportunities Via N-STEPS and More

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