

US EPA ARCHIVE DOCUMENT



*Use of Level IV  
Ecoregion Reference  
Stream Data  
to Develop  
Regionalized Water  
Quality Criteria*

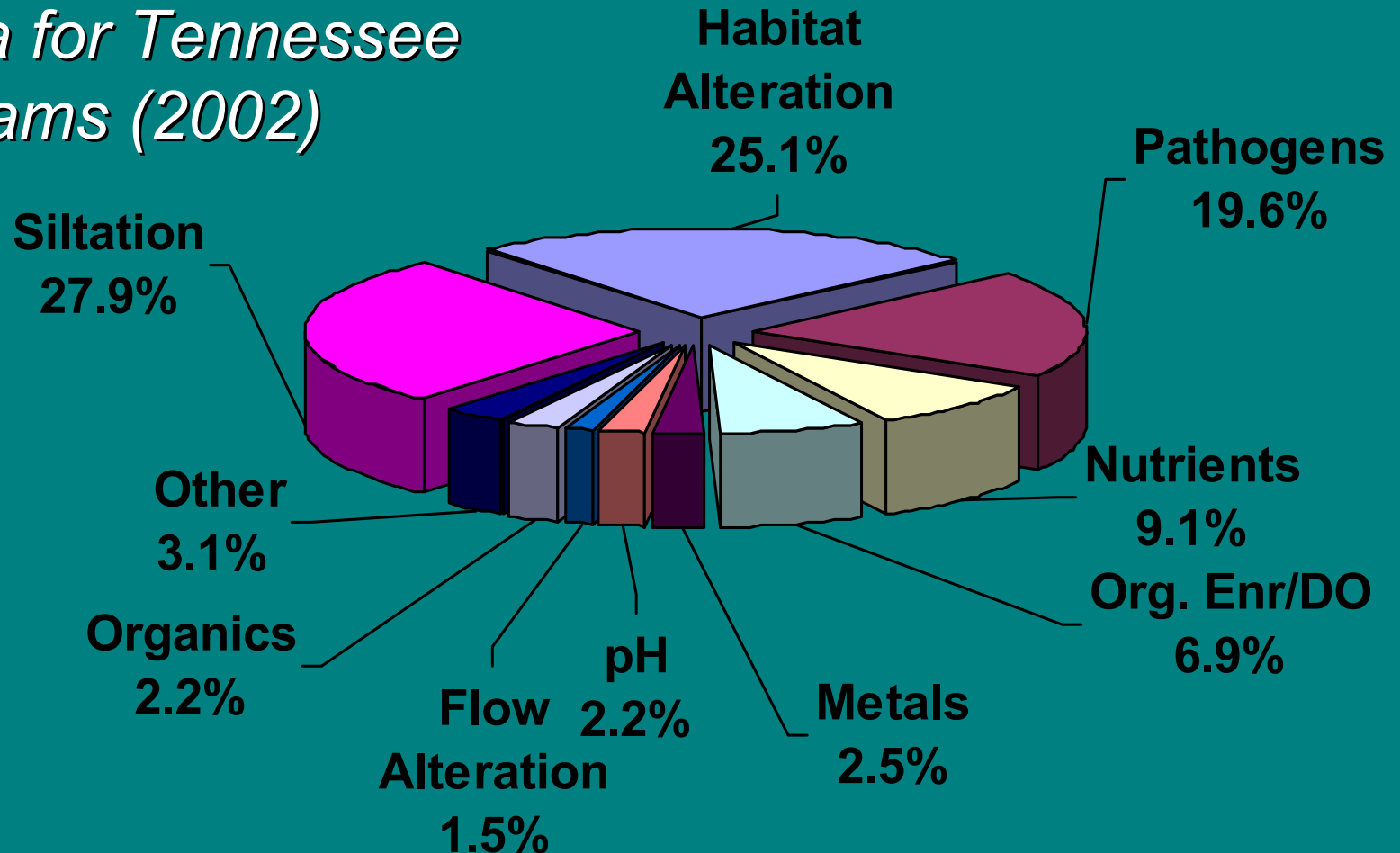
*Greg Denton  
Tennessee Division of  
Water Pollution Control*



*Following the completion of the 1991 triennial review of water quality standards, we decided to take proactive steps to improve water quality standards.*

*Nutrients, siltation, habitat alteration, and loss of biological integrity are major causes of nonsupport in Tennessee waterbodies:*

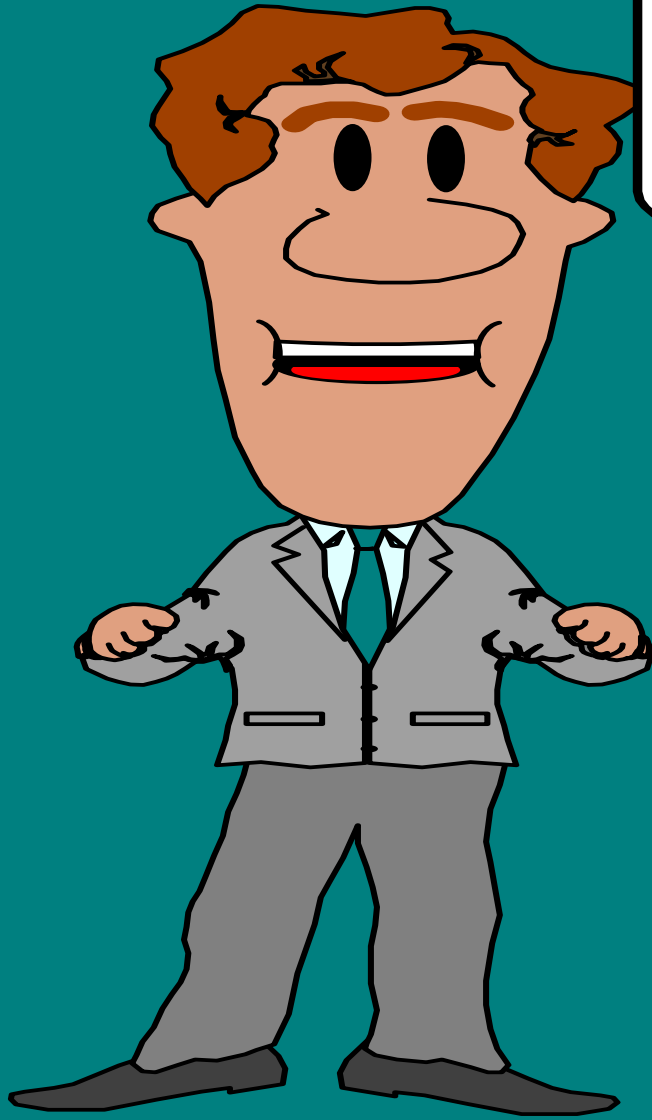
*Data for Tennessee streams (2002)*



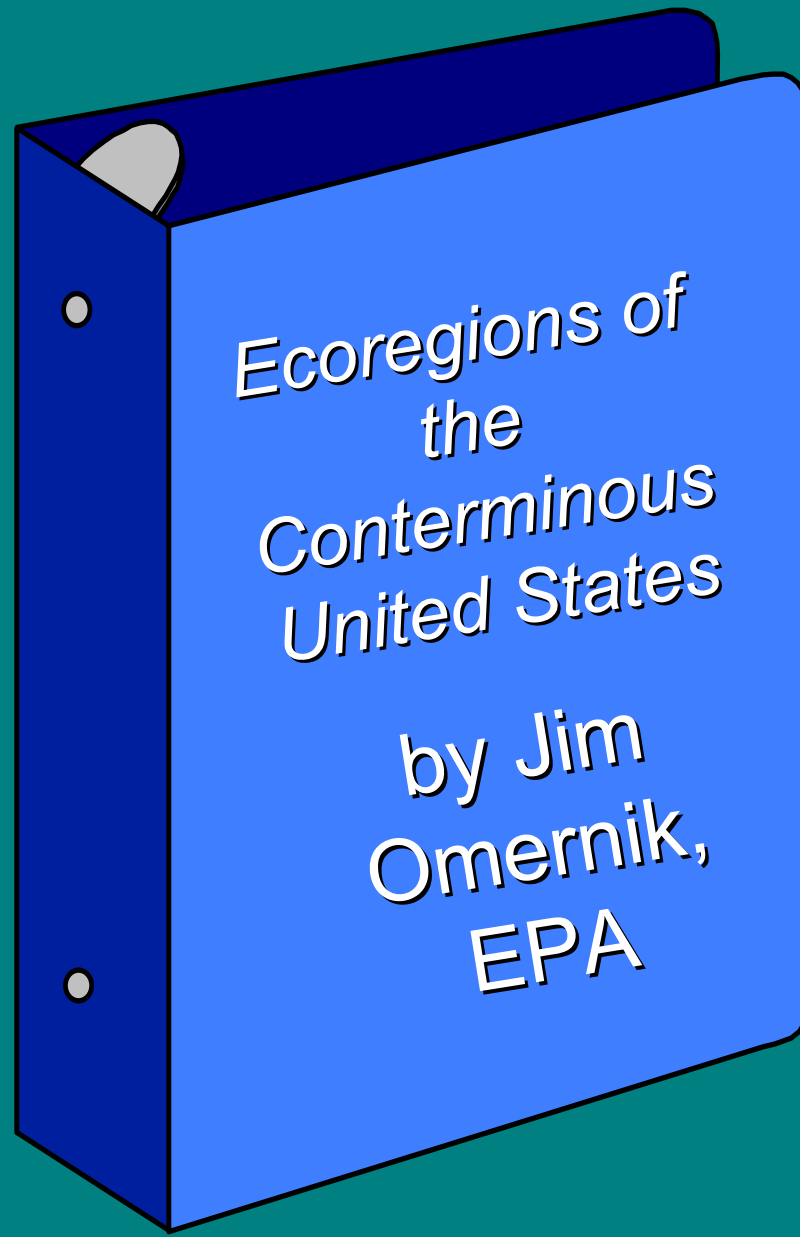
# *The problem with the two kinds of General Water Quality Criteria:*

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- *Numeric Criteria - “One Size Fits All”. Statewide numeric criteria leave little room for regional flexibility.*
- *Narrative Criteria - Need an objective means of regional interpretation.*



*So we need  
regional criteria.  
What geographic  
basis?*



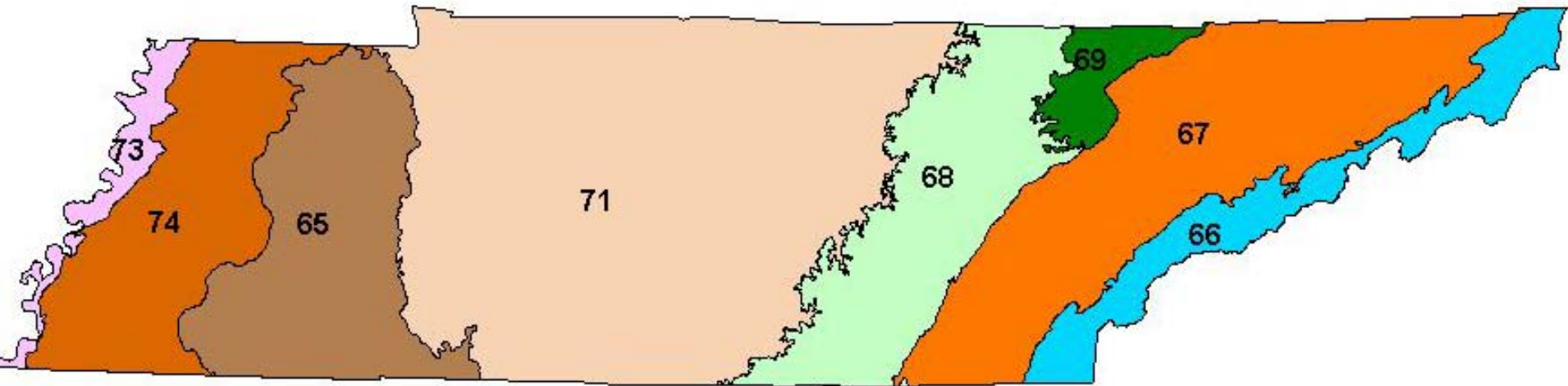
We learned  
about the  
ecoregions  
of  
Tennessee

# *Ecoregions*

*are relatively homogenous  
areas defined by similarity of  
climate, landform, soil, potential  
natural vegetation, hydrology,  
or other ecologically relevant  
variables.*



# *Level III Ecoregions of Tennessee*



# *The Ecoregion Project was envisioned with three phases.*



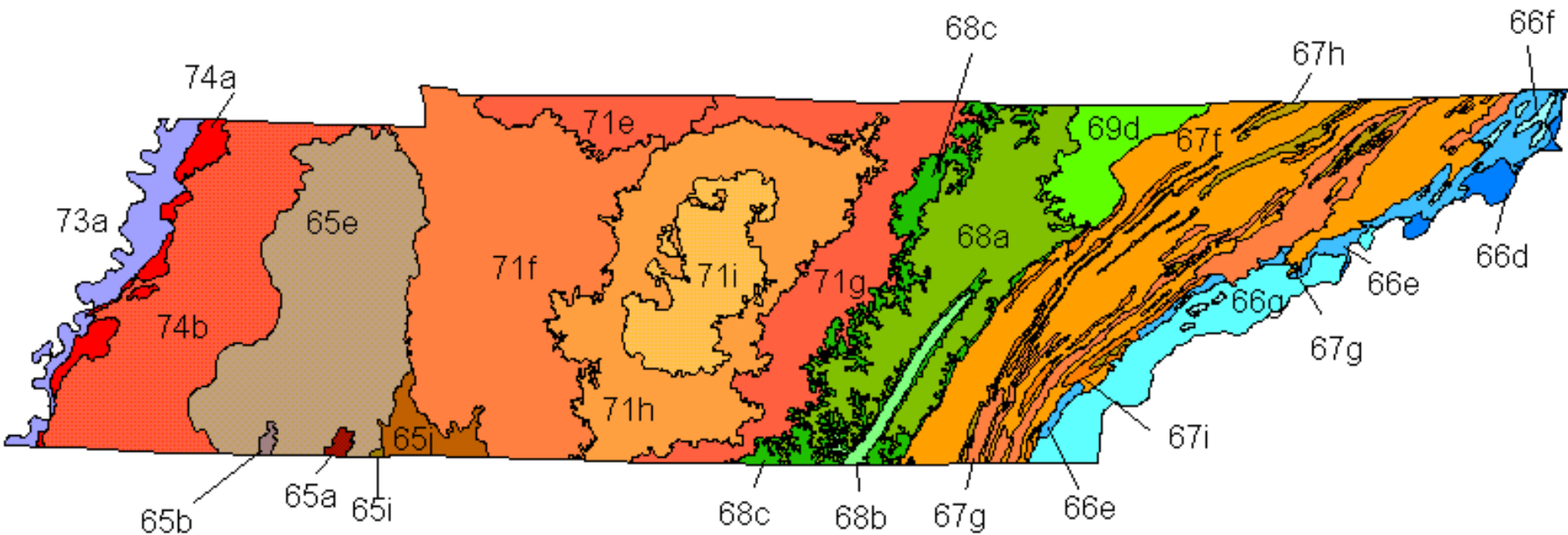
■ *Subecoregion  
Delineation*

■ *Reference Stream  
Selection*

■ *Reference Stream  
Monitoring*

# *Task 1:*

## *Subdelineate Ecoregions in Tennessee*



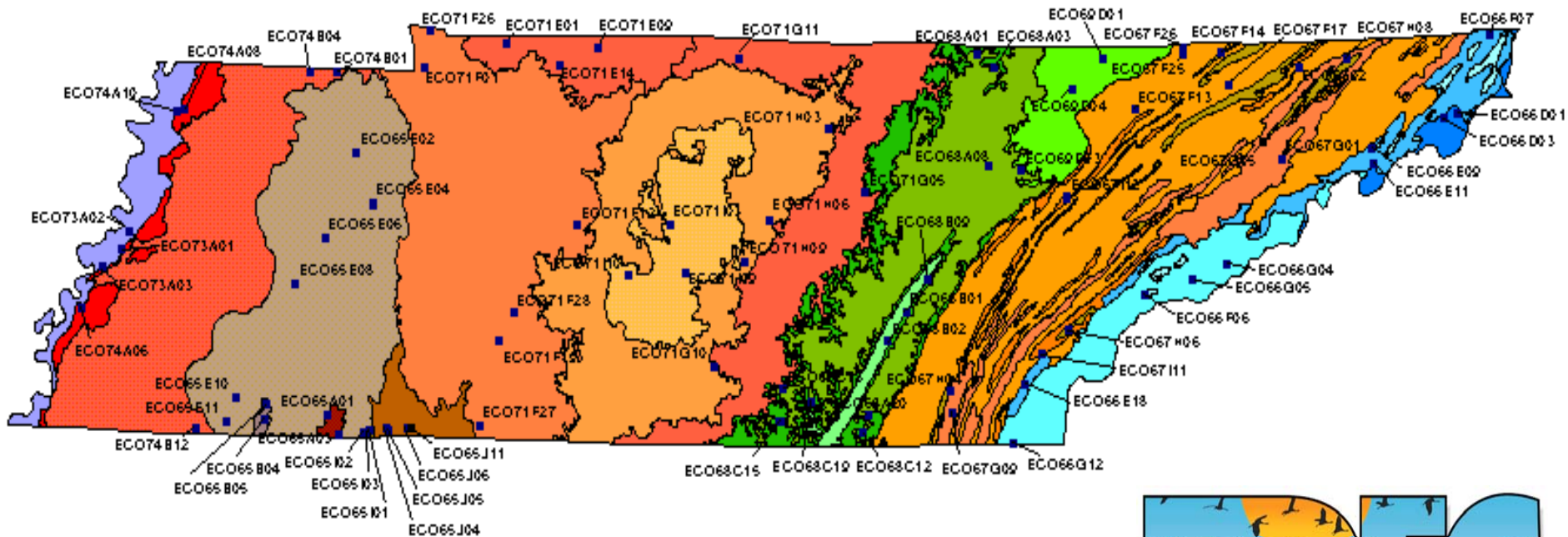
*Level IV Ecoregions*

# *Identify and Intensively Monitor Reference Streams*

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*A reference stream is a least impacted, but representative, waterbody within an ecoregion that can be monitored to establish a baseline to which other waters can be compared. Reference streams are not necessarily pristine or undisturbed by humans.*

## Reference Stream Locations



# *Reference Stream Monitoring*

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- *Over 100 stations sampled semi-annually for biology, quarterly for chemical for 3 + years.*
- *Generally, 3 streams per sub-ecoregion.*
- *Modified “clean” techniques used.*

# *Steps in the Process for Developing Tennessee's Regional Criteria*

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- *Establish ecoregional data ranges for the various substances or conditions.*
- *Select potential criteria points.*
- *Field test potential criteria levels (explore relationships between levels and biological harm).*
- *Develop final report containing recommended criteria levels, plus an implementation strategy.*
- *Initiate triennial review of water quality standards.*



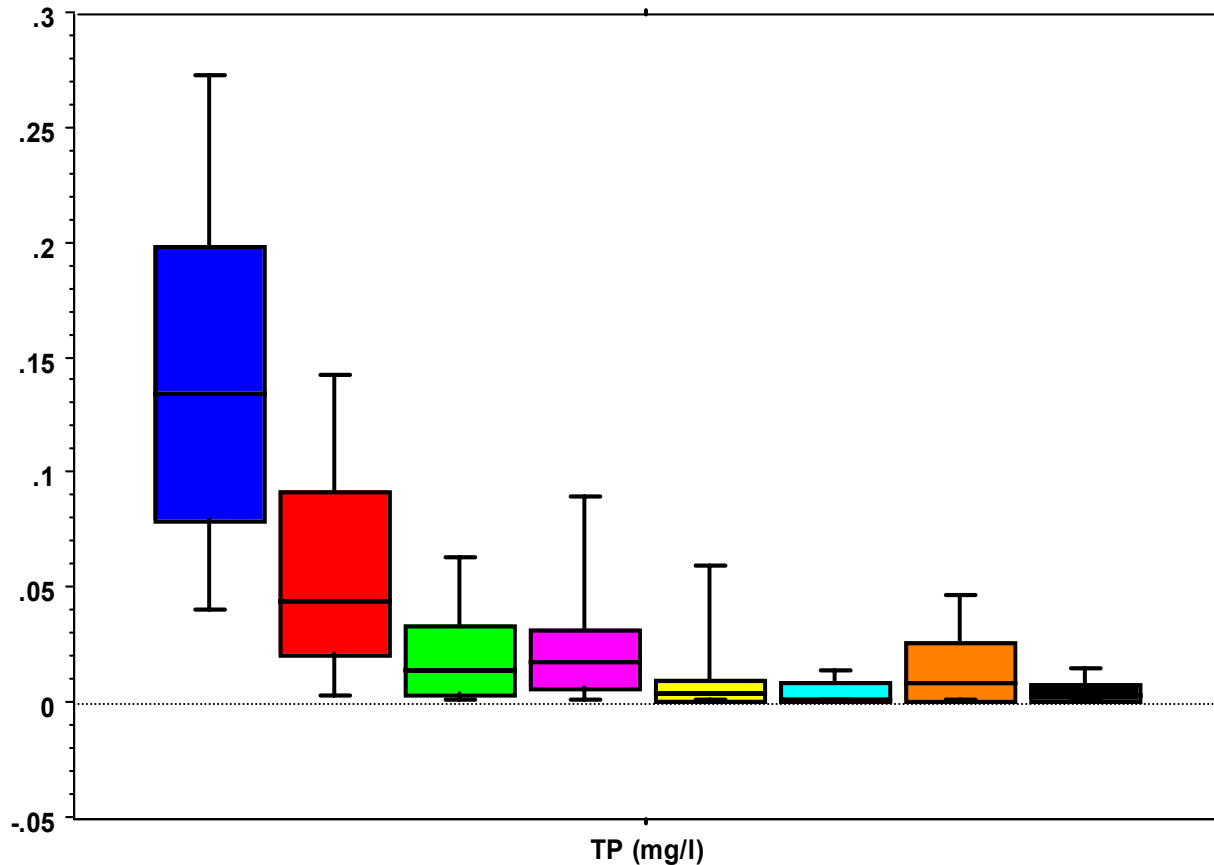
# *Nutrients*





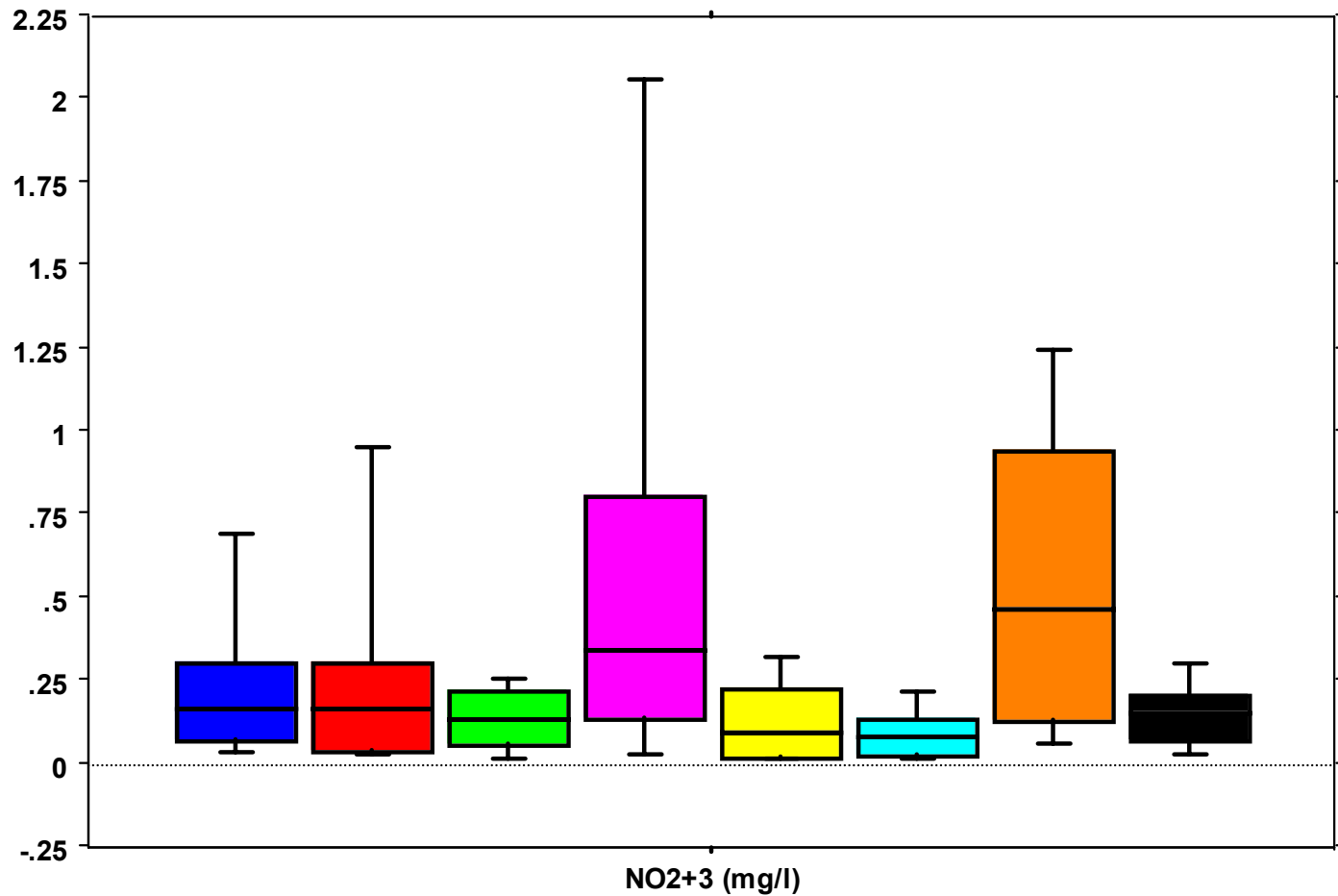
# *Total Phosphorus Concentrations*

## Level III Ecoregions



# *Nitrite + Nitrate Concentrations*

## Level III Ecoregions



1-ECO73 2-ECO74 3-ECO65 4-ECO71 5-ECO68 6-ECO69 7-ECO67 8-ECO66

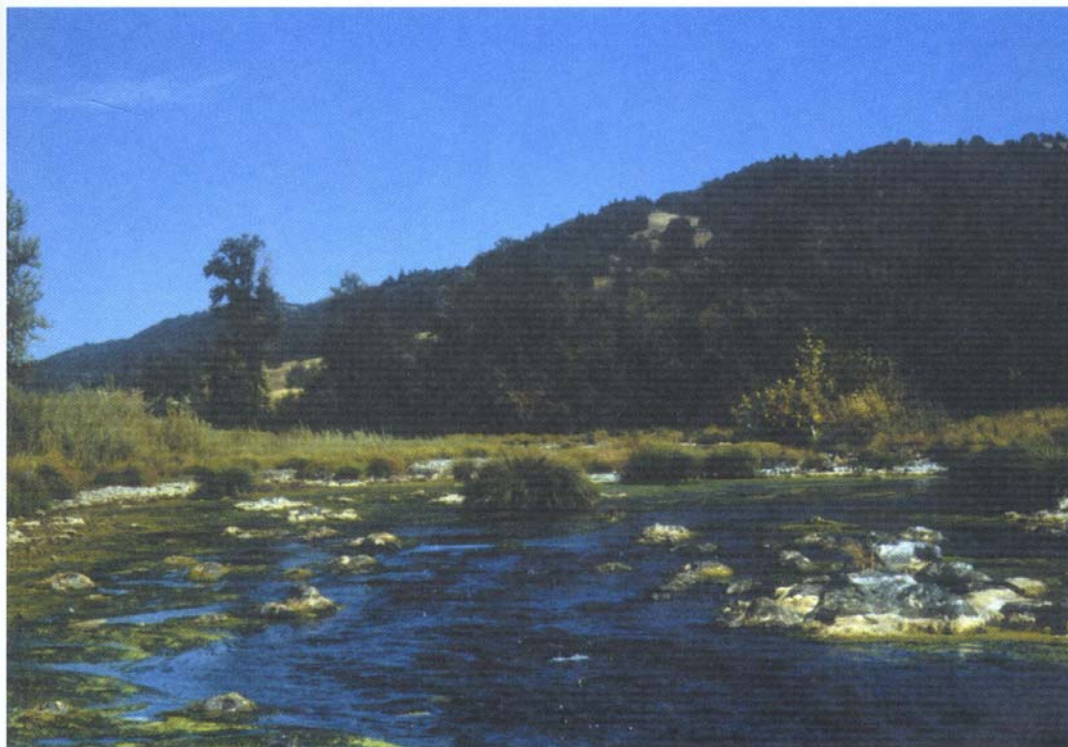
*We tested the  
75<sup>th</sup> and 90<sup>th</sup>  
percentiles of  
the data ranges  
as potential  
criteria levels.*





# Nutrient Criteria Technical Guidance Manual

## Rivers and Streams



*We wrote a  
Case Study  
for EPA's  
"Nutrient  
Criteria  
Technical  
Guidance  
Manual"  
for rivers  
and streams.*



# *Nutrient Criteria Report*

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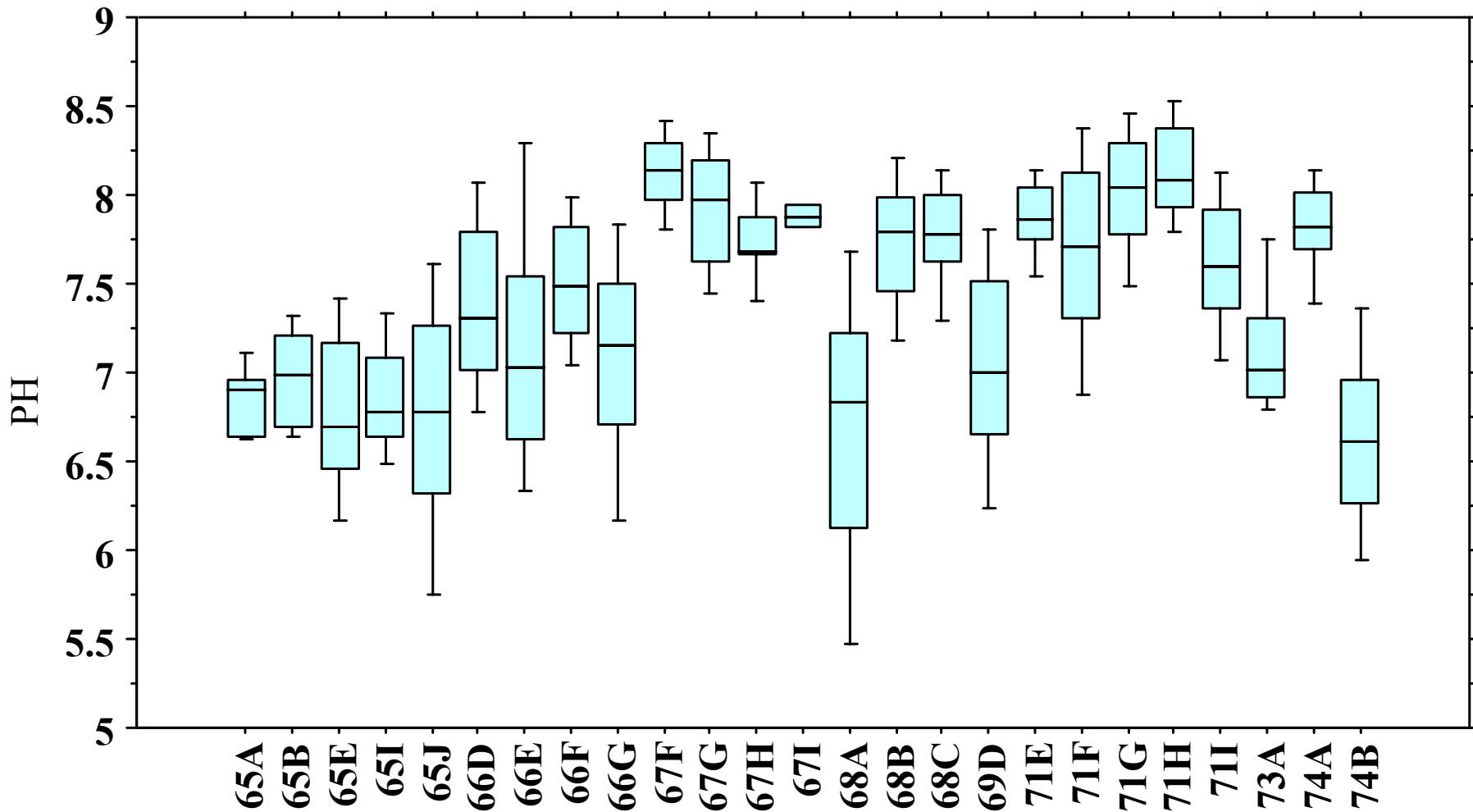
- *Draft report peer reviewed by members of Region IV RTAG Group. Final report published in August, 2001.*
- *Documented the reference condition for nitrate + nitrite and total phosphorus in each of the 25 subcoregions.*
- *Proposed the 90<sup>th</sup> percentile of the reference condition as a regional interpretation of the narrative criteria.*



*pH*

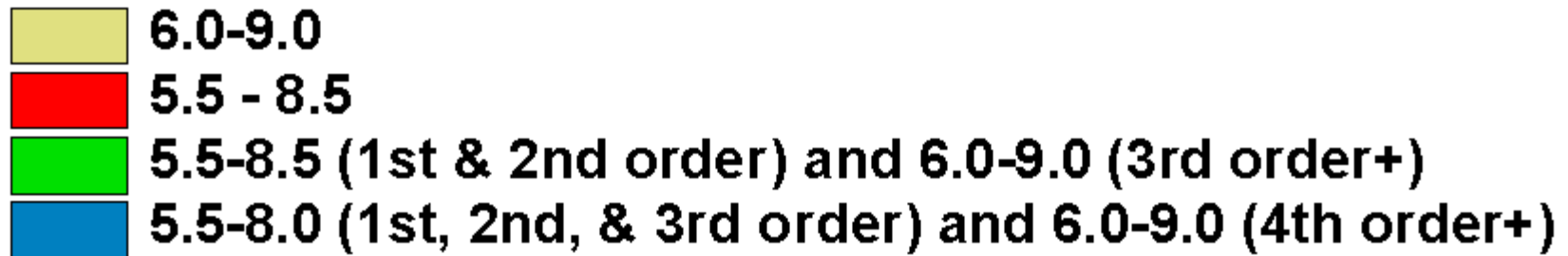
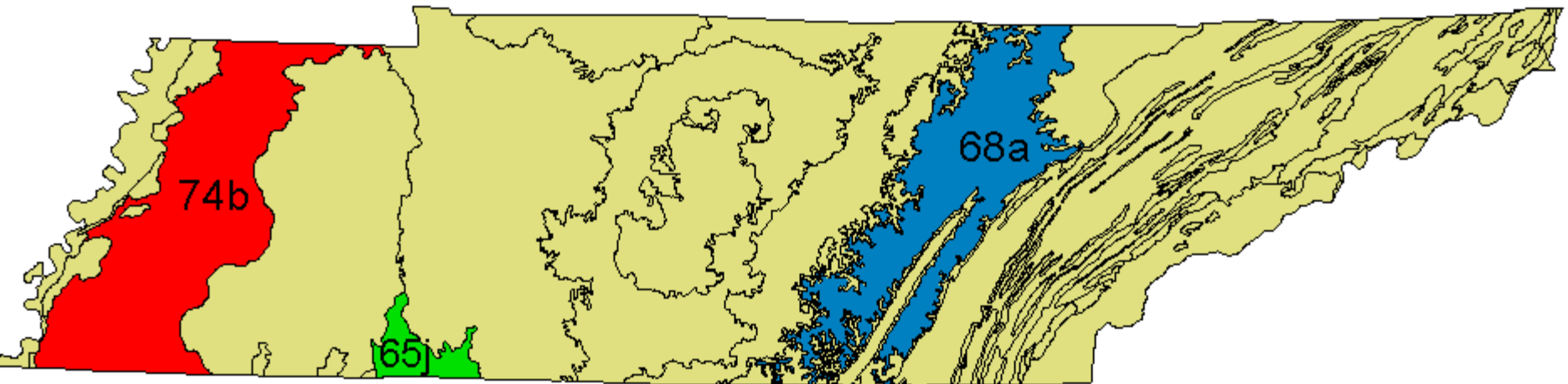


# *Reference pH by Subecoregion*





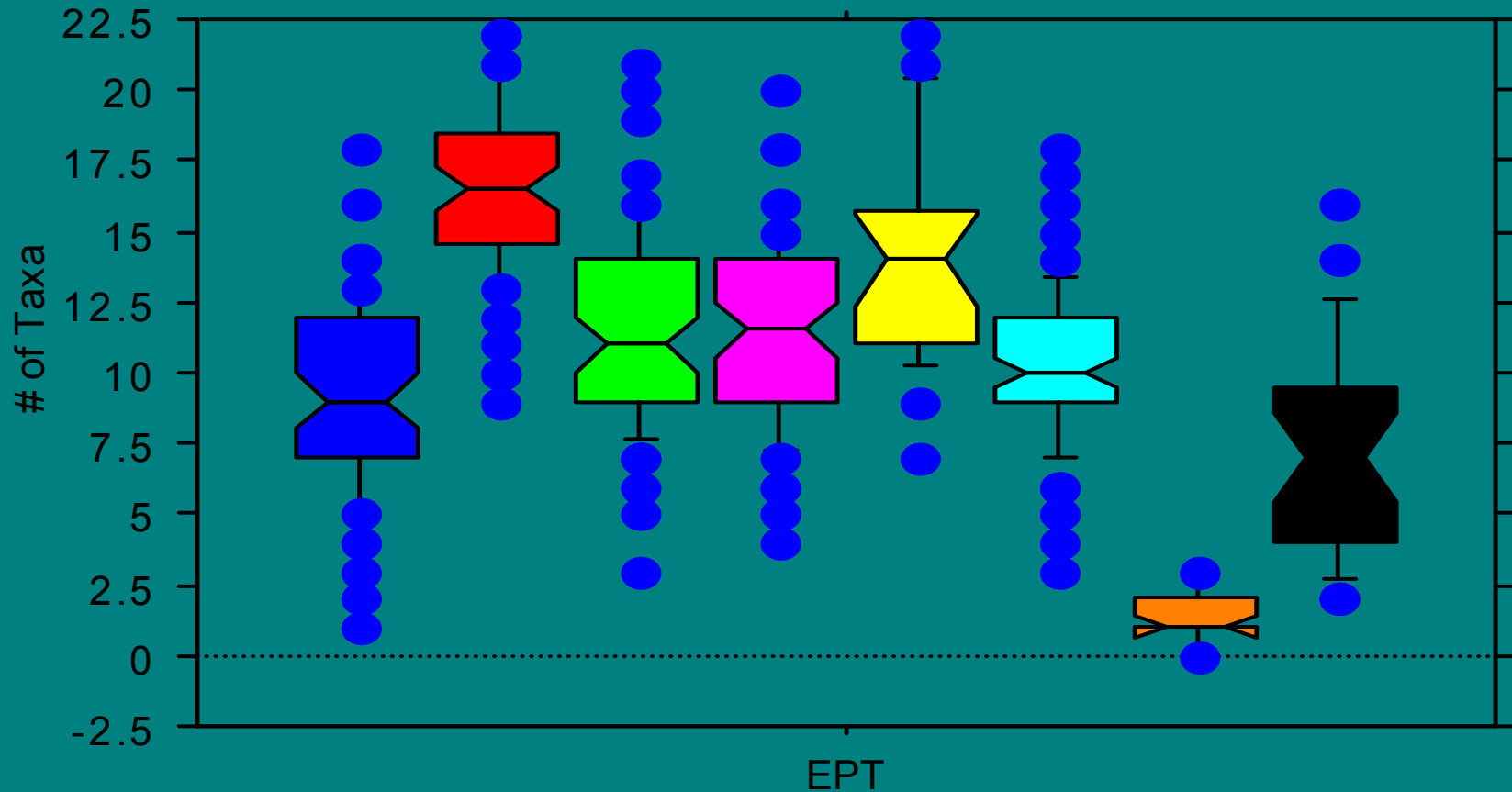
# Proposed Regional pH Criteria



# *Biological Integrity.....*



# *EPT Richness by Ecoregion*



# ***FINAL METRIC SELECTION***

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***TAXA RICHNESS (TR)***

***EPT RICHNESS (EPT)***

***EPT ABUNDANCE (% EPT)***

***OLIGOCHAETE & CHIRONOMID ABUNDANCE (%OC)***

***NORTH CAROLINA BIOTIC INDEX (NCBI)***

***PERCENT DOMINANT ORGANISM (% DOM)***

***PERCENT CLINGERS (% CLING)***

***Subregion 71e (Western Pennyroyal Karst)***

***Target Index Score (Feb-June) = 32***

***Target Index Score (July-Nov) = 28***

***Method: SQKICK***

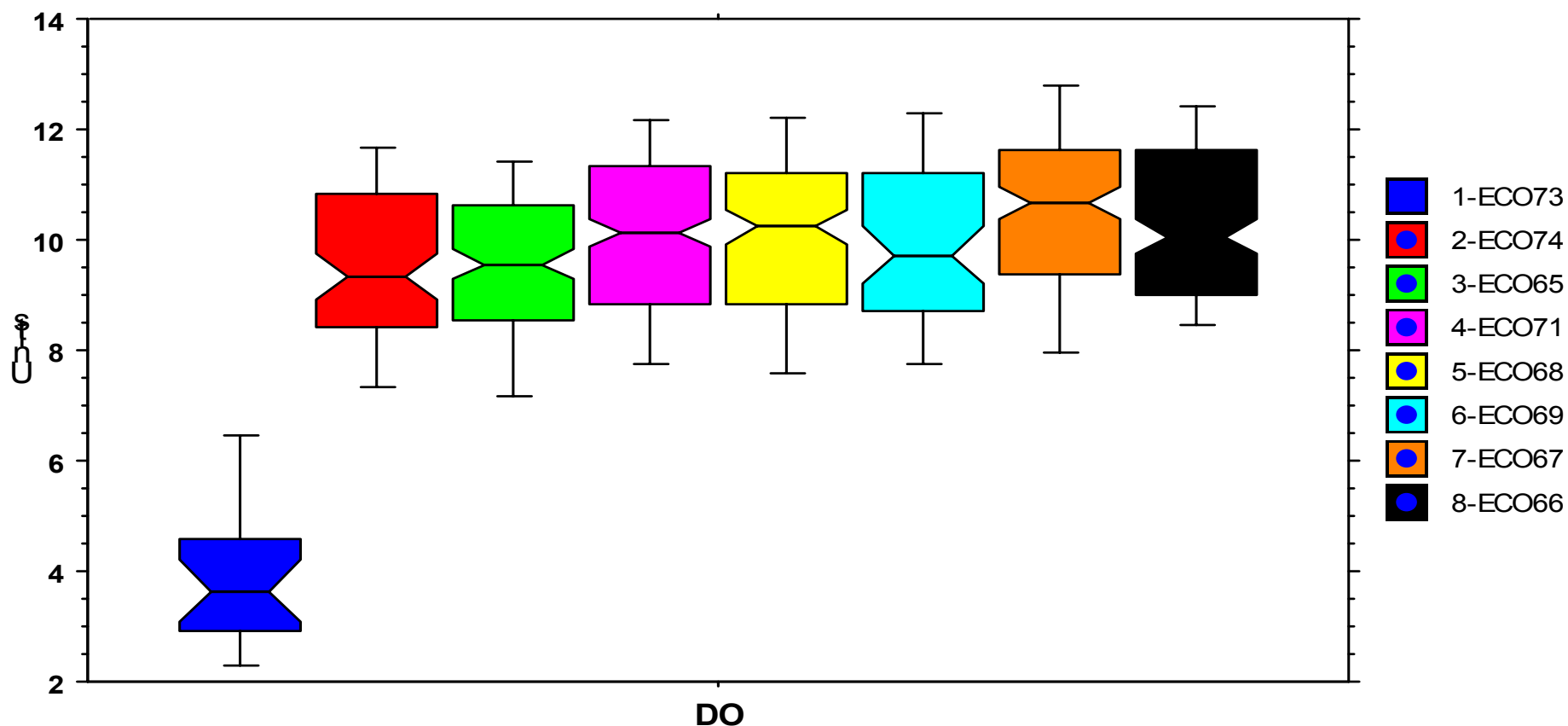
<b><i>Metric</i></b>	<b><i>6</i></b>	<b><i>4</i></b>	<b><i>2</i></b>	<b><i>0</i></b>
<b><i>TR</i></b>	<b><i>&gt; 23</i></b>	<b><i>16 – 23</i></b>	<b><i>8 – 15</i></b>	<b><i>&lt; 8</i></b>
<b><i>EPT</i></b>	<b><i>&gt; 7</i></b>	<b><i>5 – 7</i></b>	<b><i>3 – 4</i></b>	<b><i>&lt; 3</i></b>
<b><i>%EPT</i></b>	<b><i>&gt; 48.9</i></b>	<b><i>32.7–48.9</i></b>	<b><i>16.4-32.6</i></b>	<b><i>&lt; 16.4</i></b>
<b><i>%OC</i></b>	<b><i>&lt; 26.7</i></b>	<b><i>26.7-51.1</i></b>	<b><i>51.2-75.6</i></b>	<b><i>&gt; 75.6</i></b>
<b><i>NCBI</i></b>	<b><i>&lt; 5.05</i></b>	<b><i>5.05-6.69</i></b>	<b><i>6.70-8.34</i></b>	<b><i>&gt; 8.34</i></b>
<b><i>%Dominant</i></b>	<b><i>&lt; 35.1</i></b>	<b><i>35.1-56.6</i></b>	<b><i>56.7-78.2</i></b>	<b><i>&gt; 78.2</i></b>
<b><i>% Clingers</i></b>	<b><i>&gt; 59.8</i></b>	<b><i>40.0-59.8</i></b>	<b><i>20.1-39.9</i></b>	<b><i>&lt; 20.1</i></b>



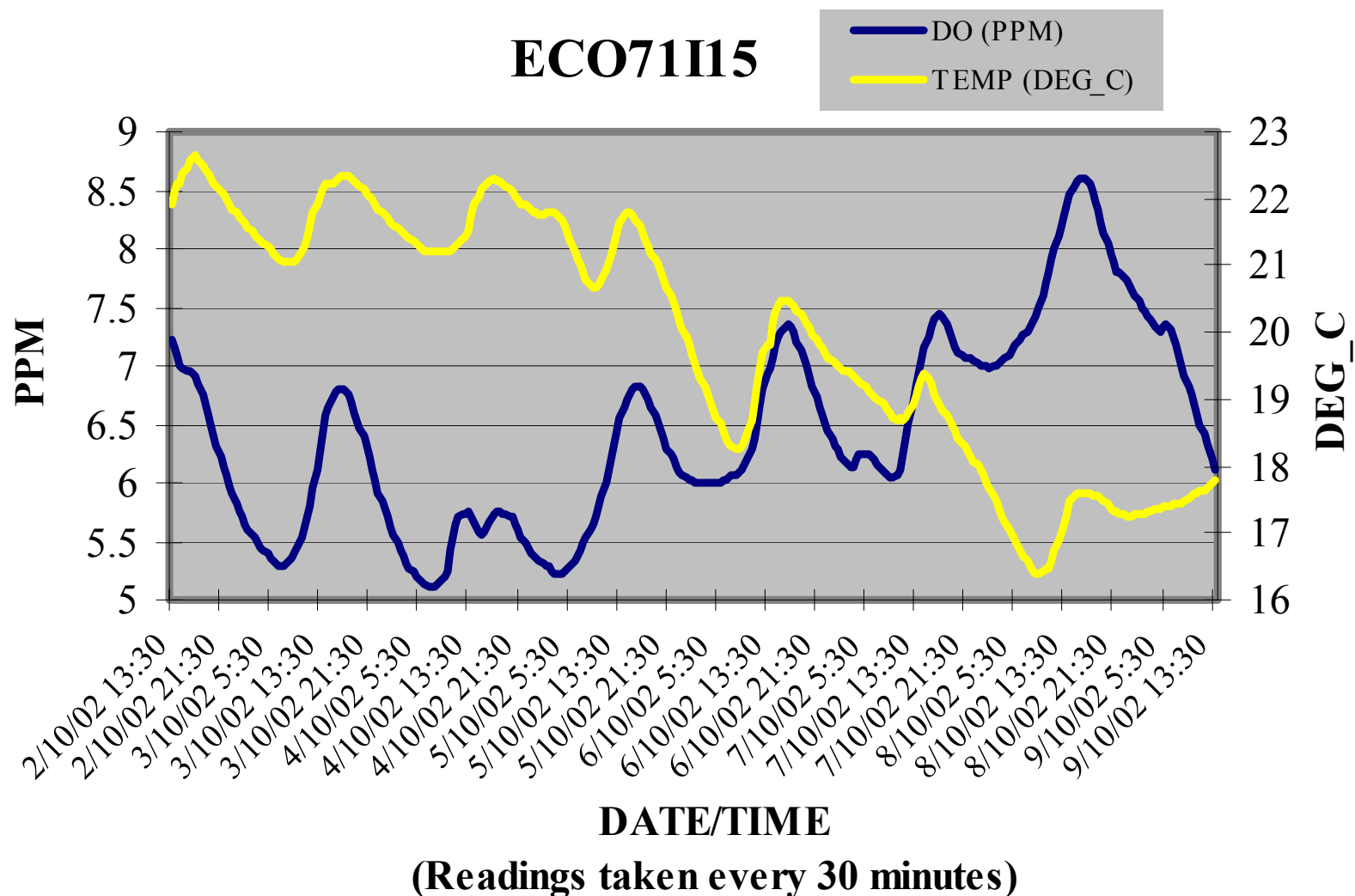
*Dissolved  
oxygen...*



# *Dissolved Oxygen Levels in Level III Reference Streams*



# *Diurnal Dissolved Oxygen Levels at Harpeth River Reference Site*





# *DO Proposal (most stringent criteria in southeastern U.S.)*

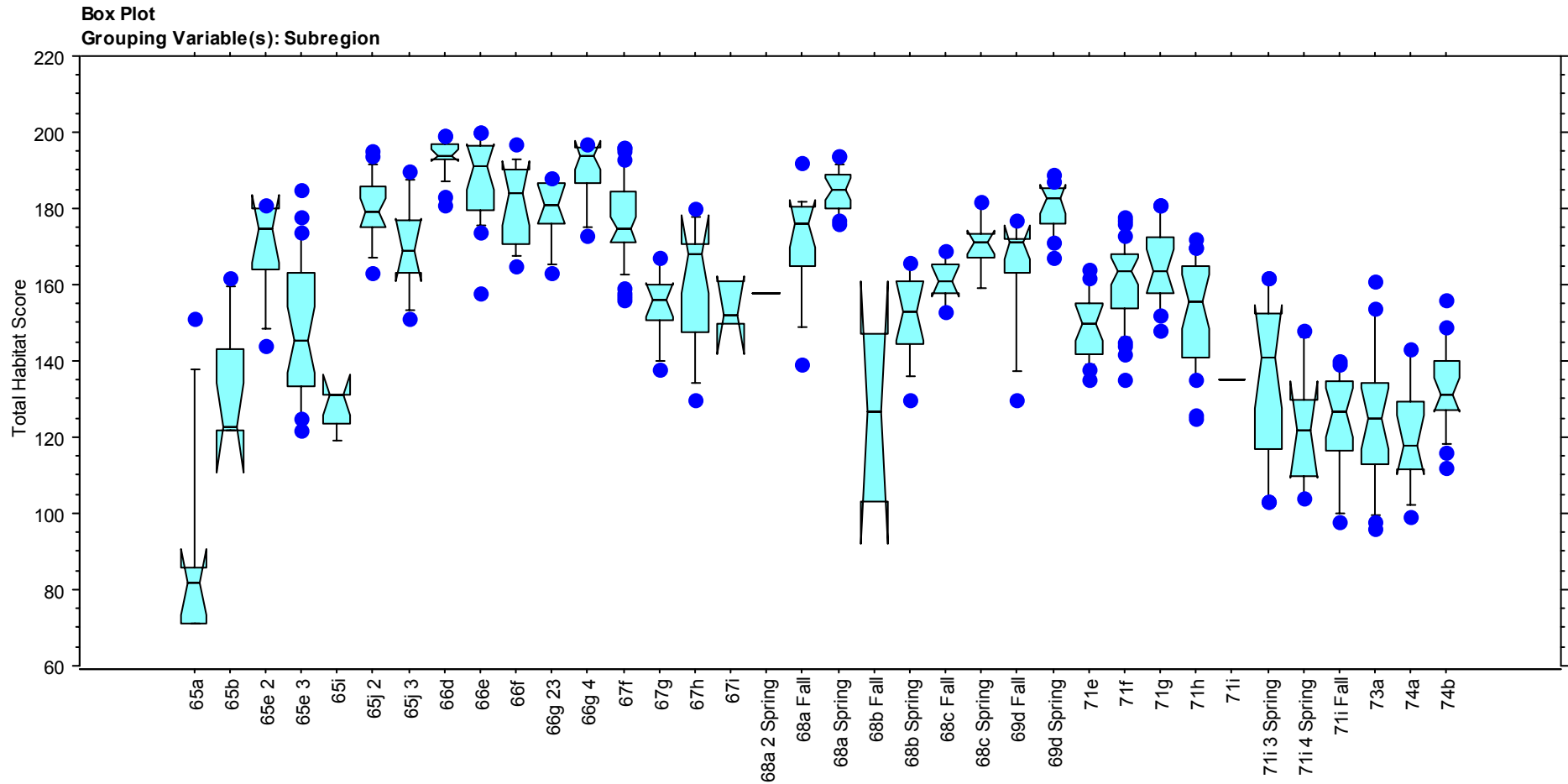
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- *No less than 5.0 mg/L, except as follows:*
- *In 71i & 73a, daily ave. DO 5.0, minimum 4.0*
- *Designated trout streams, 6.0 mg/L*
- *Any wadeable stream in Blue Ridge Mountains ecoregion (66), 7 mg/L*
- *Naturally reproducing trout streams (incl. any stream in GSMNP), 8 mg/L.*

# *Habitat...*



# *Habitat Scores By Subcoregion*



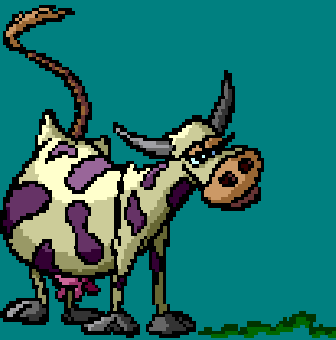
# *Habitat Proposal:*

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- *Guidance only.*
- *Based on 75 percent of the median reference scores for each subecoregion.*
- *Narrative criteria.*



# *So What Did We Do About Siltation?*



*Suspended Solids?*

*Turbidity?*

*Habitat  
Assessments*

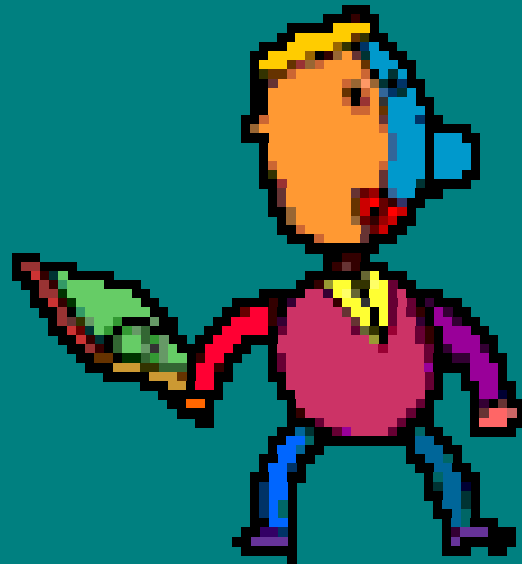
# *2001 Triennial Review of Water Quality Standards Summary*

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- *Nutrients: proposed new numeric criteria.*
- *pH: proposed regional revisions to statewide numeric criteria.*
- *Biological Integrity: proposed numeric biocriteria.*
- *Dissolved oxygen: proposed regional revisions to statewide numeric criteria.*
- *Habitat: created guidance for interpreting narrative criteria*

# *Success?*

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# *Nope...*

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# *Triennial Review Issues Raised:*

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- *Criticism of reference approach*
- *Implementation questions about numeric nutrient criteria*
- *Good science/ bad science*
- *Regulated community/ environmental group opposition to biocriteria.*
- *Agriculture concerns*

# *The Better Part of Valor: Our Fallback Position*

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- *Nutrients: new narrative criteria that recognizes methodology.*
- *Biological Integrity: revised narrative criteria that recognizes methodology.*
- *pH and dissolved oxygen: stuck to our position.*

# *EPA Response: Stay Tuned*



*Tennessee WQS Proposal*

*All of our  
criteria  
development  
reports  
can be  
downloaded  
from our  
Webpage:*



*[www.state.tn.us/environment/wpc/publications](http://www.state.tn.us/environment/wpc/publications)*

# *My Office*



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# *The End*

