A Biological Condition Gradient Approach for Using Diatoms to Assess Nutrient Conditions: New Jersey Streams

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Nutrient Criteria for New Jersey

- Excess nutrients a major problem
- Reassessing current standard of 100 ug/L for rivers and streams
- Protect designated uses, weight of evidence approach, biological basis
- Reference site approach not realistic
Outline / Approach

• Diatom TP and TN Indices
• Biological Condition Gradient approach to develop impairment categories (e.g., good, fair, poor)
• Use BCG category boundaries to identify nutrient criteria options
Study sites 2000 – 2004

Ponader et al. 2007, 2008

Piedmont 28
Ridge & Val. 5
Highlands 12
Coastal Plain 34

Total: 79 streams
Abundance of taxa

Total P conc. gradient – Study streams
The Biological Condition Gradient – Concept

1. Natural structure & function of biotic community maintained
2. Minimal changes in structure & function
3. Evident changes in structure and minimal changes in function
4. Moderate changes in structure & minimal changes in function
5. Major changes in structure & moderate changes in function
6. Severe changes in structure & function

Increasing Effect of Human Activity

(Davies and Jackson 2006)
Diatom BCG Approach

- Classify sites based on natural characteristics
- Define stressor gradient
- Assign taxa to BCG Attributes
- Assign sites to BCG Categories; Workshop of diatom experts
New Jersey Study Sites and Ecoregions

North
- High-gradient Rock substrate
- pH > 7

South
- Low-gradient Sand / silt substrate
- pH < 7 and > 5.5

95 Sampling Sites
> 200 Samples
Principal Components Analysis
Stressor Variables
73 Sites

Axis 1 used to create PCA-Stressor Scores
Stressor Gradient
Assign taxa to BCG attributes based on distributions along the stressor gradient

Modified from Original Courtesy of Chris Yoder, CABB
Placoneis conspicua

Tolerant
New Jersey Diatom BCG Workshop – Aug 2009

Assigned 57 diatom counts to BCG Categories

Diatom Experts
Rex Lowe
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Percent of Valves in BCG Attributes

Average Diatom Workshop BCG Score
Nutrient criteria options

25 - 50 ug/L

Ave. Diatom Workshop BCG Score

< 30 ug/L

Ridge and Valley / Northern Highlands

Northern Piedmont

50 ug/L

Outer Coastal Plain

Inner Coastal Plain

50-100 ug/L ?? complex

TP μg / L
Diatom TP Index

Diatom Workshop BCG Category

50 µg/L Reference line
Conclusions

• The diatom BCG approach is effective for developing nutrient category boundaries

• Diatom TP and TN Indices can be used to assess site nutrient condition wrt BCG category boundaries

• Nutrient criteria options are 50 µg/L or less, below current standard of 100 µg/L

• Recommendations are being evaluated with 42 new samples; BCG rules being developed
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