

National Biological Assessment  
and Criteria Workshop

Advancing State and Tribal Programs



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**TALU 202**

*Tiered Aquatic Life  
Uses: Implementation  
of Bioassessment and  
Biocriteria in Water  
Quality Management  
Programs*

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*Presented by*

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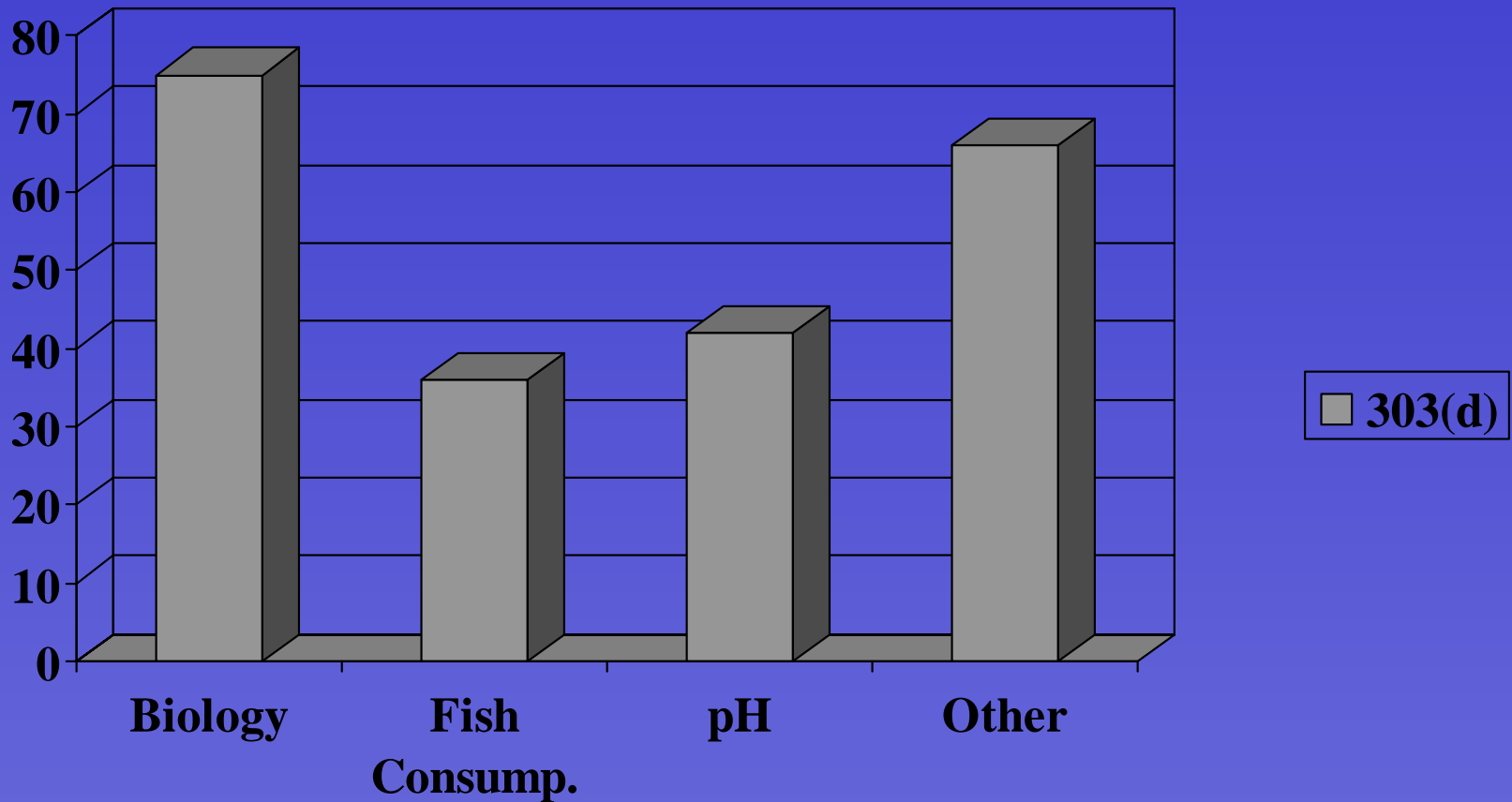
# Monitoring and Biocriteria Development in Wadeable Streams

- More than 20 years of fish and macroinvertebrate biomonitoring using standardized methods;
- All monitoring and assessment conducted by in-house staff;
- Same staff over 20 year time period;
- In some cases, same equipment;
- Over 1500 sampling events at more than 1000 sites;

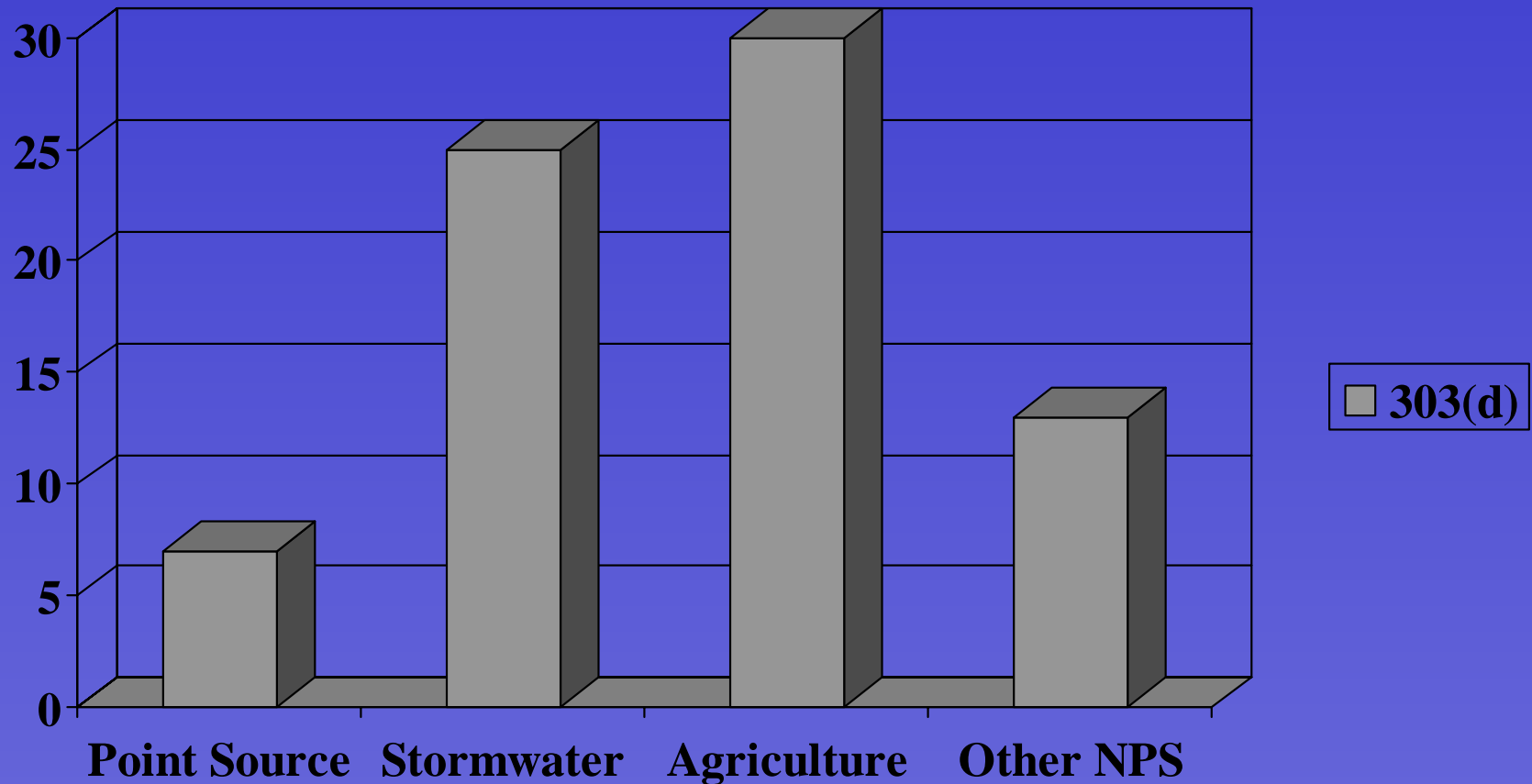
# Biocriteria Implementation

- Informal implementation of threshold criteria to determine compliance with Vermont water quality standards;
- Threshold criteria established by best professional judgment – no formal analysis;
- Described condition levels from “excellent” to “poor” – represented an informally designed biogradient;

# Vermont 303(d) list – Water Body Segments by Use Impairment



# Biologically Impaired Segments by Source Category



# 3 - Tiered Aquatic Life Use Narrative Criteria

**Class A1 – Minimal change** from natural condition; measures of biological integrity for aquatic macroinvertebrate and fish assemblages are within the range of the natural condition;

Class B, Management Type 1 – change from the reference condition for aquatic macroinvertebrate and fish assemblages shall be limited to **minor changes** in the relative proportions of taxonomic and functional components; relative proportions of tolerant and intolerant components are within the range of the reference condition;

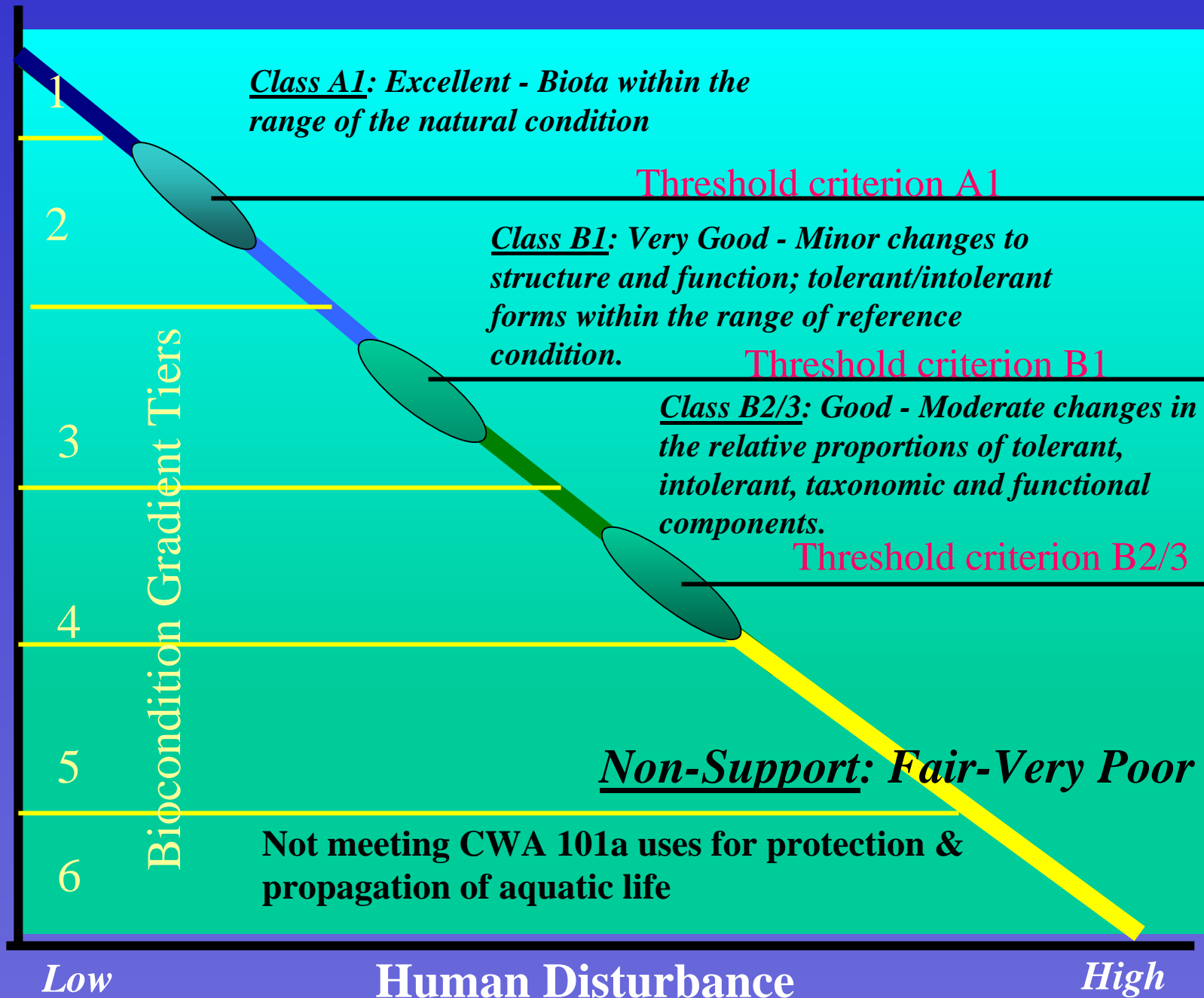
Class B, Management Types 2 and 3 – changes in the reference condition limited to **moderate changes** in taxonomic, functional, tolerant and intolerant components;

# Designated Aquatic Life Uses in Vermont

natural/  
minimally  
altered

Biological  
Condition

highly  
altered



## Biogradient

## Vermont WQS's

**High(Natural/  
Minimally  
Altered)**

Natural: Unaltered by human activity

Within the range of the natural condition

Minimal changes in structure  
and function

Minor changes to structure and function;  
tolerant/intolerant components within natural range;

Evident changes in structure

Moderate changes to structure and function  
and tolerant/intolerant components

Moderate changes in structure  
and function

Not supporting aquatic life use;

Conspicuous changes to structure  
and function

Aquatic community not sustainable;

Extreme changes in structure and function

**Biological  
Condition**

**Low(Highly  
Altered)**

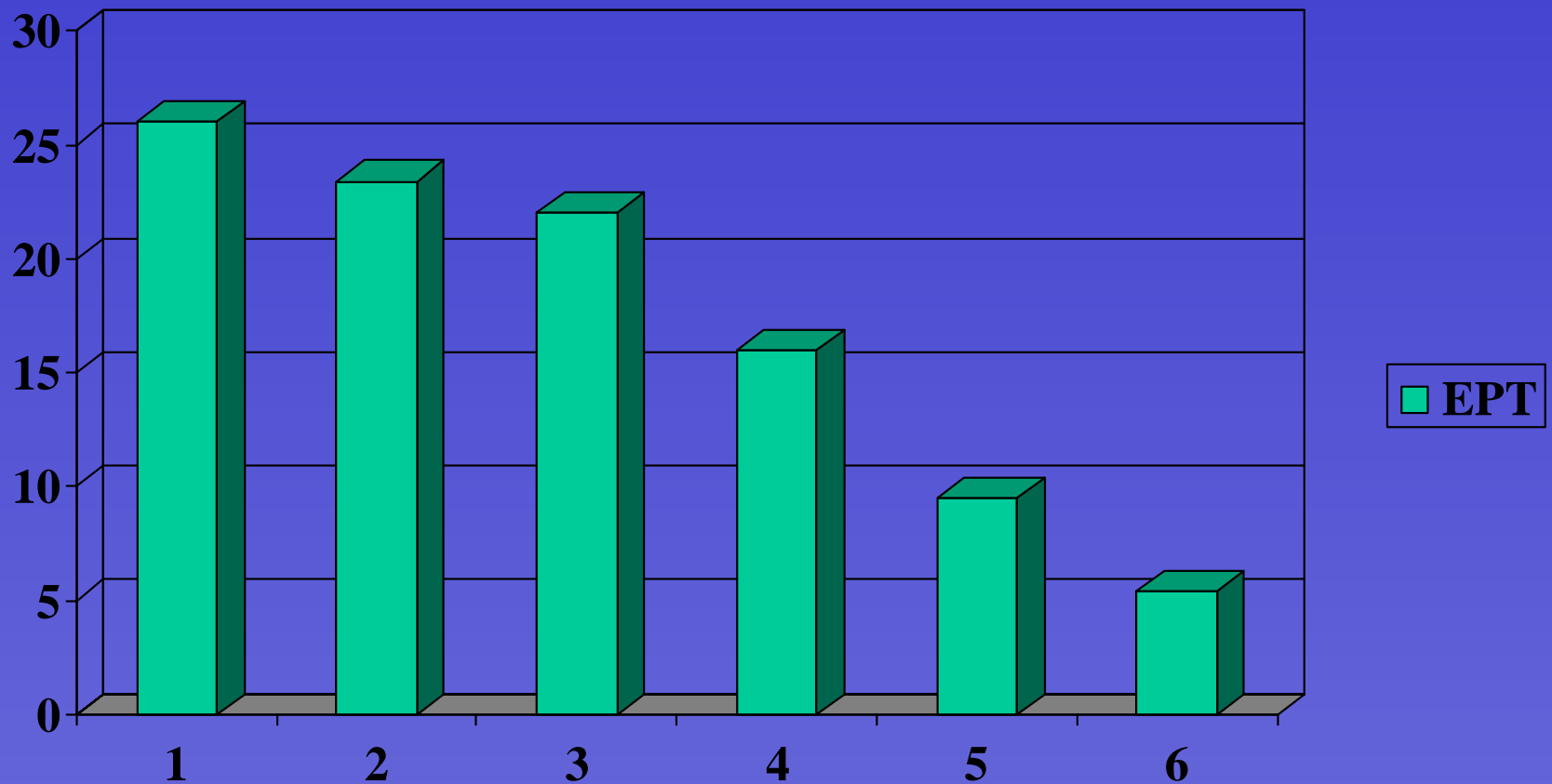
**Bioaxis/Water Quality  
Standards Semantics**



# Biocondition Gradient Response to Sensitive Taxa Metrics – Four “categories”



# Biocondition Gradient Response to Sensitive Taxa Metrics – Six “categories”



# Conclusions

- There is general concordance between Vermont tiered aquatic life uses and the biocondition gradient language;
- The “gradient” of biological condition is continuous and can be sub-divided into any number of categories;
- The conceptual basis of the biocondition gradient is validated by biological assessment data from wadeable streams in Vermont;

# Opportunities for Protection Basin Planning

- Waters with existing high biological quality are identified with biological assessment;
- List of water bodies assembled as candidates for reclassification to higher aquatic life use management type;
- Basin planning process convenes public process to evaluate list and make recommendations;

# Basin Planning (cont)

- Currently in initial stages of process;
- No reclassifications to date;
- Tiered uses in conjunction with biogradient have been invaluable tools in public education and comprehension of the concepts of ecological gradients;
- Greatest impediment to public acceptance has been inability to predict land use implications related to higher aquatic life use classification standards;

# Watershed Restoration Adaptive Management

- Vermont has found that biological criteria in the context of tiered uses are a good match with watershed restoration plan based on adaptive management;
- Adaptive watershed restoration plans as TMDL equivalents for impaired watershed affected primarily by non-point or non-steady state sources;
- A reasonable and cost-effective approach to dealing with the uncertainties associated with predicting biological response to management action at the biocriteria precision level;

# Adaptive Management (cont)

- Develop TMDL or equivalent restoration plan;
  - identify aquatic life restoration targets;
  - implement aggressive reasonable and cost-effective management actions;
  - monitor biological response and evaluate progress toward goals;
  - adjust management actions in response to monitoring information;
  - continue until biological performance standards (biocriteria) are met;

# Adaptive Management (cont)

- Process is open-ended with assurance that standards will be restored but within an undetermined time frame;
  - some permitting programs under CWA (NPDES) require assurance that standards will be restored within a specific time period;
  - biological condition performance standards validated by biological gradient theory have been widely accepted by Vermont stakeholders as reasonable;
  - using primarily for stormwater management



# Public Education

- The implementation of biocriteria has been an extremely valuable tool for educating the public and stakeholders about ecological theory and ecological values associated with biological integrity;
- Public process has resulted in a high degree of acceptance of and confidence in the implementation of biocriteria in Vermont;

# Final Thoughts

The most critical implementation issues have occurred at the science/policy interface. Tensions are created between the predictive and pass/fail decision demands of regulatory and planning processes and the reality of the predictive and classification uncertainties intrinsic to biological data.

These tensions can be addressed through reasonable and defensible implementation of biological criteria within the context of an open decision-making process that is able to accommodate a certain degree of uncertainty.