National Biological Assessment and Criteria Workshop

Advancing State and Tribal Programs

Coeur d'Alene, Idaho
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RFC 101

Development of Reference Conditions for Management Classes

Presented by

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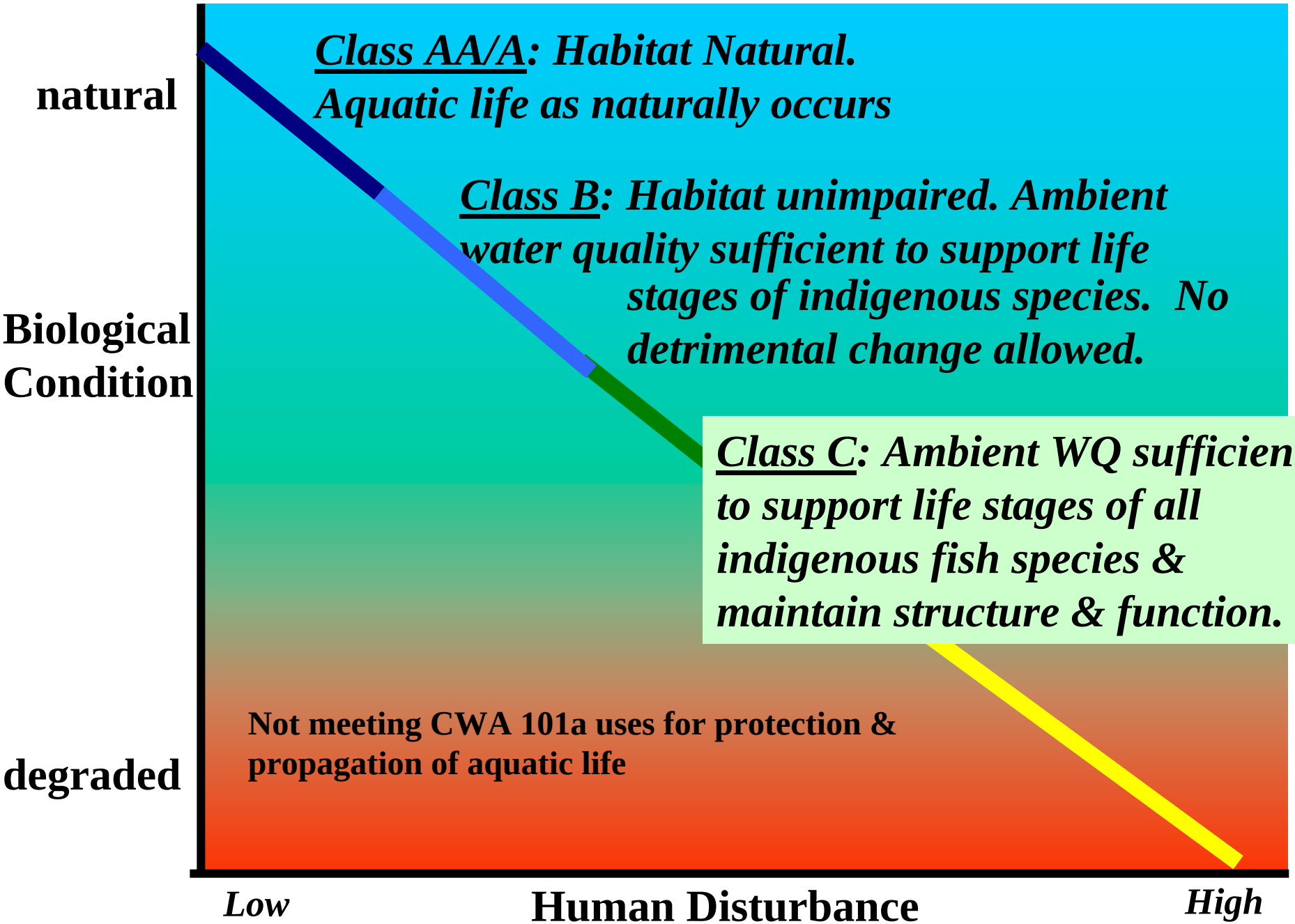
Why Establish Management Classes (Conditions) of Aquatic Life Use Support

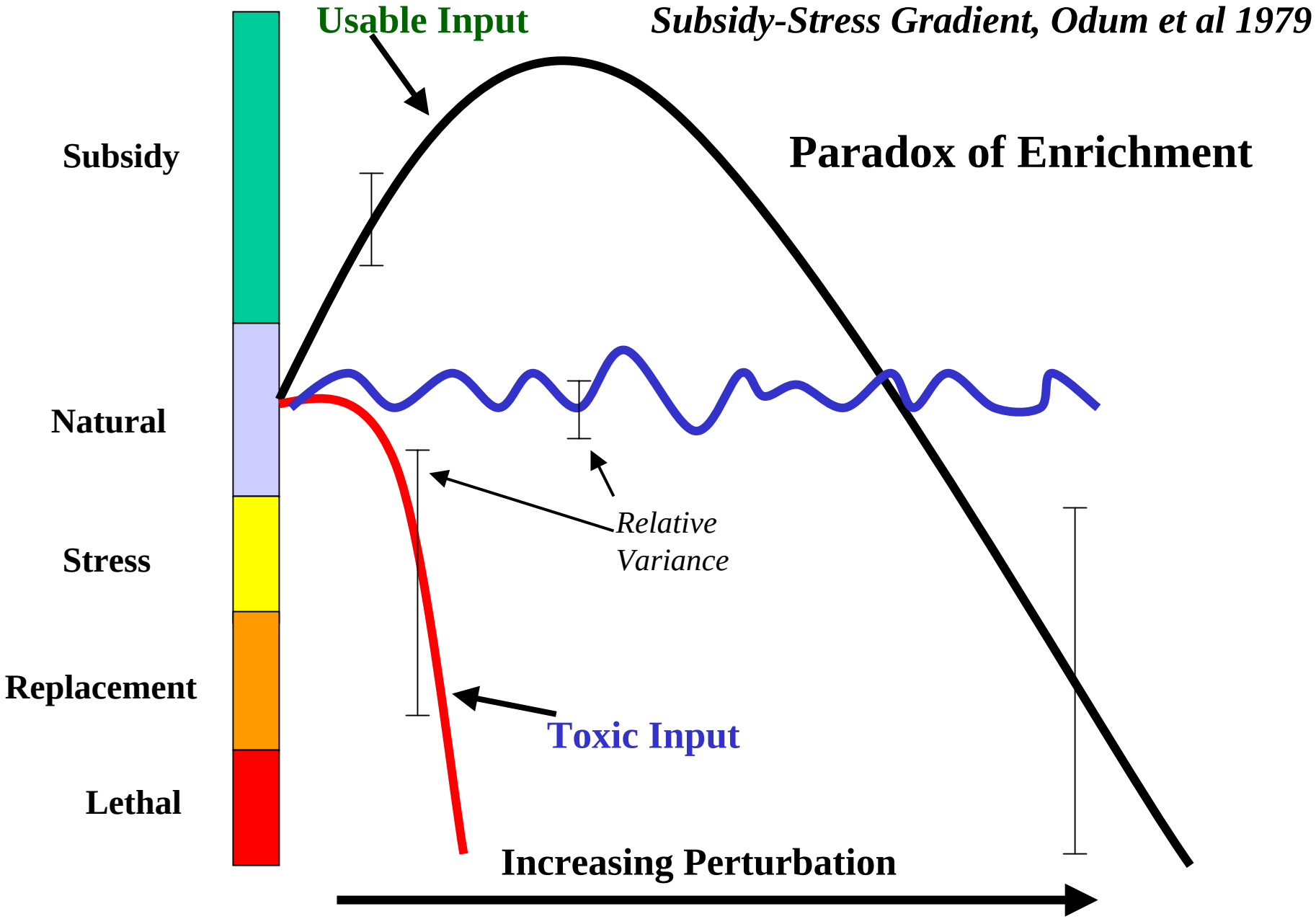
- Define the biological condition for different levels of disturbance (references other than “pristine”, “least disturbed”, “best attainable”)
- Establish ‘acceptable’ patterns of biological response to disturbance (“reference library” along the Biocondition Gradient).
- Establish interim goals for aquatic life uses. Provide management with measurable targets along the Biocondition Gradient

Designated Aquatic Life Uses: MAINE



How Can Management Classes (Conditions) Differ

- **Conditions may be set *a priori***
- **Used to aggregate complex responses**
- **May be non-linear**


Usable Input
Subsidy-Stress Gradient, Odum et al 1979
Subsidy
Paradox of Enrichment
Natural
Stress
Relative
Variance
Replacement
Toxic Input
Lethal
Increasing Perturbation

Establishing *a priori* Classes (Conditions)

1. **Establish water quality classes that define biological conditions (use of narrative biological standards, definitions)**
2. **Identify ecological attributes that describe the defined biological condition**
3. **Identify measures that are sensitive to changes in the attributes**
4. **Construct reference models**

Maine's Water Classification

- **Classes A and AA (same aquatic life use)**
  - **Aquatic life shall be as naturally occurs.**
- **Class B**
  - **no detrimental changes to resident biological community**
  - **maintain all indigenous species, allow recruitment**
- **Class C**
  - **maintain structure and function of community**
  - **maintain all indigenous fish species**
- **Non-attainment of any class (NA)**

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Maine Tiered Uses Based on Measurable Ecological Values

Narrative Standard	Biological Attribute
CLASS A *natural*	**Taxonomic and Numeric Equality; Presence of Indicator Taxa**
CLASS B *unimpaired, maintain indigenous taxa*	**Retention/recruitment of taxa and numbers; Absence of hyperdominance; Presence of sensitive taxa**
CLASS C *maintain structure and function*	**Resistance, Redundancy; Resilience; Balanced Distribution Energy Transfer; Resource assimilation; Reproduction**

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Maine Tiered Uses Based on Measurable Ecological Values

Narrative Standard	Biological Value	Quantifiable Measures
CLASS A *natural*	Taxonomic and Numeric Equality ; Presence of Indicator Taxa	**Similarity, Richness, Abundance, Diversity; EPT, Indicator Taxa, Biotic Index**
CLASS B *unimpaired, maintain indigenous taxa*	Retention of taxa and numbers; Absence of hyperdominance; Presence of sensitive taxa	**Community loss; Richness; Abundance; diversity; equitability; evenness; EPT; Indicator Taxa, Biotic Index**
CLASS C *maintain structure and function*	Resistance, Redundancy; Resilience; Balanced Distribution	**Richness; Diversity; Equitability; Evenness**
	Energy Transfer; Resource assimilation; Reproduction	**Trophic groups; Richness; abundance; community loss; fecundity; colonization rate**

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Development of Linear Discriminant Models

- **DEP biologists assigned 376 blind samples to one of four *a priori* groups -**
  - **Class A (n = 120)**
  - **Class B (n = 117)**
  - **Class C (n = 72)**
  - **Non-attainment (NA) of criteria (n = 67)**
- **Assignment of samples was based on abundance, richness, community structure, and ecological theory.**

Consistency of *a priori* Assignments

- **Consistency of MDEP biologists**
  - **96%** **of independent assignments were unanimous OR majority agreement (2 of 3)**
- **Non-MDEP biologists independently assigned *a priori* classes to samples**
  - **80%** **of independent assignments concurred with MDEP biologists assignments**
- **Interpretations never differed by more than one class in either direction**

Model Performance

Class A Model				B or Better Model				C or Better Model			
		Model Prediction				Model Prediction				Model Prediction	
		A	B,C,NA			A,B	C,NA			A,B,C	NA
A Priori	A	**87%**	13%	A Priori	A,B	**94%**	6%	A Priori	A,B,C	**96%**	4%
	B,C,NA	9%	91%		C,NA	6%	94%		NA	12%	88%

Does the model accurately classify minimally disturbed streams?

- **27** samples selected with following criteria:
  - not used to build the model
  - no known point sources
  - average % of upstream watershed
    - **97% forested; (3% logged)**
    - **2% crop**
    - **1% residential, urban, industrial, commercial**
- **24 (89%)** of samples had model outcomes of **Class A**

For More Information

- Biomonitoring Web Site
  - http://www.state.me.us/dep/blwq/docmonitoring/biomonitoring/index.htm
- Methods Manual
  - http://www.state.me.us/dep/blwq/docmonitoring/finlmeth1.pdf
- Fifteen Year Retrospective
  - http://www.state.me.us/dep/blwq/docmonitoring/biomonitoring/biorep2000.htm
- E-mail
  - biome@maine.gov