USE OF BIOLOGICAL DATA CURRENT AND FUTURE

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FEDERAL WATER POLLUTION CONTROL ACT

"The objective of this Act is to restore and maintain the chemical, physical, and **biological integrity** of the Nation's waters."

"provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water "…..

Biological Integrity

from the EPA ANPRM, 1998.

A Balanced, Adaptive Community Possessing the -

- Species composition
- Diversity
- Functional Organization

Comparative to the Natural Habitat of the Region

- Not Necessarily Pristine.

(a) In all **FW1 waters** the designated uses are:

1. Set aside for posterity to represent the natural aquatic environment and its associated biota;

(b) In all **PL waters** the designated uses are:

2. Maintenance, migration and propagation of the natural and established biota indigenous to this unique ecological system;

(c) In all **FW2 waters** the designated uses are:

1. Maintenance, migration and propagation of the natural and established biota;

Use of Biological Data In the Past and Currently:

- List of Water Quality Limited Waters = **303(d) List**
- **305(b) Report**
- **Inform** the Surface Water Quality **Standards Program**
    - C1 designations
    - Trout Water Classifications
- Support Enforcement Actions

Integrated List: 305(b) + 303(d)

- Sublist 1: All uses met.
- Sublist 2: Some uses met, some not met.
- Sublist 3: Insufficient information to assess a use.
- Sublist 4: Use not met; TMDL completed.
- Sublist 5: Use not met; TMDL necessary, (or some other enforceable measure).

BENTHIC RESULTS
FW2 Non Trout Waters

- Moderately Impaired → Non Support *
- Severely Impaired Non Support *
- Nonimpaired → Full Support*

- *Note assessment currently done in conjunction with chemical data when available.

BENTHIC MACROINVERTEBRATE RESULTS:
Trout Production
Trout Maintenance Waters

2 DATASETS REQUIRED:

(1) Benthic Data + (2) DO and Temperature Data (Trout criteria)

- Violation of either 1 or 2 = Non Support
- If Temp or DO data not available = Insufficient data

USE OF FISH IBI ASSESSMENTS

IBI Assessment	Use Support Assessment
Excellent	Full Support*
Good	Full Support*
Fair	Currently on hold. Use assessed using other datasets
Poor	Non Support*

*Note assessment done in conjunction with chemical data when available.

AL Use Decision: Assessment Integration

- A assessment of impaired condition in either indicator alone may lead to a use attainment assessment of “impaired” or “non support” from a bio-indicator perspective.

Pinelands Commission Lake and Stream Bioassessments

- Currently from Mullica and Rancocus River Watersheds.
- Based upon Stream Vegetation, Fish, and Anuran Populations.
- Each indicator reported along a 5 - step condition gradient
  - 1 = undisturbed
  - 5 = most disturbed

- Undisturbed quintile = Full Support
- Most disturbed quintile = Non Support
- Remaining quintiles = Insufficient data

LAKE AL ASSESSMENTS (Non PL)

ASSESSMENTS PROVIDED BY BUREAU OF FRESHWATER FISHERIES

Fishery Assessment	Use Attainment Assessment
-Pop well balanced -Good diversity -Consistent recruitment	Full Attainment
-Fishery assessments incomplete	Insufficient Data
-Reduced or poor diversity -Predators to prey pop. not in balance -Inconsistent or poor recruitment. -Fishery dominated by few tolerant species	Non Attainment

Tiered Aquatic Life Use Assessment (TALU)

The Future of Bio Assessment

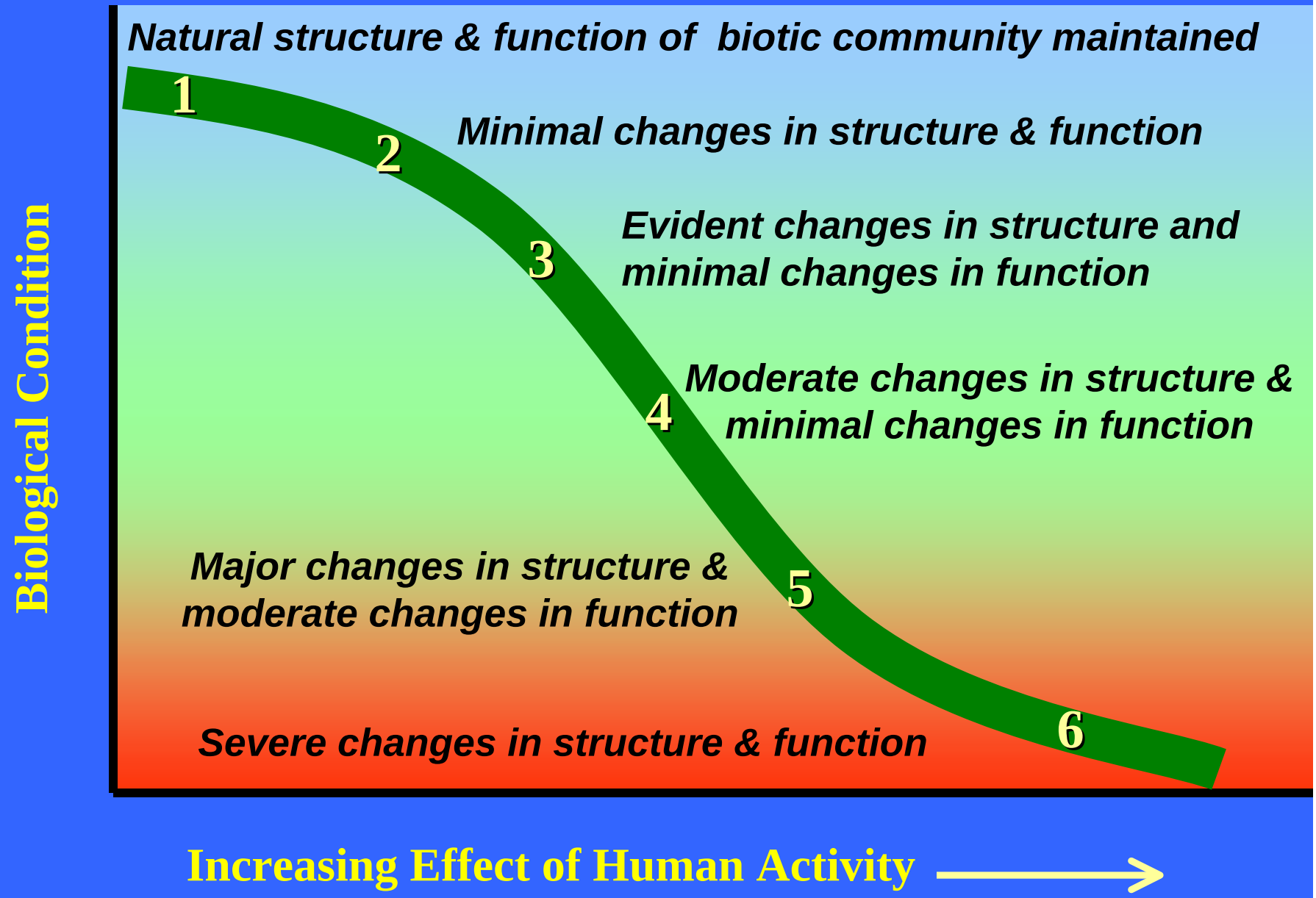
Old Method of Assessment

- Yes/No
- Pass/Fail
- Full Support/Nonsupport
- 303(d) listed/Not listed
- Currently use a modified method using bio data in conjunction with chemical data.

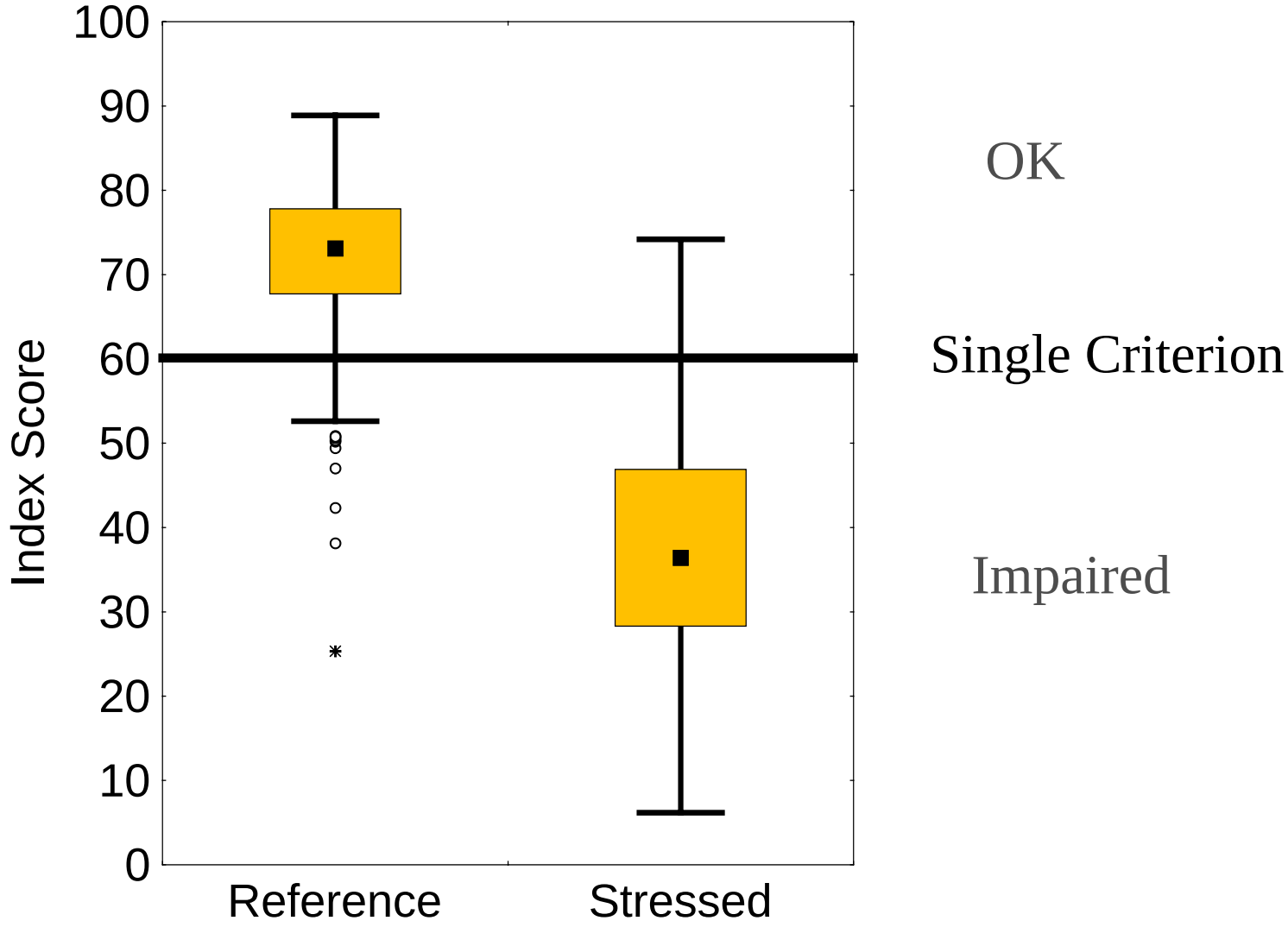
Tiered Aquatic Life Use Assessment (TALU)

- Based upon the concept of a Biological Condition Gradient (BCG)
- Creates a conceptual model to gauge CWA goal attainment.
- Categories Biological Condition into Tiers.
- Can support development of narrative biological criteria and numeric criteria.

The Biological Condition Gradient – Concept



Why have tiers?



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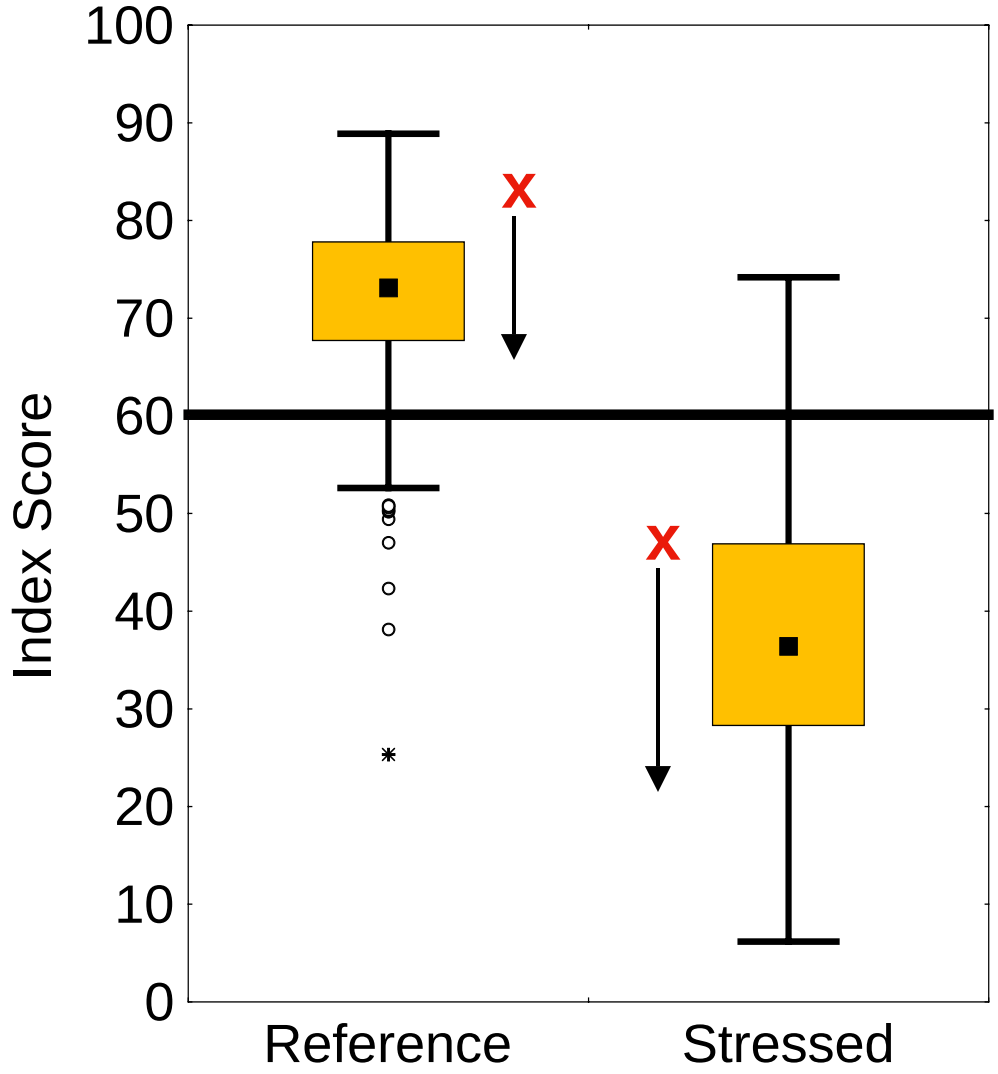
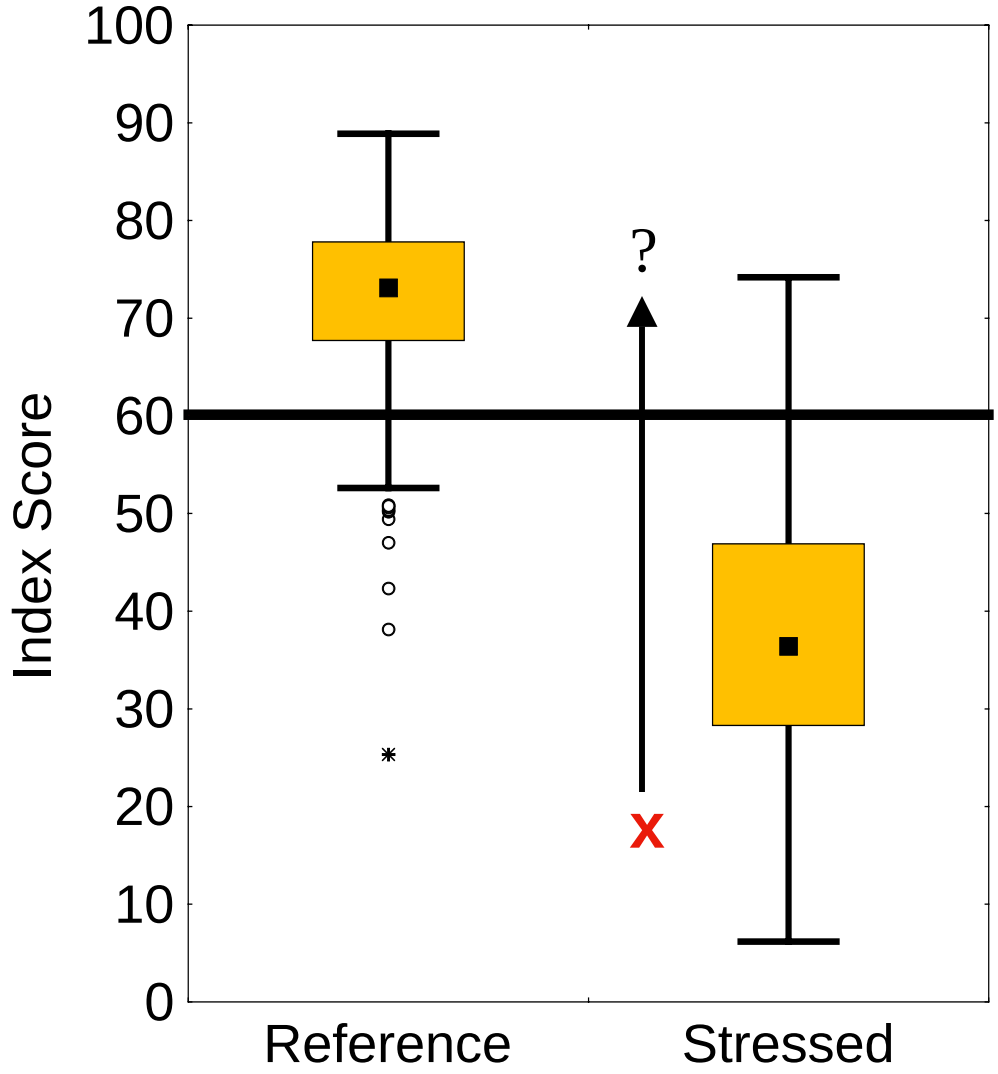


How do we protect the best sites?

Single Criterion

How do we keep intermediate sites from getting worse?

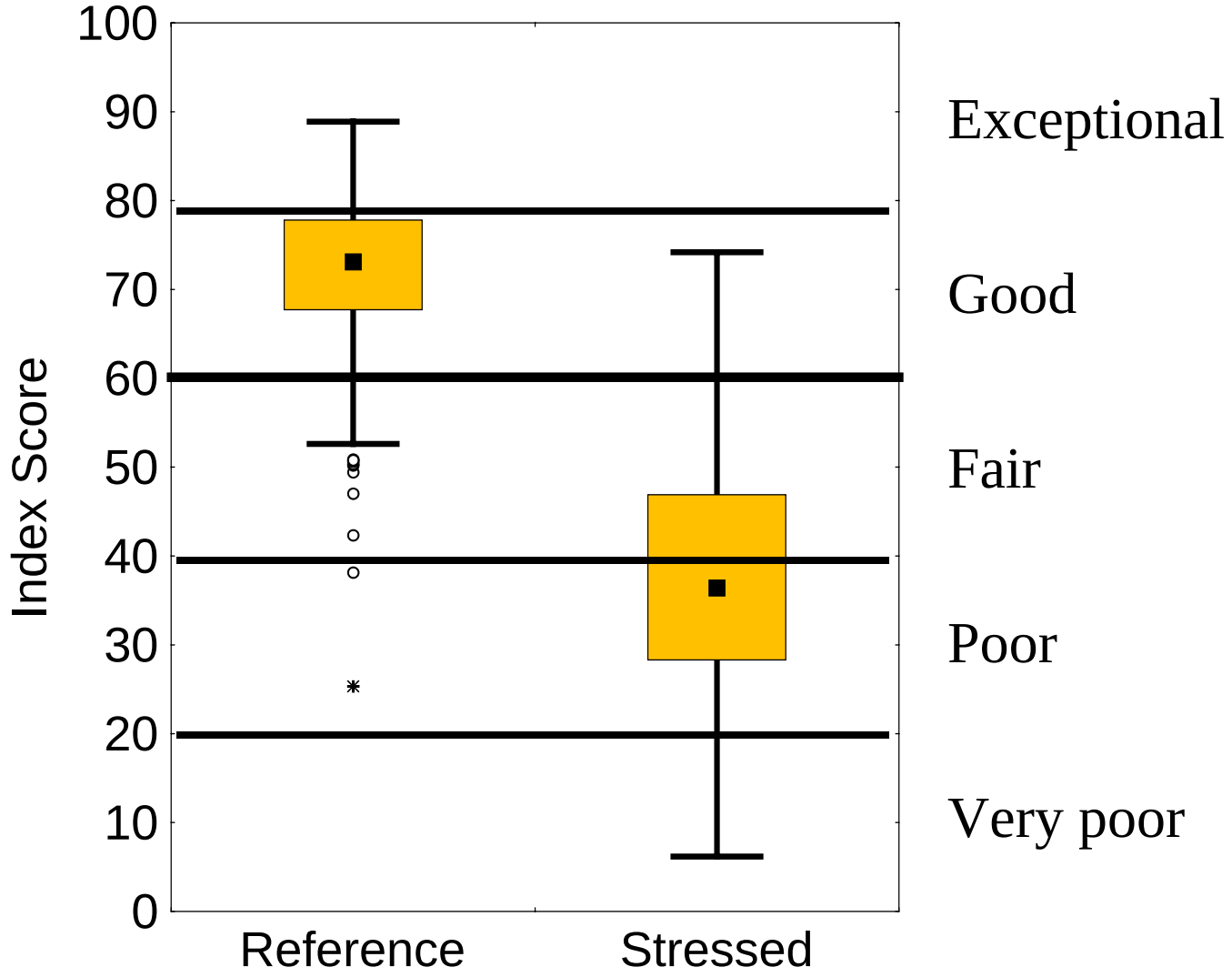
Why have tiers?

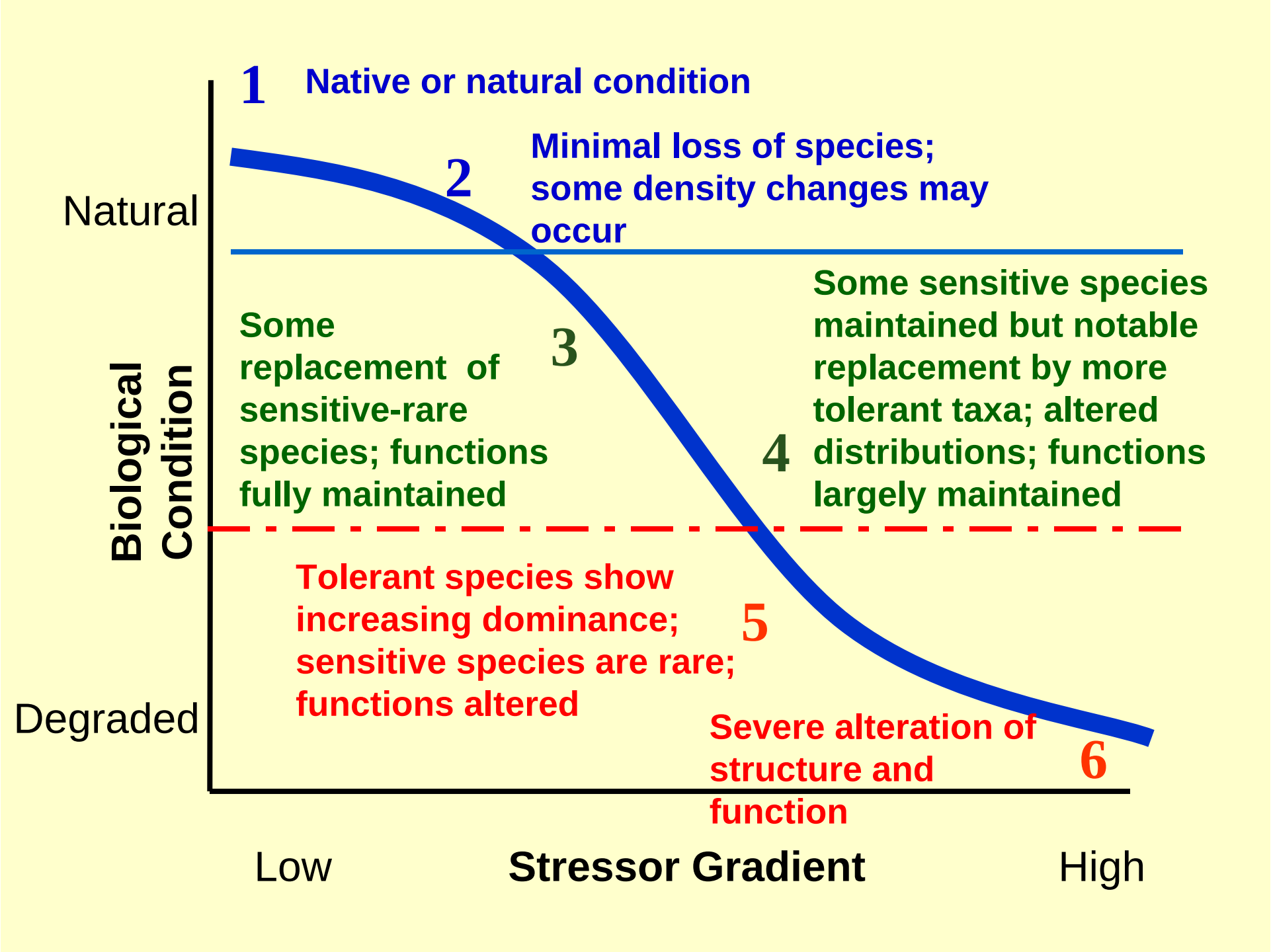


Is the reference condition a reasonable restoration goal for all impaired streams?

Single Criterion

Tiers


100
90
80
70
60
50
40
30
20
10
0
Index Score
Reference
Stressed
Exceptional
Good
Fair
Poor
Very poor


1
Native or natural condition
2
Minimal loss of species; some density changes may occur
Natural
Some replacement of sensitive-rare species; functions fully maintained
3
Some sensitive species maintained but notable replacement by more tolerant taxa; altered distributions; functions largely maintained
4
Biological Condition
Tolerant species show increasing dominance; sensitive species are rare; functions altered
5
Degraded
Severe alteration of structure and function
6
Low
Stressor Gradient
High

Minimally disturbed, forested watershed

Courtesy of Susan Davies, ME DEP

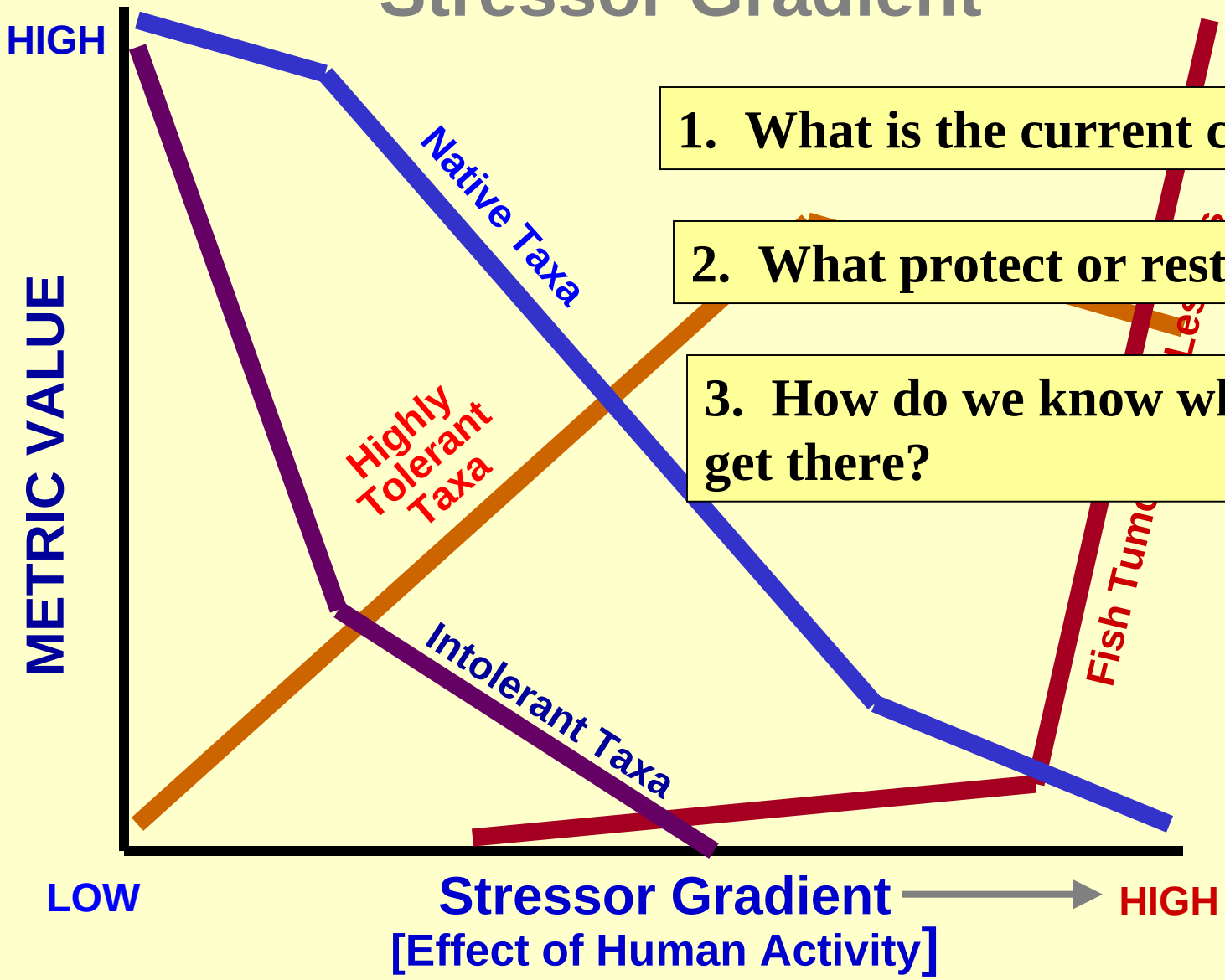
Stream through a cow pasture

Courtesy of Susan Davies, ME DEP

Stream draining a shopping mall

Courtesy of Susan Davies, ME DEP

Metric Behavior Along the Stressor Gradient



1. What is the current condition?
2. What protect or restore to?
3. How do we know when we get there?

Modified from Original Courtesy of Chris Yoder, CABB

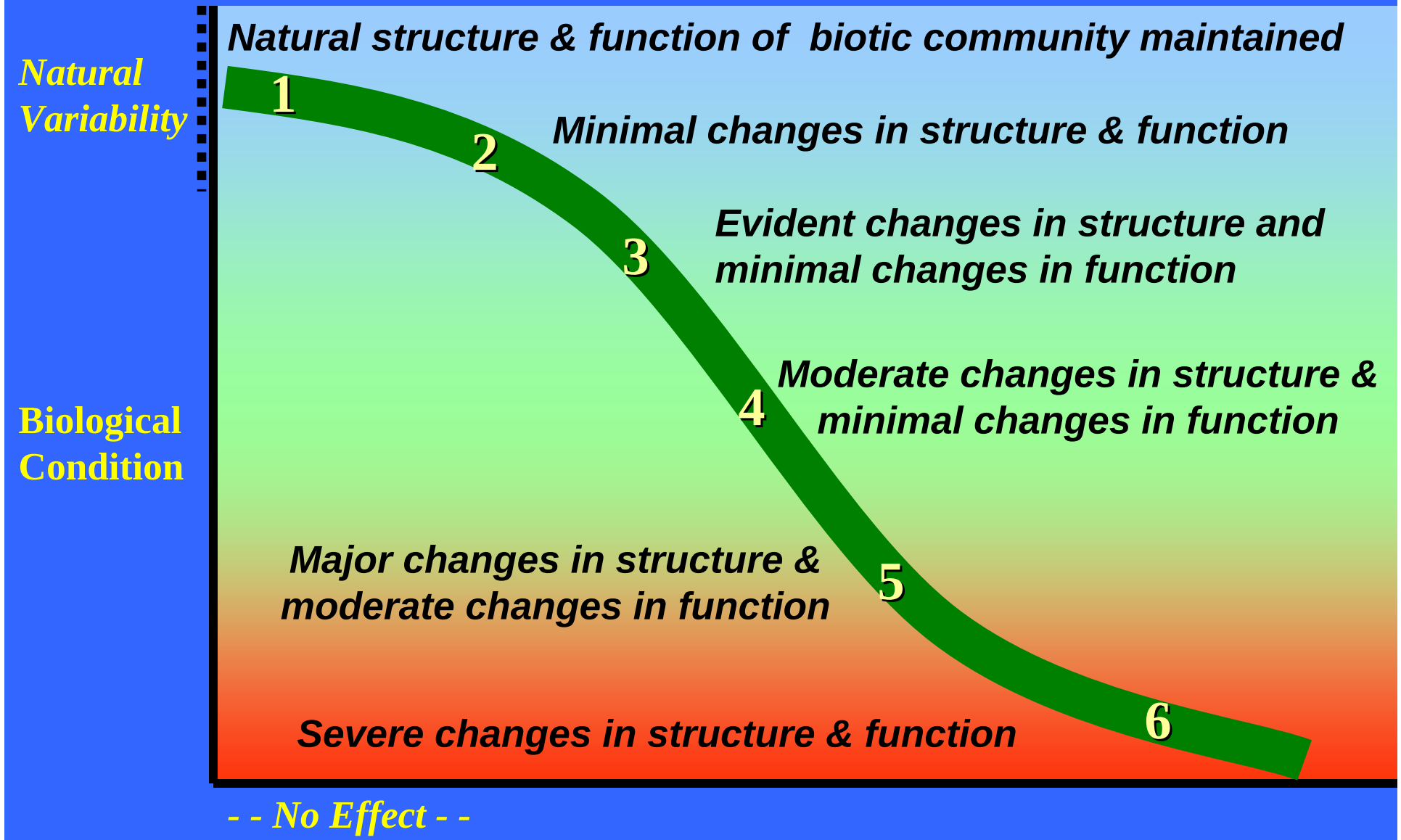
Assemble a Expert Panel of Biologists

- Review a multitude of biological sites and find consensus as to what represents -
  - biological integrity on a regional basis
  - support and nonsupport of the CWA goals
  - waters of exceptional biointegrity

Attributes are Assigned to Genera

I. Sensitive regionally endemic taxa
II. Highly sensitive Taxa
III. Sensitive & common taxa
IV. Taxa of intermediate tolerance
V. Tolerant Taxa
VI. Indicator taxa

The Biological Condition Gradient



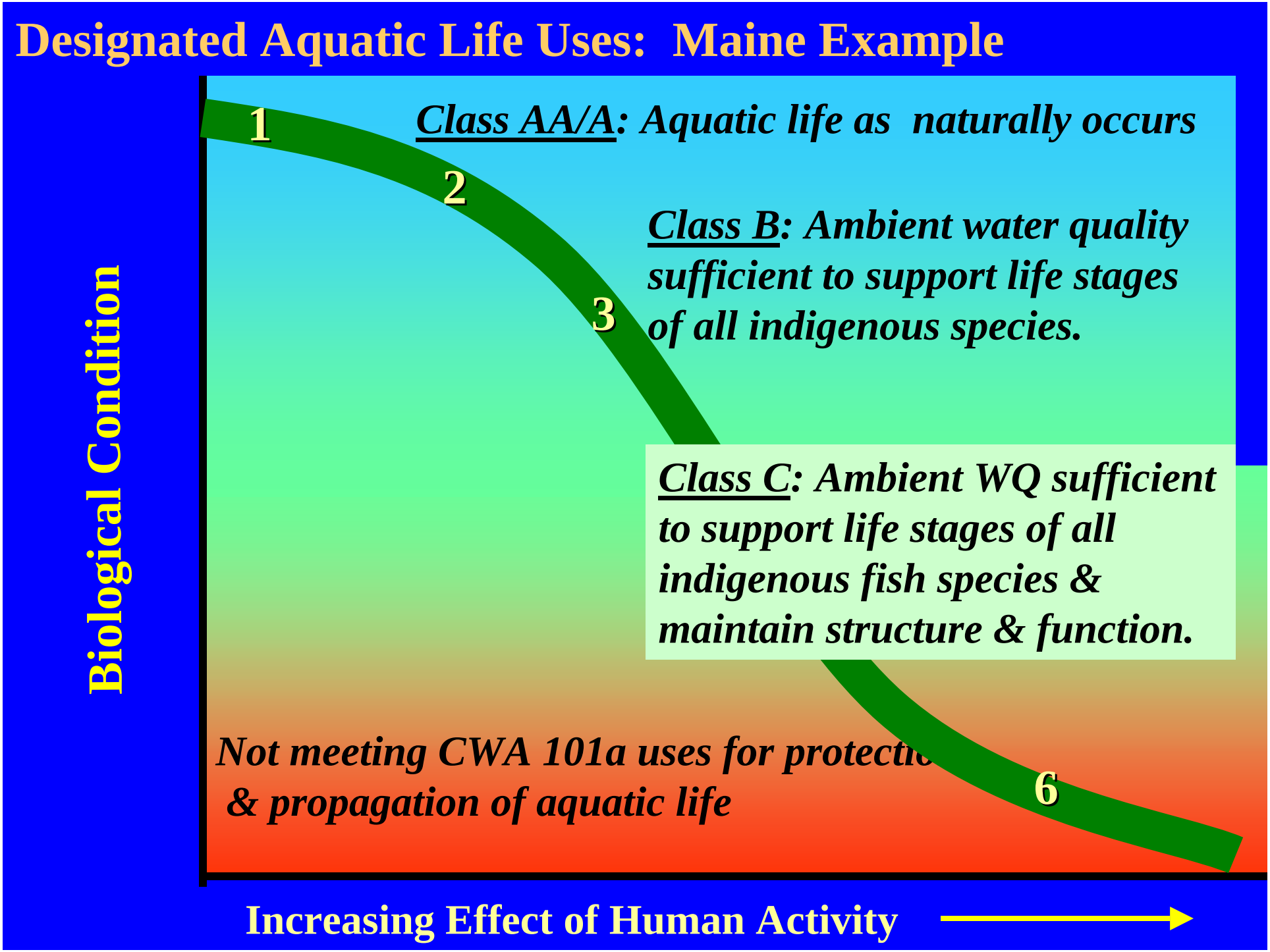
Increasing Effect from Human Influence/Disturbance

BCG Attribute	FinalID	Individuals	Order	Family (Tribe)
5	Lumbricidae	1	Haplotaxida	Lumbricidae
5	Limnodrilus claparedianus	1	Tubificida	Tubificidae
4	Gammarus fasciatus	39	Amphipoda	Gammaridae
4	Caecidotea	1	Isopoda	Asellidae
4	Stenelmis markeli	8	Coleoptera	Elmidae
4	Ectopria nervosa	1	Coleoptera	Psephenidae
4	Psephenus herricki	2	Coleoptera	Psephenidae
5	Phaenopsectra obediens	1	Diptera	Chironomidae
5	Microtendipes tarsalis	1	Diptera	Chironomidae
5	Polypedilum illinoense	1	Diptera	Chironomidae
5	Cricotopus bicinctus	1	Diptera	Chironomidae (Orthocladiinae)
5	Tanytarsus guerlus	1	Diptera	Chironomidae (Tanytarsini)
3	Helicopsyche borealis	16	Trichoptera	Helicopsychidae
2	Goera	4	Trichoptera	Limnephilidae
3	Neophylax	1	Trichoptera	Limnephilidae
4	Sphaerium fabale	1	Veneroida	Pisidiidae
4	Gillia altilis	22	Mesogastropoda	Hydrobiidae
5	Physella gyrina	1	Basommatophora	Physidae
5	Hydrolimax grisea	1	Proseriata	Plagiostomidae
5	Cura foremanii	3	Tricladida	Planariidae

Table 3-4. Decision rules for New Jersey High Gradient Streams

Attributes	**Tiers**					
	1	**2**	**3**	**4**	**5**	**6**
All Taxa						Low richness (<10 taxa) Low abundance (<50 individuals)
I *Sensitive, regionally endemic taxa*		(No rules determined for Attribute 1)				
II *Highly sensitive taxa*		Taxa >= 50% of any other Attribute (± 10)%	*Taxa >=2* (± 2 taxa)	May be absent	May be absent	May be absent
III *Sensitive & common taxa*		Taxa (2 + 3) >= Taxa (4 + 5) (± 2 taxa)	Taxa (2 + 3) > 50% of Taxa (4 + 5) (± 10%)	Taxa (2 + 3) ≥ 3 (± 2 taxa) Abund (2+3) >10%	May be absent; abund (2 + 3) <10% (or less than 3 taxa) (± 5%)	May be absent
IV *Taxa of intermediate tolerance*					Taxa (4) ~= Taxa (5) Abund (4) >= Abund (5)	
V *Tolerant taxa*		<20% of total abundance (± 5%) (if tiers 2 and 3 ambiguous)	<50% of total abundance (± 10%)		Relative abundance of Attributes 4, 5	Taxa (5) > Taxa (4) (± 2 taxa) Abund (5) > Abund (4)
VI *Indicator taxa*		Tolerant Hydropsych. <= 10% abundance (± 5%)	Tolerant Hydropsych. <= 50% abundance (± 10)%		Hydropsych. may dominate Tubificidae not dominant	Mayflies absent Tubificidae dominate Attrib 5
Combinatorial rules (above indic. By RxC)		(II,2) and (III,2) and (IV,2) and (V.a,2)	(not (II,2) or not (III,2)) and (II,3) and (III,3) and ((V,3) or (V.a,3))	(Not (II,3) or Not (III,3)) and (III,4)	Not (III,4)	

Designated Aquatic Life Uses: Maine Example



<u>The Model Can Serve As:</u>

- **Communication tool for policy makers, managers, and lay public**
- **Common framework to facilitate discussion among disparate management groups**
- **Framework to set goals for a waterbody based on current condition and restoration potential**

On a Nationwide Consensus

- Tier 4 to 5 represent the transition from support of to nonsupport of the CWA goals in regards to aquatic life support.

Bottom Line:
TALU gives us the tools to decide

- What do we want to see in our biota
- Is the use supported
- What sites need protection
- What sites need improvement and to what degree can they be improved
- What sites are beyond remediation

New Jersey's Plans for TALU

- Finalize TALU for invertebrates.
- Incorporate Fin Fish Data.
- Craft Narrative Biological Criteria based upon Biological Gradients.
- Optional: Craft Numerical Biological Criteria based upon Rules defining Tiers.

The End

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