Development of an Index of Relative Condition for Impounded Great Salt Lake Wetlands

Background and Meeting Goals

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Great Salt Lake Wetland Project: A History

>5 years of research (primarily conducted by others around the table) in response to stakeholder suggestions that the wetlands around the Great Salt Lake may impaired by nutrients.

Primary focus of research has been on both **impounded/diked wetlands** (**today's topic**) and on sloped/sheetflow wetlands.

Overall goal of research
"for the specific purpose of developing a wetlands assessment protocol that will be used to develop numeric nutrient criteria for Great Salt Lake wetlands. These numeric criteria are based upon multiple lines of evidence across multiple levels of these wetland ecosystems."

We have since reconsidered the need for numeric nutrient criteria due to significant variation among wetlands in biogeochemical processes, instead we can ensure that wetland uses are protected by measuring designated use support.

Programmatic Issues Surrounding these Wetlands

Historically, Great Salt Lake Wildlife Management Areas (WMAs) have had 3B and 3D aquatic life use designations with associated criteria.

<u>This presents at least three problems</u>

1) The **boundaries are political, not ecological**, and different species use different wetland classes, which alters interpretation of biological uses.
2) **Not all of the wetlands around the Great Salt Lake are expressly protected** and many of these water are important to our stakeholders.
3) **Some numeric criteria**, currently universally applied to all waters in WMAs **may not be appropriate**. In particular, the current DO and pH criteria are not appropriate for impounded wetlands.

Our last changes to water quality standards attempted to address the boundaries to some degree by creating a wetland class for the sloped wetlands, however broader changes to our standards are needed.

Proposed Short- and Longterm Changes to our WQSs

Ultimately…

Create Additional Use Classes for all Wetlands & appropriate changes to numeric criteria, which requires:

- A Use Attainability Analyses (UAA) to justify the change in use;
- Clear and concise definitions of key wetland classes and maps;
- documentation and evidence that new standards will protect the uses.

We are making progress on all of these steps, but work remains for each product.

Short-term Fix…

Fix the most urgent issues, which are the DO and pH criteria in WMA impounded wetlands with a footnote to standards.

All of these proposed changes will require that we have an assessment framework that documents how we are protecting the use!

Key DWQ Programs are Making this an Urgent Concern

We are required, by Federal Regulation, to submit an *Integrated Report* (IR) every other year. We are already behind on our 2008 report, and the next report need to be submitted to EPA on April 1, 2010.

September

- Develop WQS language
- Finalize a draft of the assessment methods
- Discussions with our WQS Workgroup

October

- Peer Review of Assessment Methods
- Request from the Water Quality Board permission to proceed with rulemaking

November /Early December

- Public hearings
- Responsiveness summary

December/January

- Go to WQM for approval of rule
- Submit the new standard to EPA for approval (30-days required)

February

- Submit the IR for public comment (30-days) and DWQ response.

Overarching Goals of Today's Meeting

1. Establish a framework for the development of a tool that **quantifies the relative condition of** Great Salt Lake **impounded wetlands**.
   - Address as many comments, questions, and concerns as possible
   - Objectively rank potential indicators of condition (metrics)
2. Coordination Among Wetland Scientists for Future Efforts
   - Review the First Version of the Assessment Framework
   - Help improve the impounded wetland framework and similar tools for other classes of wetlands.

Measures of Condition and the Clean Water Act

The central goal of the Federal Clean Water Act is…

"to maintain and restore the **chemical**, **physical** and **biological integrity** of the Nation's Waters"

This statement led to key concepts in water quality such as designated uses, narrative criteria, and numeric criteria.

Today we will evaluate the relatives strengths and weaknesses of data that can help quantify the chemical physical and biological integrity of impounded wetlands.

Biological Integrity: the Potential Biological Condition of a Water Body

"the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region." *

*Karr and Dudley (1981), following Frey (1975)

Relevant Beneficial Uses Utah's Water Quality Standards

Class 3: Protection for use by aquatic wildlife.

Aquatic life designated uses are required for all surface waters, due to the "fishable and swimmable" protections required under the clean water act.

Two of Utah's Aquatic Life Uses

d. Class 3D -- **Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.**

e. Class 5E Transitional Waters along the Shoreline of the Great Salt Lake *Beneficial Uses* -- Protected for **infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.**

Measures of biological condition are useful because they:

- directly measure resource quality,
- can simultaneously measure the effects of multiple pollutants,
- respond to pollutants that may be difficult to monitor,
- measure the effects of both point- and nonpoint-source pollutants

Focusing on the Use Instead of Individual Pollutants

The overarching intent of the Clean Water Act is to protect the use, numeric criteria are one means to that end.

If a waterbody is found to be impaired because it is in violation of a numeric WQS, then we must develop a TMDL for each pollutant in violation.

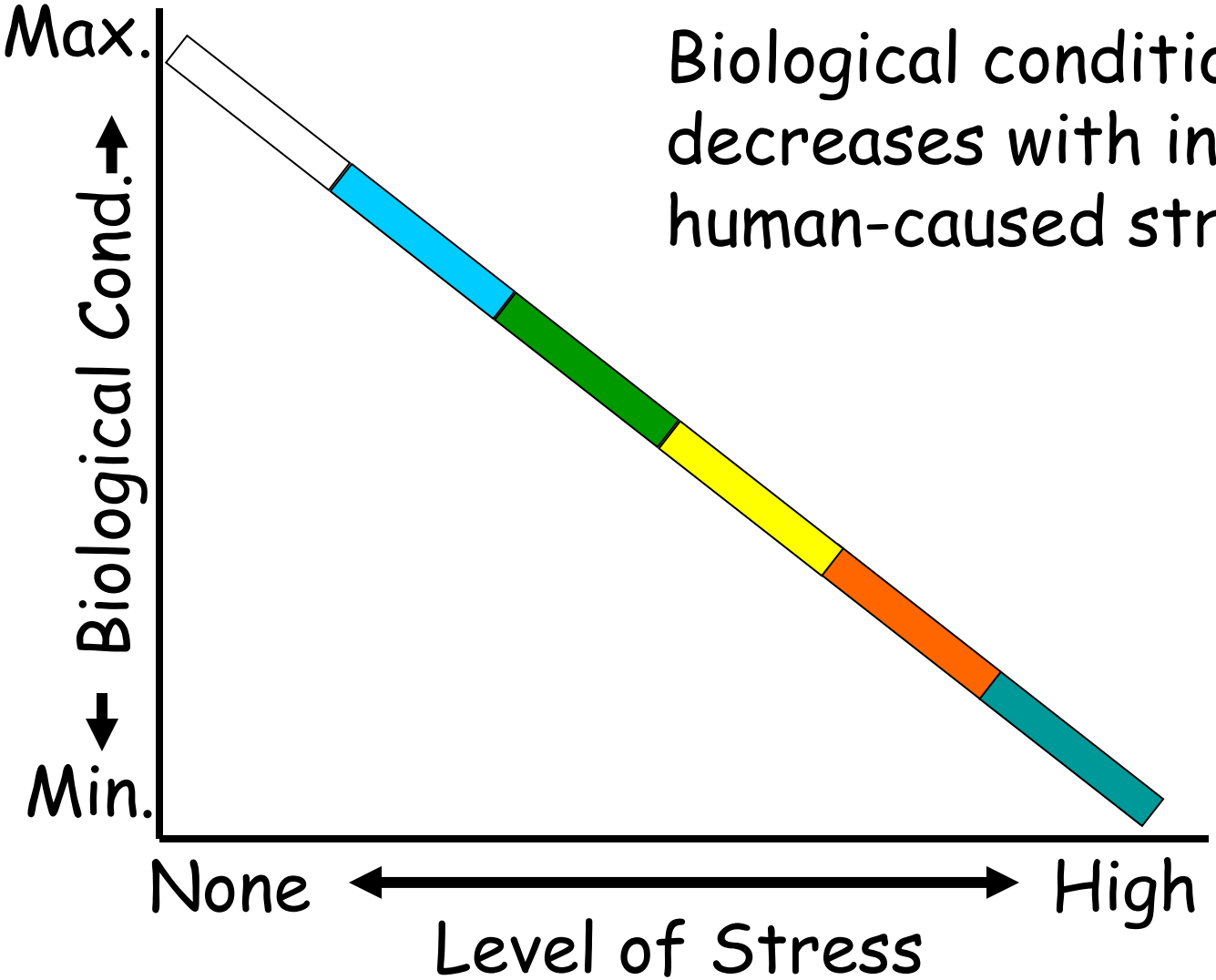
If a waterbody is found to be biologically impaired, then the next step is to evaluate all causes of impairment and then develop a comprehensive plan to address the problems.

Is this just something that we dreamed up?

Biological assessments are directly referenced in Federal rules and regulations and are part of water quality monitoring, assessments and standard development.

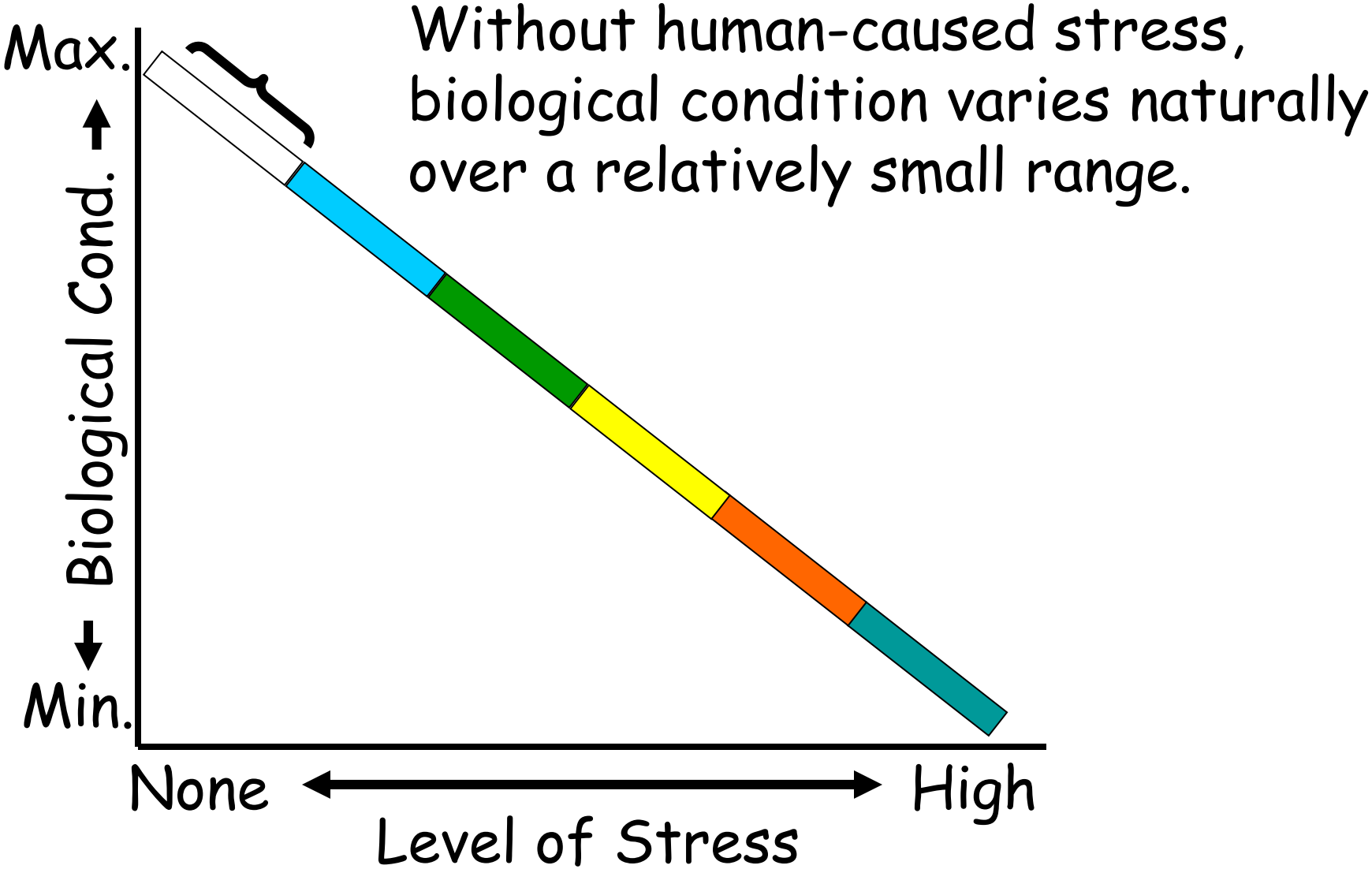
These MMI techniques have been used for over 20 years for these purposes.

Scientific Foundations

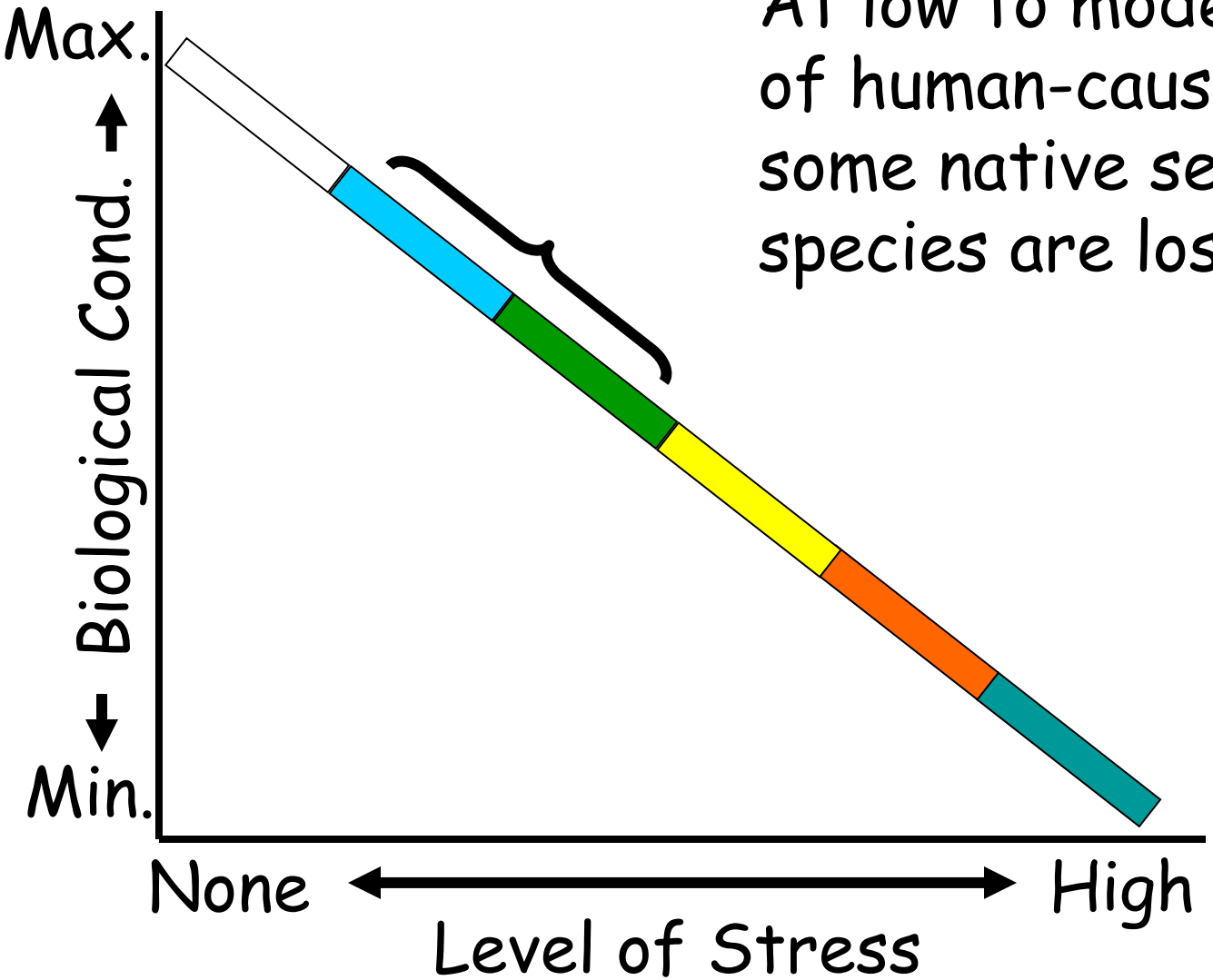


Biological condition decreases with increasing human-caused stress.

Scientific Foundations

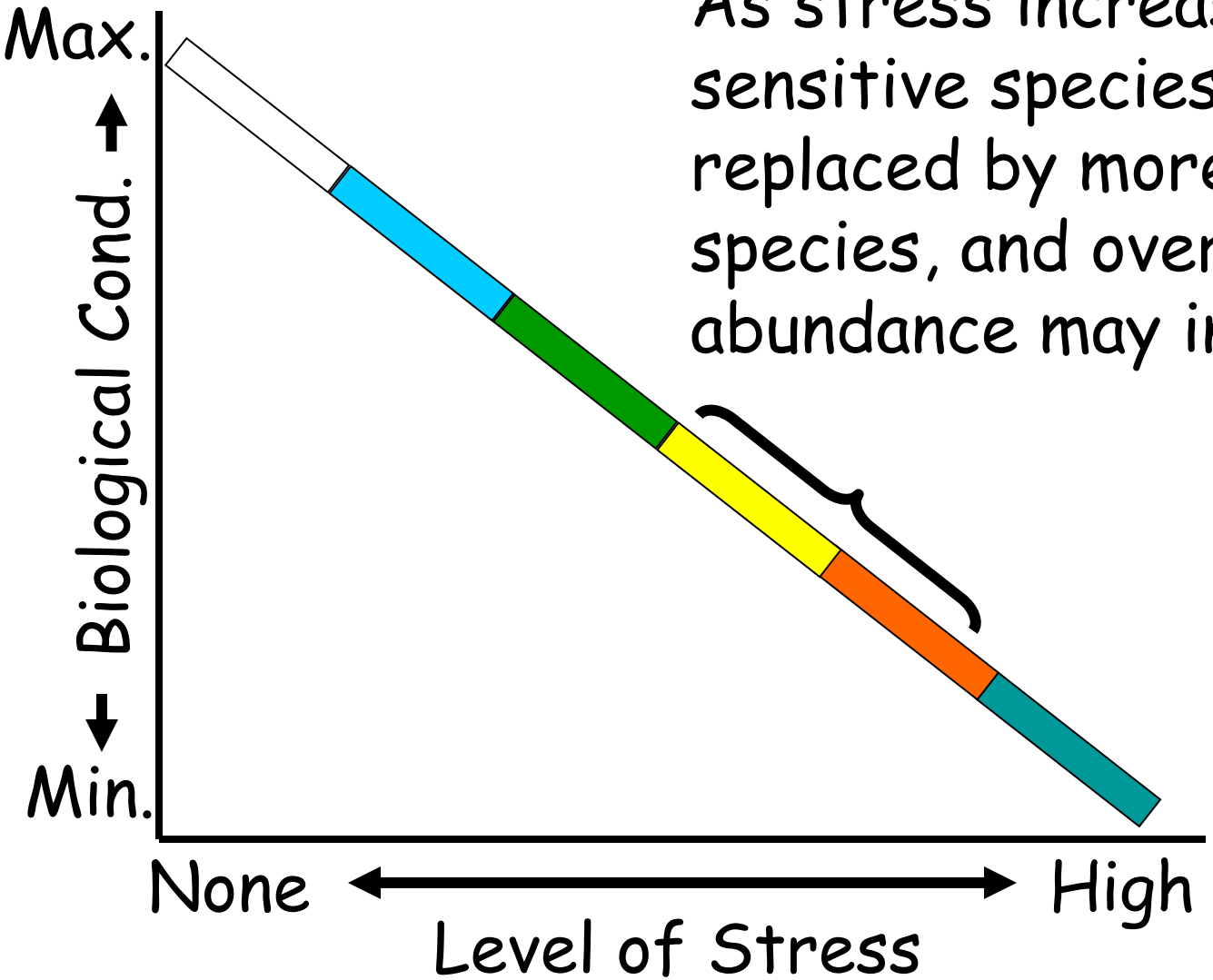


Scientific Foundations



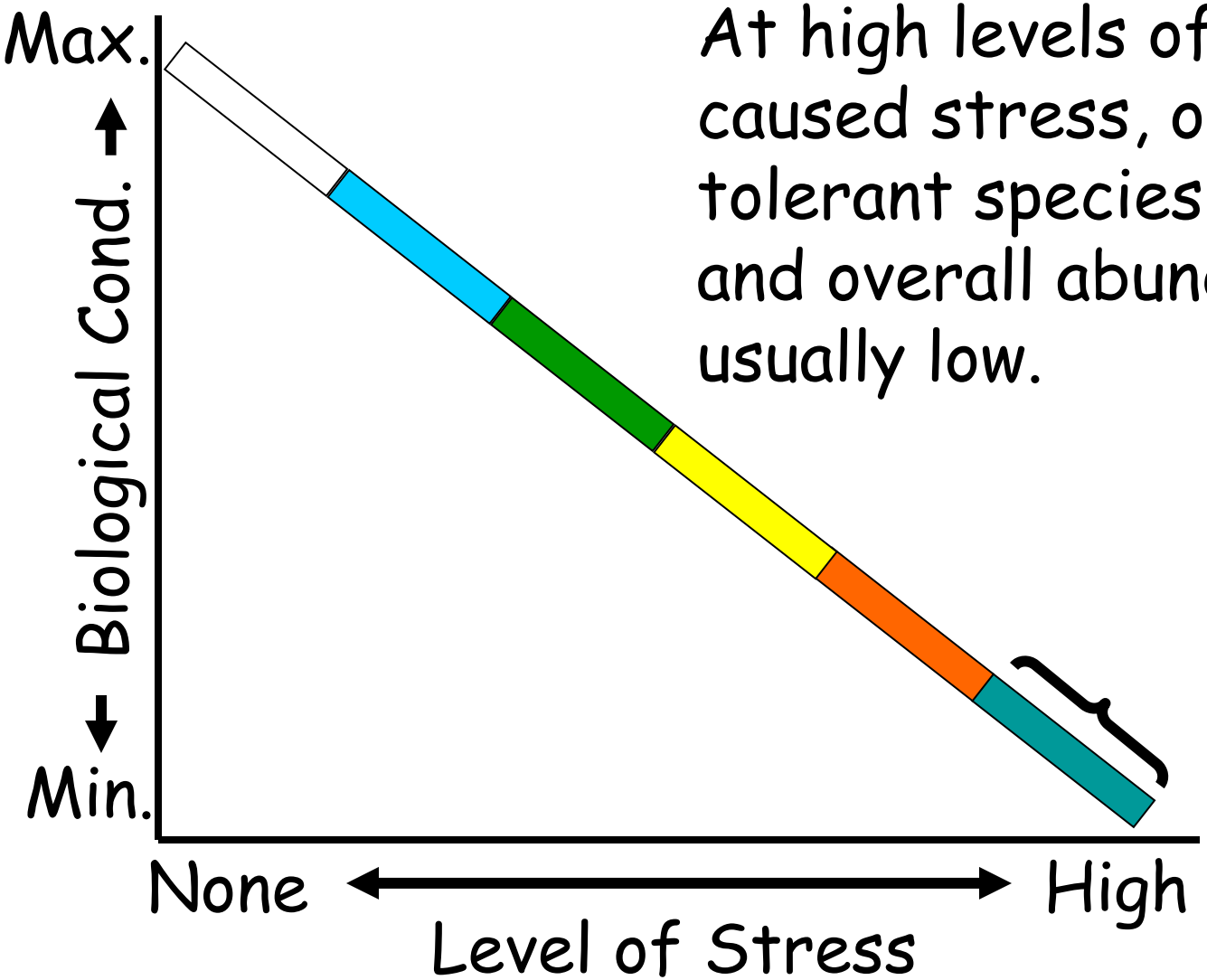
At low to moderate levels of human-caused stress, some native sensitive species are lost.

Scientific Foundations



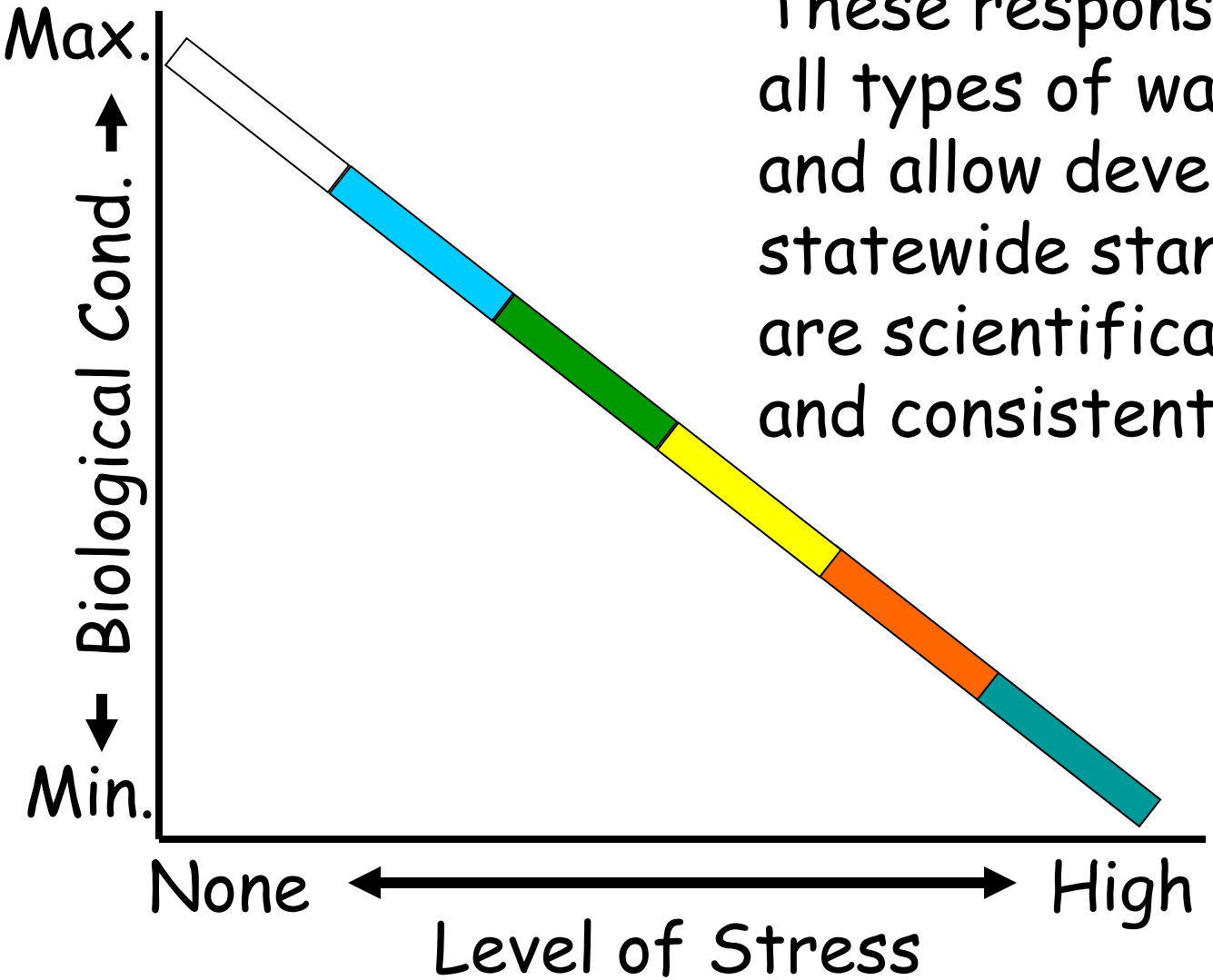
As stress increases, sensitive species are replaced by more tolerant species, and overall abundance may increase.

Scientific Foundations



At high levels of human-caused stress, only very tolerant species occur, and overall abundance is usually low.

Scientific Foundations



These responses occur in all types of water bodies and allow development of statewide standards that are scientifically sound and consistent.

Metric selection for MMIs is typically accomplished with the following steps (from Karr and Chu):

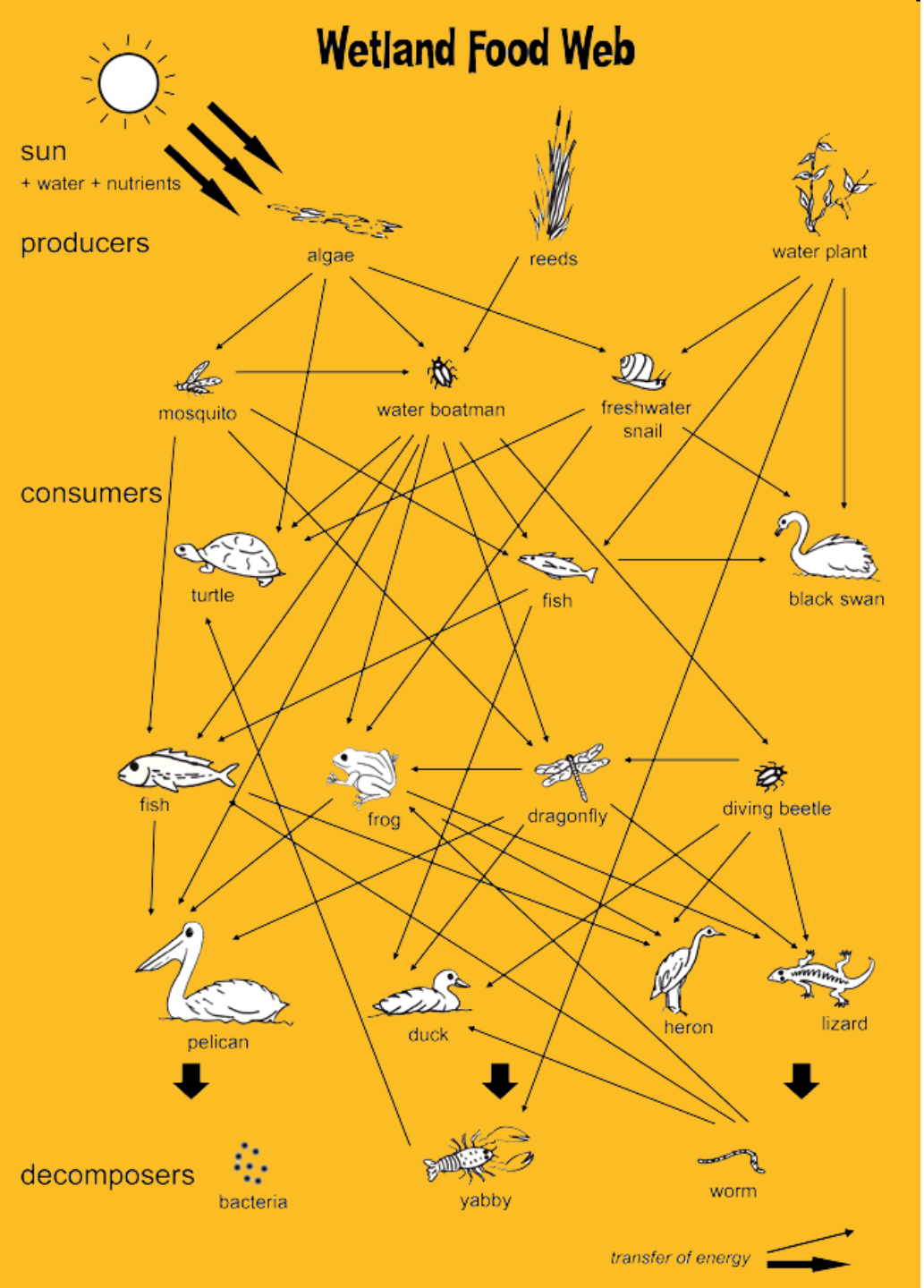
1) **Select candidate metrics** that are grounded in ecological theory and have direct ties to policy. In this case, we want direct measures of physical and biological integrity, as interpreted through water quality standards.

2) Ensure that the **metrics are not strongly correlated** otherwise you potentially overweight a single line of evidence.

3) **Evaluate the metric against potential covariates** that may alter our interpretation of the data.

4) **Evaluate the metric's response to a number of stressors key (see handout)**.

   Consider: 1) We do not expect to see strong, linear relationships because biological responses are rarely linear and often interactive, 2) we hope that different metrics respond differently to different stressors, and 3) if we selected metrics that have key ties to the use, the most important consideration is that the metrics respond predictably to stress.



What to Measure?

EPA policy and regulations clearly suggest that the most assemblages should be selected.

The central idea is to identify sites with potential problems early enough to prevent a collapse of the community.

What to Measure?

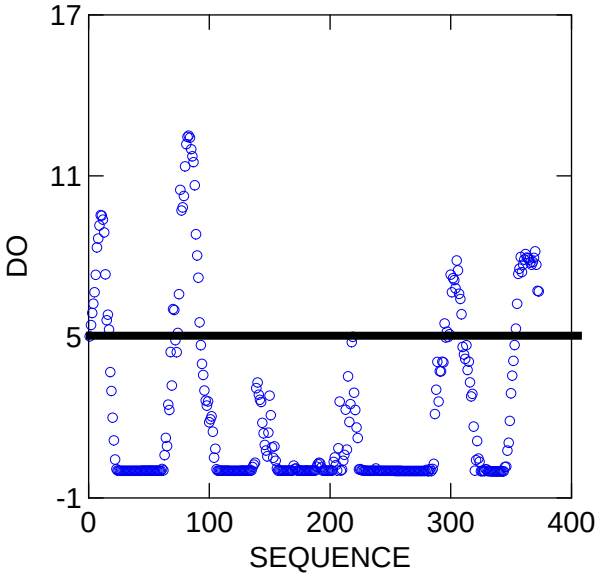
"the capability of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region."

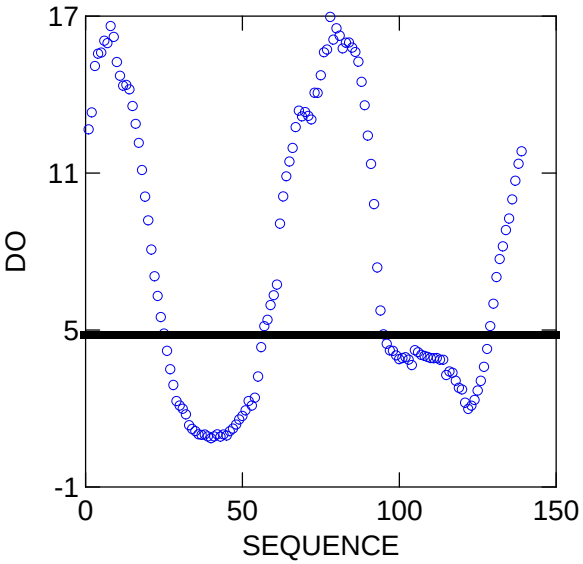
Community Metrics: Richness & Diversity, high diversity generally improves resilience to natural disturbance.

Measure of abundance: Measures like %cover or overall abundance especially if they characterize food or habitat.

Sensitivity to specific pollutants: Comparisons of the relative composition tolerant:intolerant taxa. Can be useful to identify potential causes of impairment.

Water Quality Concerns in GSL Impounded Wetlands





There are some indicators of water quality that if evaluated alone, suggest real threats to the aquatic life of these wetland.

However, these patterns vary extensively both temporally and spatially.

Developing a indicator based on multiple lines of evidence will provide a more comprehensive understanding of where the designated uses of these waters is most threatened.

Wetlands Provide Key Ecosystem Services Related to Water Quality

Wetlands serve as sinks and for sediment and other pollutants, and process nutrients removing them from water.

These functions are natural and valuable, yet their capacity to provide these services is limited.

Indicators of condition vary extensively for GSL wetlands, which suggests that conditions can be improved.

Wetlands drastically decrease nutrient from the Jordan R before they enter Farmington Bay.

Surface Mat Metrics: Ties to Standards

Aquatic Life Uses

- Tie to early senescence of SAV
- At extremes, shading can cause prolonged anoxic condition, which directly threatens all aquatic life in the water column (bugs and zooplankton)
- At extremes can potentially affect the use of ponds by birds, forage compromised

Recreation Uses

- Inhibits boating,
- Aesthetically unpleasing, especially at extremes,
- Tough to walk through and unpleasant; secondary contact recreation

Direct Reference in Narrative Criteria

It shall be unlawful, …for any person **to** discharge or **place any** waste or other **substance** in such a way **as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life** …; **or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life**, …

SAV Metrics: Ties to Standards

Aquatic Life Uses

- *Direct*- measure of desirable part of foodweb
- *Direct*- Food for both ducks and invertebrates
- *Indirect*- Habitat for invertebrates
- *Indirect*- Nutrient sequestration; improve conditions for aquatic organisms; pollutant filtration & deposition (all relates to ties within the food chain)

Macroinvertebrate Metrics: Tie to Uses

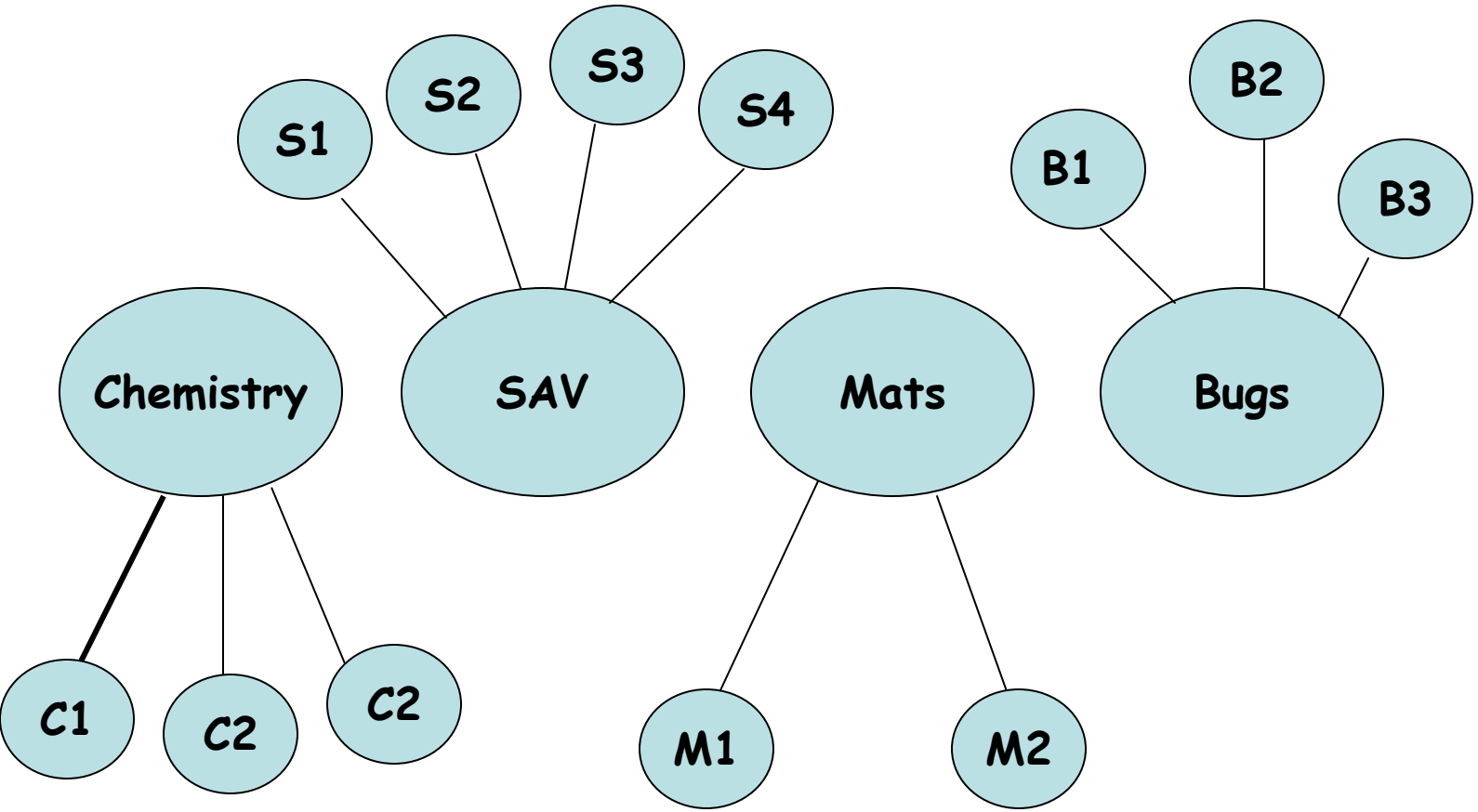
Aquatic Life Uses

- Macroinvertebrates are a key component of wetland food webs, providing food to birds and other "aquatic-oriented" wildlife (i.e., amphibians).
- Macroinvertebrates have multiple feeding strategies and can serve as indicators of functional processes.
- Different taxonomic groups are sensitive to different pollutants.

Recreation Uses

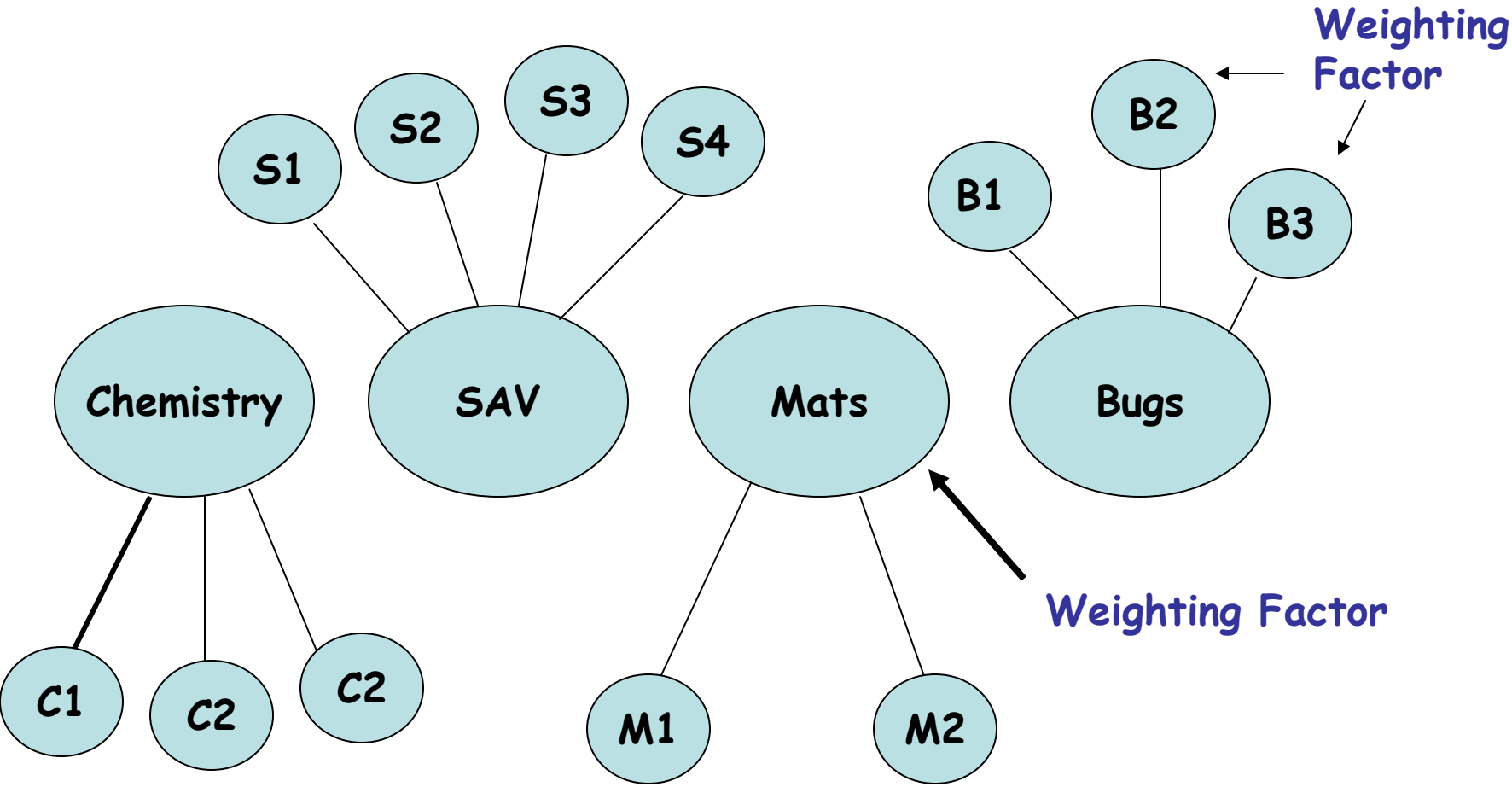
- Recent evidence suggests that corixid beetles are as effective at mosquito abatement as spraying.

Bringing it all Together: Multiple Lines of Evidence



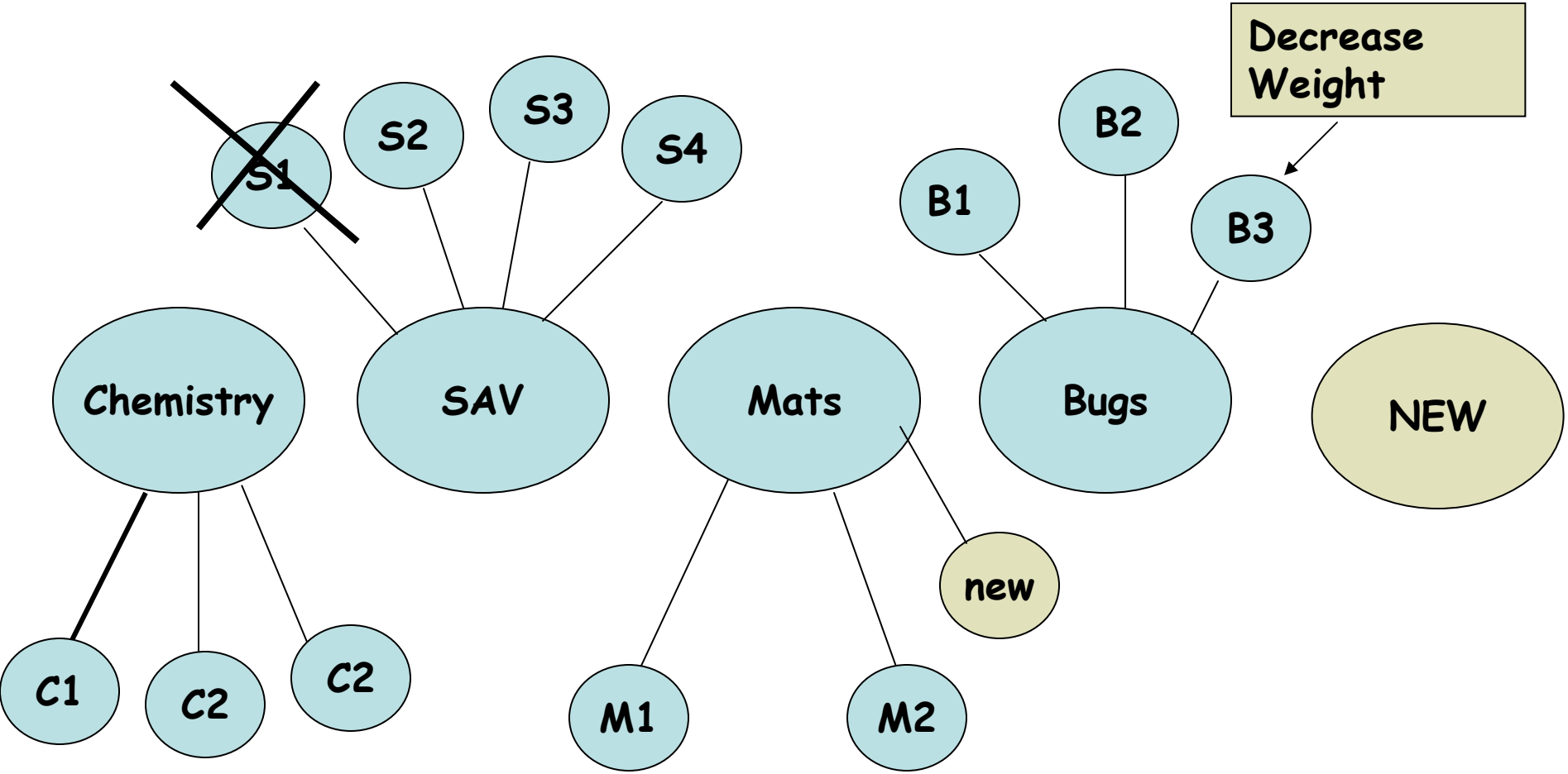
Multiple indicators paint a more complete picture of condition.

Bringing it all Together: Multiple Lines of Evidence



Weighting factors that address scientific uncertainty, weaker connections to condition, etc. can be applied to both individual metrics and different metric classes.

Bringing it all Together: Multiple Lines of Evidence



New scientific evidence, as it becomes available, can be used to decrease or increase weighting factors, add new lines of evidence, or new metrics.

We need your help!

- Multiple lines of evidence approaches require the cooperation of people with different areas of expertise.
- Solutions to any water quality problems necessitate cooperation among key managers.

Today

- Identify the strengths and witnesses of key metrics
- Pose key concerns that we should address with the tool

Later

- Review our first version of an assessment framework
- Help improve later versions with new data
- Develop similar tools for other wetland classes.

Our Discussion Today

We are focused on answering the following question:

How can we best use existing data to quantify the relative chemical, physical or biological integrity of impounded wetlands?

Not…

- The causes of degradation
- key mechanisms to explain current conditions
- discussions about how these measure of condition will be used

All are important discussions, but these discussion can occur later, once we have data from our initial assessment tool.