

Context and Goal of Today's Discussion

- Both biointegrity and biostimulatory (nutrients) projects had science advisory panels formed to provide ongoing peer review of science and its application to policy
- When we combined the projects, we also decided to combine the expertise into one Panel.
- April 19-20, 2017 was the first meeting of this combined Panel, focused on providing feedback on the work plan

Goal: Discuss preliminary panel findings and recommendations and vet Tech Team response

Can revisit when they've submitted their report (but we aren't expecting much to change)

SCIENCE PANEL CHARGE QUESTIONS

1. Appropriateness and suggested refinements to the Biostimulatory-Biointegrity Science Plan (Sutula et al., 2017, Appendix 1)
2. Appropriateness and suggested refinements to the ASCI Work Plan (Theroux et al., 2016, Appendix 2)
3. Statistical Models to Link CSCI and ASCI assessment endpoints to numeric targets for nutrients and organic matter abundance.

Tech Team Responses To Science Panel Recommendations Can Be Put in Four Categories:

- Need context from YOU in order to address
- Practical to implement; incorporate as priorities and resources allow
 - Your input on the relative importance of suggestions are encouraged!
- Implement as part of a watershed approach (not practical to apply to a statewide approach)
- Other Advice—No immediate action needed

We will note which category the comment falls as we discuss them

Need Context from Policy Options to Address

- **Focal Beneficial Uses for Policy:** Science Plan focuses on analyses related to ALU. Do you want to specifically consider other BUs? Examples below show how decisions on thresholds could be supported

REC2

- Cite existing recreational user surveys as basis for a % Cover Target



MUN and REC1:

- Cyanotoxins - Cite EPA drinking water and recreational criteria; OEHHA voluntary guidance



- Other indicators linked to eutrophication (Tetra Tech 2006)

This will be summarized in the eutrophication synthesis

Eutrophication Response Pathways: Relationships with **Multiple** Beneficial Use Types

Beneficial Use	Altered Aquatic Life Diversity	Altered Food Web	Unaesthetic Blooms	Water Quality: Reduced DO	Water Quality: Algal Toxins et al. Metabolites	Water Quality: Increased Turbidity
COLD	X	X		X	X	X
WARM	X	X		X	X	X
SPWN	X	X		X	X	
MIGR	X	X		X	X	
RARE	X	X		X	X	
MUN					X	X
REC-1			X	X	X	X
REC-2			X			X

adapted from Tetra Tech (2006)

ASCI: Confirm that Desire is for Generalized Disturbance Gradient

- Approach is appropriate; don't work force the use of both MMI and O/E if not needed.
- Index tuned to a generalized stressor gradient (similar to CSCI), with stressor diagnostics as a follow up, will be more useful
 - We agree
 - What do you think?

Setting targets for Bio-integrity indices

We discussed two approaches towards setting targets:

- Standard departure from reference (e.g., 10th percentile)
- Link to inferred function and services (e.g., Biological Condition Gradient models)

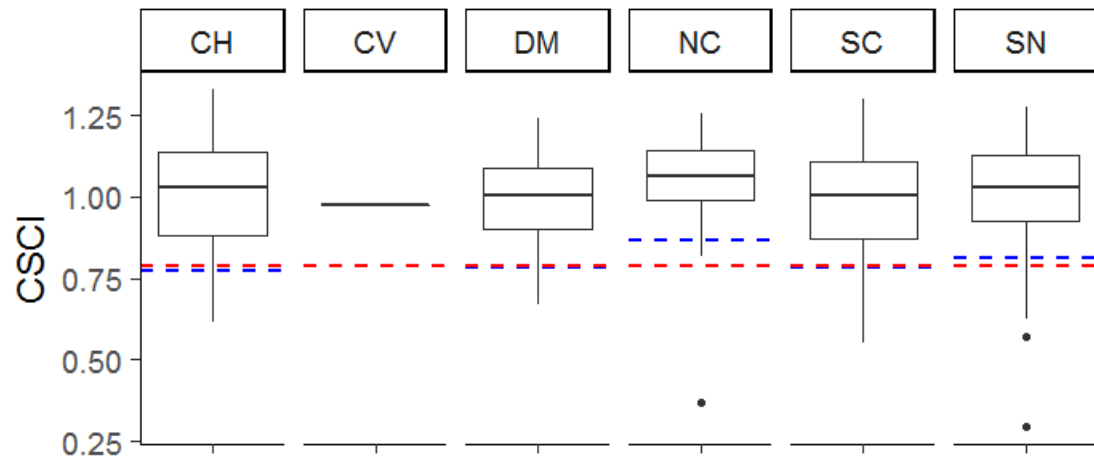
Science panel did not recommend one approach over another, but provided feedback on both

BCG approach

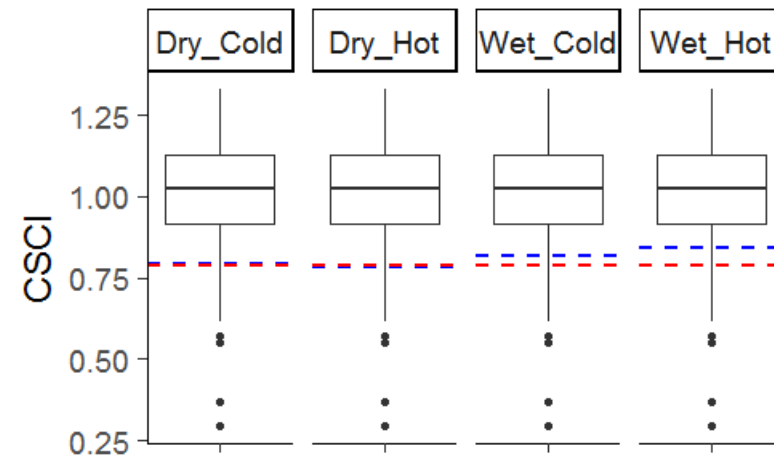
- Panel members agreed that the expert opinion process provides valuable insight about biological response to stress
- Panel feedback concerned interpretation, but not analytical approach.
- Diverse opinions on whether a BCG model adds value. None indicated that it was essential to set thresholds—though some thought it would be very helpful.
- But some argued that indices alone (without BCG model) can provide substantial insight beyond a simple numeric interpretation of condition.
- Some potential benefits/interpretations of BCG model overstated. It may imply too much certainty about our ability to measure ecosystem function

Reference variability

- Although index sets a consistent reference expectation for all streams, natural variability around reference may vary from setting to setting.
- Panel recommends exploring ways to set targets that account for these differences
- Regional (or climatic) thresholds may work, but watch for “boundary effects”



Levene's Test of equal variance: $p = 0.10$



Levene's Test of equal variance: $p = 0.28$

Linking bio-integrity to biostimulatory : Recap

- Goal is to provide technical foundation for decisions on numeric guidance (e.g., a numeric objective) for biostimulatory nutrients or conditions that protect biological integrity.
- Numbers should be applicable in most streams, statewide

Science panel concerns and suggestions

SP: Consider a risk-based approach. i.e., choose a level of biostimulatory conditions associated with an acceptably low risk of poor biological integrity.

Two examples, depending on policy framing

- “What are the ranges and uncertainty in TN concentration associated with a BCG-binned ranges of ASCI?”
- “What is the benthic chl-a concentration and associated error that has a probability of 0.5 of CSCI falling below 0.79?”

Thoughts or Preferences?

Science panel concerns and suggestions

SP: Lots of noise could be reduced through consideration of a number of site-specific factors...

- Nutrient concentration limits vs. loading limits
- Time series of stressor data
- Consider causal analysis (specifically, structured equation modeling)

Tech team response:

We will explore as priorities and resources allow. These suggestions are data intensive, and are well suited for a watershed approach, rather than a statewide approach.

Science panel concerns and suggestions

SP: Combine N, P, etc. into a single “eutrophication stressor” index

Tech team response:

We can explore this option in the future. We agree that interactive/cumulative effects are important. However, objective is to support the setting of targets, not to explain variation in index scores.

This could complicate implementation: Can you put a eutrophication index in a permit? Or a number for one factor that depends on another?

Science Panel Concerns and suggestions

SP: Role of natural factors, part 1: Some stream types may be more sensitive than others to eutrophication impacts, or more noisy.

Tech team response:

We can consider this. In the absence of contrary evidence, we suggest presuming a consistent approach across stream-types.

Again, this might complicate implementation: You would need to determine the stream-type to make assessment, perhaps up-front.

Science panel concerns and suggestions

SP: Role of natural factors, part 2: Some nutrients have natural sources. Model response to deviation from background levels? Consider models developed by Olson & Hawkins (2013) for P and N. (“ELOHA for nutrients”)

$$\text{CSCI} \sim N + P \rightarrow \text{CSCI} \sim \Delta N + \Delta P$$

Tech team response:

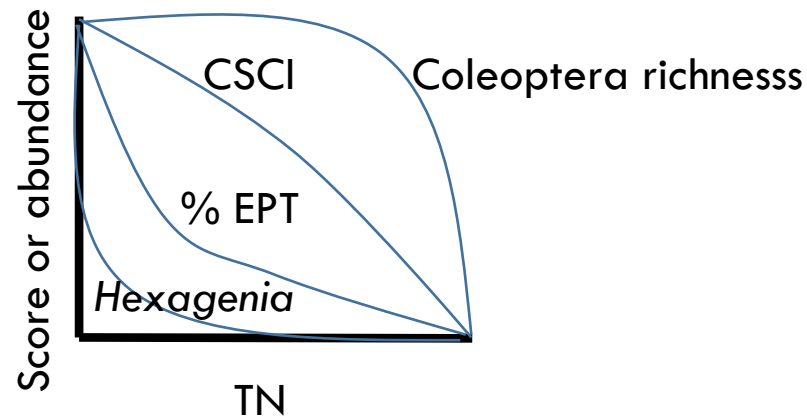
This has been moderately successful in Nevada (Vander Laan et al. 2013), and we will explore feasibility here.

Background levels are important at low levels of enrichment, but trivial when TN > 5 mg/L.

Again, this complicates implementation, with some up-front analysis needed to make assessments.

Science panel concerns and suggestions

SP: Biological indices may “average out” important responses at the metric or taxon level, so your numeric targets may not be as protective as possible.



Tech team response:

We propose to evaluate index-level responses, as these underpin our measurements of bio-integrity. But we can go further if RG and WB staff are interested in these biological responses.