

Biostimulatory- Biointegrity Policy Science Advisory Panel (SAP) Meeting #2

Meeting Summary

December 12-13, 2018

SCCWRP Offices, Costa Mesa CA

MEETING GOALS

- Receive preliminary technical feedback from Science Panel on the draft science products
- Provide an opportunity for policy-makers, technical staff, and stakeholders to pose technical questions and receive input from the Science Panel

MEETING MATERIALS:

- Technical products and key definitions
- Panel charge questions (to be submitted to the Panel by Water Board staff)
- Stakeholder comments and concerns (to be added to the Panel dropbox on or before December 12, 2018)

MEETING ATTENDEES

In-Person or Via Webinar (Science Panel Members are Bolded)

<u>Name</u>	<u>Affiliation</u>		
Chuck Hawkins	Utah State Univ.	Ashli Desai	LWA/CASQA
Lester Yuan	EPA OW/OST	Chris Sommers	EOA/SCVURPPP
Paul Stacey	Emeritus, GB NERR	Karen Wisenbaker	Aquatic Bioassay
Ken Reckhow	Emeritus, Duke Univ.	Scott Johnson	Aquatic Bioassay
Cliff Dahm	Emeritus, UNM	Dawn Koepke	McHughs Koepke
Jan Stevenson	Michigan State Univ.	Assoc.	
Lori Webber	State Water Board	John Rudolph	Wood Environmental
Jessie Maxfield	State Water Board	Karen Ashby	LWA/CASQA
Joseph Westhouse	State Water Board	Tom Grovhoug	LWA/CASA
Rebecca Fitzpatrick	State Water Board	Josh Westfall	LACSD
Martha Sutula	SCCWRP	Renee Pinel	WPHA
Rafi Mazor	SCCWRP	Stephen Opot	LA SAN
Susie Theroux	SCCWRP		
Marcus Beck	SCCWRP		
Chad Loflen	San Diego Water Board		

Via Webinar

<u>Name</u>	<u>Affiliation</u>		
		Lester Yuan	EPA OW and OST
		Rebecca Fitzgerald	State Water Board

Shirley Birosik	LA Water Board	Brian Laurenson	LWA
Steve Butkus	North Coast WB	G Fred Lee	Fred Lee Assoc.
Ed Cheslak	PG&E	Nick Martorano	State Water Board
Janis Cooke	Central Valley WB	Stephen Maurano	EPA Region 9
Jim Davis	Not listed	Rob McCarthy	Water Board
Bonnie de Berry	EOA Inc.	Danny McClure	Central Valley WB
Ali Dunn	State Water Board	James Nunez	MBC Aquatic
Diana Engle	LWA	Peter Ode	CA Fish and Wildlife
Rich Fadness	North Coast WB	Michael Paul	Tetra Tech
Betty Fetscher	San Diego WB	Paul Randall	EOA Inc.
Terrence Fleming	EPA Region 9	Ann Roseberry Lincoln	Tetra Tech
Rebecca Franklin	Sacr. Sewer District	John Rudolph	Wood Env.
Suzan Given	OC Watersheds	Scott Thomas	Stetson Engineers
Andy Gordus	Not listed	Jared Voskuhl	CASA
Cynthia Gorham	San Diego Water Board	Jo Ann Weber	San Diego County
Tom Grovhoug	LWA	Debbie Webster	Central Valley
Lisa Haney	OCSA	CWA	
Vanesa Iniguez	Not listed	Josh Westfall	LACSD
Emiko Innes	LA County DWP		
Bill Isham	Wood Env.		
Ben Jessup	Tetra Tech		
Craig Johns	Calif. Resource Strat.		
Michael Johnson	M. Johnson Environ.		
Roxolana Kashuba	Exponent Inc.		

MEETING SUMMARY

December 12, 2018

9:15-9:30 CONTEXT FOR BIOSTIMULATORY – BIOINTEGRITY SCIENCE PRODUCTS AND REVIEW OF PANEL CHARGE QUESTIONS

Participants introduced themselves. Notably, sector leads from CASQA (Ashli Desai; AD), Karen Ashby (KA), and Chris Sommers (CS), CASA (Tom Grovhoug (TG) and Josh Westfall (JW)), and agriculture (Renee Pinel; RP) were present.

Martha Sutula (MS) presented the goals of meeting, meeting format and agenda and the process for interactions. Lori Webber provided an overview of scope and status of combined policy. Martha Sutula described science products. See presentation #1 for details.

Discussion ensued. Chris Sommers asked if we had prepared written responses to earlier comments (first panel meeting). MS answered yes. The Panel was briefed in July 2017 on tech team preliminary responses to Panel recommendations following the April 2017 meeting. MS promised to send the Panel report and the presentation summarizing tech team responses to the SAG and RG (and she emailed it that morning).

9:30-10:15 ADVISORY GROUP CONCERNS ACROSS ALL TECHNICAL PRODUCTS

TG presented an overview of concerns from POTWs (see presentation). In particular, he noted that the technical products address preferred metrics/conditions in high quality Wadeable streams, tools developed to identify these locations, and suggested biointegrity/beneficial use (BU) links to eutrophication. What products don't address includes: information needed to set policy that are not high quality, whether metrics can be achieved (ever), whether desired outcomes can be achieved. Additional needs include: technical work to help answer whether reasonable management measures will resolve/prevent biostimulatory and biointegrity problems, consideration of management options that are feasible, tools to link management to metrics, more work to improve connection between metrics and desired BU outcomes. Discussion ensued. Lori Webber said that she understand these concerns, including those about "not high quality" streams. TG indicated that the POTW sector is supportive of developing a "categorical" and a "watershed" approach.

AD presented comments from stormwater agencies (see presentation slides X through Y). She expressed agreement with POTW concerns, and wanted to make sure technical products allow Water Board to consider multiple options (and don't preclude any options before policy decisions are made). Technical products should not include implied or explicit policy decisions, so science products should include disclaimers. Products need to include more work to evaluate achievability of proposed objectives, how is this science applicable to wet weather events, does not address non-perennial streams, should address regionality, we want a categorical approach for waters in developed landscapes (i.e., expectations for different waterbodies that have constraints).

Chuck Hawkins (CH) asked for clarification of meaning behind the term "categorical". AD explained that it's a "type" of waterbody (e.g., constrained channels, engineered channels, or ag drains), which may have a different set of expectations.

CH and Jan Stevenson (JS) asked for explanation of the types of analyses that would support a range of options. AD confirmed that evaluating multiple criteria would satisfy this concern, and cautioned that technical documents seem to indicate a single threshold should be used. She noted that many reference streams in certain regions don't meet the thresholds in technical documents.

Ken Reckhow (KR) asked if the types of tools POTWs want include mathematical models to evaluate how stormwater controls affect endpoints. TG replied yes, we need models to help predict whether we can achieve TN of 0.32 in non-high quality streams. TG indicated that it could be done on a watershed basis, but also on a categorical level as part of policy development (e.g., ag drains in the Central Valley). We need to assess variability in these settings and models can help.

KR asked if the Water Board is expecting to use or develop models to allow these analyses. LW replied that the state does not have this expectation, but is considering options--everything is on the table for developing policy. KR indicated that this is different from requesting a predictive models that relates controls to meaningful endpoints. Jessie Maxfield (JM) commented that the Board wants to consider as many options as possible at this time.

KA commented that the use of single thresholds (e.g., in the channels in developed landscapes analyses) should instead reflect a range of expectations.

JS commented on the need to translate “jargon” among scientists, policy makers, and stakeholders.

Renee Pinel (RP) commented that the ag sector is playing catch-up, and that the process has changed from a narrative goal to a potentially numeric program. She expressed concern that the scientific process is operating in a vacuum. Science is moving forward in a way that ignores impact on policy. Science shouldn't drive the policy. The ag sector wants to be more engaged.

10:15-11:15 ALGAL STREAM CONDITION INDEX

Susie Theroux (ST) presented developments for the ASCI (see presentation materials). Sector leads then presented their concerns, with questions for the science panel.

AD described overarching concerns that the indices have sufficient precision and accuracy, that the absence of trait information may hamper ASCI performance, that the indices consist mostly of increaser metrics, and that regional variability should be considered (particularly in the Central Valley, where there are few reference sites). Adoption of the ASCI into policy context may be premature.

Chris Sommers asked for clarification on “intermittent”. How are we defining perennial vs ephemeral vs intermittent, should we consider these concerns?

Paul Stacey was unclear on criteria to define reference/stressed/intermediate sites. ST referenced the table in the manuscript.

Josh Westfall (LACSD) expressed general concern that the ASCI attempts to do two tasks at once: Condition assessment and causal assessment. It may not be good at discriminating reference from intermediate sites--we don't need an index to tell us that a concrete channel isn't in reference condition. Lack of modeling is a concern, particularly for under-represented setting. Expressed some concern about reference conditions – some regions were under-represented as reference sites (low elevation, large watershed, low slope).

KR asked for clarification of why predictive modeling didn't improve MMIs, and asked for the term "modeling" to be defined where appropriate.

Lester Yuan expressed concern that, unlike the O/E, the MMI doesn't offer a readily interpretation, and that the selected metrics don't directly speak to measures of biological integrity. He suggested articulating how this compares with other metrics and indicators in terms of quantifying ALU support, as opposed to creating a tool to discriminate between reference and stressed sites.

Cliff Dahm expressed support for investigating the performance of the ASCI in intermittent streams, noting the extent of these streams in arid regions. Raphael Mazor noted that the extent of intermittent streams in the calibration data sets is unknown. Susie Theroux noted that she did not exclude known intermittent sites from the calibration data sets.

Jan Stevenson asked about the concepts behind biological condition, and suggested evaluating some of the non-selected proto-MMIs to see if they offered more interpretable metrics. Jan echoed Lester's concerns, noting that "high copper indicators" is more of a stress indicator than a biointegrity indicator. There is a need to reframe discussion about how metrics are indicators of biological condition vs indicators of specific stressors.

Chuck Hawkins noted that Sarah Spaulding had better success with diatom O/E models under modified lab protocols (noting rare species not detected by fixed counts, using image scanning methods), but commented that this information may be too late to be useful. Susie Theroux noted that molecular methods may improve detection of rare species in samples.

Chuck Hawkins asked if we compared the range of conditions at ref sites to the test data. Raphael Mazor commented that we relied on analyses of Ode et al. (2016), which evaluated a nearly identical data set. Chuck suggested redoing some of these analyses, given concerns about the non-predictive index.

Chuck Hawkins would like to see more plots showing how metrics and ASCI varied in response to specific conductance among reference sites only.

Science panel discussed a few topics that may account for lack of effective models. Lester noted the high dissimilarity among repeat samples (which metagenomics did not improve); Susie noted that preliminary results in California suggest improvements in molecular samples. Jan asked about ecoregional approaches; Susie commented that these approaches did not improve performance. Chuck advised against over-interpreting the lack of geographic clustering for the O/E models, but suggested evaluating seasonal and annual variation, noting that in NC, day of year was the best predictor for a bug O/E index.

Paul Stacey commented that using TN/TP as stressors was difficult, as concentrations do not reflect loading. Can we look at TN and TP in algal biomass vs. water column? Are we really measuring stress? Martha commented that, without watershed models, we treat streams as chemostats. She's a fan of using concentration rather than load in riverine systems, because its extremely difficult to constrain nutrient mass balance in streams.

Chris Sommers clarified that we are talking about measurements collected at one time, during bioassessment (baseflow conditions), ignoring variability

Jan Stevenson noted that reference sites are typically species diverse, with great variability among sites. Predicting which species you find may depend heavily on local factors (and thus be hard to predict). In contrast, it's not hard to predict what percent of species are characteristic of reference-like conditions. Metrics vary less than species identity.

11:15- 12:00 BIOLOGICAL CONDITION GRADIENT MODEL

Raphael Mazor (RM) presented analyses on biointegrity goals (see presentation). Sector leads then presented their concerns, with questions for the science panel, then discussion ensued.

Karen Ashby commented that the crosswalk slide suggests policy options, and that urban streams and channels that are highly altered that there might be a different range of expectation, where we might need to consider a different CSCI for these sites. This is a policy option we would want the tools to support if the board wants to go in that direction.

Chuck Hawkins says there is a concern between what science can do and can't do. Science can tell you whether the values you observe are in accordance to a reference condition. Science can't imply that there are these specific values that say should be used. Karen agrees

and asks the science panel to evaluate the technical documents to see if they support a range of options. Lori Webber says from the Water Board perspective, there are issues with some water bodies never reaching these expectation, but that we still take care in restoring them.

Ken Reckhow noted that thresholds is only one piece of the policy analysis, and that these is a cost to achieve it. Many times water quality standards are based on sound science but may not make sense from a policy perspective.

Paul Stacey: the science tells you different things and then it really becomes a policy decision. We shouldn't try to hard to acclimate the science to the policy. This is a pretty good model.

Josh Westfall appreciates the technical work behind the BCG, but comments that there is a disconnect between these thresholds and reference thresholds that complicates communication (e.g., some thresholds > 1). Raphael Mazor said that this was interpreted to indicate that some reference sites may be affected by low levels of disturbance.

Jan Stevenson asked about the reluctance of some BCG members to assign sites to Bin 1. Raphael Mazor commented that the was discussion among both panels, and that the algae panel also were reluctant to assign sites to Bin 6.

Discussion of the original purpose and motivation for the BCG model ensued. Chuck Hawkins noted that BCG is better suited as a precursor for index development, not as a validation of index performance. He suggested that we may be "packaging" the BCG incorrectly. Lori Webber noted that the BCG could be a good communication tool.

Chris Sommers noted that the reference and BCG thresholds don't align with each other, and the Water Board may have a policy that protects different ecological states if it applies a 10th percentile reference threshold for both CSCI and ASCI. Raphael Mazor noted that there isn't an expectation that the two approaches result in identical thresholds.

Paul Stacey noted similarities between California's and New England's experience.

Someone noted that table 3 was missing from supplements. **Action Item: Martha Sutula will find this missing table.**

Lester Yuan suggested communicating uncertainty around BCG thresholds. Ken Reckhow cautioned that uncertainty should be displayed in a way that supports decision makers.

Paul Stacey suggested that a margin of safety would be appropriate.

12:45-1:45 PM CHANNELS IN DEVELOPED LANDSCAPES

Marcus Beck presented the model and maps identifying potentially constrained streams (see presentation). Discussion ensued.

Ashli Desai noted that there was confusion about the choice of thresholds in the technical documents, but wants to see the Water Board consider options for evaluating constrained streams. There are concerns about whether the models are appropriate for intermittent or ephemeral streams. Is a consistent (statewide) approach warranted? Are other tools helpful for highlighting constrained streams?

TG : POTWs see usefulness in the model, and agrees with stormwater concerns.

In response to questions from Chris Sommers, Marcus clarified that the San Gabriel watershed contains both perennial and intermittent streams.

Ken Reckhow suggested exploring mechanistic or causal models (such as structural equation modeling -SEM). Raphael Mazor noted that we tried to follow previous national studies by EPA (Hill, Fox). Martha noted that Betty Fetscher used SEMs in earlier work.

Cliff Dahm noted that the term “constrained” has geomorphic connotations, and that the concepts for floodplain re-connectivity may be related. Can these tools help evaluate flow criteria?

Chuck Hawkins noted efforts in Arizona to map non-perennial streams. Raphael Mazor noted related research to accomplish this.

Chuck Hawkins commented on the need for field validation, given known errors in StreamCat and NHD+.

Paul Stacey distinguished between restoration potential and recovery potential. Open space allows recovery potential. He also suggested evaluating riparian land use in a more nuanced way than StreamCat offers.

Cliff Dahm: You said your model doesn't work very well in the sierras area, are you finding your predicted csci scores lower than the range to be predicted. Chuck Hawkins: you want to know the biological potential of different stream sights, theoretically if you left them alone for 100

years it would recover where as with the LA basin that's a completely different story. Marcus: with the sierra nevadas even though the model was less precise in that region, its telling us based on the landscape potential those sights are more likely to maintain biological integrity. Marcus: if you wanna go way back hydraulic mining issues have caused a huge problem. And you wonder where is that shifting baseline.

Lester Yuan noted that technical documents don't link this work with biostimulatory response models. Raphael Mazor commented that these links will be explored based on feedback from advisory groups and guidance from the Water Board.

BIOSTIMULATORY SCIENCE PART I

Martha Sutula presented the conceptual model and a review of indicators of eutrophication (See presentation). Sector leads then presented their concerns, with questions for the science panel. Discussion ensued.

Ashli Desai asked the science panel to comment on the validity of the assumptions and framing. There are concerns about the use of AFDM and % cover leading to false positives. Also, observations of high AFDM with low chl-a are concerning.

Tom Grovhoug commented on nuances in the assumptions, noting that assessments should be more integrated and look at both substances (e.g., nutrients) and conditions (e.g., flow, light). He is concerned that causal assessments may presume nutrients as a cause of poor biointegrity.

Josh Westfall noted high variability, and the need to consider uncertainty. He suggested evaluating multiple lines of evidence and robust causal assessment to mitigate this uncertainty, but noted challenges in permit enforcement.

Ken Reckhow: You could do an analysis to see how sampling frequency would be useful to making a decision. Martha Sutula : there is a category in the science plan called implementation support that we left pretty undescribed. The analyses that you are describing would fit well within the workplan, once the policy options under consideration are described.

Jan Stevenson: Why aren't human activities that produce biostim factors placed in conceptual model? It's important for transparency. Why didn't you include sources in conceptual model? Martha: that's a good question, we started on the road to describe the drivers and nutrient sources. The USGS sparrow modeling was more comprehensive—though the website is down now. The biointegrity program is producing info on hydromod and environmental flows. Chuck: CADDIS from EPA has published a number of conceptual models could be a good resource.

Chuck Hawkins: I'm glad you separated indicators with regards to sestonic and benthic. I wanted to point out measuring sestonic chl-A in streams may be a really good thing to do, it seems like since the benthic is always sloughing to some extent it gives you a repeatable way of what the algal impact is doing to the bottom of the stream. Martha: in general I think it will be important for us to think about water column chl-A and how it links to sestonic toxins from cyanobacterial blooms; in many watersheds our wadeable streams are downstream from reservoirs, so we will likely recommend that water column chl-a and particulate cyanotoxins be monitored in wadeable streams going into the future.

Paul Stacey: Generic conceptual model can be modified. Include interactions and entanglement of stressors. It can be a mistake to use biointegrity endpoint to reflect biostimulatory stressors. Conceptual model is infused with policy (e.g., designated uses). Ecosystem goods and services are in tune with a functional ecosystem. Martha: We have to crosswalk ecosystem services to designated uses and be transparent. Ken disagrees with Paul: Yes, designated use is a policy decision. But many designated uses (once selected) are in the scientific arena. Science tells us if use is achieved. Extend bayes-net from candidate criteria to a quantified measure of the designated use.

Paul Stacey: How frequently should they be measured? Tough question. We don't have anything in front of us about data quality objectives, QAPP, etc. You should write up the QAPP. Do data reflect processes or state?

Cliff Dahm: Three things jump at me. 1) Limiting nutrients. 2) Uptake rates. Look up STREAMIS EU project for how these can be used. 3) Assessment of whether the source of biostim is point vs. nonpoint.

Jan Stevenson: There's lots of research bridging social sciences to link this to designated uses and stakeholder values. Both conceptual and empirical models.

BIOSTIMULATORY SCIENCE - PART 2

Raphael Mazor presented update on biostimulatory response models, and Martha Sutula presented synthesis and comparisons with criteria from other regions/literature (See presentation). Sector leads then presented their concerns, with questions for the science panel. Discussion ensued.

Ashli Desai noted that some thresholds are lower than observed in reference, and that other stressors may be at play. Analyses show correlation, not causation. There may be temporal

variability in these relationships. For SoCal, a significant percentage of sites will not reach thresholds for the various indicators, e.g., over 40% of reference sites would exceed AFDM derived for Ref10 threshold. How do you develop policy in this context even if ref sites are not meeting potential thresholds? Related, there are regional differences and what that means for the thresholds, they are concerned that an assumption was made that all sites across the state will respond the same to biostim factors. Finally, a concern regarding biostim/bioint assumptions, there are clearly cases where other stressors affect BI, related to correlation/causation issue. Ken Reckhow asks, what's your expectation when you expect science to show causation? Are there other modeling approaches that can support this?

Tom Grovhoug noted that thresholds are well below achievable effluent limits. POTW – (Tom) numbers in the range of 0.3 TN, etc. are not practical for effluent-dominated streams, super impossible to do this. How would the policy work in effluent-dominated streams? Also provided an example from Delta showing that there was no comparable benefit in applying a conservative objective. Overall, be cognizant of statewide policies that may affect regulated parties, e.g., NPDES, what will be the benefit of doing so? Josh – upgrades would be very expensive and impractical, targets impossible to meet. One option is to push burden to WB, we'll deal with this through implementation. Other option, are there other meaningful indicators we can look at that could be attainable given addl or other biostim factors? This could get at incremental protections if other targets are used. Paul – no such indicators exist... we have exceeded ecosystems capacity to assimilate.

Tom went on to add that DOC numbers from CalFed were first evaluated in terms of achievability, followed by potential benefit--we saw no benefit in the Delta. Ken Reckhow said he disagreed and that their work on a reservoir TMDL shows how to use DOC impacts on water treatment to link to eutrophication.

Josh Westfall noted that thresholds may cost hundreds of billions of dollars to achieve, and lead to other environmental problems (carbon footprint, brine disposal), and still might not improve ALU or REC benefits. Two paths forward: 1) Shift burden to Water Board and address through implementation, and 2) Science panel can weigh in on meaningful ecological indicators for tracking incremental improvements.

Paul Stacey disagreed that these challenges suggest a problem with the indicators.

Cliff Dahm noted that alkalinity is less problematic an indicator than pH

Chuck Hawkins expressed concerns about getting different biological responses in different settings. Jan Stevenson suggested classification to account for natural variability.

Lester Yuan asked how risk-based numbers should be used in policy?

Paul – these approaches are compelling for use of state variables as biostim. But consider another perspective of what a changepoint/effect means – we can normalize effect across diff watersheds. For example, think about the problem in terms of enrichment factors, i.e., no enrichment = 1 lots of enrichment = 50. There was good correspondence with BCG and changepoint. This works well across scale, location, ecoregion, etc. Enrichment factors could be a useful biostim factor in addition to state variables.

Cliff – there are situations in California that we can treat for, e.g., SAC POTW upgrade, nitrification can have positive effects. Also, pH is difficult to measure, may not be easy to get a handle on this.

Chuck – worry about contingency, i.e., you will get different responses in different settings due to natural variation.

Jan – classification, tiering are needed. Are current analyses aren't quite there to allow us to do this.

Lester – issues with regression, high quality water need to be discussed, framing of analyses and how they're presented (what to use for, what not to use for) is very important.

RECAP OF STAKEHOLDER PERCEPTIONS AND CONCERNS

[Go-To meeting disconnected at 4:30 pm, so no comments from the phone were possible apart from Lester Yuan or Rebecca Fitzgerald, who were called by cell phone]

Chad Loflen (Regional Board 9) noted that his agency is establishing its own biological objectives based on the CSCI. They are evaluating CSCI scores at intermittent reference sites, finding that the index correctly indicates reference conditions, probably because the CSCI calibration data included sites that were subsequently confirmed to be intermittent. This may not be true in other regions.

Paul Stacey: The watershed approach is good because it's an ecosystem approach, applicable across waterbody types.

Ken Reckhow: It's best to apply criteria at the point in the causal chain closest to the endpoint (e.g, nutrient concentrations, not loads or drivers). Paul Stacey: That's a matter of opinion.

Rebecca Fitzgerald: We want to hear about the adequacy of the science, and work towards understanding reference conditions and high quality streams. We should take into account what is reasonable, balancing this against a mandate to protect full uses. We want to respect existing permits.

December 13, 2018 (3 pm)

PANEL REPORT OUT WITH INITIAL REFLECTIONS ON CHARGE QUESTIONS

Martha Sutula reconvened the meeting, reviewing goals for today.

Science Panel introduced themselves.

Jan Stevenson described process. We split chapters among panel members, shared notes from yesterday/review, and gathered our own thoughts in the same room. We then shared thoughts in a single document. One individual would take a lead role in addressing documents/charge questions. We have a quick overview of initial thoughts; we will follow this up with detailed review of the documents, to be shared towards end of January. All comments here are to be considered preliminary, pending detailed review of the materials.

PRELIMINARY REFLECTIONS ON ASCI (THEROUX ET AL.)

Jan Stevenson was the lead reviewer on ASCI. He reviewed the ASCI material, but other colleagues provided valuable perspectives. We addressed charge questions/stakeholder concerns, although our comments may not be directly linked to these questions.

We were impressed with the ASCI and how it as done, generally think to being used and implemented. Still digesting information. We think it's close to being ready for implementation. Performance was high, but there are opportunity to explore improvements. Lots of possibilities (some of which the tech team has already done). The tech team has done the state of the art science, including stuff that hasn't yet been done with algae (or even invertebrates).

Concerns exist why the O/E index didn't work. It would be desirable if it did work, but it's not necessary as long as we get good discrimination. Figuring out why it didn't work can help us understand the ecology of the systems here.

Site-specific modeling to account for natural variability among sites didn't work. We think the tech team knows how to do this, but we need a better explanation why it didn't work.

Thought about other metrics that may work. Natural variability in conductivity—look at more conservative characters of the landscape (e.g., water chem, alkalinity, specific ions) to account for natural variability. But this may not be critical for implementation.

Is the ASCI helpful in bioassessment, given that you already have CSCI? EPA recommends multiple indices as backup/redundant info. The two indices are complementary for assessing biological condition. We think there's a lot of complementarity—try to document this complementarity.

Preliminary evidence indicates that ASCIs are more sensitive to nutrients than the CSCI. That would support complementarity as an early-warning indicator.

Is it worth doing soft algae? Lots of pros and cons. Clearly, the ASCI-H has a bit better performance. Given costs, are there better ways to use the funds? A cost-benefit analysis would help address these things. Transitioning to molecular approach to characterize algal taxonomy: Cost should disappear. It's important to maintain continuity in the program.

Metrics seem to be indicators of stressors. That's a common approach to developing MMIs. Using multiple metrics helps you evaluate different human disturbances. Newer concepts focus on biological condition, which include components of stressor indicators. These stressor indicators are a slightly different concept of biointegrity (than compositional measures?). Panel is concerned about lack of info about limiting nutrients. Consider diffusing substrate experiments. These can be cost-effective.

Application to intermittent/ephemeral/channelized streams? Does it reflect conditions in these channels? Report will address.

Martha: What about the fact that indices seem to respond more at the cleaner end of the stressor gradient?

Jan: Changes at high end are smaller than changes at low end. Rescale the x-axis to look for responses at both levels.

PRELIMINARY REFLECTIONS ON BIOLOGICAL CONDITION GRADIENT MODEL

The lead reviewer was Paul Stacey. Overall, panel has a favorable response to quality of document, with the usual questions about how it applies to policy.

With respect to data suitability, adequacy credibility, data needs to be better qualified to answer suitability, adequacy. How much variability can be attributed to sampling error?

Data were treated as truth, which is good for biointegrity indicators, but maybe not for stressors. [More about response models?]

Traits: Data talks. Relationships look pretty good. That suggests credibility for relationships

Value of biodata as integrators is an important attribute of suitability.

Spatial density may be limiting to capture full range of responses. State (snapshot concentrations) variables may not reflect conditions.

Stressor data must be qualified better, checked against data quality objectives. What's your power?

What are the structural and functional elements for CA streams?

Methodology: They are fine. Suggestion that use of [PO]LR may obscure transitions. Try repeating on binary classes.

Purpose of the BCG still not too clear. What are the expected outcomes of its intended use.

If after considering uncertainty, if results for bugs and algae differ, it'll be good to ask why experts got different responses.

More details on disagreement on tier assignments should be reported.

Poor discrimination by algal experts, and they were reluctant to assign 1 and 6. Please report explanations as to why.

Should you expect tiers to line up across organisms?

Stakeholder concerns and policy outcomes: Most stakeholder concerns are about the number. It's objectively derived—no technical ways to improve this. BCG and TALU offers flexibility, though. A range of options to preserve, manage, mitigate. A good framework for adaptive management and interim goals.

Concerns about range vs. single numbers: Using process-model applications.

Application at smaller spatial scales might help (site-specific differences)

Use of different stressor measures (land cover) to extrapolate into Bin 6. Marcus's paper has a super high correlation!

Request for clarification: If this is a communication tool for reference, or for selecting a numeric endpoint?

PRELIMINARY REFLECTIONS ON CHANNELS IN DEVELOPED LANDSCAPES (BECK ET AL.)

Chuck Hawkins was the lead reviewer on this manuscript. Overall, Panel was happy and see a lot of potential value added. Here's all the devil in the details.

Definitions: Common theme among the panel about the need to clarify what "constrained" means. Other uses of term in stream ecology, geomorphology. Consider another term or define carefully.

Channel modification may not be represented by riparian land cover. Aerial imagery and field verification should help.

Comprehensiveness: Some alteration may not be captured by StreamCat, specifically hydro/thermal modification. Some of which could be considered non-restorable. Is it possible to use other kinds of predictors? Please address these limitations in predictive performance and in policy implications.

Could this couple with nutrient response models? Yes.

Statistical sufficiency? Yes, good data set. Random forest modeling is well suited. Independent validation by going to the field to check against field measurements (STREAMCAT ground truthing). How often do errors emerge from bad predictors vs modeling?

Different interpretations among panel members as to why. Why use the range (quantile vs traditional)? Clarify why.

Applications to stakeholder concerns. Some liked, see many uses. Others less so. Clearly need better communication.

General applicability? Affected by flow duration? We know that bio attributes vary. We recognize that the tool is ideal for perennial, but we recognize that aren't bright lines between stream-types. Intermittent systems creep into the data set. Understand this influence, if any.

Can you tease out mitigatable constraints? Can modified channels ever support reference biology? No. We shouldn't hold them to the same standards. Predictors in model get at these influence, but also includes mitigatable and unmitigatable predictors. Are they truly all in one basket? Probably not.

It is not clear how predicted ranges are to be attributed. But caveats [We have a terminology issue with "modification"]

Some objectives should be clarified. To address stakeholder concerns, the regulatory context needs to be clarified.

There are potentially other value added; tool may help flow inundation models.

Add TN and TP to predictor variables, partial dependence plots to see if there are trends associated with stream chemistry (not just catchment)

Case study was interesting, but may not be appropriate for journal.

Why not link to non-linearities in stressor-response relationships? We may need to provide more context to tech team.

Martha: We may need different communication strategies for journal products vs staff report products

Lester: Good strategy!

Marcus: Consistency with panel comments and peer review comments from journal where the manuscript was submitted.

PRELIMINARY REFLECTIONS ON TR871 SCIENTIFIC FOUNDATION FOR ASSESSMENT OF BIOSTIMULATORY IMPACTS TO CA WATER BODIES (SUTULA)

Ken Reckhow was the lead reviewer on this and noted that Panel is still digesting comments and material. Overall, TR 871 is a comprehensive view of literature and science. Very thorough.

Given need for numeric guidance to link indicators with uses. It would be strengthened if it included recommendations for these quantitative analyses to do so.

Figures will help evaluate if anything was left out.

A set of causal models with specific BUs would be useful. TetraTech example is potentially good.

Generally good criteria for eutrophication indicators.

With respect to criterion of clear link to BUs, this should be presented with statistical modeling and causal analysis.

With respect to criterion of “Indicators should show a trend with eutrophication with acceptable signal to noise ratio”: At points, causal assessment is discussed. Stakeholders want this. Consider SEM and Bayesian networks to address and supplement this discussion. Ken noted that there was some disagreement among panel that the focus should be on TN and TP, as Paul STacey noted that total forms include non-bioavailable components. Ken disagreed with that comment though. TN and TP are good long term forms to look at because these organic forms can get remobilized to inorganic nutrients downstream.

Sestonic responses are good to include explicitly.

Add bacteria and disease endpoints.

Adding expectations for human activities for drivers.

Include reference to CADDIS framework.

(https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=311236&Lab=NHEERL)

DOC: Precursor of trihalomethane. To get most, use reaeration coefficient.

Martha: The stakeholders want to hear about Panel thoughts on the principles and assumptions. Please consider that in your detailed review. Also, Cliff the comments on reaeration coefficient speaks to measurement of metabolism. Cliff: I’ll detail in my report.

PRELIMINARY REFLECTIONS ON TR1048 SYNTHESIS OF BIOSTIMULATORY IMPACTS ON WADEABLE STREAMS (SUTULA ET AL)

Cliff Dahm was the lead reviewer on TR1048. He noted that we should take input as preliminary and that there was significant overlap with Ken's report on TR871.

Overall, the strengths include a good initial synthesis of what's available. Including seston chl-a is good and it was good to see that ecosystem processes are included.

We have a number of question and concerns, as follows.

Approach groups results together in analyses. This could be misleading, e.g., to a conclusion where there are multiple incremental changes over time. Consider starting point (low v high nutrient streams).

Macro algal % cover info. There can be important thresholds in low Ortho-P (20 to 30 ug/L)

DOC: It's an important variable to measure. It plays different roles, including one not included in thematic diagram: It's a reason for poor light penetration. Humic systems, especially. Optical impacts. Treatment impacts. Contaminant. Energy source. DOC standards: These are problematic because they are linked to other things, not within purview of human control. For example, strongest correlate is % wetland coverage globally.

Continuous variables (loggers) can inform ecosystem processes like respiration. You need info on exchange of gasses between water and atmosphere. You can derive these coefficients (geomorph, modeling).

Consider intermittent streams more directly in the report.

PRELIMINARY REFLECTIONS ON EUTROPHICATION THRESHOLDS THAT IMPACT BIOINTEGRITY OF WADEABLE STREAMS (MAZOR ET AL.)

Lester Yuan was the lead reviewer on this manuscript.

Comments should be considered preliminary. Overall, two big points.

First, re: correlation vs causation, these relationships are correlative. The policy options should clarify statistical approaches that map onto potential uses, then. Alternatively, consider more complex modeling approaches (SEM, Bayesian to consider confounding factors.

Other main comments: Flexibility. Stakeholders need this. This flexibility can be accommodated with different mechanism, e.g., selecting targets or implementing. Consider bioconfirmation.

Underlying science doesn't change with these flexibility measures. Inform policy makers about their tradeoffs. E.g., different thresholds (ref30, ref10) represent different bio communities. This gives rise to uncertainty on how you're managing your science. Communicate these uncertainties.

ASCI vs CSCI: Work out why and how their sensitivities differ. Good reasons to expect ASCI sensitivity to nutrient enrichment. Good to test whether those hypotheses are born out. Use of AFDM and chl-a as stressors for ASCI is odd to some panel members.

There is room to investigate relationship between these models and Beck's Channels in Developed Landscape Models: Lots of room here.

Martha: ASCI and AFDM/Chl-a. It's circular, right? You're seeing compositional changes in algae align with biomass changes. Lester: Articulate. Not a bad idea, just clarify.

Jan clarified that nutrients (not biomass) directly affects algae species composition. Biomass (not nutrients) has direct impact on bugs.

Lester: Complex models sacrifice communicability.

Martha: You make a good point that we didn't develop the conceptual basis to explain what we were showing.

Paul: Biomass, chl-a: It's hard to capture during an index period.

MEETING ADJOURNED 4:40 PM